



General Plan

DRAFT DISASTER PREPAREDNESS & SAFETY ELEMENT

Appendix A: Disaster Preparedness & Safety Existing
Conditions Report





Disaster Preparedness and Safety Existing Conditions Report

Rincon Consultants, Inc. (hereinafter referred to as "Rincon") prepares vulnerability assessments that evaluate climate change hazards, including wildfire, based on numerous sources, including third party consultants, State and Federal mapping resources, and various software modeling programs that are considered industry standard best practices. The vulnerability assessment prepared for this Disaster Preparedness and Safety Existing Conditions Report evaluated wildfire hazards based on CAL FIRE's Fire Hazard Severity Zones. Wildfire is unpredictable, and the specific conditions of wildfire could result in fire behavior that diverges from the assumptions used in this analysis. There is no guarantee that wildfire behavior and specific treatment to avoid such behavior will follow or prevent wildfire impacts. Rincon is not responsible for any damage to life or property that might occur based on the results of the vulnerability analyses in the Disaster Preparedness and Safety Existing Conditions Report, and any accompanying recommendations.

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1 Introduction

The following report provides a desktop analysis of natural and human-made hazards that impact the Berkeley community. It was developed to provide guidance on the creation of safety policies and programs within the City of Berkeley's (City) Disaster Preparedness and Safety Element of the General Plan.

State Government Code Section 65302(g) requires cities to include a safety element in their general plan that has goals, policies and programs that seek to protect the community from unreasonable risks associated with natural and human-made hazards. Hazards that must be considered in a safety element include seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, dam failure, slope instability leading to mudslides and landslides, subsidence, liquefaction, and other seismic hazards. The safety element must also address wildfire and flooding hazards.

In accordance with California Government Code Section 65302(g), as amended by Senate Bill 379 and Senate Bill 1035, climate change adaptation and resilience strategies must also be included in a city's Safety Element. Senate Bill 1035 specifically requires that this information be regularly updated, at minimum every 8 years or upon each revision of the Housing Element or Local Hazard Mitigation Plan. The review and update must consist of the following components:

1. A vulnerability assessment that identifies the risks climate change poses to the local jurisdiction and the geographic areas at risk from climate change.
2. A set of adaptation and resilience goals, policies, and objectives based on the information specified in the vulnerability assessment.
3. A set of feasible implementation measures designed to carry out the goals, policies, and objectives identified in the adaptation objectives.

2 Vulnerability Assessment

State law (California Government Code Section 65302 (as amended by Senate Bills 379 and 1035)) requires a Safety element to include an assessment of exposure to hazards and an evaluation of how climate change may affect the risk of each hazard. In addition, a Safety Element must identify populations and assets that are most at-risk. The purpose of this assessment is to identify risks that climate change poses to Berkeley as a whole, and to areas and populations within the City that are most at risk from climate change impacts.

While this report identifies vulnerability disparities across communities, it is essential to recognize that these disparities are not random, but are the result of long-standing institutional policies, planning practices, and systemic disinvestment based on racial and income biases. Research has shown that structural causes, such as exclusionary zoning, inequitable transportation funding, and biased enforcement practices, have historically marginalized certain populations and increased their vulnerabilities to hazards. This report aims to support policy development that not only mitigates harm but also begins to dismantle the systems that perpetuate inequities in the built environment.

2.1 Methodology and Approach

As described below, the City followed guidance from the California Governor's Office of Emergency Services and the Office of Land Use and Climate Innovation (LCI), as well as community input to identify populations and assets most at risk from hazards and climate change-related impacts.

2.1.1 *California Adaptation Planning Guide*

To assist local cities and counties to comply with these requirements, the Governor's Office of Emergency Services published the California Adaptation Planning Guide (Cal APG). The Cal APG recommends a four-phase planning process that is outlined in **Figure 1** below. Phase 1 and 2 of the process consist of conducting a vulnerability assessment. This report aligns with relevant components of Phase 1 and all components of Phase 2 (shown in **Figure 2**). The adaptation strategies defined during Phase 3 will be incorporated into the City's General Plan Disaster Preparedness and Safety Element. Phase 4 involves implementation of the policies and programs identified in the Safety Element, which will occur on an ongoing basis. Implementation efforts will be re-evaluated and refined during the next update to the General Plan.

Figure 1 California Adaptation Planning Guide Phases

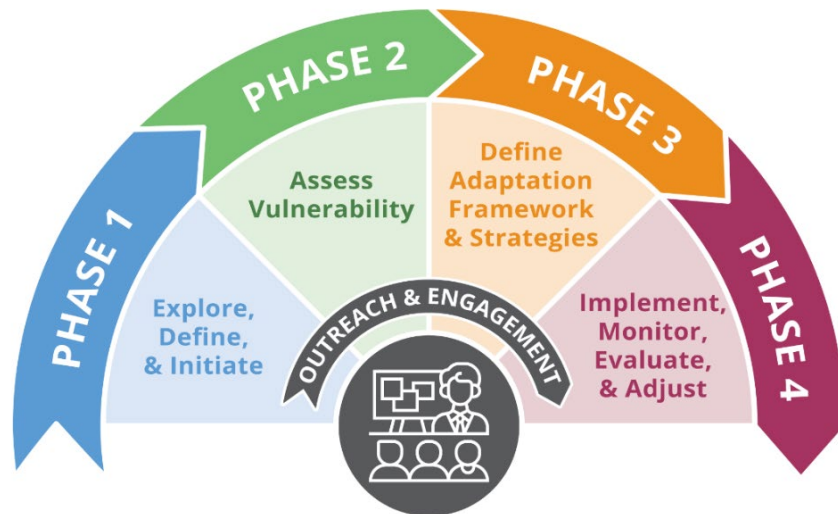
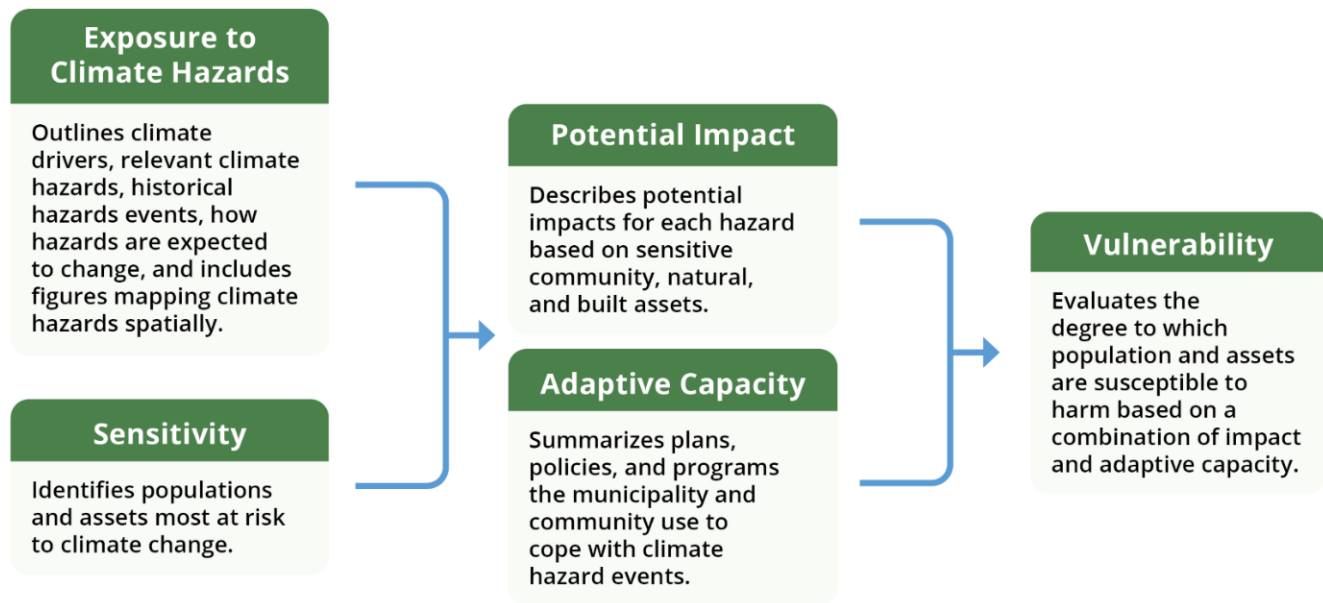


Figure 2 Vulnerability Assessment Process (Phase 2)



2.1.2 California Resource Guide for Defining Vulnerable Communities

In 2018, LCI published a resource guide through the Integrated Climate Adaptation and Resiliency Program (ICARP) that includes information to help define vulnerable communities in the context of climate change adaptation.¹ This resource guide, along with several other sources, was consulted to support this assessment and to describe the vulnerable communities identified within it. These include the California Department of Public Health’s

¹ https://lci.ca.gov/docs/20180723-Vulnerable_Communities.pdf

2.2 Climate Change Vulnerability Assessment

Climate change is primarily driven by human activities that release gases such as carbon dioxide and methane into the atmosphere. These gases, known as greenhouse gases (GHGs), absorb and re-emit heat from the Earth's surface, thereby trapping heat and enhancing the natural greenhouse effect. Since the 1800s, human activities have been accumulating GHGs in the atmosphere, leading to a continuous rise in global temperatures. Climate change is expected to exacerbate the impacts of all hazards in Berkeley. Considering the geography and topography of Berkeley, climate change-related impacts that pose a particular risk include a heightened risk of wildfires and deteriorating air quality, along with rising sea and groundwater levels. Berkeley will also face increased extreme heat events and more severe storms because of climate change, that could in turn, lead to storm drain overflow, creek flooding, or prolonged droughts.

The climate change vulnerability assessment uses the following data sources and tools, many of which are recommended within the California Adaptation Planning Guide:

- **Alameda County Heat Vulnerability Map** was developed for Alameda County by Four Twenty Seven and StopWaste.Org in 2019. The [map](#) identifies the social and environmental factors contributing to community heat vulnerability in Alameda County. It was utilized in this report to explore tree canopy and heat vulnerability in Berkeley (Alameda County 2019).
- **Cal-Adapt (Version 2.0) Local Climate Change Snapshot** is an [online tool](#) that presents historic and modeled climate projections based on 10 different global climate models as part of California's Fourth Climate Change Assessment (see bullet below). The tool was developed and is maintained by the University of California, Berkeley Geospatial Innovation Facility with funding and oversight by the California Energy Commission (CEC). This tool was used for this report to present projection data related to extreme heat, and drought (CEC). The Cal-Adapt Analytics Engine houses downscaled climate projections in support of California's Fifth Climate Change Assessment. At the time this report was written access to the [Analytics Engine JupyterHub](#) service was limited to a small group of alpha testers, and therefore was not used for this report.
- **California's Fourth Climate Change Assessment** was developed by the CEC and other State of California coordinating agencies to present up-to-date climate science, projections and potential impacts associated with climate change. The CEC and coordinating agencies developed nine reports to provide regional-scale climate information to support local planning and action. The San Francisco Bay Area Region

² CalBRACE Project - Climate Change & Health Equity,
<https://www.cdph.ca.gov/Programs/OHE/Pages/CalBRACE.aspx>

Summary Report (2018) presents an overview of climate science, regional projections, specific strategies to adapt to climate impacts, and key research gaps needed to spur additional progress on safeguarding the San Francisco Bay Area from climate change. The San Francisco Bay Area Region Summary Report was used in developing this report to understand regional changes that may affect Berkeley both directly and indirectly (Ackerly et al. 2018). As of the writing of this report in September 2025, the CEC is preparing the Fifth Climate Change Assessment, which is anticipated to be available in the summer of 2026.

- City of Berkeley 2024 Local Hazard Mitigation Plan (LHMP) serves four functions:
 1. Documents the current understanding of hazards present in Berkeley, along with Berkeley's vulnerabilities to each hazard – the ways that the hazard could impact Berkeley's buildings, infrastructure, community, and environment.
 2. Presents the City's Mitigation Strategy for the next five years. The Mitigation Strategy reflects a wide variety of both funded and unfunded actions, each of which can contribute to reducing Berkeley's hazard vulnerabilities.
 3. Outlines actions that Berkeley community members can take at the household level to reduce their own vulnerabilities to hazards in Berkeley.
 4. Fulfills requirements of the Disaster Mitigation Act (2000), ensuring that Berkeley will remain eligible to apply for mitigation grant funding before disasters, and to receive federal mitigation funding and additional State recovery funding after disasters.

Information from the 2024 LHMP was used in this report to identify recent historical events, determine hazard exposure, and characterize the vulnerability of certain assets. It was also used in this report to understand existing and planned efforts to offset impacts of climate hazards in Berkeley.

- **The Intergovernmental Panel on Climate Change (IPCC)**, a United Nations body dedicated to advancing and communicating climate change knowledge, has developed several scenarios to project future GHG emissions and associated warming. The scenarios used to assess Berkeley's vulnerability to climate change hazards (including wildfire, sea level rise, groundwater rise, extreme heat, creek flooding, and drought) consistent with guidance from the California Government Office of Emergency Services (Cal OES) California Adaptation Planning Guide, are:³
 - **Representative Concentration Pathway (RCP) 4.5:** This "medium emissions" scenario assumes that emissions will peak around 2040 and then decline by the end of the century, contingent on global agreement and implementation of GHG reduction strategies.

³ The latest climate models are now using Shared Socioeconomic pathways (SSPs), which model how socioeconomic factors may change over the next century. These include considerations such as population, economic growth, education, urbanization and the rate of technological development.

- **Representative Concentration Pathway (RCP) 8.5:** This "high emissions" scenario assumes that emissions will continue to rise throughout the 21st century.

2.3 Social Vulnerability Assessment

Social vulnerability, or "sensitivity" to climate change risks can be described as the degree to which human systems are susceptible to harm based on a number of factors. This assessment is complex since certain factors can make specific populations more sensitive than others. These factors include, but are not limited to:

- Inequities in educational opportunities and attainment;
- Inequities in environmental and living conditions and health status;
- Institutional bias and exclusion from decision-making power; or
- Differences in individual health, age and ability.

Historical and ongoing environmental injustices have created conditions in the built environment that make some populations more susceptible to climate change risks than others in the community. For example discriminatory housing practices, such as [redlining](#), concentrate pollution, hazardous environments, and vulnerability to climate change impacts in communities of color and low-income areas. These policies restrict access to safe housing and healthy neighborhoods, leading to unequal exposure to environmental burdens and exacerbating health disparities. The purpose of this social vulnerability assessment is to

While vulnerable populations are distributed throughout Berkeley, the Social Vulnerability Map identifies neighborhoods with the highest concentrations of individuals at heightened risk from climate impacts. These communities often face multiple, overlapping challenges, such as economic insecurity, limited access to healthcare, and language barriers, which cumulatively can intensify and complicate their vulnerability to climate-related hazards. The analysis in this report focuses on these high-vulnerability areas to help guide policy prioritization, ensuring that resources and interventions are directed where they are most urgently needed.

identify these communities and work collaboratively to rectify these harms, and in doing so build climate resilience in a way that best addresses the needs of the communities most at risk.

Individuals and communities can be affected by more than one factor at once, and individuals in the community who are exposed to a higher number of these factors may be particularly vulnerable. This section describes the methodology to identifying populations and assets that are highly vulnerable to natural hazards and climate change impacts in Berkeley. It is important to note that the existence of highly vulnerable groups is an indication of the shortcomings of social, economic, and political systems to provide adequate support, respect and protection to all community members. It is not an indication of any individual failure or

weakness (Thomas et al., 2018). The City of Berkeley is also in the process of preparing a new Environmental Justice Element to its General Plan, pursuant to the requirements of Senate Bill 1000. This effort includes a related assessment to identify areas in the City that are disproportionately impacted by pollution exposure and adverse health impacts, in addition to socioeconomic vulnerability. This Environmental Justice assessment is described in more detail in the Environmental Justice Existing Conditions Report: <https://berkeleyca.gov/your-government/our-work/adopted-plans/general-plan>.

2.3.1 Communities Facing Social Vulnerability

This section describes each of the factors that are included in the social vulnerability assessment for the City of Berkeley's Disaster Preparedness and Safety Element. The data source for this information is the American Community Survey 5-Year estimates (2018-2022). Recognizing that local knowledge and context is critical to identifying communities that face social vulnerability in Berkeley, the City incorporated additional community-specific data in its analysis based on feedback from the project's Community Advisory Committee (see Summary of Community Engagement Activities for more information about the Community Advisory Committee: <https://berkeleyca.gov/your-government/our-work/adopted-plans/general-plan>).

Age (Children Under Age 5)

Vulnerability to climate change risks among children is especially high because of physiological and development factors: their lungs are developing, they breathe at a higher rate than adults, and they spend more time outdoors (California Building Resilience against Climate Effects (CalBRACE) Project, n.d.). In addition, children are more likely to experience negative consequences as a result of extreme weather events, such as injury, stress, and death (Executive Order B-30-15 Resiliency Guidebook, n.d.). According to 2022 American Community Survey (ACS) 5-year estimates, about 3.2 percent of Berkeley's population is under 5 years of age.

Age (Adults 65 Years and Older Living Alone)

Factors that contribute to vulnerability among older adults include health status, economic situation and level of social isolation. Older adults are more likely to have chronic health conditions that require medication and/or assistance with daily activities. Older adults with limited incomes may be more vulnerable to the effects of extreme heat events due to the high cost of air conditioning. In addition, almost one-quarter of Americans aged 65 and older are socially isolated, which can impact an individual's ability to cope with climate-related stressors, receive emergency information and/or ask for help (The Impact of Climate Change: Why Older Adults Are Vulnerable Research Report, n.d.). According to 2022 American Community Survey (ACS) 5-year estimates, about 12 percent of Berkeley households include a member who is 65 years or older and living alone.

Disability

Disability is a broad term that refers to any condition or impairment of the body or mind that limits a person's ability to do certain activities. Vulnerability to climate risks are heightened among this group due to factors such as lower income, educational attainment, and employment status. Limited mobility, reliance on medical equipment and public transportation contribute to vulnerability, especially during emergency events that require evacuation or cause power interruption (California Building Resilience against Climate Effects (CalBRACE) Project Short Title: Disability, n.d.) (Executive Order B-30-15 Resiliency Guidebook, n.d.). According to 2022 American Community Survey (ACS) 5-year estimates, about 19 percent of Berkeley households include a person with a disability.

Income

Income is the largest determinant of health in the United States. Higher income is associated with greater life expectancy. This is due in part to access to quality health care, but more so due to social determinants of health, such as environmental quality, social and economic situations, and the built environment, which influence stress levels and behaviors. The lower health status of lower-income people exacerbates climate change risks, as these groups have fewer resources to cope with emergencies and respond to rising prices. Additionally, groups with lower incomes are more likely to live in housing that is substandard, and therefore more susceptible to damage from disasters (Executive Order B-30-15 Resiliency Guidebook, n.d.).

According to 2022 American Community Survey 5-Year estimates, about 40.3 percent of Berkeley households are considered very low income, meaning a two-person household earning no more than 50 percent of the area median income for Alameda County, or \$62,300 (California Department of Housing and Community Development, 2024). Some types of families are more likely to have lower income than others. These include families headed by a single parent (13.5 percent of whom earn below \$62,300) and families with heads of household who have less than a high school degree (4.6 percent of whom earn below \$62,300).

Housing Cost

Availability of safe, sanitary and affordable housing reduces vulnerability to climate-related impacts and supports recovery. High housing costs can limit financial resources needed to prepare for and recover from climate-related impacts, while a lack of safe and secure housing can increase vulnerability to impacts.

Factors including household income, market rents and home prices, available unit sizes, and household size can all contribute to cost burden. A household is considered to have a housing cost burden if it spends more than 30 percent of gross income on housing expenses (rent or mortgage payments and utilities). A household is considered as having a severe cost burden if expenses make up more than 50 percent of gross income (City of Berkeley(d)).

According to the City of Berkeley Housing Element (Sixth Cycle), 23 percent of all Berkeley households are severely cost-burdened. Cost burden is more prevalent among renter households than among households who own their home (32 percent versus 12 percent) (City of Berkeley(d)).

Housing conditions impact health, and availability of safe and secure housing can impact vulnerability to climate related risks by exposure to environmental hazards caused by climate change, such as extreme heat (Cartwright et al., 2025). Building improvements such as ventilation, window shades, insulation, roof and wall materials can all reduce impacts from climate-related risks. According to the Housing Element, structures over 30 years old are likely to have significant rehabilitation needs, which may include a new roof, foundation repairs, or new plumbing. Over 95 percent of Berkeley's housing stock is over 30 years old. Lack of sufficient plumbing and kitchen facilities is another indicator of substandard housing conditions. Although units without sufficient plumbing or kitchens are rare in Berkeley, less than 5 percent, renter households are more likely to reside in a unit with at least one of these issues in the City of Berkeley(d)). While most of Berkeley's housing stock remains functional, its age and the presence of some substandard conditions, particularly among renter-occupied units, suggest a need for continued attention to housing maintenance and rehabilitation.

Linguistic Isolation

Linguistic isolation refers to a household in which all persons 14 years of age or older speak a language other than English and no one speaks English very well. Many immigrants are linguistically isolated. Linguistic isolation may hinder protective behaviors during extreme weather events or disasters by limiting access to or understanding of emergency warnings. Studies have shown that people who live in linguistically isolated households are more likely to make heat-related calls to 911 during extreme heat events (Cartwright et al., 2025).

According to the 2022 American Community Survey (ACS) 5-Year Estimates, about 3.8percent of households (or about 1,740 households) in Berkeley are considered "Limited English-Speaking Households", meaning that no member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English "very well." About 1.3 percent of those households speak Chinese (including Mandarin and Cantonese), about 0.7 percent speak an Indo-European language (French, German, Hindi, and Persian), and another 0.7 percent speak an Asian and Pacific Island language (Chinese, Japanese, Telugu, and Hawaiian). About 0.3 percent speak Spanish.

Communities of Color

Structural racism creates racial disparities in educational attainment, income and wealth, which in turn contribute to increased vulnerability to climate risks (Thomas et al., 2018). Communities of color also experience greater vulnerabilities due to compounding factors such as income, educational attainment, health, language barriers, social isolation, occupational exposures and less access to air conditioning. Differences in vulnerability may be linked to

social and economic disparities. For example, due to discrimination, communities of color (Black, Indigenous, Hispanic/Latino, Asian American, Pacific Islander, Middle Eastern, and North African) are more likely to have lower incomes and live in areas with more risks from pollution and fewer health-promoting features (e.g., parks, grocery stores). Also, communities of color may have less access to information about risk mitigation, as well as resources to prepare for, adapt to, and recover from climate-related events (Executive Order B-30-15 Resiliency Guidebook, n.d.). According to the 2022 American Community Survey (ACS) 5-Year Estimates, approximately 48 percent of Berkeley residents identify as people of color. The racial and ethnic breakdown is as follows: 21 percent identify as Asian, 12 percent as Hispanic or Latino, 8 percent as Black or African American, 7 percent as multiracial, 1 percent as another racial identity not listed, 0.2 percent as American Indian or Alaska Native, and 0.2 percent as Native Hawaiian or Pacific Islander.

Vehicle Ownership

Vehicle ownership is an indicator of access to personal transportation, which is a critical resource during extreme weather events or in scenarios requiring evacuation. Access within a household to a personal vehicle is important because it can be a source of shelter from wildfire, air pollution, heat or flooding (Executive Order B-30-15 Resiliency Guidebook, n.d.). Approximately 20 percent of households in Berkeley do not have access to a vehicle.

Immigrants and Refugees

Immigrant and refugee populations may be more vulnerable to climate change impacts due to potentially experiencing displacement due to previous climate change impacts or disasters. These populations may also be overrepresented among low-income groups but underrepresented in public benefits enrollment. The most vulnerable immigrants and refugees include people with low socioeconomic status, people who are experiencing homelessness, single mothers with young children, and people with limited English. These individuals are less likely to ask for help from government officials and tend to be linguistically isolated. Many people in this group work in conditions that leave them vulnerable to exposure to climate change impacts, such as extreme heat. Because many undocumented immigrants or refugees do not have adequate access to services, they may receive lower levels of support to address climate stresses (Executive Order B-30-15 Resiliency Guidebook, n.d.). According to the ACS 5-year estimates, about 24 percent of residents are of voting age and are not U.S. citizens. While citizenship status alone does not determine vulnerability, it can intersect with other factors—such as income level, refugee or asylum status, and access to services—which compound climate-related risks.

2.3.2 Summary of Social Vulnerability

Each of the factors explained in the previous section were recorded by census block group and analyzed to identify communities facing social vulnerability per the methodology outlined in Section 2.3.3 Cumulative Social Vulnerability. **Table 1** below provides a summary of results, showing the percentage of Berkeley’s population that is determined to experience social vulnerability.

Table 1 Summary of Social Vulnerability

Population	Size of Community in Berkeley	Data Source (ACS Table)
Individuals without a high school degree	3%	Population 25 years and over – no high school diploma (ACS 2022, Table B15003: Educational Attainment for the Population 25 Years and Over)
Very low-income households	40%	Households earning less than \$62,300 per year, or 50% of Area Median Income (AMI) for a 2-person household in Alameda County (ACS 2022, Table B19001: Household Income in the Past 12 Months and California Department of Housing and Community Development, 2024 State Income Limits, Alameda County, 2-person household, very-low income)
Severely housing cost burdened households	23%	Households spending >50% of income on housing – Severely Housing Cost-Burdened (ACS 2022, Tables B25070: Gross Rent as a Percentage of Household Income & B25091: Monthly Owner Costs as a Percentage of Income)
Communities of color	48%	People of Color – Communities of Color (ACS 2022, Table B03002: Hispanic or Latino Origin by Race)
Single parent families	9%	Families comprised of a parent/caregiver and one or more dependent children without the presence and support of a spouse or adult partner who is sharing the responsibility of parenting. ACS Census DP02 - Added Male and Female heads of household with children
Residents with Limited English proficiency	3.8%	Limited English Proficiency – Limited English-Speaking Households (ACS 2022, Table B16002: Household Language by Household Limited English-Speaking Status)
Residents who are not U.S citizens	24%	Not U.S. Citizens (Population Aged 18+) (ACS 2022, Tables B01001: Total Population by Age & B29001: Citizen Voting-Age Population)
Residents who are under the age 5	3.2%	Population Under 5 Years (ACS 2022, Table B01001: Sex by Age)
Households with a member who is 65 years and over living alone	12%	Households with 1 or more people 65 years and over – 65 and Over Living Alone (ACS 2022, Table B11007: Households by Presence of People 65 Years and Over)
Households with a person with a disability	19%	Households with 1 or More Persons with a Disability – People with a Disability (ACS 2022, Table B22010: Receipt of Food Stamps/SNAP by Disability Status)
Renter households	57%	Renter-Occupied Households – Renters (ACS 2022, Table B25003: Tenure)
Zero-vehicle households	20%	Households Without a Vehicle – Without a Vehicle (ACS 2022, Table B25044: Tenure by Vehicles Available)

2.3.3 Cumulative Social Vulnerability

Individuals can belong to more than one vulnerable group and may experience especially complex forms of climate change vulnerability as a result of overlapping population characteristics. Berkeley's cumulative vulnerability map (See **Figure 3**) was created using the San Francisco Bay Conservation and Development Commission (BCDC) 2020 Community Vulnerability Index – overlapping the many factors that affect social vulnerability – to account for this complexity.

The Berkeley Cumulative Social Vulnerability Map (**Figure 3**) includes all the indicators presented in **Table 1** above. Census block groups were identified and classified as low, moderate, high, and very high as a measure of cumulative vulnerability using the data in **Table 2**.

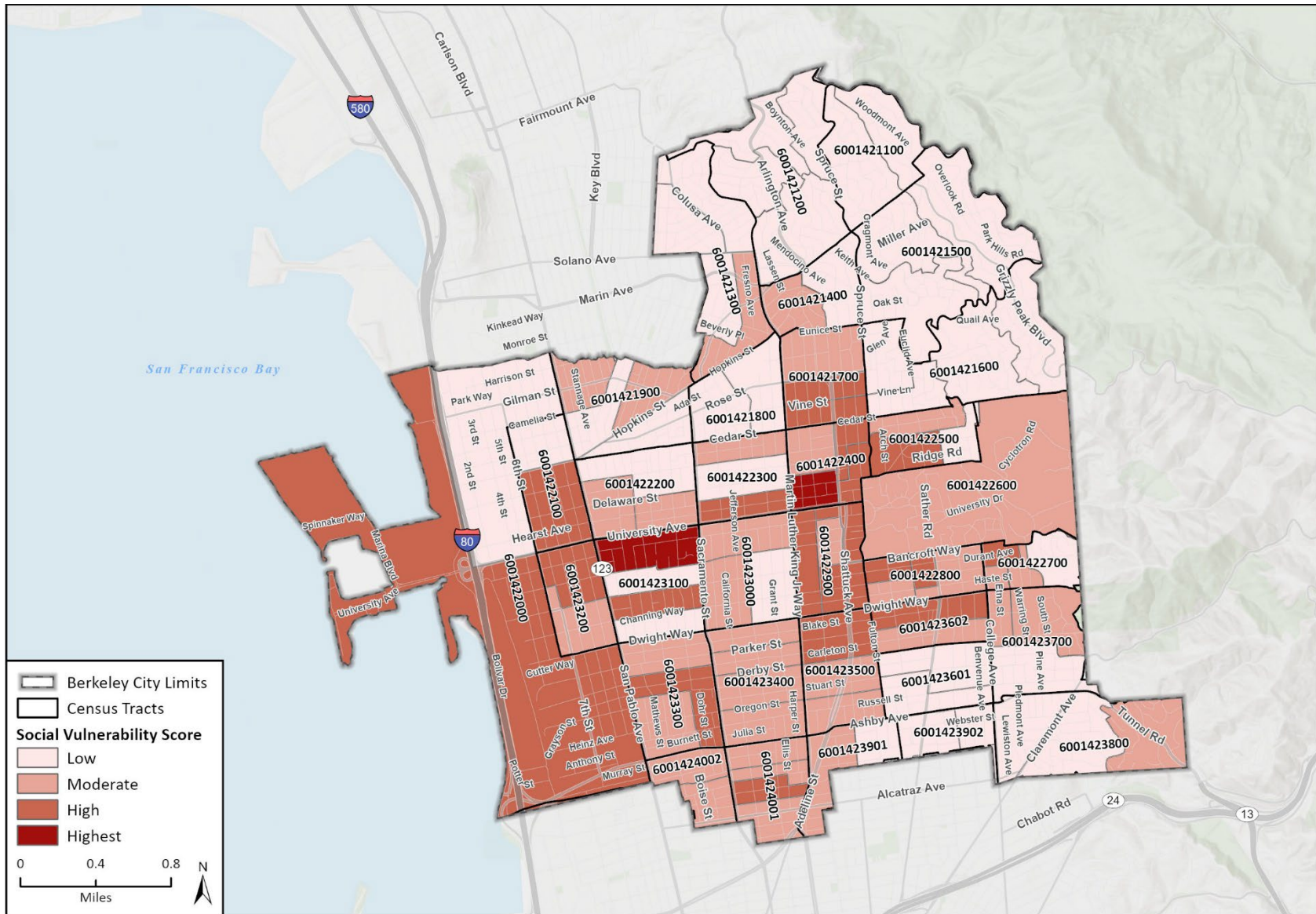
A second map, (**Figure 4**) the Berkeley Highest Cumulative Social Vulnerability Map, adjusts the threshold for indicators to identify more communities at risk. For this map, a block group is classified as an area of social vulnerability if there are seven or more indicators (see **Table 1** above) at or above the 70th percentile.

Setting the threshold for “very high” social vulnerability at the 70th percentile reflects the unique characteristics of the Berkeley population, and ensures that areas exhibiting moderate to high vulnerability, which are important to present for policy considerations, are not overlooked. The full Social Vulnerability Analysis Methodology can be found in Appendix A.

Table 2 Cumulative Vulnerability Classification Methodology

Number of indicators above 70th percentile	Cumulative Social Vulnerability Score
0 - 2	Low
3 - 5	Moderate
6 - 8	High
9 - 11	Very High

Figure 3 Berkeley Cumulative Social Vulnerability Map



Basemap provided by Esri and its licensors © 2025.
Social Vulnerability Score provided by City of Berkeley, 2025.

23-15392 EPS Safety Element
Fig X Social Vulnerability Index

Map of Berkeley, CA

Legend:

- Berkeley City Limits
- Census Tracts
- Areas of Highest Cumulative Social Vulnerability

Scale: 0 to 0.8 Miles

North Arrow: N

Map Details:

- Streets:** Carlsen Blvd, Fairmount Ave, Key Blvd, Solano Ave, Marin Ave, Kincaid Way, Monroe St, Harrison St, Park Way, Gilman St, 3rd St, 5th St, 6th St, 4th St, Hearst Ave, University Ave, Spinnaker Way, Marina Blvd, University Ave, Bolivar Dr, 7th St, Heinz Ave, Anthony St, Murray St, Colusa Ave, Fresno Ave, Beverly Pl, Hopkins St, Ade St, Rose St, Cedar St, Jefferson Ave, Sacramento St, California St, Grant St, Parker St, Derby St, Oregon St, Julia St, Ellis St, Boise St, 6001423000, 6001423100, 6001423200, 6001423300, 6001423400, 6001423500, 6001423601, 6001423602, 6001423700, 6001423800, 6001423901, 6001423902, 6001424000, 6001424001, 6001421100, 6001421200, 6001421300, 6001421400, 6001421500, 6001421600, 6001421700, 6001421800, 6001421900, 6001422000, 6001422100, 6001422200, 6001422300, 6001422400, 6001422500, 6001422600, 6001422700, 6001422800, 6001422900, 6001423000, 6001423100, 6001423200, 6001423300, 6001423400, 6001423500, 6001423601, 6001423602, 6001423700, 6001423800, 6001423901, 6001423902, 6001424000, 6001424001.
- Highways:** Interstate 580, Interstate 80, Highway 24, Highway 13.
- Geographic Features:** San Francisco Bay, Alcatraz Ave, Chabot Rd, Tunnel Rd, Claremont Ave, Piedmont Ave, Lewis Ave, Webster St, Ashby Ave, Russell St, Dwight Way, Bancroft Way, Durant Ave, Haste St, Emma St, College Ave, Benvenue Ave, Clarendon Ave, Overlook Rd, Park Hills Rd, Gizzly Peak Blvd, Quail Ave, Vine Ln, Cedar St, Arcata St, Sather Rd, University Dr, South St, Pine Ave, Claremont Ave, Tunnel Rd, Chabot Rd, Highway 24, Highway 13.

23-15392 EPS Safety Element
Fig X Social Vulnerability Index

3 Hazards in Berkeley

The following sub-sections include descriptions of the historical impacts of hazards in Berkeley, projected climate changes, and potential impacts of these climate change hazards on communities and the built and natural environment. This section also describes existing programs that can mitigate impacts, along with a summary of the overall vulnerability to these climate change hazards.

3.1 Geologic and Seismic Hazards

An earthquake is caused by a sudden slip on a fault, releasing energy in waves that travel through the earth's crust and cause ground shaking. The strength and duration of this shaking depend on factors such as soil type, and the distance, size, depth, and direction of the fault rupture. The strongest shaking occurs near the fault, with horizontal shaking causing the most damage due to inadequate structural resistance (City of Berkeley 2024(a)).

Earthquakes often strike without warning and can result in damage ranging from minimal, with few or no injuries, to catastrophic, with extensive casualties. The severity of an earthquake is measured using the Modified Mercalli Intensity (MMI) scale, which assesses the intensity at a specific location based on observed impacts such as structural damage, changes in the earth's surface, and personal experiences. The MMI scale uses Roman numerals to indicate increasing intensity, with lower numbers representing effects on people and higher numbers indicating greater levels of structural damage. Additionally, Peak Ground Acceleration (PGA) is used to quantify earthquake intensity by measuring how strongly the ground shakes at a given location.

Earthquakes can lead to ground failure in several ways:

- **Surface Fault Rupture:** When a fault movement breaks through to the surface, it can severely damage structures like buildings, roads, and pipelines.
- **Liquefaction:** In wet, sandy, or silty soils, shaking causes soil grains to consolidate, pushing water to the surface and weakening the soil, leading to sinking or lateral spreading.
- **Seismically-Triggered Landslides:** Earthquake-induced shaking can trigger landslides, with ground displacements ranging from a few inches to tens of feet, enough to break typical foundations.

In addition to these geologic hazards, certain building types are especially vulnerable to seismic impacts. Soft-story buildings, typically multi-story structures with a weak or open ground floor, such as those with tuck-under parking, are at high risk of collapse during strong shaking. These structures are common in older residential areas and pose a significant threat to life safety and structural stability in the event of a major earthquake.

In Berkeley, the City has identified a significant number of vulnerable structures through its official inventory of potentially hazardous soft, weak, or open front buildings. As of September 2023, 291 soft-story buildings had completed seismic retrofits and were removed from the City's inventory. An additional 62 were removed for other reasons, such as not meeting the criteria for inclusion. However, 8 buildings obtained permits for a seismic retrofit, and 8 buildings remained out of compliance with the City's seismic safety requirements.

3.1.1 Earthquakes

Figure 5 shows Berkeley and its proximity to known active geologic faults in the San Francisco Bay Region. This map shows most of the San Francisco Bay Area, with Berkeley outlined and shaded in gray. Many red lines are displayed across the map in a northwest to southeast direction:

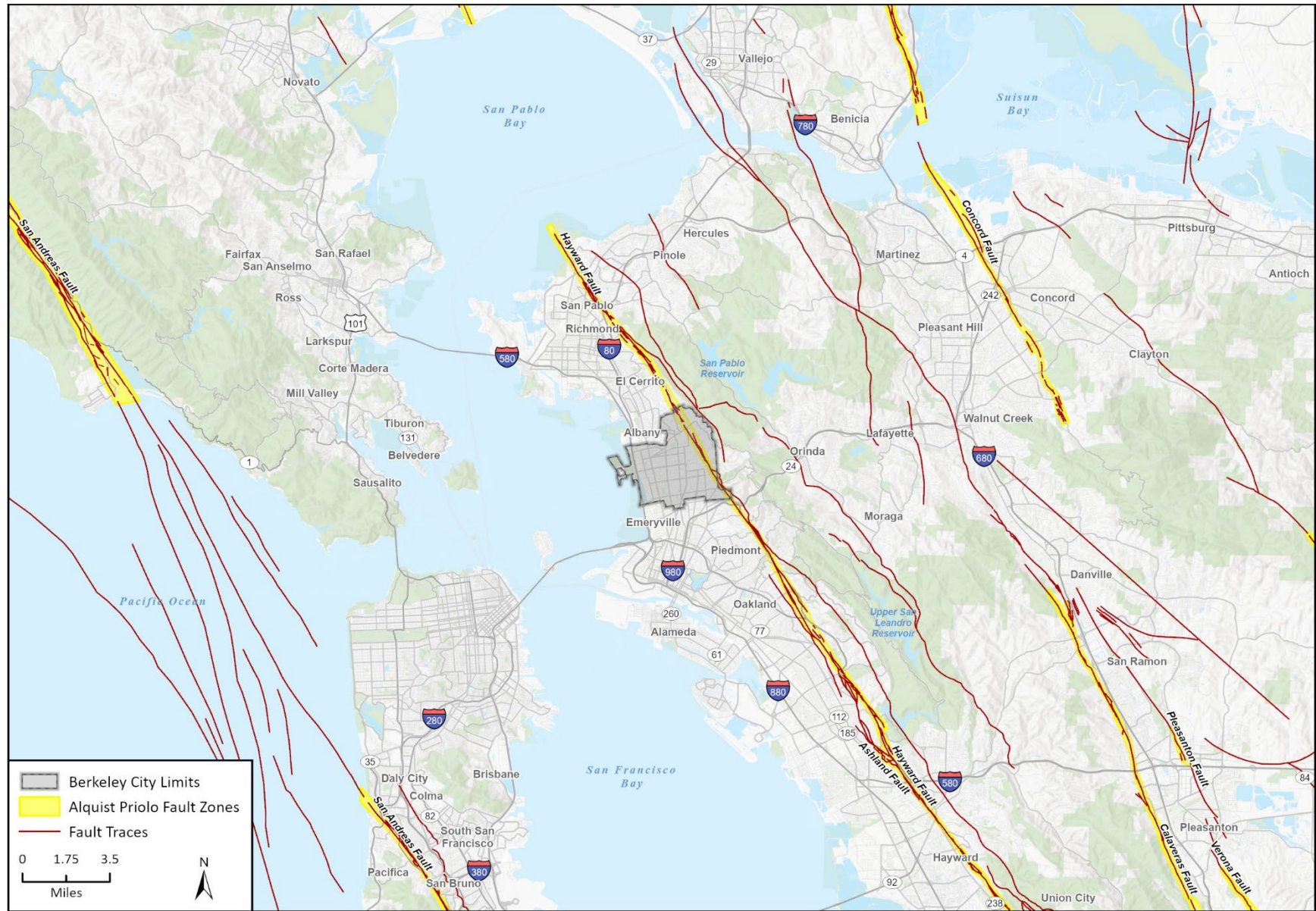
- On the western side of the figure, in the Pacific Ocean, multiple red lines move along the coast, starting and stopping. One of these lines begins in Marin, stretches through the ocean, and then continues through Daly City and down the peninsula, extended beyond the map boundaries. This is the San Andreas Fault.
- On the eastern side of the figure, another set of red lines show earthquake faults in the East Bay. One of these lines stretches from the middle of San Pablo Bay, crosses directly through the eastern section of Berkeley, and continues down the East Bay past Union City. This is the Hayward fault, which stretches to Milpitas, and is of particular concern in Berkeley.

Figure 5 and **Figure 6** also show the Alquist-Priolo Earthquake Fault Zones in yellow highlights, which are regulatory zones in California designed to mitigate the risks associated with surface fault ruptures. These zones surround the surface traces of active faults, which are faults that have shown movement within the last 11,000 years. The Alquist-Priolo Earthquake Fault Zoning Act was enacted in 1972 following the destructive 1971 San Fernando earthquake. The primary goal of the Alquist-Priolo Earthquake Fault Zoning Act is to prevent the construction of buildings intended for human occupancy directly on the surface traces of active faults. Structures must be set back a minimum distance from these faults, typically fifty feet. The Alquist-Priolo Earthquake Fault Zoning Act requires geologic investigations before new construction projects are permitted to ensure buildings are not placed on active faults. The California Geological Survey maps these zones, and the maps are used by the City to regulate land use and construction. The Alquist-Priolo Earthquake Fault Zone runs through Census Tract 2500 which contains communities facing social vulnerability.

A large earthquake on any of the illustrated faults could significantly impact communities throughout Berkeley. For example, the 1989 M 6.9 Loma Prieta earthquake was a rupture of the San Andreas fault, and the 2014 M 6.0 South Napa earthquakes occurred along the West Napa fault.

The Bay Area experienced its most recent significant earthquakes in 2022, with a magnitude 5.1 near San Jose in October and a magnitude 3.6 near El Cerrito in December, both causing minimal damage. There have been no federally-declared earthquake disasters in Berkeley since the last update to the Disaster Preparedness and Safety Element. Historically, destructive earthquakes in the Bay Area occurred in 1838, 1868, 1898, 1906, 1911, 1989, and 2014. The 2014 South Napa Earthquake (magnitude 6.0) caused significant damage, killing two people, injuring 300, and damaging over 2,000 structures. The 1989 Loma Prieta earthquake resulted in 62 deaths, primarily from the collapse of a highway in Oakland, with minor damage in Berkeley. The 1906 San Francisco Earthquake also caused structural damage in Berkeley, including chimney collapses and damage to public buildings. Smaller earthquakes over the years have caused slight damage in Berkeley.

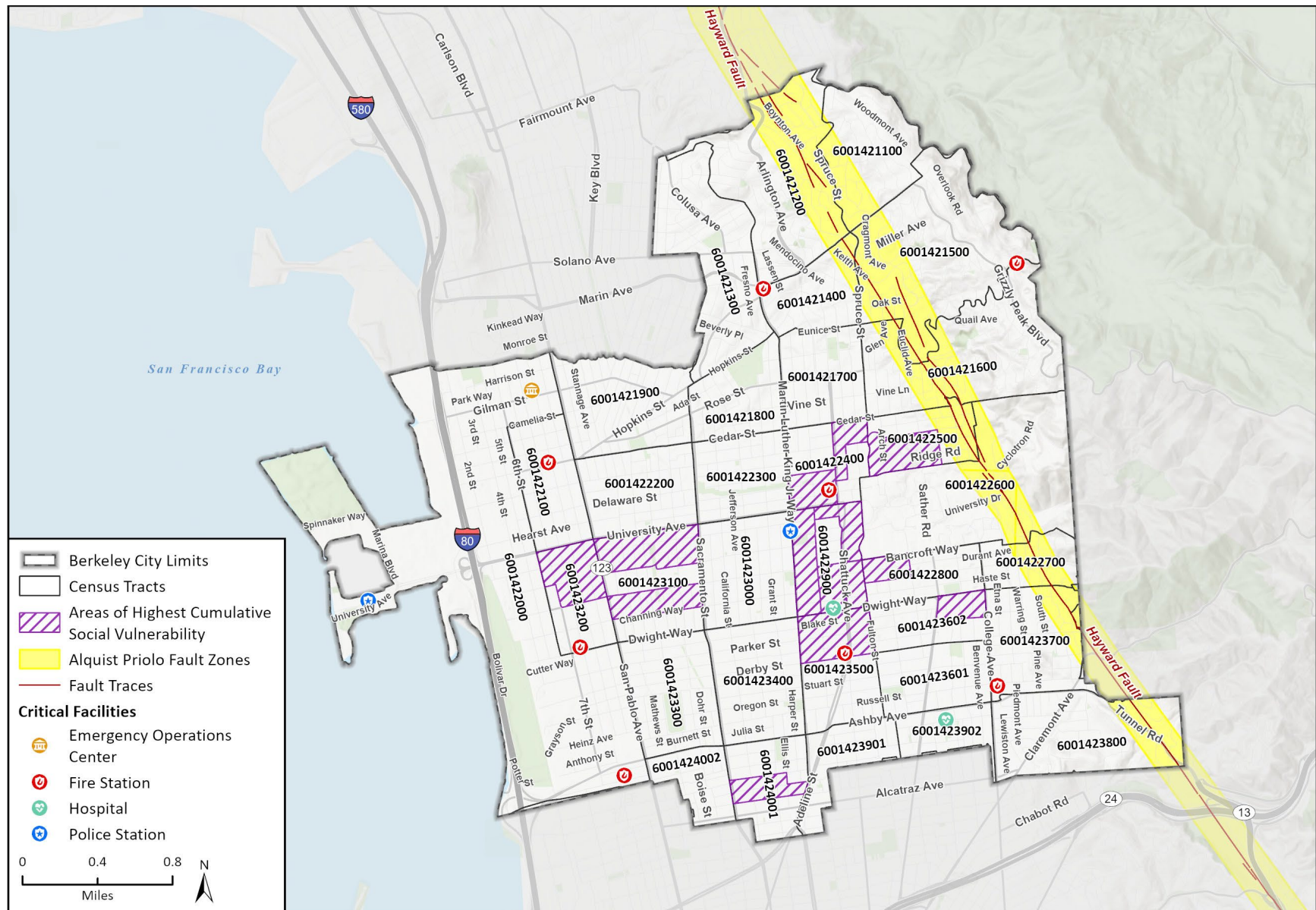
Figure 5 Faults in Berkeley and the Surrounding Area



Basemap provided by Esri and its licensors © 2025.
Additional data provided by CGS, 2024; USGS, 2022.

23-15392 EPS Safety Element
Fig X Faults Zoomed Out

Figure 6 Alquist Priolo Fault Zones



Basemap provided by Esri and its licensors © 2025. Additional data provided by CGS, 2017. Social Vulnerability Index and Critical Facilities provided by City of Berkeley, 2025.

23-15392 EPS Safety Element
Fig X Social Vulnerability and Faults

3.1.2 *Earthquake-induced Landslides and Liquefaction Hazards*

The USGS classified sediments in the Bay Area based on their susceptibility to liquefaction. **Figure 7** depicts the areas in Berkeley where soil types and groundwater conditions are more susceptible to liquefaction.

The following areas are shown in deep green, meaning they are in the liquefaction zone and experience liquefaction risk:

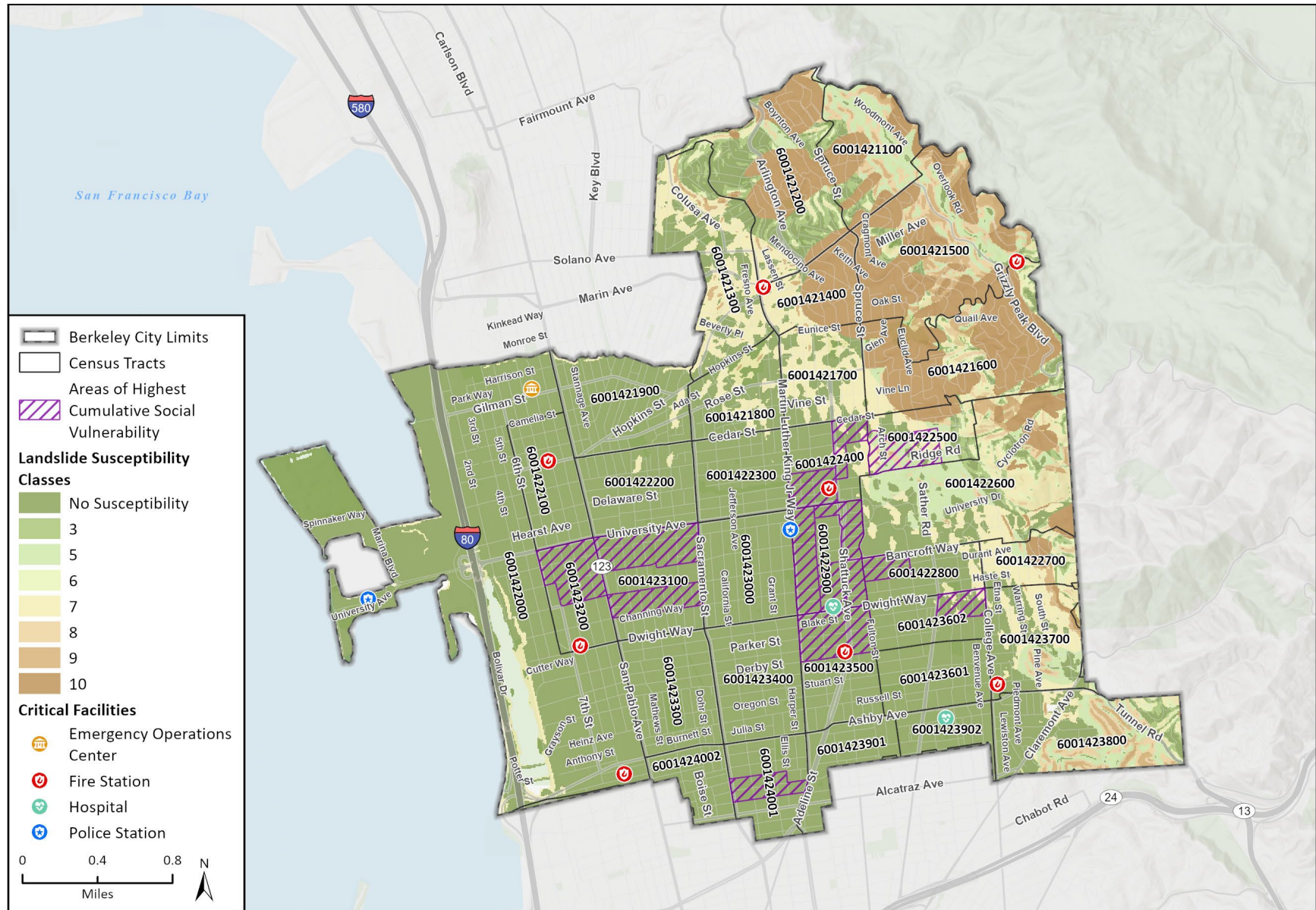
- The entire Berkeley Marina and Eastshore State Park
- Interstate 80
- Aquatic Park
- Codornices Creek and Strawberry Creek.
- In Northwest Berkeley, the zone begins at the shoreline and ends at San Pablo Ave
- In Southwest Berkeley, the zone begins at the shoreline and ends at McGee Ave

The California Geological Survey has identified the areas of Berkeley with potential to experience earthquake-induced landslide. All areas underlain by known active or dormant landslides are included in the zone. These areas are identified by combining information on rock or soil strength, slope gradient (steepness), and anticipated future shaking levels. In Berkeley, the potential for landslide from seismic activity is high in the hill areas and along creek banks. **Figure 7** indicates that significant portions of the Berkeley Hills have the potential to experience earthquake-induced landslide. These areas are shown in light brown on **Figure 7** throughout the Berkeley Hills (City of Berkeley 2024(a)).

Communities facing social vulnerability in Census Tracts 3200, 3100, 4001, and 2900 are at risk of liquefaction. In West Berkeley, three fire stations, both police stations, and the skilled nursing facilities, Chaparral House and Silverado Berkeley Memory Care are also susceptible to liquefaction. Additionally, one fire station in the Berkeley Hills, just east of Grizzly Peak Boulevard, is at risk of landslides.

The City of Berkeley offers transfer tax rebates for seismic work to encourage property owners to undertake voluntary seismic upgrades. Current or former owners of residential buildings, or mixed-use buildings with at least two residential units, can receive a rebate of up to one-third of the city's base 1.5 percent transfer tax for seismic strengthening work completed prior to or within a year of the property's sale. Eligible seismic improvements include bolting foundations, installing shear walls, securing chimneys, and other measures that significantly enhance building safety during earthquakes. To qualify, the work must comply with specific standards and guidelines, and property owners must obtain a building permit and confirm eligibility with the Berkeley Building & Safety Division (City of Berkeley n.d.(c)).

Figure 7 Seismically Triggered Landslide and Liquefaction Hazard Zones in Berkeley



Base map provided by Esri and its licensors © 2025. Additional data provided by CGS, Map Sheet 58, 2018. Social Vulnerability Index and Critical Facilities provided by City of Berkeley, 2025.

23-15392 EPS Safety Element
Fig X Social Vulnerability and Landslide Susceptibility

Potential Impacts

A catastrophic earthquake on the Hayward Fault would cause severe and violent shaking and three types of ground failure in Berkeley. Surface fault rupture could occur in the Berkeley hills along the fault, damaging infrastructure and utilities that cross the fault. Landslides are expected in the Berkeley hills during the next major earthquake, particularly if the earthquake occurs during the rainy winter months. Landslide movement could range from a few inches to tens of feet. Ground surface displacements as small as a few inches are enough to break typical foundations. Liquefaction is very likely in the westernmost parts of the city and could occur in much of the Berkeley flats. Liquefaction can destroy pavement, dislodge foundations, and damage underground and aboveground infrastructure.

Shaking and ground failure are likely to create impacts that ignite post-earthquake fires. Firefighting efforts will be simultaneously challenged due to broken water mains and damage to electrical, transportation, and communication infrastructure.

In a 6.9 magnitude earthquake on the Hayward Fault, the City estimates that over 600 buildings in Berkeley will be completely destroyed and over 20,000 more will be damaged. One thousand to 4,000 families may need temporary shelter. Depending on the disaster scenario, 100 people could be killed in Berkeley alone, and many more would be injured. Commercial buildings, utilities, and public roads will be disabled or destroyed. This plan estimates that building damage in Berkeley alone could exceed \$2 billion, out of a multi-billion-dollar regional loss, with losses to business activities and infrastructure adding to this figure.

Low-income housing units are expected to be damaged at a higher rate than other residences. Other types of housing, such as condominiums, may replace them when land owners rebuild. This could lead to profound demographic shifts in Berkeley.

Existing Programs to Offset Impacts

The City of Berkeley is implementing various programs to offset the impacts of seismic hazards in Berkeley. The list below provides information on Berkeley's existing programs.

- **Mandatory Earthquake Retrofit Programs:** The City of Berkeley requires owners of Unreinforced Masonry Buildings (URM) and Soft, Weak or Open Front Buildings (SWOF) to retrofit their property to make them safer in case of an earthquake. The City maintains inventories of URM and SWOF buildings per Berkeley Municipal Code Sections 19.38 and 19.39.
- **Funding for Seismic Retrofits:** The City offers programs to help property owners fund seismic retrofits of various building types including commercial buildings and multi-family and single-family residential buildings. These programs include the Earthquake Soft Story Retrofit Program for owner-occupied single-family homes, the Earthquake Brace and Bolt Program for owner-occupied residential buildings containing 1-4

dwelling units and the Retrofit Grants Program which reimburses property owners of eligible building types a portion of their design and/or construction costs for seismic retrofits. Additionally, new owners of residential buildings, including single-family homes, or mixed-use buildings with at least two residential units can receive a refund of their real estate transfer tax for voluntary seismic upgrades.

3.1.3 *Tsunami*

A tsunami occurs when a rapid disturbance vertically displaces water, causing a series of surges. This can be triggered by an underwater fault rupture or underwater landslides, typically caused by earthquakes. Tsunamis affecting the Bay Area can originate from offshore earthquakes within the region or from distant events, commonly from faults in Washington and Alaska. Local tsunamis can also be generated from underwater faults, such as the small tsunami triggered by the 1906 earthquake. The San Andreas Fault runs along the coast off the Peninsula, and the Hayward Fault runs partially through San Pablo Bay (City of Berkeley 2024(a)).

In 2021, the California Geological Survey and Cal OES updated the tsunami inundation maps for Alameda County, including Berkeley. The updated boundaries reflect the latest science and local geographic features impacting evacuation safety. **Figure 8**, shaded in blue, shows the potential tsunami inundation zone along Berkeley's shoreline. The zone includes areas from Fifth Street to Seventh Street at various points, capturing landmarks such as Golden Gate Fields, the Tom Bates Regional Sports Complex, Eastshore State Park, the Berkeley Marina, portions of Interstate 80, the San Francisco Bay Trail, the Amtrak Station, Aquatic Park, and the Fourth Street Business District. The Police Station at the Berkeley Marina is at risk to tsunami inundation. Communities living or working near the shoreline, including those in recreational, commercial, and transit areas, may be at elevated risk during a tsunami event. Individuals with limited mobility, limited access to transportation, or language barriers may face additional challenges evacuating quickly and safely.

In January 2023, an underwater volcano erupted near Tonga, leading to a tsunami advisory for Berkeley. Residents evacuated from boats, docks, and the shoreline, but no damage was reported despite noticeable swells and strong currents at the Berkeley Marina. The most recent damaging tsunami in Berkeley occurred after the March 2011 earthquake off the coast of Japan, causing a half-meter surge in Oakland and \$158,000 in damage to docks and boats at the Berkeley Marina. Tsunamis generally impact the Pacific Coast of California, with rare occurrences in the San Francisco Bay. Local tsunamis, or seiches, can be generated within the Bay by the Hayward fault, such as the seiche reported after the 1868 Hayward fault earthquake. The 1964 Alaska earthquake caused extensive tsunami damage in northern California near Crescent City, but data on impacts to Berkeley is unavailable.

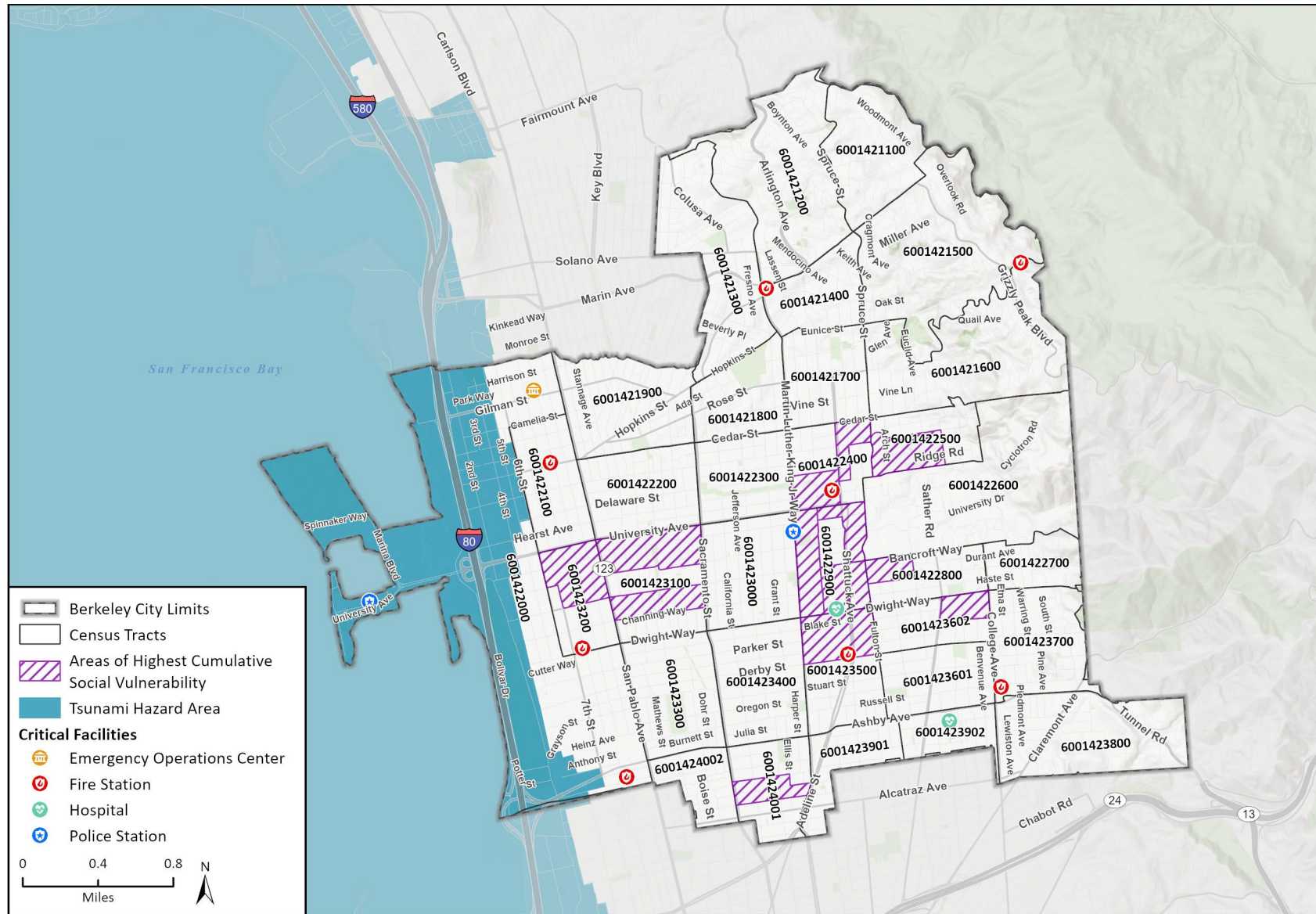
Potential Impacts

The March 2011 Japan earthquake generated a devastating tsunami, which reached the Bay Area and caused minor damage to docks and floats in the Berkeley Marina. A larger tsunami could impact much more of Berkeley's western shores. Berkeley's maritime community, which would be greatly impacted, includes low income individuals and households. Buildings, infrastructure, and roadways could be damaged, and debris and hazardous materials could cause post-tsunami fires. Deaths are possible if individuals choose not to evacuate hazardous areas, do not understand tsunami warnings, or are unable to evacuate.

Existing Programs to Offset Impacts

- **City of Berkeley 2024 Local Hazard Mitigation Plan (LHMP):** The 2024 LHMP outlines plans and strategies to offset the impacts of Tsunami. These plans include the repair of Berkeley Marina infrastructure, collaboration with state and federal agencies including the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency and community readiness efforts.

Figure 8 Berkeley Tsunami Inundation



Basemap provided by Esri and its licensors © 2025. Additional data provided by CGS, 2017. Social Vulnerability Index and Critical Facilities provided by City of Berkeley, 2025.

23-15392 EPS Safety Element
Fig X Social Vulnerability and Tsunami Hazards

3.2 Wildfire and Poor Air Quality

Background, Historical Impacts, and Climate Change Exposure

Wildfires have historically played a crucial role in maintaining the ecological balance in California and the East Bay, including Berkeley. However, the introduction of housing, invasive vegetation, and fire suppression in hillside areas has disrupted this balance, leading to catastrophic fires. A key concern in Berkeley is wildland-urban interface fires, which occur where natural landscapes and urban environments meet. Berkeley has a significant history of wildland-urban interface fires, including the 2017 Grizzly Fire, the 1991 Tunnel Fire, and the 1923 Berkeley Fire. The Grizzly Fire burned 20 acres in the Berkeley and Oakland hills, suspected to be caused by arson. The Tunnel Fire, fueled by strong winds, spread rapidly across Oakland and Berkeley, destroying neighborhoods and resulting in 25 deaths. The Berkeley Fire of 1923, driven by Diablo winds, burned 130 acres and left 4,000 people homeless. These historical fires highlight the vulnerability of Berkeley to wildland-urban interface fires, especially in areas where urban development meets natural landscapes (City of Berkeley 2024(a)).

Everyone in Berkeley can be affected by poor air quality from wildfires. Some neighborhoods experience moderate or unhealthy air quality on a regular basis due to proximity to pollution sources like highways and industry, and wildfire smoke can compound this chronic exposure, further worsening health risks for residents in these areas. There have also been several extreme examples of poor air quality that impacted the entire city due to nearby wildfires. In September and October of 2017, the wildfires in North Bay sent smoke to Berkeley, causing unhealthy air for sensitive groups, including infants, young children, people with respiratory illnesses, and people who live or work outside. In November 2018, smoke from the Camp Fire brought very unhealthy air quality. Schools were cancelled, and there were calls for the entire population to avoid outdoor activities for multiple days. In October 2019, smoke from the Kincade Fire brought unhealthy air to Berkeley for a few days. In September and October of 2020, multiple northern California wildfires brought very unhealthy air to the Bay Area for over twenty consecutive days. In August and September 2021, smoke from northern California wildfires created moderate air quality in the Bay Area for a few days. In December 2022, the Bay Area had unhealthy air mostly due to local residential wood burning and active wildfires in the state (City of Berkeley 2024(a)).

The State Fire Marshal is mandated to classify lands within State Responsibility Areas into Fire Hazard Severity Zones (FHSZ). Fire Hazard Severity Zones fall into one of the following classifications: Moderate, High, and Very High. In addition to State Responsibility Areas, the State Fire Marshal is also mandated to recommend maps of Very High Fire Hazard Severity Zones in Local Responsibility Areas in Berkeley. As shown in **Figure 9**, the State Fire Marshal designated Very High Fire Hazard Severity Zones in the northeast portion of Berkeley, along the entire eastern border of the City, and southwest of the University of California, Berkeley

campus. Following receipt of the State recommendation of Very High Fire Hazard Severity Zones, the City further interpreted the hazard and divided Berkeley into High and Very High Fire Hazard Severity Zones. These zone boundaries are adopted by the City Council, along with updates to the Fire Code.

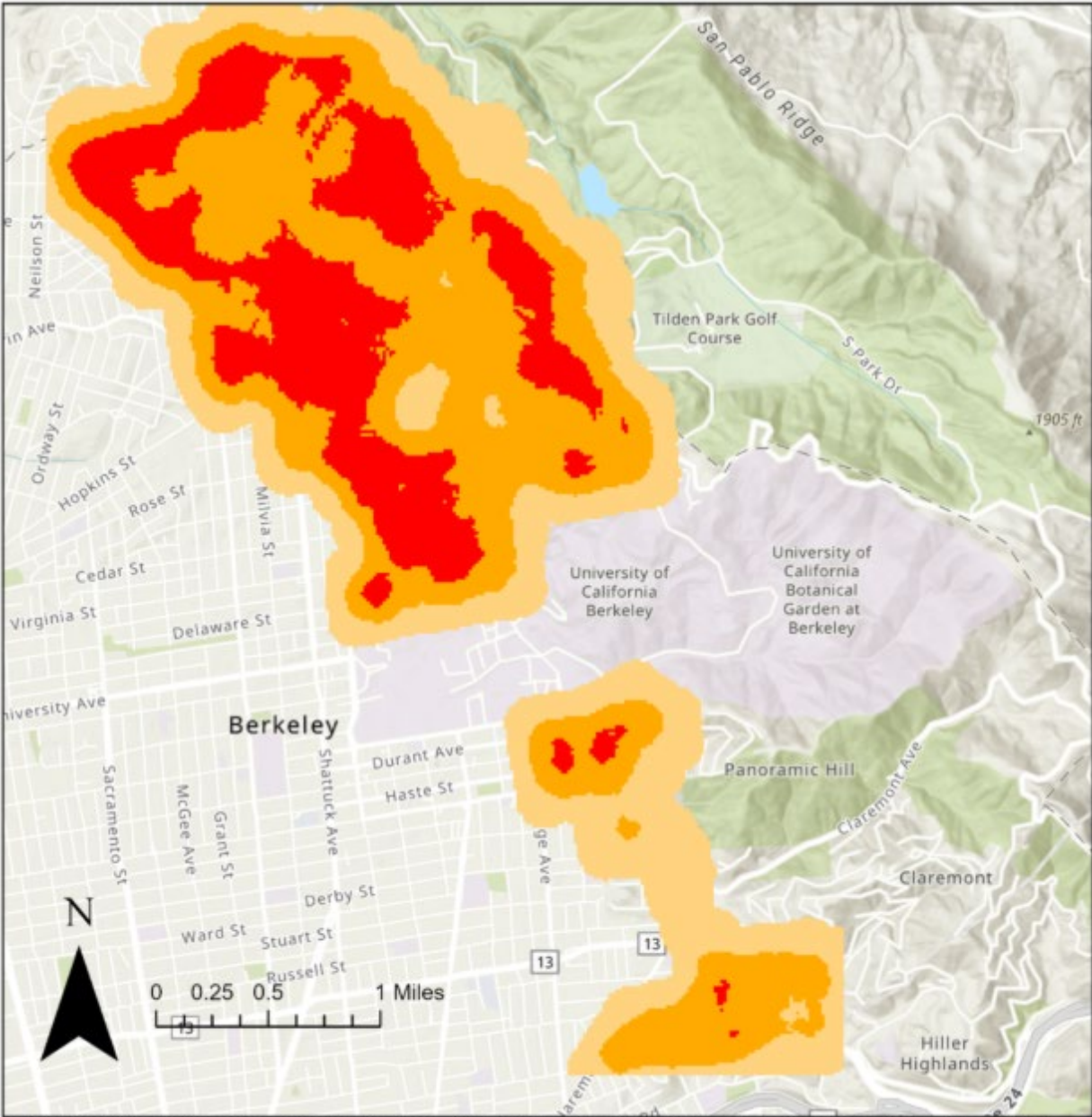
Increased structure density exacerbates the fire risk in wildland-urban interface areas. The rate of structure-to-structure ignitions rises with a higher number of structures per acre. The National Institute of Standards and Technology defines high structural density of wildland urban interface areas as more than two structures per acre. **Figure 10** illustrates that most regions of the Berkeley Hills have at least two structures per acre, classified as high structural density and depicted in dark orange. Additionally, areas marked in red, primarily in the north Berkeley Hills and around Panoramic Hill, represent the highest structural density in Berkeley's wildland urban interface areas, with more than four structures per acre (City of Berkeley 2024(a)). Areas in orange indicate high structural density with more than two structures per acre, while light orange areas show medium structural density with one or fewer structures per acre. **Figure 10** demonstrates that the structural density of Berkeley's hills areas will be a critical factor in fire spread.

Berkeley is particularly vulnerable to wind-driven fires originating from adjacent areas, posing significant risks to the community (City of Berkeley 2025). Based on climate change projections, by mid-century, the area burned in Alameda County is projected to increase between 13 percent (RCP 8.5) and 15 percent (RCP 4.5) (CEC n.d.). By end-century, the increase is expected to be between 4 percent (RCP 8.5) and 13 percent (RCP 4.5) (CEC n.d.). Changes in temperature, precipitation, and human development patterns will influence future fire frequency, potentially leading to more frequent and intense fires in Berkeley (Krawchuk 2012).

[illegible]

23-15392 EPS Safety Element
Fig X Social Vulnerability and Fire Hazard Severity Zones

Figure 10 Density of Structures in Berkeley Fire Zones 2 and 3, 2024



California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA

Structure density per acre



Potential Impacts

Wildfires pose serious risks to people in Berkeley, both from direct threats like fast-moving, wind-driven flames that can cause injuries or fatalities, and from widespread smoke that degrades air quality, especially harming sensitive groups such as children, seniors, and individuals with respiratory conditions (City of Berkeley 2024(a)). Wildfires significantly impact air quality by releasing a complex mixture of toxic fumes and particulate matter. Urban fires, in particular, pose an even greater risk, as they often involve the combustion of synthetic materials, plastics, treated wood, and industrial chemicals, producing more hazardous airborne toxins than vegetation alone. The smoke produced contains harmful pollutants such as carbon monoxide, volatile organic compounds, and fine particulate matter (PM2.5), which can penetrate deep into the lungs and even enter the bloodstream (U.S. EPA 2025). These pollutants contribute to respiratory and cardiovascular issues, aggravate existing health conditions like asthma, and increase the risk of heart and lung diseases (U.S. EPA 2025). Additionally, the spread of smoke can affect air quality far from the fire site, leading to hazardous conditions for communities miles away (Western Fire Chiefs Association 2024). These dangers are compounded in communities facing social vulnerability, which include communities of color (e.g., Black, African American, Indigenous, Native, Latinx, Hispanic, Asian, East Asian, Pacific Islander and other people of color), such as tracts 2400 and 2500, where residents may face additional barriers to evacuation, limited access to healthcare, fewer financial resources to prepare for or recover from disasters, and higher rates of pre-existing health conditions that increase sensitivity to smoke exposure.

Evacuation during wildfire events is particularly challenging in the Berkeley Hills, where narrow, winding roads can become quickly congested, delaying both residents trying to flee and emergency responders trying to reach people in need. These risks are even more severe for individuals with disabilities or limited mobility. Panoramic Hill is especially vulnerable due to its single, narrow access road that is difficult for fire apparatus to navigate and can be easily blocked by traffic, parked vehicles, or landslides, potentially trapping residents during an emergency (City of Berkeley 2024(a)).

Wildfires pose a significant threat to Berkeley's built environment, particularly in the wildland-urban interface. Intense heat from wildfire can rapidly damage or destroy homes and infrastructure, including roads, sidewalks, and drainage systems. Utility systems are especially at risk, as aboveground electrical, telephone, and cable lines, along with streetlights and traffic signals, can be destroyed by flames or heat. Fires can also compromise water infrastructure, leading to contamination and disruption of drinking water supplies, and can severely impact transportation and communication networks that residents, businesses, and institutions rely on daily (City of Berkeley 2024(a)). One fire station is located just east of Grizzly Peak Boulevard, in the City's High Fire Hazard Severity Zone.

Wildfires pose a serious threat to Berkeley's natural and cultural landscapes, including its parks, open spaces, and recreational areas. The East Bay Regional Parks, located just beyond the city's eastern edge, offer vital recreational and ecological value but are highly susceptible to wildfire damage. Similarly, Berkeley's overnight camps—set in scenic natural areas outside city limits—face increasing risk from wildfires, which could limit community access to outdoor experiences and cause long-term harm to sensitive ecosystems. These natural assets not only support biodiversity but also contribute to the city's environmental quality and residents' well-being (City of Berkeley 2024(a)).

Existing Programs to Offset Impacts

The Berkeley Fire Department is implementing various programs and protocols that help to offset the impacts of wildfire in Berkeley. The list below provides information on the programs in place to help offset wildfire impacts in Berkeley.

- **EMBER (Effective Mitigations for Berkeley's Ember Resilience).** Focuses on reducing the risk of structures igniting from wind-driven embers. A key requirement is Zone 0, the five foot buffer around a structure.
- **City of Berkeley Community Wildfire Protection Plan.** This citywide plan includes a set of wildfire mitigation policies and programs, including workforce training for fire inspectors and vegetation removal crews, annual defensible space inspections, and risk assessments for individual properties. Public awareness and education campaigns are conducted in multiple languages, with partnerships involving community groups like Firewise⁴ and Homeowner Associations (HOAs)⁵. The plan also includes fire weather information dissemination, community readiness exercises, and the development of safe road passages and evacuation procedures. Vegetation management around homes, including incentives for creating defensible space and home hardening retrofits, is emphasized. Fire ignition detection and enforcement measures, regional pre-attack coordination, and mutual aid agreements are also part of the plan. Additionally, the plan promotes hazardous tree and vegetation removal, urban forest health, and collaboration with partner departments to maintain public open spaces and disrupt fuel continuity in key fire pathways.

⁴ Firewise USA is a national program designed to help communities reduce wildfire risks. It provides guidelines and resources for homeowners to create defensible spaces around their properties, manage vegetation, and improve home resilience against wildfires. Firewise communities work together to implement these strategies, often holding meetings and volunteer activities to enhance their preparedness

⁵ HOAs are organizations within subdivisions, planned communities, or condominium buildings that enforce rules and guidelines for properties and residents. HOAs are typically run by a board of directors and collect fees to maintain common areas and facilities. They play a crucial role in community management, including aspects like landscaping, property maintenance, and sometimes even wildfire preparedness.

- **City of Berkeley 2024 Local Hazard Mitigation Plan (LHMP).** The 2024 LHMP outlines several high-priority actions to mitigate wildfire risks. These actions include updating and enforcing fire codes, managing vegetation to reduce fire risk, and promoting pedestrian evacuation routes in Fire Zones 2 and 3. The plan also focuses on improving responder access and community evacuation through roadway maintenance and parking restrictions, as well as researching and implementing infrastructure improvements to facilitate emergency evacuations. Additionally, the 2024 LHMP aims to mitigate wildfire risks at Berkeley's overnight camps, reduce fire hazards through utility undergrounding, and ensure an adequate water supply during emergencies by working with EBMUD. Coordination of regional wildfire mitigation strategies with key partners and stakeholders is also emphasized.
- **Berkeley Watershed Management Plan (2012).** This plan includes a program to have an integrated approach to fire safety. It emphasizes water quality protection, urban flooding reduction, natural waterways and habitat preservation, and rainwater re-use promotion. By enhancing the health of natural habitats and reducing urban flooding, the plan helps create conditions less conducive to severe wildfires.
- **EBMUD Climate Change Monitoring and Response Plan (2020).** This plan calls for improved fire protection measures to reduce demand for fire suppression. These measures are intended to be implemented by EBMUD on its own lands, and also in coordination with local jurisdictions, including Berkeley, and residents, who are encouraged to adopt fire-safe practices through land use planning, defensible space maintenance, and community preparedness efforts.
- **PG&E Climate Strategy Report (2022).** This report includes an incentive-based program for PG&E business and residential customers to promote the installation of equipment to generate and store energy, preparing customers for extreme weather events and possible Public Safety Power Shutoffs.
- **PG&E Climate Adaptation and Vulnerability Assessment (2024).** This assessment is designed to address the impacts of climate-driven natural hazards on PG&E's operations and infrastructure. This comprehensive plan analyzes how wildfires may affect PG&E's ability to provide safe and reliable energy. The assessment identifies potential vulnerabilities and outlines adaptation options to enhance resilience. It includes community engagement efforts to understand the specific needs of vulnerable populations and integrates climate risk into decision-making processes to ensure a clean and resilient energy system for all.
- **Berkeley Resilience Strategy (2016).** This strategy includes a program to prepare for wildfires in the Berkeley Hills. It focuses on building a connected and prepared community through initiatives like Community Emergency Response Training (CERT) classes, public awareness campaigns, and neighborhood emergency supply caches. The strategy also emphasizes adapting to the changing climate, enhancing regional resilience, and promoting reliable and clean energy. Additionally, it includes measures

for fire weather information dissemination, community readiness exercises, and the development of safe road passages and evacuation procedures.

- **Public Health Emergency Preparedness.** The City of Berkeley's Public Health Emergency Preparedness team implements the following plans and programs through messaging, alerts and Health Officer orders.
 1. **Public Health Messaging and Alerts.** The City's Health Officer has the authority to issue health orders, such as masking mandates or shelter-in-place advisories, to mitigate the effects of smoke, poor air quality, or infectious disease outbreaks. These orders are communicated through coordinated messaging systems to ensure timely and accessible information reaches all residents, including individuals with limited English proficiency or access to digital platforms.
- **Crisis & Risk Communications Plan Crisis & Emergency Risk Communication (CERC).** Developed by the U.S Centers for Disease Control and Prevention (CDC), the CERC helps communicators and emergency responders better reach people with information about disasters and other public emergencies. The City's Health Officer may issue a masking mandate or advise staying indoors, which can mitigate the effects of smoke and poor air quality. Further, personal protection equipment (PPE) can be distributed throughout the community, with a focus on communities that face social vulnerability.
- **Alameda County Public Health Smoke Response Program.** The City uses resources developed by Alameda County related to wildfire smoke communications.
<https://www.acgov.org/sustain/what/resilience/smoke.htm>
- **Medical Countermeasures Plan.** Developed by the U.S Food & Drug Administration (FDA), medical countermeasures (MCMs) are FDA-regulated products (such as PPE or vaccines) that may be distributed in the event of a public health emergency. The City's Health Officer may coordinate distribution at mobile sites throughout the city.

Wildfire and Poor Air Quality Vulnerability

Berkeley is significantly vulnerable to wildfires due to its topography, dense development in the wildland-urban interface, and the presence of communities facing social vulnerability. Fast-moving fires threaten lives, homes, infrastructure, and natural areas, while smoke exposure poses serious health risks, especially for sensitive groups. Evacuation challenges in hillside neighborhoods and limited mobility among some residents further increase risk. However, the City has taken significant steps to reduce these vulnerabilities through coordinated wildfire mitigation, emergency preparedness, public health protections, and regional partnerships aimed at improving resilience and response capacity related to wildfire and poor air quality.

3.3 Sea Level Rise

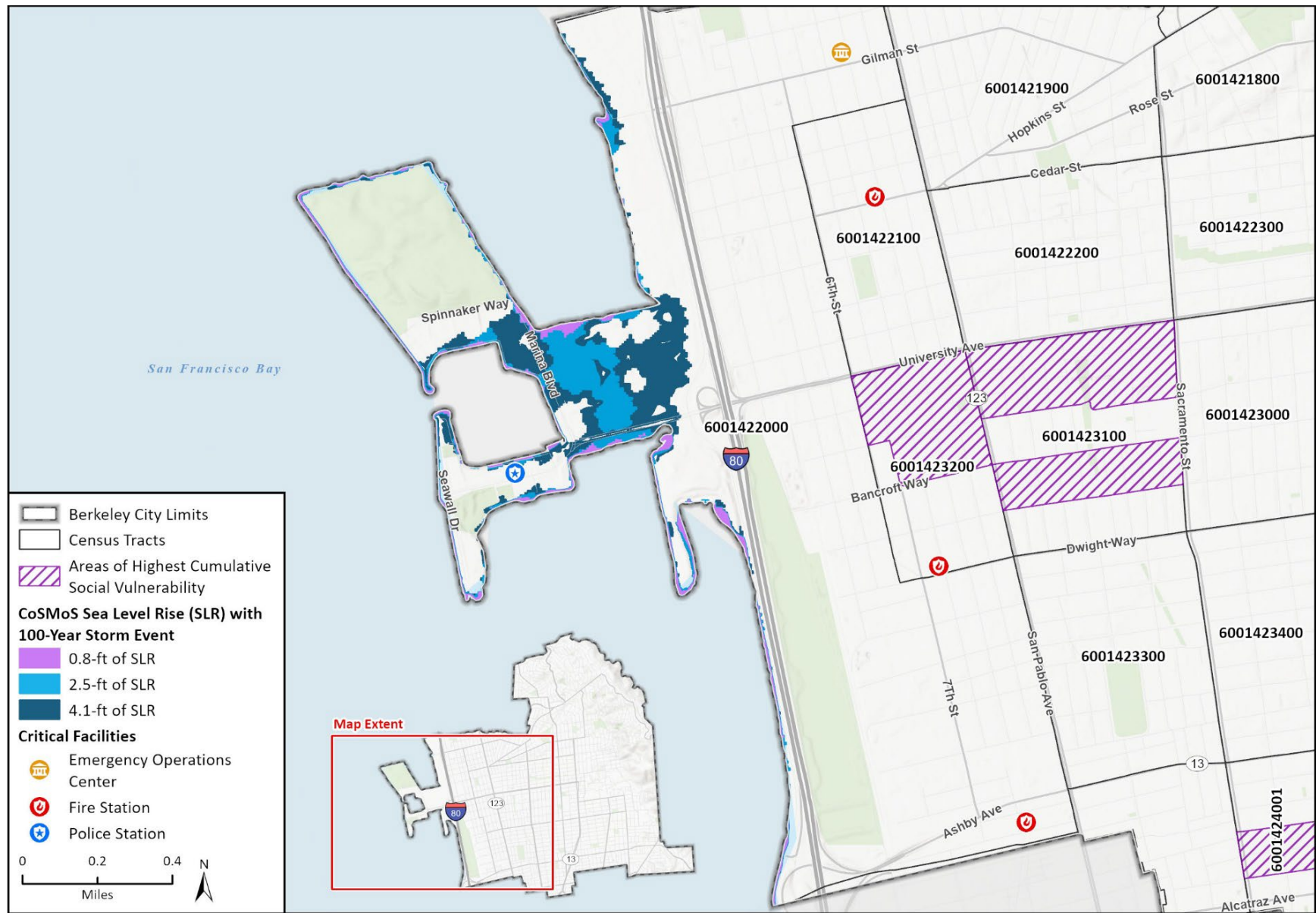
Background, Historical Impacts, and Climate Change Exposure

Historically, sea level rise has already impacted Berkeley by increasing the volume of ocean water due to melting ice and thermal expansion, which has directly influenced the San Francisco Bay. This rise in sea levels in Berkeley has led to flooding in low-lying coastal areas, infiltrating sewer systems, flooding basements, and damaging underground infrastructure. Additionally, the increased sea levels have heightened the risk of liquefaction during earthquakes, particularly in areas that have been filled for development (see section 3.1.2 Earthquake-induced Landslides and Liquefaction Hazards for more information on liquefaction hazards in Berkeley). It is estimated that the San Francisco Bay has already risen approximately 8 inches since 1900. These historical impacts underscore the vulnerability of Berkeley's shoreline and low-lying inland areas to sea level rise and its associated hazards (City of Berkeley 2024(a)).

Climate change projections indicate that sea levels could rise between 0.9 feet (2060 intermediate scenario and 2050 intermediate-high scenario) and 2.8 feet (2100 intermediate scenario and 2080 intermediate-high scenario) (California Sea Level Rise Guidance 2024). In extreme projections, sea level rise could approach 10 feet by the end of the century (BCDC 2024). This rise in sea level will exacerbate flooding risks, particularly in low-lying areas.

Figure 11 shows the inundation that may occur based on sea level rise of 0.8 feet, 2.5 feet, and 4.1 feet with a 100-year storm event using data from the Coastal Storm Modeling System (CoSMoS), which most closely aligns with the scenarios recommended by the California Ocean Protection Council 2024 California Sea Level Rise Guidance. Sea level rise is expected to mainly affect the shoreline areas of Berkeley, including Marina Boulevard and University Avenue west of the 580 Highway. The Berkeley Waterfront is the most vulnerable.

Figure 11 Sea Level Rise in Berkeley with 100-year Storm Event



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23-15392 EPS Safety Element
Fig X Social Vulnerability and Sea Level Rise

Potential Impacts

The Berkeley Waterfront, a critical community asset for recreation, education, and local businesses, faces potential financial impacts from sea level rise, including damage to buildings and infrastructure, loss of public resources and habitats, and reduced berth rental revenue (City of Berkeley 2024(a)). Although communities that face social vulnerability in Berkeley are not directly at risk from sea level rise inundation, the loss or degradation of shoreline parks, trails, and educational spaces can disproportionately affect residents with limited access to private transportation, low-income families who rely on free or low-cost outdoor spaces, youth programs, and older adults who benefit from accessible recreational areas. These groups may experience reduced opportunities for physical activity, social connection, and environmental education as a result of climate-driven changes to the waterfront.

Sea level rise threatens structures and infrastructure. The 2019 Draft Berkeley Marina Area Sea Level Rise Assessment identifies specific locations at the Berkeley Waterfront susceptible to future inundation. Consistent with **Figure 11**, the 2019 Draft Berkeley Marina Area Sea Level Rise Assessment identifies three locations in the Berkeley Waterfront that are most susceptible to intermittent inundation in the future due to Sea Level Rise: (1) Virginia Street Extension (north shore of McLaughlin Eastshore State Seashore) intersection with Marina Boulevard (2) South Shore of University Avenue (3) North-East side of the Berkeley Inner Harbor. Key transportation routes, such as underpasses and roads accessing Highway 80, are at risk of frequent flooding, impacting regional transportation. Additionally, Berkeley's stormwater and sanitary sewer systems, as well as natural gas pipelines, are vulnerable to inundation, potentially leading to service disruptions and methane leaks, which exacerbate climate change (City of Berkeley 2024(a)). None of the identified critical facilities are within the sea level rise inundation areas.

Cultural and natural resources are also at risk. The degradation of the revetment⁶ protecting the shoreline could lead to erosion and loss of landmass at César E. Chávez Park, impacting trails, recreational areas, and habitats, including Western Burrowing Owl habitat. Sea level rise will inundate beaches and shoreline habitats, altering the Bay ecosystem, reducing wetlands, and affecting water quality and wildlife. Land subsidence, common in the Bay Area, can expand areas susceptible to sea level rise. Additionally, climate change and nutrient pollution could increase harmful algal blooms, endangering human health, the environment, and the economy (City of Berkeley 2024(a)).

⁶ A revetment is a sloped structure placed on banks or shorelines made of materials such as rock, concrete, or geotextiles. Its purpose is to absorb and deflect the energy of incoming water, helping to prevent erosion and protect the land behind it.

Existing Programs to Offset Impacts

The City has two plans and one Study that include sea level rise mitigation programs, policies, and projects. The City's energy and natural gas provider is also evaluating their vulnerability to sea level rise impact. The list below provides information on the programs in place to help offset sea level rise impacts in Berkeley:

- **Berkeley Climate Action Plan (2009).** This plan calls for partnership with local, regional, and state agencies to reduce property damage associated with flooding and coastal erosion caused by sea level rise and more severe storm surge.
- **City of Berkeley LHMP (2024).** This plan includes a medium-priority mitigation strategy to mitigate the impacts of sea level rise in Berkeley.
- **Sea Level Rise Assessment Study for the Berkeley Marina (2019).** This study identifies three mitigation projects to mitigate sea level rise impacts in the Berkeley Marina. These include The Marina Boulevard Revetment Upgrade Project, University Avenue Shoreline Stabilization Project, and Collaborations with the East Bay Regional Park District for areas adjacent to or within their jurisdiction. The study projects sea level rise of 0.3 - 0.5 feet by 2030, 0.6 - 1.1 feet by 2050, and 3.4 feet by 2100 under high emission scenarios. The study also states that all current and upcoming capital projects in the Berkeley Marina near the shoreline will be designed to be resilient to mid-century sea-level rise and adaptable to end-of-century conditions.
- **PG&E Climate Adaptation and Vulnerability Assessment (2024).** This assessment is designed to address the impacts of climate-driven natural hazards on PG&E's operations and infrastructure. This comprehensive plan analyzes how sea level rise may affect PG&E's ability to provide safe and reliable energy. The assessment identifies potential vulnerabilities and outlines adaptation options to enhance resilience. It includes community engagement efforts to understand the specific needs of vulnerable populations and integrates climate risk into decision-making processes to ensure a clean and resilient energy system for all.

Sea Level Rise Vulnerability

While communities facing social vulnerability are not located directly within projected sea level rise inundation zones, they may still experience significant indirect impacts. These include reduced access to essential services, recreational spaces, and transportation routes, as well as economic disruptions tied to affected local businesses and employment centers. These communities often have fewer resources to adapt to or recover from such disruptions, due to systemic barriers such as underinvestment in infrastructure, limited mobility options, and historical exclusion from decision-making processes.

Although critical facilities are not currently located within areas projected to be directly inundated by sea level rise, they remain vulnerable to service disruptions caused by flooding of surrounding infrastructure, such as roads and utilities. These disruptions could hinder emergency response, healthcare access, and continuity of essential services.

Sea level rise poses a direct threat to the Berkeley Waterfront's natural resources. Public facilities, marinas, trails, and transportation infrastructure along the shoreline are at risk of flooding and long-term damage. In addition, coastal erosion and inundation could degrade sensitive habitats, reduce biodiversity, and limit access to recreational areas that support community well-being. Wetlands and shoreline ecosystems, which provide natural flood protection and carbon sequestration, are particularly at risk.

Existing programs aim to mitigate these impacts through various projects and partnerships, though most are broad in scope. However, there has been investment in localized studies to identify specific mitigation projects.

3.4 Groundwater Rise

Background, Historical Impacts, and Climate Change Exposure

Sea level rise can cause groundwater rise in coastal areas like Berkeley because rising sea levels exert pressure on the groundwater table, pushing it upwards. Sea level rise can cause marine flooding in coastal areas, and groundwater rise can cause the groundwater table to rise towards the ground surface or can cause groundwater inundation at the ground surface in low lying areas. Rising groundwater can mobilize contaminants at existing contaminated sites, dissolving them into the groundwater and transporting them with its flow. This can increase exposure for human and ecological receptors through several pathways:

- Bringing contaminants to the surface, increasing direct contact exposure.
- Bringing contaminants closer to or into building basements, increasing exposure through inhalation of vapors and direct contact.
- Flowing through more permeable soil, allowing contaminants to migrate more easily and increasing exposure through inhalation of vapors or direct contact.

Preferential pathways for this rising groundwater to flow in Berkeley include backfill materials for utility corridors, the utilities themselves, and historical creek alignments. Rising groundwater may also discharge into creeks and the San Francisco Bay, further increasing exposure for human and ecological receptors through direct contact.

The Shallow Groundwater Mapping project, conducted by the San Francisco Estuary Institute and Pathways Climate Institute, focuses on understanding the impact of sea-level rise on shallow groundwater levels in Alameda, Marin, San Francisco, and San Mateo counties. The project produced depth-to-groundwater maps for current conditions and ten future sea-level

rise scenarios. These maps highlight areas where groundwater may emerge or rise within 6 feet of the ground surface, posing risks to underground infrastructure (SFEI 2025).

In 2025, Rincon prepared the Groundwater Rise and Contaminated Site Analysis (Appendix B) for the City, which provides a detailed assessment and maps of current groundwater depth and contaminated sites within Berkeley. The report uses data from the Coastal Storm Modeling System (CoSMoS) to map the current groundwater levels across Berkeley. The groundwater table depth varies significantly across Berkeley, with some areas experiencing emergent groundwater at the surface, while others have groundwater depths ranging from 0 to 15 feet below ground surface. The hydraulic conductivity of the subsurface soil, which affects groundwater movement, was assumed to be moderate for purposes of the analysis (1 meter/day). This is important to note because higher hydraulic conductivity means contaminants can be more easily mobilized and transported by groundwater.

A total of 427 contaminated sites were identified within Berkeley using the GeoTracker and EnviroStor databases. These sites are categorized into several types, including:

- **Cleanup Program Sites:** 60 sites regulated under the SWRCB's Site Cleanup Program.
- **DTSC Cleanup Sites:** 46 sites including National Priorities List (Superfund), state response, voluntary cleanup, and corrective action sites.
- **DTSC Hazardous Waste Sites:** 2 sites.
- **Leaking Underground Storage Tank (LUST) Cleanup Sites:** 239 sites, primarily fuel-contaminated.
- **Land Disposal Site:** 1 site, the former Berkeley Landfill.
- **Non-Case Information Sites:** 42 sites with minimal impact or pending evaluation.
- **Permitted Underground Storage Tanks (USTs):** 33 sites.
- **Single-Walled UST Sites:** 4 sites required to be permanently closed by December 31, 2025.

As groundwater levels rise, contaminants at existing sites may be dissolved and transported more easily, posing new risks to human and ecological receptors. Rising groundwater levels associated with sea level rise will increase the risk of emergent groundwater at the surface, particularly in low-lying areas. Appendix B highlights that the hydraulic conductivity of the soil, which determines how easily groundwater can move through the subsurface, will play a crucial role in the extent of groundwater rise and the potential mobilization of contaminants. **Table 3** shows high, medium, and low priority contaminated sites for current conditions and sea level rise scenarios. The contaminated sites are ranked based on the potential risks posed by groundwater rise:

- **High Priority:** Sites where groundwater is at the surface or within 6 feet of the ground surface.

- **Medium Priority:** Sites where groundwater is deeper than 6 feet from the ground surface.
- **Low Priority:** Closed LUST sites, considered low threat due to natural attenuation of petroleum contaminants.

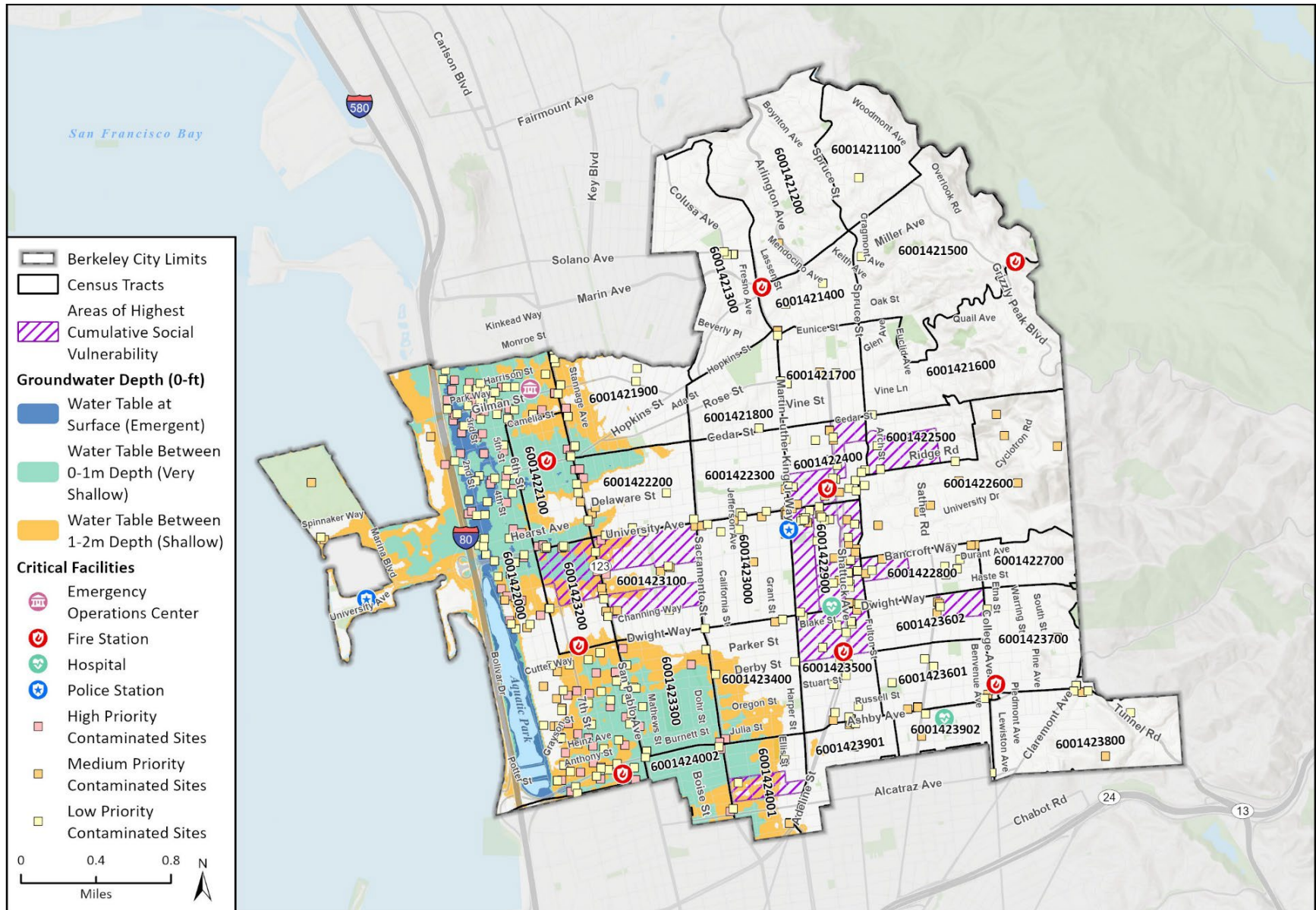
The rankings help guide policy decisions for disaster preparedness and environmental justice in Berkeley. Under current conditions, of the 427 contaminated sites within Berkeley, 100 are ranked as high priority, 100 as medium priority, and 227 as low priority. Going from current conditions to the 0.8 feet (25 cm) sea level rise scenario, only two sites change ranking from medium priority to high priority (the number of low priority sites remains the same). Going from the 0.8 feet (25 cm) sea level rise scenario to the 2.5 feet (75 cm) sea level rise scenario, no additional sites change ranking. **Figure 12** shows the locations of these sites and current conditions. As shown on **Figure 13** and **Figure 14**, the known contaminated sites are in areas where there is not projected to be a lot of change in GWR using the 0.8 feet (25 cm) and 2.5 feet (75 cm) sea level rise scenarios. For more details on the methodology and results of this analysis, refer to Appendix B.

There are high and medium priority sites currently located in areas with shallow groundwater depths (surface to 2 meter depth) within communities that face social vulnerability in Census Tract 3200, 4001, and 3100. These communities face increased health risks due to the potential mobilization of contaminants by rising groundwater. Communities that face social vulnerability often have higher rates of chronic health conditions, limited access to healthcare, and inadequate infrastructure as a result of long-standing, systems-driven inequities. These conditions contribute to higher rates of chronic health issues and increased exposure to environmental hazards, making communities that face social vulnerability disproportionately impacted by climate and public health risks. Additionally, three fire stations are located near these high and medium priority sites, which are also in areas with shallow groundwater depths.

Table 3 Priority Sites by Sea Level Rise Scenario

Projected Groundwater Depth From CoSMoS Groundwater Model	High Priority Contaminated Sites	Medium Priority Contaminated Sites	Low Priority Contaminated Sites
Current Conditions	100	100	227
0.8 feet (25 cm) Sea Level Rise Scenario	102	98	227
2.5 feet (75 cm) Sea Level Rise Scenario	102	98	227

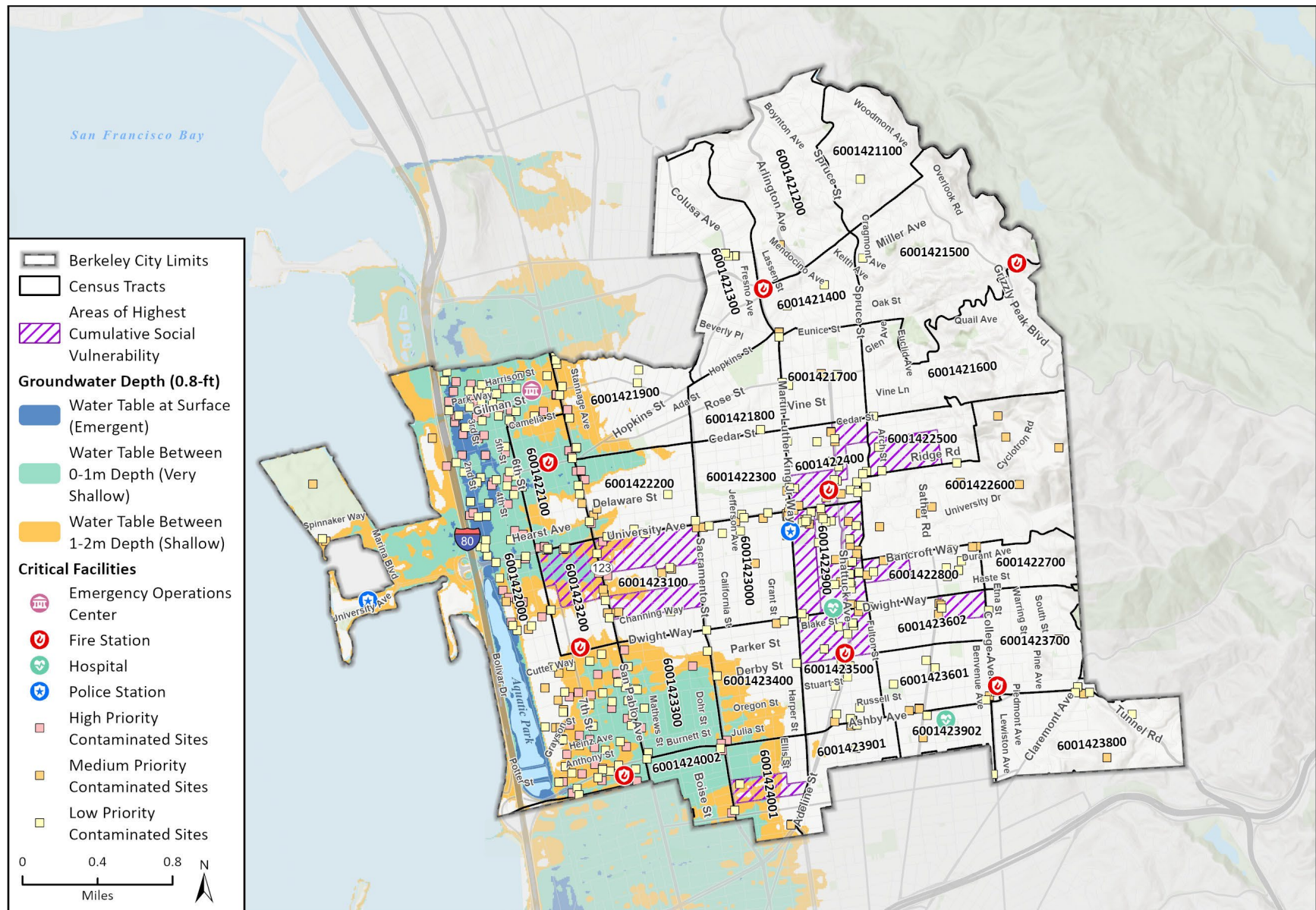
Figure 12 Groundwater Rise Current Conditions



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Fig X Social Vulnerability Index and Groundwater Current

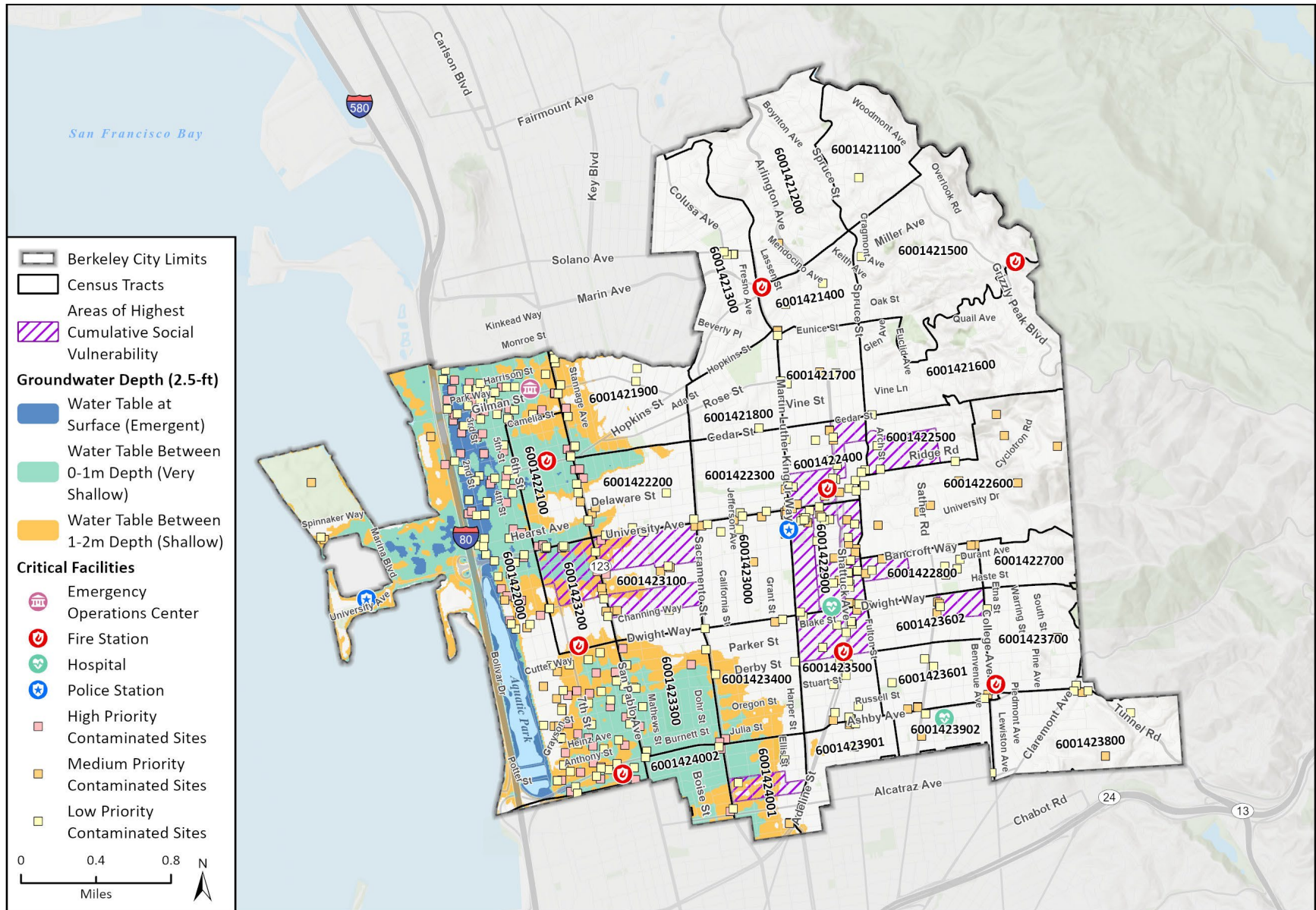
Figure 13 Groundwater Rise with 0.8 feet of Sea Level Rise



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23-15392 EPS Safety Element
Fig X Social Vulnerability Index and Groundwater 0.8 ft

Figure 14 Groundwater Rise with 2.5 feet of Sea Level Rise



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23-15392 EPS Safety Element
Fig X Social Vulnerability Index and Groundwater 2.5 ft

Potential Impacts

Communities facing social vulnerability have increased health risks due to the potential mobilization of contaminants by rising groundwater. Such communities often have higher rates of chronic health conditions, limited access to healthcare, and inadequate infrastructure, making them particularly susceptible to environmental hazards. These communities are already at risk of exposure to harmful contaminants due to groundwater rise. Future sea level rise is expected to worsen this issue, increasing the likelihood that contaminants will migrate into homes and public spaces in already-affected areas. However, under the 0.8 feet (25 cm) and 2.5 feet (75 cm) sea level rise scenarios, no new communities that face social vulnerability are projected to become newly exposed to this hazard. In other words, while the severity of exposure may increase in areas already at risk, the geographic extent of exposure remains largely unchanged under these modeled scenarios.

Groundwater rise can impact the built environment by increased flooding and infrastructure damage. Roadways may be eroded from below and home foundations could crack. Additionally, rising groundwater can infiltrate underground utility systems, such as gas lines, electrical conduits, and telecommunication infrastructure, leading to corrosion, short circuits, and potential service disruptions (MIT Technology Review 2021). There are three fire stations located near these high and medium priority sites, which are in areas where projected groundwater rise is within 6 feet (approximately 2 meters) of the ground surface. These shallow groundwater depths indicate a high potential for emergent groundwater or interaction with underground infrastructure under current and future sea level rise scenarios. In addition, two skilled nursing facilities, Chaparral House and Silverado Berkeley Memory Care, are also located in these areas and within communities that face social vulnerability. These facilities serve individuals requiring ongoing medical support who may face serious health risks if exposed to service disruptions or environmental hazards. Given the potential for groundwater rise to compromise roads, utilities, and building systems, there is an elevated risk that these sites may require evacuation or resident relocation, an especially complex process. No additional critical facilities are exposed under the 0.8 feet (25 cm) and 2.5 feet (75 cm) sea level rise scenarios.

Increased groundwater levels can impact the natural environment through contamination of freshwater sources, affecting both surface water and aquifers. This can disrupt local ecosystems, leading to habitat loss and reduced biodiversity. For example, coastal aquifers may experience seawater intrusion, impacting aquatic habitats (IISD 2020). Additionally, changes in groundwater levels can alter the hydrology of wetlands and other sensitive ecosystems, further stressing native plant and animal species (Davamani et al. 2024).

Existing Programs to Offset Impacts

Currently, there are no programs in place to mitigate the impacts of groundwater rise in Berkeley. However, the City has conducted the analysis presented in Appendix B as an initial step towards developing such programs. Appendix B includes recommended strategies for the City to deploy to limit impacts.

Groundwater Rise Vulnerability

West Berkeley, especially the communities facing social vulnerability in Census Tracts 3200, 4001, and 3100, is significantly vulnerable to groundwater rise due to current exposure and the absence of programs to mitigate these impacts. Communities in these areas are currently at risk of contaminant exposure due to groundwater rise. Additionally, three fire stations located west of San Pablo Avenue are also vulnerable to groundwater rise due to current exposure. These fire stations are located in areas with potential for emergent groundwater or interaction with underground infrastructure under current and future sea level rise scenarios.

3.5 Extreme Heat

Background, Historical Impacts, and Climate Change Exposure

Extreme heat in Berkeley is characterized by days above 87.6°F (CEC n.d.). Warm nights are defined as nights that do not cool below 60.0°F (CEC n.d.). The urban heat island (UHI) effect exacerbates these conditions, particularly in densely built areas with limited vegetation and abundant dark surfaces that absorb and release heat. The urban heat island effect can worsen air quality, particularly ground-level ozone, in urban environments.⁷ Berkeley's tree canopy, which varies significantly across different areas, helps mitigate the UHI effect by providing shade and cooling. Although the Berkeley Hills have a greater tree canopy, temperatures are often higher there than in the rest of Berkeley, due to thermal belting. Thermal belting occurs when heat absorbed by the ground during the day radiates upward at night, causing cooler air to sink into the valley and warmer air to rise and become trapped on the hilltop. In Berkeley, this results in the hills being hotter at night during extreme heat events compared to the rest of Berkeley (City of Berkeley 2024(a)). However, communities in the Berkeley Hills may be better resourced to cope with these conditions, with access to higher-quality housing, air conditioning, and healthcare, resources that are often limited in communities facing social vulnerability, where residents may live in older housing stock and face additional barriers to climate resilience.

⁷ For more information on the impacts of poor air quality in Berkeley, refer to the City of Berkeley Environmental Justice Existing Conditions Report.

Berkeley has experienced regular extreme heat events from 2019 to 2023, though none have been federally declared disasters (City of Berkeley 2024(a)). Notable events include:

- **July 2006:** 5 days above 110°F in the Bay Area, resulting in approximately 75 heat-related deaths.
- **August 2017:** Record-setting temperatures, with a high of 108.5°F in Berkeley and six heat-related deaths in nearby counties.
- **June 2019:** An early season heat wave caused multiple power outages and three fatalities.
- **August 2020:** A prolonged heat wave with record-breaking temperatures, dry thunderstorms, and the worst air quality in the world due to wildfires.
- **September 2020:** Excessive heat and dry conditions broke numerous records, flared up wildfires, and caused widespread smoke and ash.
- **July 2021:** High temperatures up to 110°F, warm overnight lows, and the Diablo Fire due to dry conditions and breezy winds (City of Berkeley 2024(a)).

Climate change is expected to increase the frequency, duration, and seasonal occurrence of extreme heat events, worsening air quality, increasing fire risk, and straining utilities, potentially leading to power outages (City of Berkeley 2024(a)). In Berkeley, average maximum temperatures are expected to rise between 3.9°F (RCP 4.5) and 6.7°F (RCP 8.5) by the end of the century, while average minimum temperatures are projected to increase by 3.8°F (RCP 4.5) to 6.6°F (RCP 8.5) (CEC n.d.).⁸ Historically, the region experienced an average of 3 extreme heat days per year between 1961-1990. By the end of the century, this number is expected to increase by 5 days per year under RCP 4.5 and approximately 12 days per year under RCP 8.5 (CEC n.d.). **Figure 15** and **Figure 16** show changes in average maximum temperature and extreme heat days, with purple lines representing high emissions scenarios (RCP 8.5), blue lines showing medium emissions scenarios (RCP 4.5), and grey lines indicating current trends. The shaded areas represent the range of data for each emissions scenario.

⁸ Compared to the 1961 - 1990 baseline.

Figure 15 Annual Average Maximum Temperature in Berkeley

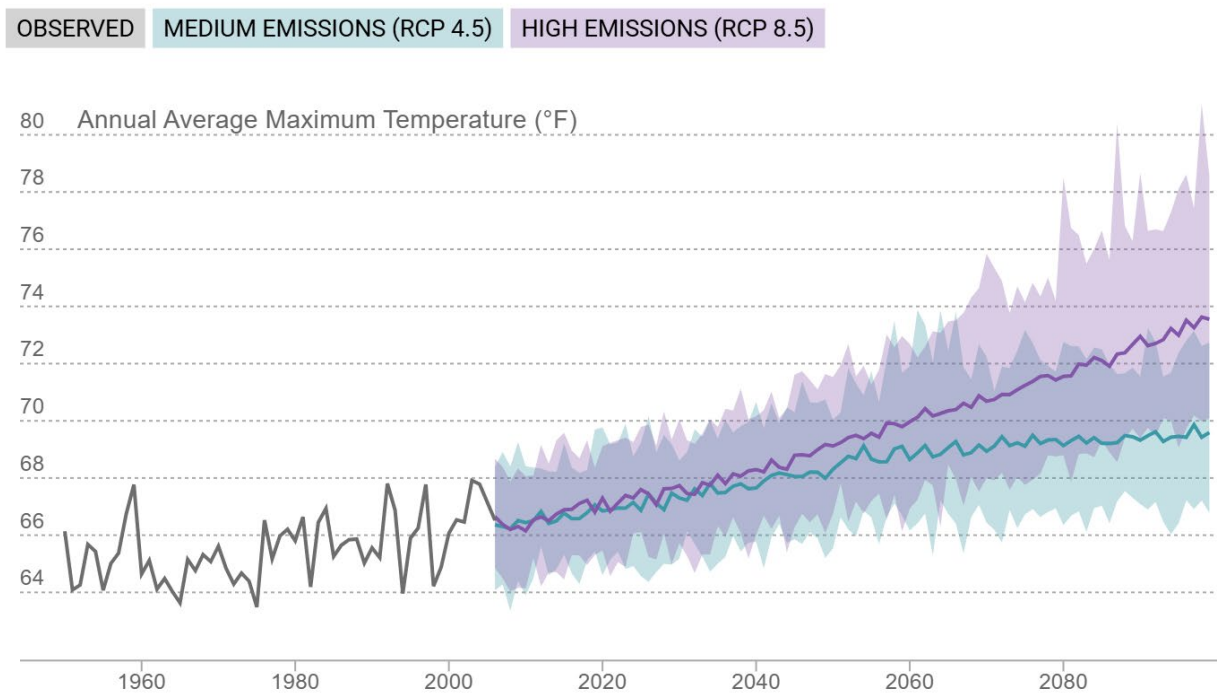
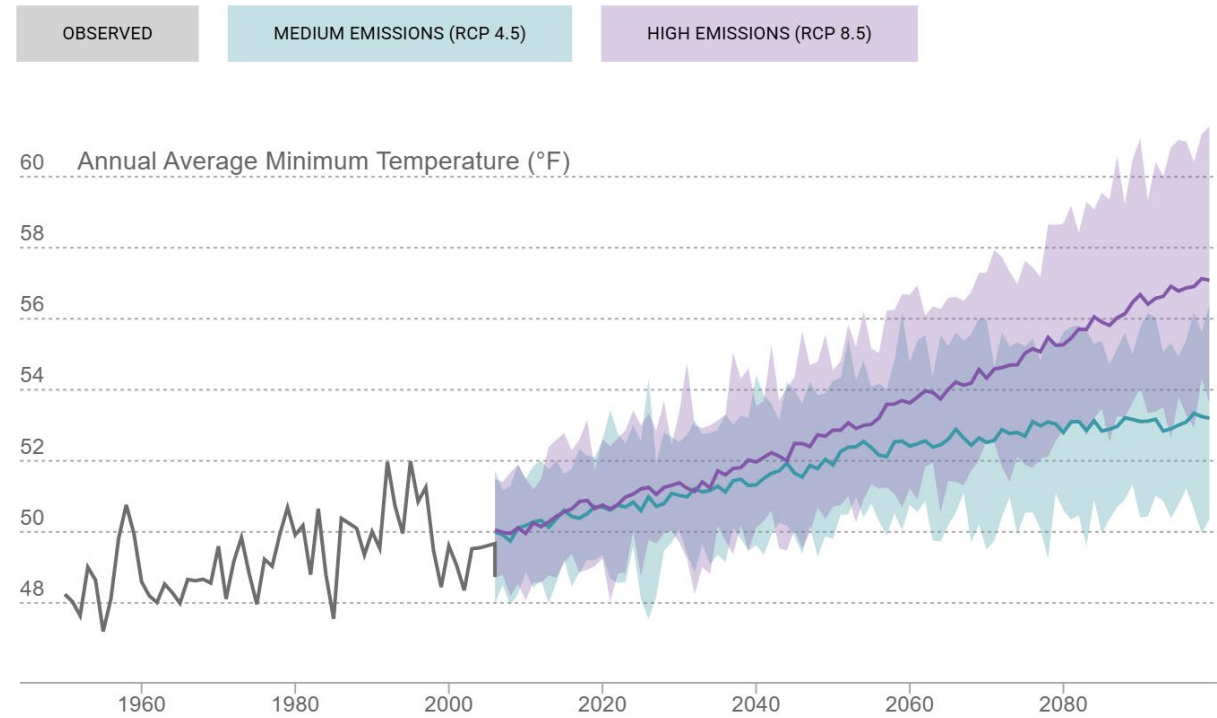


Figure 16 Extreme Heat Days in Berkeley



Potential Impacts

Extreme heat poses significant health risks to communities facing social vulnerabilities such as outdoor workers, people experiencing homelessness, seniors, young children, and individuals with chronic health conditions. These groups are at higher risk of heat-related illnesses, including heat stress, heat stroke, and dehydration, all of which can be life-threatening. Limited access to air conditioning and cooling centers exacerbates these risks. Communities experiencing social vulnerability, including communities of color (e.g., Black, African American, Indigenous, Native, Latinx, Hispanic, Asian, East Asian, Pacific Islander and other people of color) often live in housing with insufficient protection against extreme heat, further increasing their susceptibility to health impacts (Stanford Report 2023). In Berkeley, people experiencing homelessness are especially vulnerable due to their high exposure to heat and limited access to cooling resources. Unhoused individuals in urban areas like Berkeley face significant challenges in coping with extreme heat, including limited access to shade, water, and air-conditioned spaces (Gabbe et al. 2023). These individuals often experience heat-related illnesses such as dehydration, heat stroke, and exacerbation of pre-existing conditions like cardiovascular disease and diabetes (Gabbe et al. 2023). Additionally, barriers such as lack of information, transportation barriers, and restrictive policies at cooling centers further complicate their ability to seek relief (Gabbe et al. 2023).

The City of Berkeley has existing public facilities with air conditioning such as libraries and Senior Centers. In Berkeley, barriers to accessing these resources include reduced hours on weekends and holidays and limited hours of operation on weekday afternoons when temperatures peak. A lack of awareness of the danger of extreme heat and the availability of these facilities results in underutilization of these resources.

Extreme heat can strain hospitals and cooling centers, which are essential for providing relief during extreme heat events. Increased demand for medical services during extreme heat events can overwhelm healthcare facilities, leading to longer wait times and reduced capacity to treat patients (OASH 2023). Emergency responders may also face increased workloads, impacting their ability to respond effectively to other emergencies (DHS 2023). Extreme heat can lead to infrastructure damage and increased energy consumption. When temperatures exceed approximately 90°F, materials like asphalt and concrete can expand and buckle, causing damage to roads, railways, and bridges. This can result in transportation disruptions, increased maintenance costs, and safety hazards (CalHeatScore, 2024; Sustainable Earth Reviews, 2024). Additionally, cooling systems, including air conditioning units, become less efficient when temperatures rise above 95°F, leading to higher energy consumption and costs for building owners and occupants (U.S. EPA, 2023; ASID, 2023).

Extreme heat can impact the natural environment in Berkeley, including parks, forests, and wildlife habitats. High temperatures can cause heat stress and dehydration in wildlife, disrupting reproductive cycles and increasing mortality rates (State of California 2022). Plants may suffer from heat stress and drying, leading to reduced growth and increased susceptibility to pests and diseases (California Climate Adaptation Strategy n.d.). The timing of seasonal

warmth may not align with food availability, causing further stress to dependent species (State of California 2022). In Berkeley, areas with urban parks, green spaces, and coastal habitats are particularly vulnerable to these impacts (California Climate Adaptation Strategy n.d.).

Existing Programs to Offset Impacts

The City has several plans that include extreme heat mitigation programs, policies, and projects. The list below provides information on the programs to help offset extreme heat impacts in Berkeley.

- **2009 Berkeley Climate Action Plan.** This plan includes several policies and programs to offset extreme heat impacts. Key initiatives involve expanding urban tree canopy to provide shade and reduce heat island effects, promoting green building standards that incorporate cool roofs and energy-efficient designs, and enhancing green infrastructure such as rain gardens and permeable pavements to improve urban cooling. Additionally, the plan emphasizes community outreach and education on heat resilience and the benefits of green spaces. These measures collectively aim to create a cooler, more sustainable urban environment in Berkeley.
- **City of Berkeley 2024 LHMP.** This plan includes a high-priority mitigation strategy to reduce Berkeley's vulnerability to extreme heat events and associated hazards.
- **2012 Berkeley Watershed Management Plan.** This plan includes several policies and programs that indirectly contribute to mitigating extreme heat. Key initiatives include the use of green infrastructure measures such as bioretention cells, permeable paving, and vegetated swales, which help manage stormwater runoff and reduce urban heat island effects by increasing vegetation and permeable surfaces. Low impact development strategies aim to mimic natural hydrologic processes through conservation and small-scale stormwater controls, including rainwater harvesting and green roofs, which provide shade and cooling through evapotranspiration. The plan also emphasizes the importance of maintaining a healthy tree canopy to intercept rainwater and provide shade, thereby reducing heat stress in urban areas. Additionally, public outreach and education efforts are included to raise awareness about water resources and pollution prevention, which can also encompass the benefits of green spaces and vegetation in mitigating heat. These programs collectively contribute to creating a cooler, more resilient urban environment in Berkeley.
- **PG&E Climate Adaptation and Vulnerability Assessment.** This assessment includes specific considerations for extreme heat and maximum temperatures. The assessment analyzes how rising average and extreme temperatures can impact PG&E's infrastructure and operations. Extreme heat poses a threat to the electric system by increasing energy demand as customers use more electricity to cool their homes and businesses. Additionally, upgrades may be necessary to protect the company's infrastructure from heat damage and operational constraints.

- **Berkeley Resilience Strategy (2016).** This strategy includes a program to enhance community partners with preparedness tools, supplies and equipment to serve the communities that have been made the most vulnerable during events like extreme heat.

Extreme Heat Vulnerability

Extreme heat poses significant health risks to Berkeley's communities, especially communities facing social vulnerability such as outdoor workers, people experiencing homelessness, seniors, young children, and individuals with chronic health conditions. These groups are at higher risk of heat-related illnesses like heat stress, heat stroke, and dehydration. Limited access to air conditioning and cooling centers exacerbates these risks. Communities facing social vulnerability, including communities of color (e.g., Black, African American, Indigenous, Native, Latinx, Hispanic, Asian, East Asian, Pacific Islander and other people of color), often live in housing with insufficient protection against extreme heat as a result of systemic barriers such as discriminatory housing policies, underinvestment in infrastructure, and limited access to affordable, climate-resilient housing. These conditions increase exposure to heat-related health risks and reflect broader patterns of environmental and social inequity.

Extreme heat can also strain critical facilities, damage infrastructure, and impact the natural environment. Existing City programs, such as the 2009 Berkeley Climate Action Plan, the 2024 LHMP, and the 2012 Watershed Management Plan, include initiatives to mitigate extreme heat impacts through urban tree canopy expansion, green building standards, and green infrastructure enhancements.

3.6 Storm Drain Overflow and Creek Flooding

Background, Historical Impacts, and Climate Change Exposure

Floods occur when there is an overflow of water in areas that are normally dry. In Berkeley, three types of flooding typically occur: coastal flooding (described in section 3.3 Sea Level Rise), storm drain overflow, and creek flooding. Groundwater rise, driven by sea level rise and also capable of causing flooding, is detailed in section 3.4 Groundwater Rise.

Storm Drain Overflow

Berkeley's storm drainage infrastructure collects urban runoff and directs it to the Bay or nearby watercourses. Overflow can occur due to rainfall exceeding storm drain design thresholds, blockages, or damage to the infrastructure. Most of the system is designed to handle a 10-year storm, which is cost-effective and guides the sizing of drainage facilities. However, many components are over 90 years old, with eroded concrete pipes, corroded metal pipes, and sinkholes forming due to soil entering through cracks and defects (City of Berkeley 2024(a)).

The City maintains approximately 93 miles of storm drain pipelines and appurtenant structures in the public right-of-way and in easements. The City is responsible for the maintenance of approximately 0.5 miles of open creeks and nearly 4 miles of creek culverts running in the right of way or in City owned properties. A majority of the City's stormwater assets are nearing or past their expected useful life and others require an evaluation of hydraulic capacity.

During storms and flooding, community members call Berkeley's 3-1-1 service to report locations of storm drain backup or other locations where water is pooling. From January through June of 2023, which included two federally-declared storm emergencies, community members throughout Berkeley reported issues with storm drain overflow (City of Berkeley 2024(a)).

Creek Flooding

Like many urban areas, Berkeley's creeks have been impacted by urban development. Some stretches of creeks are completely contained within culverts, while open channel segments are often interrupted by shorter culverts to accommodate streets and development. Creeks in West Berkeley flow year-round, whereas the upper reaches of creeks only flow briefly after rainfall. When runoff exceeds a creek's capacity, floodwaters can overtop the banks, inundating properties and streets. Creek flooding in Berkeley typically originates on private property. To mitigate this, the City increases cleaning efforts in public rights-of-way before and during significant rainfall events. Residents are responsible for maintaining creeks and related infrastructure within their property.

The 100-year floodplain represents areas with a 1 percent chance of experiencing creek flooding in any given year, while the 500-year floodplain has a 0.2 percent chance of flooding annually. Areas within the 100-year Floodplain are also expected to flood during a 500-year flood scenario. Due to the rarity of floods reaching the 500-year Floodplain level, they are less researched, and specific impacts are less understood.

As shown in **Figure 17** in blue, in Berkeley the 100-year Floodplain is located:

- Along the edge of the Bay
- Along the interior edge of the Aquatic Park lagoon
- Along Cordonices Creek in northwest Berkeley
- Along Strawberry Creek in central Berkeley (on the University of California campus).

The following street segments are in the 100-year Floodplain:

- Along Cordonices Creek: 580 Highway, 2nd St., 5th St., 6th St., 8th St., 9th St., 10th St., Sacramento St., Monterey Ave.
- Potter St.
- Bay St.

- West Frontage Rd.
- On the UC Berkeley campus: Frank Schlessinger Way, West Entrance, Wickson Rd.

As shown in **Figure 17** in orange, the 500-year Floodplain both expands on areas in the 100-year floodplain, and adds more area to show:

- Additional inundation along the edge of the Bay
- Significant inundation of the McLaughlin Eastshore State Park in the land north of University Ave.
- Significant inundation of the Marina in the land west of Marina Blvd. and south of Spinnaker Way
- Inundation in West Berkeley between Interstate 80 and approximately 4th St.
- Inundation along Strawberry Creek in Central Berkeley, from Sacramento St. west to Strawberry Creek Park
- Inundation along Claremont Creek in the Temescal area, on Claremont between Hazel Rd. to Berkeley's southern border.

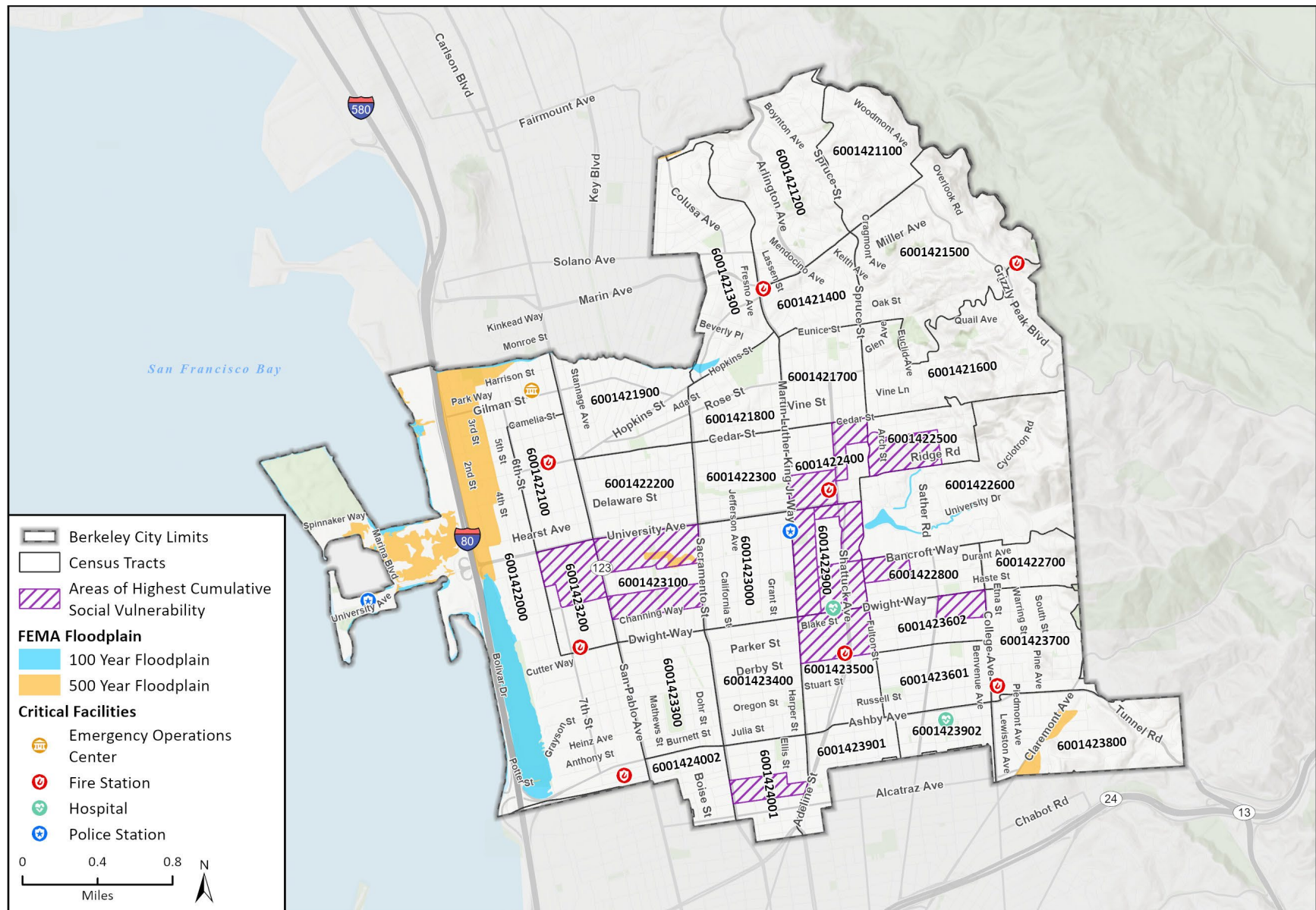
The following street segments are in the 500-year Floodplain:

- West Berkeley:
 - I-80
 - 1st St. (from Harrison St. to Addison St.)
 - 2nd St. (from Harrison St. to Addison St.)
 - 3rd St. (from Harrison St. to Addison St.)
 - 4th St. (from Harrison St. to Addison St.)
 - 5th St. (from Harrison St. to Addison St.)
 - University Ave. (Near the Marina)
- North Berkeley:
 - Colusa Ave. (along Cerrito Creek)
- Central Berkeley:
 - Allston Way (from North Valley St. to Sacramento St.)
 - Bonar St. (between Addison St. and Allston Way)
 - West St. (between Addison St. and Allston Way)
 - North Valley St.
 - Acton Crescent
 - Acton Circle
 - Acton St. (from Addison St. to Acroft Ct.)

- Claremont:
 - Claremont Ave. (between Hazel Rd. and Mystic St.)
 - Alcatraz Ave. (from Lewiston Ave. to Claremont Ave.)
 - Eton Ave.
 - Eton Ct.
 - Brookside Ave.
 - Hillcrest Rd. (only near Claremont Creek)
 - Woolsey St. (between Eton Ave. and Claremont Ave.)
 - The Uplands (only Near Claremont Creek)
 - Encina Pl.
 - The Plaza Dr.
 - Prince St. (from College Ave. to Claremont St.)
 - Oakvale Ave.
 - Hazel Rd.
 - Webster St. (between Pine Ave. and Claremont Ave.)

As shown in **Figure 17** census tracts within the 100-year Floodplain include 2000, 1300, and 2600. None of these are home to communities facing social vulnerability. Census tracts within 500-year Floodplain include 2000, 3100, and 3800. Census Tract 3100 includes communities that face social vulnerabilities. There are no critical facilities within the 100-year Floodplain or 500-year Floodplain.

Figure 17 100-Year and 500-Year Floodplains in Berkeley



Base map provided by Esri and its licensors © 2025. Additional data provided by FEMA, 2025. Social Vulnerability Index and Critical Facilities provided by City of Berkeley, 2025.

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Fig X Social Vulnerability and Flood Hazards

Berkeley experienced significant flooding in December 2022 and January 2023 due to powerful storm systems that brought over 15 inches of rain in 20 days, an event that occurs only once every 50 years according to the National Oceanic and Atmospheric Administration (NOAA). The winter of 2023 saw severe storms with flooding, high winds, and landslides, leading to three federally declared disasters in Alameda County. In October 2022, an atmospheric river caused heavy rains, nuisance flooding, and downed trees and powerlines. Historical flooding events include widespread flooding in 2004, the 1997-1998 El Niño season, and the early 1960s when Strawberry and Codornices Creeks overflowed, causing short-duration, shallow flooding in small areas, including some buildings on the UC Berkeley campus (City of Berkeley 2024(a)).

Climate Change Exposure

Climate change is projected to increase the intensity and frequency of extreme precipitation events in the San Francisco Bay Area. This will result in more severe storm drain overflow and creek flooding. The region's largest winter storms, known as atmospheric rivers, are expected to become more intense, contributing to heavy rainfall and substantial flood risk. Increased precipitation variability, with more frequent "boom and bust" cycles, will exacerbate these conditions. The combination of higher rainfall and rising sea levels will challenge existing stormwater management systems, leading to increased overflow and flooding (Ackerly 2018). Given the climate projections, relying on a 10-year storm design is inadequate. This standard, which is commonly used in stormwater management, may not account for the increased intensity and frequency of extreme precipitation events. Additionally, culvert sizing may be deficient, given climate change projections, and could lead to exacerbated creek overflows and heightened flood risks. More information on the climate change exposure and impacts of sea level rise can be found in Section 3.3 Sea Level Rise and Section 3.4 Groundwater Rise.

Potential Impacts

Flooding can disrupt daily life and pose health risks to residents. Communities facing social vulnerabilities, including communities or individuals experiencing poverty and homelessness, are particularly vulnerable. These individuals often live in flood-prone areas and lack the resources to evacuate or recover from flood damage. Flooding can lead to injuries, loss of personal belongings, and displacement, exacerbating existing inequities. Additionally, damage to hospitals and healthcare facilities can limit access to medical care, exacerbating health impacts during and after flooding (City of Berkeley 2024(a)). Flooding can also cause mold and mildew to grow on damp surfaces, posing health risks to humans and animals (City of Berkeley 2024(a)).

Critical facilities such as fire stations, police stations, and emergency operations centers are essential for community safety and functioning. Climate change-induced flooding can damage these facilities, disrupting essential services and emergency response capabilities. For example, inundation of fire stations can impede rescue operations during flood events. The

built environment, including residential and commercial buildings, transportation infrastructure, and utilities, is susceptible to flood damage. Flooding can cause structural damage to buildings, leading to costly repairs and potential displacement of residents and businesses.

Flooding can also impact the natural environment, including parks. Floodwaters can erode soil, damage vegetation, and alter habitats, impacting biodiversity and ecosystem services. Aquatic species may be particularly vulnerable to changes in water quality and flow patterns. Flooding can also lead to sedimentation in waterways, affecting water quality and aquatic habitats.

Existing Programs to Offset Impacts

The City has several plans that include storm drain overflow or creek flooding mitigation programs, policies, or projects. The list below provides information on the programs in place to help offset extreme precipitation events and flooding impacts in Berkeley

- **City of Berkeley 2024 Local Hazard Mitigation Plan Update.** The LHMP update includes one high-priority mitigation strategy to maintain City participation in the National Flood Insurance Program and a medium-priority mitigation strategy to reduce Berkeley's vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.
- **City of Berkeley Green Infrastructure Plan.** The purpose of this Green Infrastructure Plan is to guide the identification, implementation, tracking, and reporting of green infrastructure projects within the City of Berkeley. "Green infrastructure" refers to a sustainable system that slows runoff by dispersing it to vegetated areas, harvests and uses runoff, promotes infiltration and evapotranspiration, and/or uses bioretention and other low impact development practices to improve the water quality of stormwater runoff.
- **Berkeley Vision 2050: Sustainable and Resilient Infrastructure.** Former Berkeley Mayor Jesse Arreguin launched Vision 2050, an initiative to encourage long-term planning to meet the serious challenges to our infrastructure, including climate change, inequality, population increases, and obsolescence. The Vision 2050 Task Force was formed in Spring 2018 and included over 40 Berkeley community members with technical expertise and in-depth knowledge.
- **2012 Berkeley Watershed Management Plan.** This plan includes several policies and programs aimed at flood mitigation. Key initiatives involve enhancing stormwater infrastructure to manage runoff and reduce flooding risks by upgrading drainage systems and implementing green infrastructure like rain gardens and permeable pavements. Additionally, the plan focuses on updating floodplain maps to better understand flood risks and inform planning and development decisions. Community engagement is also a priority, with efforts to educate residents about flood risks and encourage participation in flood preparedness activities. Emergency response plans are

being developed and refined to ensure quick and effective action during flood events. Collectively, these measures aim to reduce the impact of flooding on Berkeley's communities and infrastructure.

- **Berkeley Stormwater Master Plan (in progress).** The purpose of this plan is to identify key deficiencies in the stormwater system, prioritize capital improvement projects, identify funding needs, develop City specific drainage design standards, and update maintenance and inspection plans for stormwater facilities. The Plan would also analyze potential funding mechanisms to supplement current funding levels for the program as needed to support enhanced operations, regulatory compliance implementation, and capital improvements identified.
- **PG&E Climate Adaptation and Vulnerability Assessment.** This assessment is designed to address the impacts of climate-driven natural hazards on PG&E's operations and infrastructure. This comprehensive plan analyzes how extreme storms and flooding may affect PG&E's ability to provide safe and reliable energy. The assessment identifies potential vulnerabilities and outlines adaptation options to enhance resilience. It includes community engagement efforts to understand the specific needs of vulnerable populations and integrates climate risk into decision-making processes to ensure a clean and resilient energy system for all.

Storm Drain Overflow and Creek Flooding Vulnerability

Flooding in Berkeley disrupts daily life and poses serious health risks, particularly for communities facing social vulnerability in Census Tract 3100. These communities reside in flood-prone areas due to a legacy of exclusionary land use policies, discriminatory housing practices, and economic disinvestment that have limited access to safer, climate-resilient neighborhoods. These systemic factors have concentrated risk in specific geographies, often without adequate infrastructure or emergency planning support. As a result, residents may lack the resources to evacuate safely or recover after a disaster, leading to disproportionate risks of injury, loss of personal belongings, and displacement. Flooding can also damage hospitals and healthcare facilities, limiting access to medical care, and cause mold growth, posing health risks. Although there are no critical facilities located within the 100-year or 500-year Floodplains, they may be vulnerable to storm drain overflow, which has occurred throughout Berkeley. Critical facilities such as fire stations and police stations are crucial for public safety but can be disrupted by flood damage. The built environment, including homes, businesses, and infrastructure, is susceptible to costly repairs and displacement. Additionally, flooding affects the natural environment by eroding soil, damaging vegetation, and altering habitats, impacting biodiversity and ecosystem services. To mitigate these impacts, the City has implemented several programs. The Local Hazard Mitigation Plan (LHMP) includes strategies to maintain participation in the National Flood Insurance Program and reduce vulnerability to severe storms through proactive research, planning, zoning regulations, and improvements to stormwater drainage facilities. The Berkeley Watershed Management Plan

focuses on enhancing stormwater infrastructure, upgrading drainage systems, implementing green infrastructure, updating floodplain maps, and engaging the community in flood preparedness activities. These measures aim to reduce the impact of flooding on Berkeley's communities and infrastructure.

3.7 Drought

Background, Historical Impacts, and Climate Change Exposure

Drought is defined as a prolonged period of deficient rainfall relative to the statistical multi-year average for a region, resulting in water shortages that affect ecosystems, agriculture, and human activities. Historically, Berkeley has experienced impacts from droughts, particularly multi-year droughts. These droughts have led to diminished water supplies, necessitating stringent water conservation measures and the development of diversified and resilient water supply portfolios to ensure long-term water reliability. For instance, the 1987-1992 drought period was a critical time that highlighted the need for improved water management and infrastructure to mitigate the effects of future droughts. EBMUD's response to these challenges includes implementing a comprehensive drought management program and investing in infrastructure improvements to enhance water supply reliability during drought conditions (EBMUD 2020(a)).

Climate change is expected to lead to more intense droughts in Berkeley. Rising temperatures will increase evaporation rates, reducing water availability and exacerbating drought conditions. Additionally, changes in precipitation patterns, with more frequent and severe dry spells, will further strain water resources (Ackerly 2018). In Berkeley, the maximum length of days without rain is expected to increase by 8 days (RCP 4.5) and 11 days (RCP 8.5) by the end of the century.⁹

Potential Impacts

For communities facing social vulnerability, including low-income households and individuals experiencing homelessness, drought can exacerbate existing inequities. Limited access to water can lead to health issues, reduced hygiene, and increased stress, further straining these communities (Pacific Institute 2016). Water shortages can also lead to increased water rates, making it more difficult for low-income households to afford their water bills.

Critical facilities such as fire stations are essential for community safety and functioning. Drought can strain these facilities by reducing water availability for firefighting (Association of Bay Area Governments n.d.). This can hinder emergency response capabilities and compromise public health and safety during drought conditions.

⁹ Compared to the 1961 - 1990 baseline of 102 consecutive days without rain each year.

Drought also significantly impacts the natural environment. Reduced water levels can lead to habitat loss, affecting biodiversity and ecosystem services (The Climate Reality Project n.d.). Aquatic species are particularly vulnerable to changes in water quality and flow patterns, which can lead to population declines (Pacific Institute 2022). Additionally, drought can increase the risk of wildfires, further threatening natural habitats and species (The Climate Reality Project n.d.). Soil erosion and vegetation loss due to drought can alter landscapes, reducing the resilience of ecosystems to future climate events.

Existing Programs to Offset Impacts

Drought mitigation efforts for Berkeley are led by EBMUD. EBMUD has implemented a comprehensive set of policies and programs to mitigate the impacts of drought within its service area. The district's Water Shortage Contingency Plan outlines staged responses to drought conditions, including demand reduction measures, customer conservation incentives, and supply augmentation strategies. Key programs include mandatory and voluntary water use restrictions, expanded public outreach and education campaigns, and rebate programs for water-efficient appliances and landscaping. Additionally, EBMUD actively pursues water recycling projects and regional water transfers to supplement supply during shortages. The 2020 Urban Water Management Plan further supports these efforts by incorporating long-term resilience planning, including investments in infrastructure improvements and groundwater banking partnerships. Together, these measures help EBMUD respond to drought conditions while maintaining reliable water service for its customers.

Drought Vulnerability

Berkeley faces limited drought vulnerability. Communities who face social vulnerability, particularly low-income households and individuals experiencing homelessness, are disproportionately affected, as limited water access can exacerbate health issues, reduce hygiene, and increase financial strain due to rising water costs. Critical facilities, such as fire stations, may also experience reduced water availability, potentially hindering emergency response efforts and public safety. Additionally, drought poses severe risks to the natural environment, leading to habitat loss, declining aquatic species populations, and an increased risk of wildfires, which further degrade ecosystems.

To address these challenges, EBMUD has implemented a range of drought mitigation programs, including water conservation incentives, public outreach, and supply augmentation strategies such as water recycling and regional transfers. The district's long-term resilience planning, outlined in the 2020 Urban Water Management Plan, further strengthens Berkeley's ability to adapt to drought conditions through infrastructure investments and underground water storage, known as groundwater banking.

4 Human-Made Hazards

Hazardous materials release could harm community members by exposing people to vapors that are toxic, suffocating, cause burns or are irritating. Hazardous materials release can threaten not only life and property, but also the environment, in areas such as creeks, the Aquatic Park lagoons and the San Francisco Bay.

The impacts of a release depend on its chemical characteristics, the amount and rate of substance spilled, the location, and its dispersion. Flammable and combustible materials can cause fires in areas that are largely constructed of wood; they may also cause explosions. Wind speed and direction, as well as topography, can greatly impact the dispersion plume of a release.

A hazardous materials release can occur throughout the city near where hazardous materials are manufactured, stored, used, or transported. Hazardous materials release can occur as a result of a natural hazard, such as earthquake shaking, or can happen accidentally. In Berkeley, a hazardous material event is more likely to occur in the City's industrial area in West Berkeley where there is a concentration of industrial sites and transportation routes.

Airborne toxic plumes, including smoke, can travel into Berkeley from surrounding cities. Petrochemical refineries and other large chemical facilities in Contra Costa County could release hazardous materials that could impact the Berkeley community.

Hazardous materials also travel through Berkeley by truck and rail.

There are 528 facilities within Berkeley that are regulated by the Toxics Management Division.¹⁰ The majority of the 528 facilities in Berkeley are Level 3 automotive- or medically-related facilities with limited quantities of hazardous materials and hazardous waste.

Berkeley has not recently experienced significant hazardous materials releases secondary another natural hazard. However, the city has experienced industrial accidents from both mobile and fixed sources.

Existing Programs to Offset Impacts

Over the last 25 years, Berkeley has seen a more than 90 percent reduction in the number of facilities with extremely hazardous materials. The City carefully tracks hazardous materials within its borders, and works closely with companies using large amounts of potentially dangerous materials.

¹⁰ Of the 528 facilities indicated, 469 meet chemical minimums; the remainder are smaller hazardous waste only generators that do not meet volume thresholds quotes. There are many more facilities that have some sort of hazardous materials on their sites, but they are not regulated by the City's Toxics Management Division (per City of Berkeley Toxics Management Division, August 2023).

Potential Impacts

According to the Environmental Protection Agency, hazardous materials may irritate the skin or eyes, make it difficult to breathe, cause headaches and nausea, or result in other types of illness. Some hazardous substances can cause far more severe health effects, including: behavior abnormalities, cancer, genetic mutations, physiological malfunctions, physical deformations, and birth defects.

In the wildland-urban interface (WUI) in the Berkeley hills, there are two major sources of dangerous chemicals: UC Berkeley and the Berkeley Lab. Both have significant amounts of flammable and toxic chemicals, including radioactive chemicals. While both sites have active disaster preparedness programs, WUI fires are notoriously difficult to fight and hazardous materials could be released in a major conflagration.

Outside of the WUI, the Bayer facility located in West Berkeley operates a large ammonia refrigeration system. Bayer is considered Berkeley's highest-risk industrial facility and is regulated under CalARP. Risks associated with the Bayer facility could include release of hazardous materials due to seismic activity or accident.

Roadway or railroad closures during a transportation-related hazardous material release could have serious impacts on the local economy and the ability to provide essential services. Hazardous materials can also contaminate water systems, impacting service and public health.

Hazardous materials can be devastating to animals and the natural environment. Hazardous materials can kill organisms, destroy plants and animals, causing health complications in animals, and or limit the ability of the ecosystem to survive.

5 Public Safety Services

5.1 Fire Protection

The City operates its own Fire Department. The Berkeley Fire Department provides 24-hour response to fires, medical emergencies, hazardous materials events, water rescues, disasters, and other life-threatening situations. Its dedicated personnel prevent and prepare for these emergencies through training, fire prevention, disaster preparedness, and public education programs (Berkeley Fire Department n.d.). There are seven fire stations, a Division of Training facility, Fire Administration Office, Fire Warehouse, and Water Rescue facility located in Berkeley (City of Berkeley n.d.(a)). Station locations and apparatus assigned to each station are listed in **Table 4**.

Table 4 Fire Stations

Station & Address	Apparatus Assigned
Station 1 2442 Eighth Street 94710 (510) 981-5510	<ul style="list-style-type: none"> • Engine One • Ambulance (Medic 1) • Ambulance (Reserve)
Station 2 2029 Berkeley Way 94704 (510) 981-5520	<ul style="list-style-type: none"> • Battalion Chief • Truck Two • Engine Two • Ambulance (Medic 2) • Type VI 4x4 • Hazardous Materials Vehicle • Reserve Truck • Reserve Ambulance • Utility Vehicle
Station 3 2710 Russell Street 94705 (510) 981-5530	<ul style="list-style-type: none"> • Engine Three • Ambulance (Medic 3) • Reserve Ambulance
Station 4 1900 Marin Avenue 94707 (510) 981-5540	<ul style="list-style-type: none"> • Engine Four • Reserve Engine
Station 5 2680 Shattuck Avenue 94704 (510) 981-5550	<ul style="list-style-type: none"> • Engine Five • Truck Five • Ambulance (Medic 5) • Reserve Engine Type III
Station 6 999 Cedar Street 94710 (510) 981-5560	<ul style="list-style-type: none"> • Engine Six • Reserve Engine

Station & Address	Apparatus Assigned
Station 7 3000 Shasta Road 94708 (510) 981-5570	<ul style="list-style-type: none"> • Engine Seven • Reserve Engine • Quick Response Vehicle • EBRPD Engine (Seasonal)
Division of Training 997 Cedar Street 94710 (510) 981-5595	<ul style="list-style-type: none"> • Training Tower & Classroom • Division of Training • Division of Emergency Medical Services (EMS)
Fire Administration 2100 Martin Luther King Jr. Way 94704 (510) 981-FIRE (3473)	<ul style="list-style-type: none"> • Office of the Fire Chief • Division of Fire Prevention • Administrative Support Staff • Office of Emergency Services
Fire Warehouse 1011 Folger Ave 94710 (510) 981-FIRE (3473)	<ul style="list-style-type: none"> • Storage for fire response equipment, including Above Ground Water System
Water Rescue Berkeley Marina (510) 981-FIRE (3473)	<ul style="list-style-type: none"> • "Confidence" Fire boat and rescue watercraft

The City of Berkeley Fire Department has established several mutual aid agreements to enhance its emergency response capabilities. These agreements include partnerships with CAL FIRE for wildfire response, the City of Albany and the City of Oakland for fire protection and emergency medical services, and participation in the Alameda County Mutual Aid system. Additionally, Berkeley collaborates with the Alameda County Fire Chiefs for structural, wildland, and hazardous materials response. These agreements enable Berkeley to effectively mobilize resources and personnel during emergencies, providing comprehensive support and enhancing community safety.

5.2 Police Protection

The City also operates its own Police Department. The Berkeley Police Department is a professional full-service law enforcement agency providing public safety for community members by engaging with the public, keeping the peace and responding to emergencies (City of Berkeley n.d.(b)). The Berkeley Police Headquarters is located at 2100 Martin Luther King, Jr. Way, Berkeley and the Berkeley Police Traffic Bureau Substation is located at 125 University Avenue, Berkeley. In 2020 the City also began the Reimagining Public Safety (RPS) Initiative. The goal of the RPS initiative is to foster an equitable, holistic, and community-centered approach to safety, transforming traditional public safety models to prioritize health, wellness, and security for all residents. Through a collaborative, multidisciplinary strategy, the RPS initiative seeks to reshape the scope of a traditional police-centered model, address systemic inequities, and enhance community trust and wellbeing. The multi-year initiative includes a

comprehensive and inclusive process that is unfolding in three main phases from 2020 to 2026. (City of Berkeley 2024(b)).

As part of Phase 2 implementation, the Diversity, Equity and Inclusion (DEI) Officer position was established. The DEI Officer leads the Diversity, Equity and Inclusion Division within the City Manager's Office. The primary vision guiding the DEI Division is to centralize and embed equity and justice practices within the City's infrastructure. By adopting this approach, the City aspires to not only address present disparities but also to cultivate strong alliances with community organizations. The overarching goal is for City Departments to continue to evolve into entities that are both responsive and truly accountable to the diverse communities they serve.

5.3 Public Health and Environmental Health

The City of Berkeley Public Health Emergency Preparedness (PHEP) program is responsible for the administration of the PHEP and Pandemic Influenza grants. The PHEP program provides strategic planning and training to strengthen the Health, Housing and Community Services Department to respond to a range of public health threats, including infectious diseases, natural disasters, and biological, chemical, nuclear, and radiological events. The PHEP program leads the medical and health planning efforts for emergency response to disasters that impact the health of our community. PHEP collaborates with many different stakeholder groups, including healthcare facilities, community-based organizations, law enforcement, fire personnel, other programs within the City's Department of Health, Housing and Community Services and many more to ensure a coordinated and effective response for the whole community.

The City's Planning and Development Department, Toxics Management Division (TMD) is the City's regulatory agency and a State-Certified Unified Program Agency (CUPA), responsible for implementing, inspecting and enforcing California Environmental Protection Agency and hazardous materials codes associated with the Governor's Office of Emergency Services and State Fire Marshall within the City of Berkeley. TMD also responds to community complaints, assists the City with toxicological concerns, and inspects industrial sites for storm water pollution prevention.

6 Disaster Readiness

The State of California mandates that all municipal governments prepare and plan for potential emergencies, including natural, human-made, and health-related events. The City and agencies that serve Berkeley aim to protect residents, property, and infrastructure in the event of a disaster through comprehensive land use controls, effective hazard mitigation, robust emergency response efforts, and proactive community programs.

Major disaster readiness efforts in Berkeley include:

- Implementation of mitigation measures identified in the City of Berkeley LHMP, including regular updates to the LHMP
- Implementation of the City of Berkeley Community Wildfire Protection Plan
- Establishment and implementation of policies, authorities, structures, and responsibilities of the departments and the Emergency Operations Center in the City of Berkeley Emergency Operations Plan
- Implementation of urban flood reduction policies and programs in the City of Berkeley Watershed Management Plan
- Water conservation measures and programs identified in the EBMUD Urban Water Management Plan (2020), including regular updates to the Urban Water Management Plan
- Operation of AC Alert, Genasys Protect, and the outdoor warning system three tools among others that keep residents informed about emergencies
- Provision of emergency skills training for the community through the Community Emergency Response Training (CERT) and other disaster preparedness and fire safety training through the City of Berkeley Fire Department
- Upgrades to buildings and infrastructure to comply with building and fire codes
- Incentive program for residential structures to seismically upgrade buildings

The City deploys several other programs to increase readiness for the Berkeley community. More information can be found here: <https://berkeleyca.gov/safety-health/disaster-preparedness>

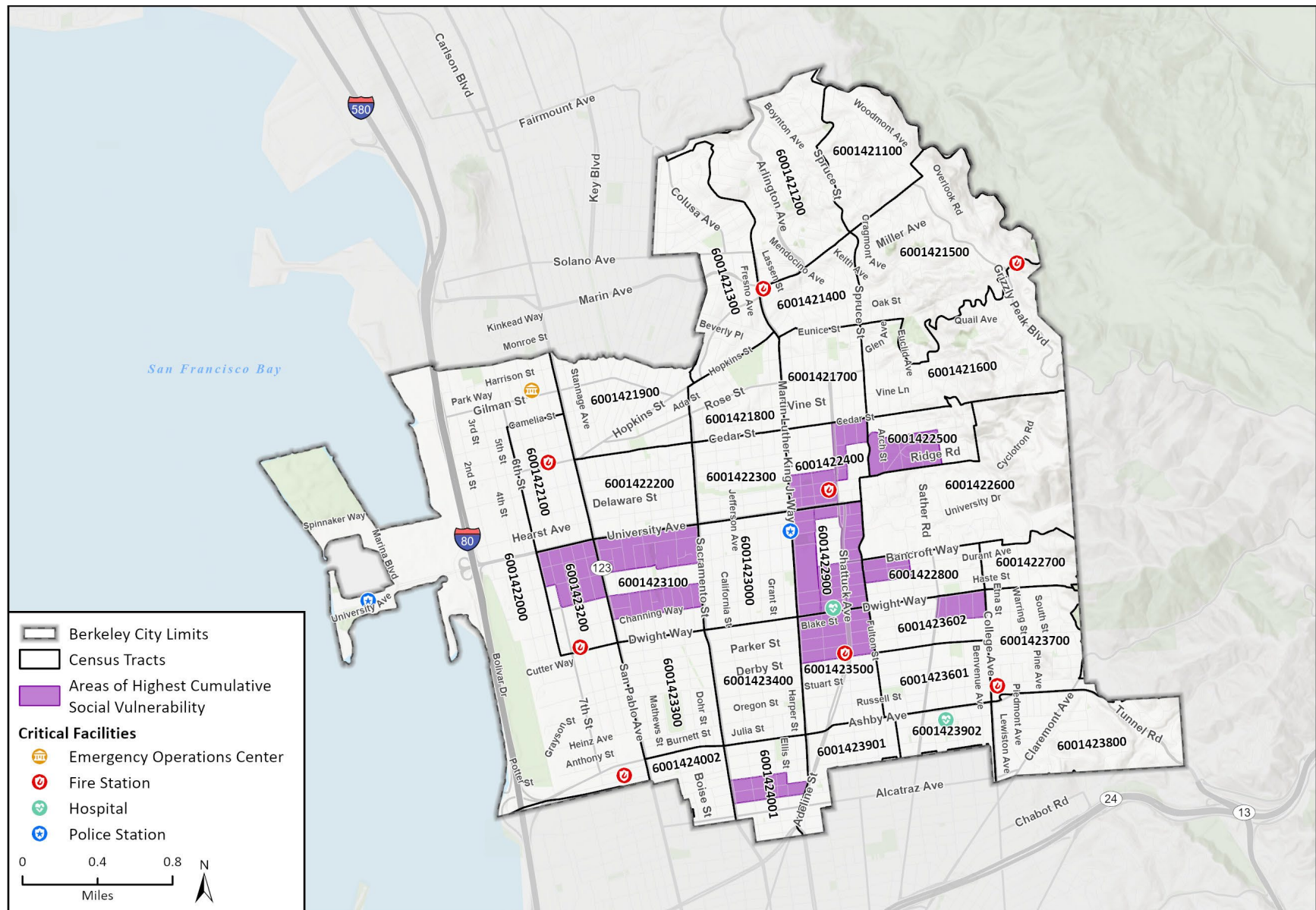
6.1 Critical Facilities and Services

Figure 18 shows the critical facilities identified in Berkeley as part of the Disaster Preparedness and Safety Element update process. Critical facilities include eight fire facilities, two police facilities, two emergency operations centers, and two hospitals. Fire facilities are distributed throughout Berkeley. The police stations are centrally located near the intersection of Martin Luther King Jr. Way and University Avenue, and at the Berkeley Marina off University

Avenue. The hospitals are situated in south Berkeley, one on Ashby Avenue and the other on Dwight Way.

Critical facilities are generally well-distributed across the City, with several located within or near census tracts identified as having high cumulative social vulnerability. These vulnerable areas, concentrated primarily in the central and southern parts of the City, benefit from the proximity of essential services that can support emergency response and public safety during wildfire events. While some facilities, like the Emergency Operations Center, are situated outside the most vulnerable zones, others, such as fire stations and hospitals, are positioned to provide more immediate access to communities with heightened needs.

Figure 18 Critical Facilities in Berkeley



Basemap provided by Esri and its licensors © 2025.
Social Vulnerability Index and Critical Facilities provided by City of Berkeley, 2025.

23-15392 EPS Safety Element
Fig X Critical Facilities

6.2 Emergency Evacuation

State government code mandates cities to identify residential developments in hazard areas with fewer than two emergency evacuation routes. In February 2024, the City prepared the Access Impaired Neighborhood Analysis, fulfilling the requirements of California Government Code Section 65302(g)(5) and Senate Bill 99. The Access Impaired Neighborhood Analysis relied on various data sources, including CAL FIRE Fire Hazard Severity Zones, FEMA flood zones, tsunami zones, earthquake zones, and street centerline data, to locate Access Impaired Neighborhoods. The analysis also identified Berkeley's most narrow and winding roads with conditions that can exacerbate challenges for evacuation. For more results of this detailed analysis and information on methodology, see Appendix C.

State government code mandates cities to identify evacuation routes and their capacity, safety, and viability under various emergency scenarios. In March 2024, following the completion of the Access Impaired Neighborhood Analysis (mentioned above and provided as Appendix C), the City completed the Evacuation Route Safety, Capacity, and Viability Analysis, addressing the requirements of California Government Code Section 65302.15 and Assembly Bill 747. The analysis utilized multiple data sources, including crash data, pavement conditions, flood zones, earthquake zones, and fire hazard severity zones, to evaluate the safety, capacity, and viability of evacuation routes within the City of Berkeley. The report identifies evacuation routes with the highest capacity, safety, and viability and evacuation routes that are more vulnerable during emergency evacuation events due to narrow, winding roads and exposure to hazards like flooding and landslides. For more information on the methodology and results of the analysis, see Appendix D.

Including the two analyses mentioned above, the City of Berkeley conducted a comprehensive Evacuation Time Study. This study was completed in July 2025. The study models how evacuation might unfold during a wildfire, tsunami, or other emergency situation, and analyzes factors such as roadway capacity, transportation resource needs, and expected evacuee behavior. The study identified evacuation time estimates, compared evacuation times to how quickly hazards like wildfires or Tsunamis could impact the community, and other factors that could inform emergency response strategies, including housing policy, public alert systems, transportation planning, and roadway design. For more information on the Evacuation Time Study methodology and results, see Appendix E.¹¹

¹¹ Additional information is also available on the City of Berkeley Office of Emergency Services webpage at: <https://berkeleyca.gov/community-recreation/news/study-stresses-need-household-fire-and-evacuation-plans>.

7 Cascading Impacts

Berkeley's critical facilities, services, and infrastructure are vulnerable to climate change and natural hazards. Cascading impacts refer to a chain reaction of consequences that occur when one system or infrastructure failure leads to subsequent failures in other interconnected systems. For example, a power outage can disrupt communication networks, water supply systems, transportation, and emergency services, creating a ripple effect that broadens the scope of impact beyond the initial failure. These interconnected failures can affect multiple subsystems and populations, exacerbating the overall impact of the initial event.

Communities facing social vulnerability, such as low-income households, people with disabilities, seniors, and communities of color, often have fewer resources to prepare for, respond to, and recover from these disruptions. For example, a power outage may disproportionately affect individuals who rely on medical devices, lack access to backup power, or depend on public transit for evacuation. These compounding effects can deepen existing inequities and prolong recovery timelines for already marginalized populations. Below are summaries of the key cascading impacts in Berkeley.

7.1 Energy Systems

Cascading impacts on energy systems include power outages caused by wildfire, extreme heat, flooding, and earthquakes. Loss of power in homes would prevent community members from running their air conditioning or gas or electric heaters, and gas and electric kitchen appliances. For individuals who rely on in-home medical and/or mobility devices, power disruption could directly impact health and safety. If the power outages occur during bad air quality days from regional wildfire smoke, people with underlying health conditions could experience worsening health conditions. Traffic signals, cell-towers without back-up power, and critical facilities that lack backup power would cease to function. Losing many of these energy dependent amenities during events like heatwaves and wildfires can create increased risks to public health, including heat related illness, food access constraints, evacuation challenges, overloaded emergency services, and increased hazard exposure.

7.2 Water Systems

The East Bay Municipal Utility District (EBMUD) provides water service in Berkeley. The EBMUD water supply system collects, transmits, treats, and distributes high-quality water from its primary source, the Mokelumne River, to its customers. EBMUD's secondary water source is local runoff from the East Bay area watersheds, which is stored in the terminal reservoirs outside city limits and within EBMUD's service area (EBMUD 2020(a)).

EBMUD maintains two key long-term planning documents, updated at least every 5 years in accordance with the Urban Water Management Planning Act (California Water Code Section 10610-10657): the Urban Water Management Plan and the Water Shortage Contingency Plan.

In the 2020 Urban Water Management Plan, EBMUD assesses water supplies against expected demands over a 30-year planning horizon. The plan outlines actions to address future uncertainties, including a diversified and resilient water portfolio, as well as recycled water and conservation programs (EBMUD 2020(a)). The 2020 Water Shortage Contingency Plan provides a framework to address potential water shortages, exploring a range of scenarios to test assumptions and adapt to changes such as climate impacts, population growth, and other uncertainties. These plans are crucial components of EBMUD's long-range strategy to ensure reliable water service, particularly during multi-year drought periods (EBMUD 2020(b)).

Berkeley's water systems could face significant challenges due to higher water usage and lower availability during extended drought and extreme heat conditions. Wildfire mitigation during droughts further depletes water resources. These issues can raise water rates and impact public health, especially for people who are unable to afford higher costs. Water shortages also affect power generation and firefighting efforts, and insufficient water can harm Berkeley's tree canopy, which helps cool the area and manage stormwater.

Sea level rise can cause saltwater to contaminate freshwater sources and increase coastal flooding, damaging water infrastructure. Rising groundwater levels can lead to flooding from below, impacting underground water infrastructure. Extreme heat boosts water demand for cooling and landscaping, speeds up evaporation, and raises wildfire risk. Heavy rains and flooding can damage water facilities and contaminate sources, overwhelming stormwater systems. Earthquakes can break pipelines and reservoirs, disrupt water supply, and trigger fires, increasing water demand for firefighting and disrupting water supplies.

7.3 Transportation System

Several freeways and major arterial routes run directly through wildfire, landslide, liquefaction, and earthquake hazard zones in Berkeley, creating broad transportation system and infrastructure vulnerabilities. There are many resulting cascading impacts from transportation sector disruptions which could result in mobility isolation for the community, reduced ability for emergency services to respond, and constrained evacuation routes. Transportation impacts can occur from a wide range of causes including direct physical damage associated with climate hazards within city limits or external climate impacts afflicting regional transportation networks and services. Power outages could cause traffic signal failures. Transit system failures could place the community in increased danger with inability to evacuate or seek medical attention.

Interstate 80 and State Route 13, as well as University Avenue and Ashby Avenue, overlap multiple hazard zones and simultaneously serve as major evacuation routes. This type of infrastructure exposure can result in both city-wide and regional cascading impacts, limiting evacuation and emergency service accessibility.

7.4 Communication System

Communication networks, which consist of utility, telephone, and broadband infrastructure, can experience disruptions and service failures from exposure to extreme heat, wildfires, landslides, and flooding. The viability of a communication network is greatly improved with redundant communication networks, backup power, and alternative forms of communication (e.g., radio) to help minimize the extent of impact to community members. The cascading impacts resulting from downed communications can vary from interrupted evacuation communications to general isolation and heightened risk due to inability to receive hazard information. Areas across Berkeley that fall within hazard zones, such as portions of West Berkeley near the shoreline, hillside neighborhoods prone to landslides, and areas with aging infrastructure, are more likely to experience communication service interruptions. These disruptions can trigger cascading impacts, including delayed emergency response, isolation of communities facing social vulnerability, and breakdowns in coordination among critical services.

7.5 Food Systems

Food supply chains, including transportation, storage, and distribution infrastructure, can experience disruptions and service failures from exposure to extreme heat, wildfires, landslides, and flooding. The viability of food systems is greatly improved with redundant supply chains, backup power for storage facilities, and alternative distribution methods to help minimize the extent of impact to community members. The cascading impacts resulting from disrupted food systems can vary from interrupted food deliveries to increased food insecurity and heightened risk due to inability to access safe and nutritious food.

Climate hazards can also significantly impact food production. Extreme heat can stress crops and livestock, reducing yields and productivity. Wildfires can destroy agricultural land and contaminate water sources, while landslides can bury crops and disrupt irrigation systems. Flooding can lead to soil erosion and waterlogging, making land unsuitable for farming. Drought can reduce water availability and quality, leading to crop failure and pasture losses, and can also contribute to insect outbreaks and increased wildfire risk. These impacts can result in decreased food availability and increased prices regionally, further exacerbating food insecurity.

7.6 Healthcare Systems

Healthcare systems are impacted by various climate hazards, including wildfires, extreme heat, flooding, and earthquakes. Wildfires can lead to increased respiratory issues and cardiovascular problems due to smoke inhalation, causing a surge in emergency visits and straining healthcare facilities. Additionally, wildfires can directly damage healthcare infrastructure and necessitate evacuations, disrupting services and reducing access to care.

Extreme heat events result in a higher patient load with heat-related illnesses such as heatstroke, dehydration, and kidney damage, often overwhelming hospitals and clinics and leading to overcrowding. The strain on infrastructure, including power outages affecting cooling systems and medical equipment, further exacerbates the situation. Flooding due to extreme precipitation can damage healthcare facilities, increase demand for services due to injuries and infections, and disrupt transportation routes, making it difficult for patients and healthcare workers to reach facilities. The stress associated with flooding can also lead to long-term mental health issues. Earthquakes pose a severe threat to healthcare systems by causing structural damage to facilities, increasing trauma cases, and disrupting utilities such as water, electricity, and telecommunications. Evacuations may be necessary, further straining the healthcare system. Each of these hazards requires robust emergency preparedness and response plans to mitigate their impacts and ensure continuity of care. The recovery process for any disaster will impact the communities that have been made the most vulnerable at disproportionate rates (SAMSA, 2017). The stress associated with disasters can also lead to long-term mental health issues which may require an increased level of services provided by the city and its partners.

7.7 Hazardous/Toxic Materials

Climate hazards such as wildfires, sea level rise, groundwater rise, and flooding can have cascading impacts on hazardous and toxic materials, posing risks to public health and the environment. Wildfires can lead to the release of toxic materials from burned structures, including asbestos, lead, mercury, and chemicals from household products. These materials can contaminate the air and soil, posing health risks if inhaled or managed improperly. Sea level rise threatens coastal hazardous waste facilities, potentially leading to the release of toxic substances into the environment. Rising tides can inundate these facilities, causing incalculable damages and environmental harm if not addressed. Groundwater rise, driven by sea level rise, can infiltrate polluted sites, including contaminated sites, and spread hazardous substances such as heavy metals, pesticides, and industrial chemicals. This can expose nearby communities to significant health risks. Flooding from extreme precipitation can trigger chemical spills from industrial sites, sewage systems, and household waste. Floodwaters can carry these toxic materials, leading to health issues such as dermatitis, rashes, burns, headaches, and nausea.

8 Summary

Berkeley faces significant challenges related to hazard risks, which require comprehensive planning and mitigation strategies to ensure community safety and resilience. The key findings from this report are summarized below. These findings highlight the need for robust emergency preparedness, mitigation strategies, and community engagement to address the diverse challenges posed by hazards in Berkeley.

Equity Considerations

- **Equity Gaps:** Across all topics assessed, there is a need to center policies and programs on communities facing social vulnerability. Current plans and strategies lack sufficient data, analysis, and clarity on how equity—particularly cultural responsiveness, language access, and geographic service distribution—is integrated into climate resilience, public safety, and disaster readiness efforts.

Hazards

- **Geologic and Seismic Hazards:** Berkeley is at risk from earthquakes due to its proximity to active faults like the Hayward Fault. Earthquakes can cause ground shaking, surface fault rupture, liquefaction, and landslides. Specific areas at risk include the Berkeley Marina and Eastshore State Park, which are susceptible to liquefaction, and the Berkeley Hills, which are at risk of landslides. In West Berkeley, three fire stations, both police stations, and the skilled nursing facilities, Chaparral House and Silverado Berkeley Memory Care are also susceptible to liquefaction. Additionally, one fire station in the Berkeley Hills, just east of Grizzly Peak Boulevard, is at risk of landslides. The LHMP outlines mitigation strategies to address these risks. The City offers grant opportunities and transfer tax rebates for seismic work to encourage property owners to undertake voluntary seismic updates.
- **Tsunami:** Tsunamis can impact Berkeley's shoreline, with updated inundation maps identifying vulnerable areas. Specific areas at risk include the Berkeley Marina, portions of Interstate 80, the San Francisco Bay Trail, the Amtrak Station, Aquatic Park, and the Fourth Street Business District. The City has measures in place to manage tsunami risks outlined in the LHMP.
- **Wildfire and Poor Air Quality:** Berkeley is vulnerable to wildland-urban interface fires, exacerbated by factors such as low humidity, high winds, climate change, and development patterns near fire-prone areas. Historical fires like the 2017 Grizzly Fire, 1991 Tunnel Fire, and 1923 Berkeley Fire highlight Berkeley's susceptibility. Certain areas face elevated risk, particularly Census Tract 2500, which includes communities that face social vulnerability and lies within a High Fire Hazard Severity Zone. The Berkeley Hills, are also at heightened risk due to their combination of dense housing and proximity to flammable natural landscapes. Within this area, North Berkeley Hills

and Panoramic Hill are particularly vulnerable due to their high housing density, which housing density exceeding four structures per acre, well above the two-structure-per-acre threshold identified by the National Institute of Standards and Technology as indicative of high structural density in wildland urban interface zones. Across the City, all residents are exposed to poor air quality from wildfires, but communities facing social vulnerability (located in Census Tracts 2500, 2400, 2900, 2800, 3602, 3500, 4001, 3100, 3200) are disproportionately at risk from its health and economic impacts. Programs like the Community Wildfire Protection Plan and LHMP help to mitigate these risks.

- **Policy Gaps:** The City has established strong implementation programs and protocols to mitigate wildfire impacts. However, there is a need to center these policies and programs more explicitly around communities experiencing social vulnerability, as highlighted under the Equity Considerations and Gaps bullet above.
- **Sea Level Rise:** Rising sea levels threaten Berkeley's shoreline and low-lying areas, leading to flooding, infrastructure damage, and increased liquefaction risk. Specific areas at risk include the Berkeley Waterfront, which is most vulnerable to sea level rise, with potential for frequent flooding and infrastructure damage. Key transportation routes, such as underpasses and roads accessing Highway 80, are at risk of frequent flooding. César E. Chávez Park is at risk of erosion and loss of landmass, impacting trails, recreational areas, and habitats. The LHMP and Berkeley Marina Area Sea Level Rise Assessment identifies mitigation strategies and projects to address these impacts.
 - **Policy Gaps:** Existing programs aim to mitigate sea level rise impacts through projects and partnerships that are broad in scope. There has been investment in a localized study to identify specific mitigation projects for sea level rise and it would be beneficial to conduct more of these studies to address the needs of specific communities identified as vulnerable for geographic and equity considerations.
- **Groundwater Rise:** Sea level rise can cause groundwater rise in coastal areas like Berkeley because rising sea levels exert pressure on the groundwater table, pushing it upwards. Rising groundwater can mobilize contaminants at existing contaminated sites, dissolving them into the groundwater and transporting them with its flow. This can increase exposure for human and ecological receptors through several pathways. Specific areas at risk include West Berkeley, which is particularly vulnerable due to shallow groundwater depths and the presence of contaminated sites. Communities that face social vulnerability in Census Tracts 3200, 4001, and 3100 face increased health risks due to potential contaminant mobilization. Three fire stations are located near high and medium priority contaminated sites. In addition, two skilled nursing facilities located in communities that face social vulnerability may face elevated risks from groundwater rise, which could impact health, disrupt infrastructure, and require complex evacuations of residents who rely on ongoing medical support.

- **Policy Gaps:** The City does not currently have policies or programs to mitigate groundwater rise. However, the findings of the Groundwater Rise and Contaminated Site Analysis (Appendix B) and this report will serve as a foundation for developing new policies and programs to address this issue.
- **Extreme Heat:** Extreme heat in Berkeley is characterized by days above 87.6°F. The urban heat island (UHI) effect exacerbates these conditions, particularly in densely built areas with limited vegetation and abundant dark surfaces that absorb and release heat. Berkeley has experienced regular extreme heat events from 2019 to 2023, though none have been federally declared disasters. Across the City, all residents are exposed to extreme heat, but communities facing social vulnerability (located in Census Tracts 2500, 2400, 2900, 2800, 3602, 3500, 4001, 3100, 3200) face disproportionate health and economic risks due to limited resources and adaptive capacity. The Berkeley Hills, which experience higher temperatures at night during extreme heat events due to thermal belting, are also at risk though residents may be better equipped to cope due to greater access to resources and higher-quality housing. Areas with limited tree cover, such as neighborhoods identified during the City of Berkeley Safety Element Update Community Workshop #1 (February, 2025), are also at risk.
 - **Policy Gaps:** Most of the City's extreme heat mitigation policies and programs are broadly written, making implementation challenging. It would benefit the City to explore specific policy recommendations addressing extreme heat and the impacts of climate change, especially in areas of Berkeley with communities facing social vulnerability.
- **Storm Drain Overflow and Creek Flooding:** Floods occur when there is an overflow of water in areas that are normally dry. In Berkeley, three types of flooding typically occur: coastal flooding, storm drain overflow, and creek flooding. Increased precipitation and aging infrastructure contribute to storm drain overflow and creek flooding. Specific areas at risk include the 100-year Floodplain, which includes areas along the edge of the Bay, Aquatic Park lagoon, Codornices Creek, and Strawberry Creek. The 500-year Floodplain expands on the 100-year Floodplain, including additional areas in West Berkeley, McLaughlin Eastshore State Park, and the Marina. Census Tracts within floodplains include 2000, 1300, and 2600 (100-year floodplain); 2000, 3100, and 3800 (500-year floodplain), with Census Tract 3100 including communities facing social vulnerability.
 - **Policy Gaps:** Approximately half of the City's existing policies and programs aimed at mitigating flood risks are underfunded. Additionally, the current flood mitigation policies do not explicitly address the impacts of climate change, which is crucial for developing effective and resilient strategies.

- **Drought:** Droughts lead to water shortages, impacting communities and ecosystems. EBMUD's drought management programs and infrastructure improvements aim to enhance water supply reliability.
 - **Policy Gaps:** The City does not currently have a Water Action Plan which could guide work to mitigate impacts of future droughts, and to reduce water use by municipal operations, residents and businesses and improve stormwater management. This type of a Plan could work in tandem with the Watershed Management Plan, EBMUD Plans, Green Infrastructure Plans, and more.

Public Safety Services

- **Fire and Police Protection:** Berkeley operates its own Fire and Police Departments, providing essential services including fire response, medical emergencies, hazardous materials management, and law enforcement. The Fire Department has seven stations and various specialized facilities, while the Police Department has two main locations.
- **Reimagining Public Safety:** Berkeley is shifting towards community-based solutions and alternative response teams to address issues like mental health crises, homelessness, and traffic enforcement, aiming to enhance community trust and wellbeing.
- **Water Service:** Water service is provided by EBMUD, which has long-term planning documents to ensure reliable water supply, including the Urban Water Management Plan and the Water Shortage Contingency Plan.

Disaster Readiness

- **Disaster Readiness:** Berkeley has implemented various disaster readiness measures, including the City's LHMP, Community Wildfire Protection Plan, Emergency Operations Plan, Watershed Management Plan, Public Health Emergency Preparedness program, and water conservation programs. The City also operates emergency alert systems and provides community emergency response training.

Cascading Impacts

Hazards do not impact all communities equally. Communities already facing systemic challenges, such as limited access to healthcare, economic insecurity, or inadequate housing, are often the most affected by cascading impacts. These interconnected disruptions can compound existing vulnerabilities, making it even harder for communities already facing systemic challenges to prepare for, respond to, and recover from climate-related events.

- **Energy Systems:** Climate hazards can cause power outages, affecting homes, medical devices, traffic signals, and critical facilities. Backup power and alternative communication methods are essential to minimize impacts.

- **Water Systems:** Drought, extreme heat, sea level rise, and flooding can strain water systems, leading to shortages, contamination, and infrastructure damage.
- **Transportation System:** Major evacuation routes overlap hazard zones, creating vulnerabilities. Transportation disruptions can isolate communities and hinder emergency response.
- **Communication System:** Areas across Berkeley that fall within hazard zones, such as portions of West Berkeley near the shoreline, hillside neighborhoods prone to landslides, and areas with aging infrastructure, are more likely to experience communication service interruptions. These disruptions can trigger cascading impacts, including delayed emergency response, isolation of communities facing social vulnerability, and breakdowns in coordination among critical services.
- **Food Systems:** Disruptions to food supply chains can lead to food insecurity. Climate hazards can impact food production, reducing availability and increasing prices.
- **Healthcare Systems:** Wildfires, extreme heat, flooding, and earthquakes can strain healthcare facilities, increase patient loads, and disrupt services. The stress associated with disasters can also lead to long-term mental health issues which may require an increased level of services provided by the city and its partners.
- **Hazardous/Toxic Materials:** Climate hazards can lead to the release of toxic materials, posing health risks and environmental damage.

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Appendix A

Social Vulnerability Analysis Methodology

Social Vulnerability Analysis Methodology

City of Berkeley

State Law and Policy Guidance

California Government Code Section 65302 (as amended by Senate Bills 379 and 1035)) requires Berkeley to include climate adaptation and resiliency information in the Safety Element of its General Plan. The purpose of this assessment is to identify risks that climate change poses to Berkeley as a whole, and to the specific areas at risk from climate change impacts. The assessment must describe how climate change may affect each of the risks addressed in the Safety Element.

California Adaptation Planning Guide

To assist local cities and counties to comply with these requirements, the Governor's Office of Emergency Services published the California Adaptation Planning Guide (Cal APG). The Cal APG recommends a planning process that is outlined in **Figure 1** below. Phase 1 and 2 of the four-phase process consist of conducting a vulnerability assessment. This Memorandum aligns with relevant parts of Phase 1 and all of Phase 2; it also includes the steps shown in **Figure 2**. Climate adaptation strategies will be developed and included in the General Plan Disaster Preparedness and Safety Element during Phase 3. Implementation of the policies and programs in the General Plan Disaster Preparedness and Safety Element will occur in Phase 4 and on an ongoing basis, and will be re-evaluated and refined during the next update to the Element.

Figure 1 California Adaptation Planning Guide Phases

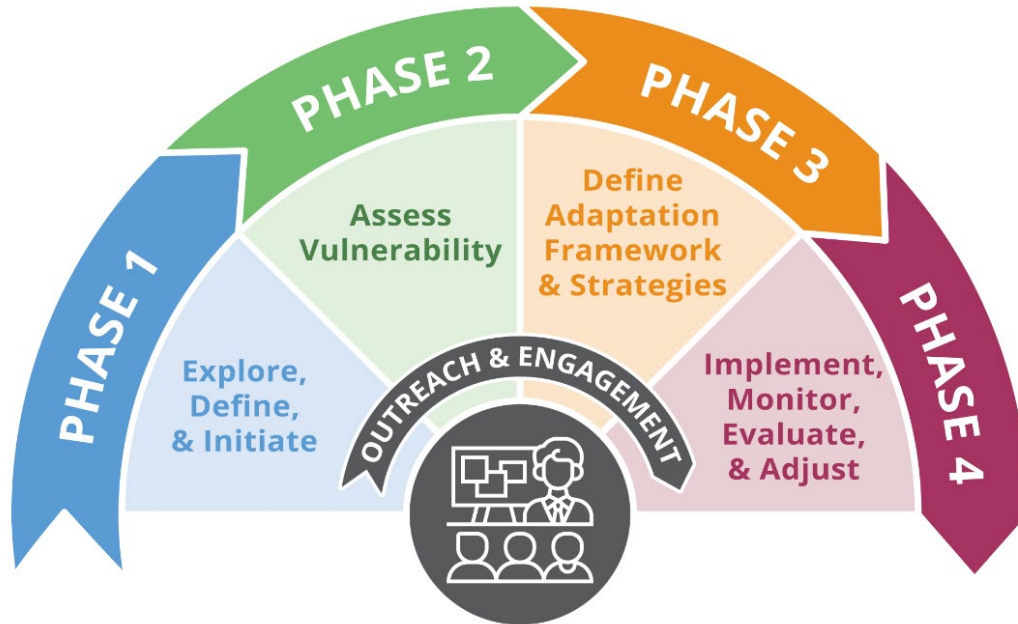
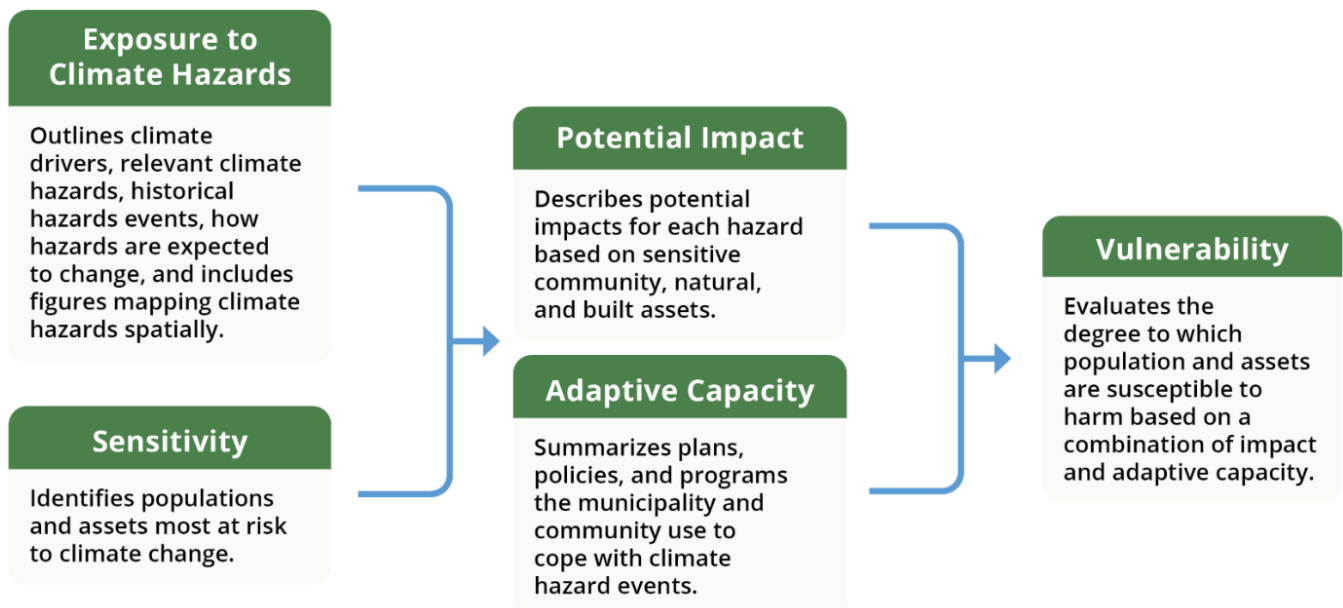


Figure 2 Vulnerability Assessment Process (Phase 2)



Resource Guide for Defining Vulnerable Communities

In 2018, the Governor's Office of Land Use and Climate Innovation (LCI) published a resource guide through the Integrated Climate Adaptation and Resiliency Program (ICARP) that includes information to help define vulnerable communities in the context of climate change adaptation.¹ This resource guide was consulted as part of this assessment. In addition, several resources were consulted to describe vulnerable communities identified in this assessment. These include the California Department of Public Health's CalBrace Project,² LCI's Vulnerable Communities Descriptions, and the City of Berkeley Sixth Cycle Housing Element.

Identifying Vulnerable Communities

Social vulnerability, or "sensitivity" to climate change risks can be described as the degree to which human systems are susceptible to harm based on a number of factors. Certain factors can make certain populations more sensitive than others. These factors include, but are not limited to:

- Inequities in educational opportunities and attainment
- Inequities in environmental and living conditions and health status
- Institutional bias and exclusion from decision-making power
- Differences in individual health, age and ability

Historical and ongoing environmental injustices such as housing discrimination have created conditions in the built environment that make some populations more susceptible to climate change risks than others in the community. The purpose of this social vulnerability assessment is to identify these communities and work collaboratively to rectify these harms, and in doing so build climate resilience in a way that best addresses the needs of the communities most at risk.

Individuals and communities can be affected by more than one factor at once, and those in the community who are exposed to a higher number of these factors may be particularly vulnerable. This section identifies groups that are highly vulnerable to the impacts of climate change risks, or hazards. It is important to note that the existence of highly vulnerable groups is an indication of the shortcomings of social, economic, and political systems to provide

¹ https://lci.ca.gov/docs/20180723-Vulnerable_Communities.pdf

² [CalBRACE Project - Climate Change & Health Equity.](https://www.cdph.ca.gov/Programs/OHE/Pages/CalBRACE.aspx)
<https://www.cdph.ca.gov/Programs/OHE/Pages/CalBRACE.aspx>

adequate support, respect and protection to all community members. It is not an indication of any individual failure or weakness.³

This section describes each of the factors that are included in the social vulnerability analysis for the City of Berkeley's climate vulnerability assessment. The data source for this information is the American Community Survey 5-Year estimates (2018-2022).

Age (Children Under Age 5)

Vulnerability to climate change risks among children is especially high because of physiological and development factors: their lungs are developing, they breathe at a higher rate than adults, and they spend more time outdoors.⁴ In addition, children are more likely to experience negative consequences as a result of extreme weather events, such as injury, stress, and death.⁵ According to 2022 American Community Survey (ACS) 5-year estimates, about 3.2 percent of Berkeley's population is under 5 years of age.

Age (Adults 65 Years and Older Living Alone)

Factors that contribute to vulnerability among older adults include health status, economic situation and level of social isolation. Older adults are more likely to have a chronic health condition that requires medication, and may need assistance with daily activities. Older adults with limited incomes may more vulnerable to the effects of extreme heat events due to the high cost of air conditioning. In addition, almost one-quarter of Americans aged 65 and older are socially isolated, which can impact an individual's ability to cope with climate-related stressors, and they may not receive emergency information or ask for help.⁶ According to 2022 American Community Survey (ACS) 5-year estimates, about 12 percent of households in Berkeley include a member who is 65 years or older and living alone.

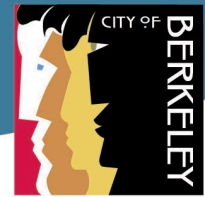
³ Thomas, K., Hardy RD., Lazrus H., Mendez M., Orlove B., Rivera-Collazo, I., Roberts JT., Rockman M., Warner BP., Winthrop R., Explaining differential vulnerability to climate change: A social science review (December 2018) <https://wires.onlinelibrary.wiley.com/doi/full/10.1002/wcc.565>

⁴ CalBrace, "Children <5 years." November 8, 2019.

https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHVIs/Children0to4_788_Narrative.pdf

⁵ https://lci.ca.gov/docs/20180312-Vulnerable_Communities_Descriptions.pdf

⁶ https://ltsscenter.org/reports/The_Impact_of_Climate_Change_Why_Older_Adults_are_Vulnerable.pdf



Disability

Disability is a broad term that refers to any condition or impairment of the body or mind that limits a person's ability to do certain activities. Vulnerability to climate risks are heightened among this group due to factors such as lower income and educational attainment and employment. Limited mobility, reliance on medical equipment and public transportation contribute to vulnerability, especially during emergency events that would require evacuation or cause power interruption.^{7 8} According to 2022 American Community Survey (ACS) 5-year estimates, about 19 percent of Berkeley households include a person with a disability.

Income

Income is the largest determinant of health in the United States. Higher income is associated with greater life expectancy. This is due in part to access to quality health care, but more so due to social determinants of health – environmental quality, social and economic situations, and the built environment – which influence stress levels and behaviors. The lower health status of lower-income people exacerbates climate change risks, as these groups have fewer resources to cope with emergencies and respond to rising prices. Additionally, groups with lower incomes are more likely to live in housing that is substandard, and therefore more susceptible to damage from disasters.⁹

According to 2022 American Community Survey 5-Year estimates, about 40.3 percent of Berkeley households are considered very low income, meaning a two-person household earning no more than 50 percent of the area median income for Alameda County, or \$62,300.¹⁰ Some types of families are more likely to be lower income than others. These include families headed by a single parent (13.5 percent of those below \$62,300, and those who have less than a high school degree (4.6 percent of those below \$62,300).

7

https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHVIs/BRACE_Disability_Narrative_79_5_11-16-2016.pdf

⁸ https://lci.ca.gov/docs/20180312-Vulnerable_Communities_Descriptions.pdf

⁹ https://lci.ca.gov/docs/20180312-Vulnerable_Communities_Descriptions.pdf

¹⁰ California Department of Housing and Community Development, 2024 State Income Limits, 2-person household in Alameda County, <https://www.hcd.ca.gov/sites/default/files/docs/grants-and-funding/income-limits-2024.pdf>

Housing Cost

Availability of safe, sanitary and affordable housing reduces vulnerability to climate related impacts, and supports recovery. High housing costs can limit financial resources needed to prepare for and recover from climate-related impacts, while a lack of safe and secure housing can increase vulnerability to impacts.

Factors including household income, market rents and home prices, available unit sizes, and household size can all contribute to cost burden. A household is considered to have a housing cost burden if it spends more than 30 percent of gross income on housing expenses (rent or mortgage payments and utilities). A household is considered as having a severe cost burden if expenses make up more than 50 percent of gross income.¹¹

According to the City of Berkeley Housing Element (Sixth Cycle), 23 percent of all Berkeley households are severely cost-burdened. Cost burden is more prevalent among renter households than among households who own their home (32 percent versus 12 percent).¹²

Housing conditions impact health, and availability of safe and secure housing can impact vulnerability to climate related risks by exposure to environmental hazards caused by climate change, such as extreme heat.¹³ Building improvements such as ventilation, window shades, insulation, roof and wall materials can all reduce impacts from climate related risks. According to the Housing Element, over 95 percent of Berkeley's housing stock is over 30 years old. Less than five percent of the housing stock needs rehabilitation.¹⁴

¹¹ City of Berkeley Sixth Cycle Housing Element, Section 3.5.5, Housing Costs and Affordability, [Berkeley_2023-2031 Housing Element_02-17-2023v2_0.pdf](https://berkeleyca.gov/sites/default/files/documents/Berkeley_2023-2031_Housing_Element_02-17-2023v2_0.pdf)

¹² https://berkeleyca.gov/sites/default/files/documents/Berkeley_2023-2031%20Housing%20Element_02-17-2023v2_0.pdf

¹³ Cartwright, A., Khalatbari-Soltani, S., Zhang, Y., Housing conditions and the health and wellbeing impacts of climate change: A scoping review (April 2025).

<https://www.sciencedirect.com/science/article/pii/S0013935125000970>

¹⁴ https://berkeleyca.gov/sites/default/files/documents/Berkeley_2023-2031%20Housing%20Element_02-17-2023v2_0.pdf

Linguistic Isolation

Linguistic isolation refers to a household in which all persons 14 years of age or older speak a language other than English and no one speaks English very well. Many immigrants are linguistically isolated. Linguistic isolation may hinder protective behaviors during extreme weather events or disasters by limiting access to or understanding of emergency warnings. Studies have shown that people who live in linguistically isolated households are more likely to make heat-related calls to 911 during extreme heat events.¹⁵

According to the 2022 American Community Survey (ACS) 5-Year Estimates, about 3.8% of households (or about 1,740 households) in Berkeley are considered "Limited English-Speaking Households", meaning that no member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English "very well." About 1.3 percent of those households speak Chinese (including Mandarin and Cantonese), about 0.7 percent speak an Indo-European language (French, German, Hindi, and Persian), and another 0.7 percent speak an Asian and Pacific Island language (Chinese, Japanese, Telugu, and Hawaiian). About 0.3 percent speak Spanish.

Communities of Color

Structural racism creates racial disparities in educational attainment, income and wealth, which in turn contributes to increased vulnerability to climate risks.¹⁶ Communities of color also experience greater vulnerabilities due to compounding factors such as income, educational attainment, health, language barriers, social isolation, occupational exposures and less access to air conditioning. Differences in vulnerability may be linked to social and economic disparities. For example - Due to discrimination, people in communities of color are more likely to have lower incomes and live in areas with more risks from pollution and fewer health-promoting features (e.g., parks, grocery stores). Also, communities of color may have decreased access to information about risk mitigation, as well as resources to prepare for, adapt to, and recover from climate related events.¹⁷ According to the 2022 American Community Survey (ACS) 5-Year Estimates, about 48 percent of residents identify as a person of color. The racial and ethnic breakdown is as follows: 21 percent identify as Asian, 12 percent as Hispanic or Latino, 8 percent as Black or African American, 7 percent as multiracial, 1 percent as another racial identity not listed, 0.2 percent as American Indian or Alaska Native, and 0.2 percent as Native Hawaiian or Pacific Islander.

¹⁵ ibid

¹⁶ <https://wires.onlinelibrary.wiley.com/doi/full/10.1002/wcc.565>

¹⁷ https://lci.ca.gov/docs/20180312-Vulnerable_Communities_Descriptions.pdf

Vehicle Ownership

Vehicle ownership is an indicator of access to personal transportation, which is a critical resource during extreme weather events or in a scenario that requires evacuation. Access within a household to a personal vehicle is important because it can be a source of shelter from wildfire, air pollution, heat or flooding.¹⁸ Approximately 20 percent of households in Berkeley do not have access to a vehicle.

Immigrants and Refugees

Immigrant and refugee populations may be more vulnerable to climate change impacts due to potentially experiencing displacement due to previous climate change impacts or disasters, as well as being overrepresented among low-income groups but underrepresented in public benefits enrollment. The most vulnerable immigrants and refugees include people with low socioeconomic status, or who are experiencing houselessness, single mothers and young children, and people with limited English. Further, they are less likely to ask for help from government officials, and tend to be linguistically isolated. Many people in this group work in conditions that leave them vulnerable to exposure to climate change impacts, such as extreme heat. Because many undocumented immigrants or refugees do not have adequate access to services, they may receive lower levels of support to address climate stresses.¹⁹ According to the ACS 5-year estimates, about 24 percent of residents are of voting age and not a citizen.

Summary of Social Vulnerability

There are various publicly-available tools and datasets available to identify vulnerable communities. Indicators were selected based on best-practice methodologies. The data source for this analysis is the American Community Survey (ACS) 5-Year estimates (2018-2022). **Table 1** provides a summary of the indicators, size of community in Berkeley, and data source.

¹⁸ *ibid*

¹⁹ *ibid*

Table 1 Summary of Social Vulnerability

Population	Size of Community in Berkeley	Data Source (ACS Table)
Individuals without a high school degree	3%	Population 25 years and over – no high school diploma (ACS 2022, Table B15003: Educational Attainment for the Population 25 Years and Over)
Very low-income households	40%	Households earning less than \$62,300 per year, or 50% of Area Median Income (AMI) for a 2-person household in Alameda County (ACS 2022, Table B19001: Household Income in the Past 12 Months and California Department of Housing and Community Development, 2024 State Income Limits, Alameda County, 2-person household, very-low income)
Severely housing cost burdened households	23%	Households spending >50% of income on housing – Severely Housing Cost-Burdened (ACS 2022, Tables B25070: Gross Rent as a Percentage of Household Income & B25091: Monthly Owner Costs as a Percentage of Income)
Communities of color	48%	People of Color – Communities of Color (ACS 2022, Table B03002: Hispanic or Latino Origin by Race)
Single parent families	10%	Families comprised of a parent/caregiver and one or more dependent children without the presence and support of a spouse or adult partner who is sharing the responsibility of parenting. ACS Census DP02 - Added Male and Female heads of household with children
Residents with Limited English proficiency	3.8%	Limited English Proficiency – Limited English-Speaking Households (ACS 2022, Table B16002: Household Language by Household Limited English-Speaking Status)
Residents who are not U.S citizens	24%	Not U.S. Citizens (Population Aged 18+) (ACS 2022, Tables B01001: Total Population by Age & B29001: Citizen Voting-Age Population)
Residents who are under age 5	3.2%	Population Under 5 Years (ACS 2022, Table B01001: Sex by Age)
Households with a member who is 65 years and over living alone	12%	Households with 1 or more people 65 years and over – 65 and Over Living Alone (ACS 2022, Table B11007: Households by Presence of People 65 Years and Over)
Households with a person with a disability	19%	Households with 1 or More Persons with a Disability – People with a Disability (ACS 2022, Table B22010: Receipt of Food Stamps/SNAP by Disability Status)
Renter households	57%	Renter-Occupied Households – Renters (ACS 2022, Table B25003: Tenure)
Zero-vehicle households	20%	Households Without a Vehicle – Without a Vehicle (ACS 2022, Table B25044: Tenure by Vehicles Available)

Cumulative Social Vulnerability

Individuals can belong to more than one vulnerable group and may experience especially complex forms of climate change vulnerability in the aggregate. To ensure that the social vulnerability analysis accounts for this fact, a cumulative vulnerability map (See **Figure 3**) was created using the San Francisco Bay Conservation and Development Commission (BCDC) 2020 Community Vulnerability Index. The cumulative vulnerability map includes all of the vulnerable populations presented in **Table 1** above. Census block groups were identified and classified as low, moderate, high, and very high cumulative vulnerability according to **Table 2**. A block group is classified as having “very high” social vulnerability if there are seven or more indicators (see **Table 1** above) at or above the 70th percentile. In other words, that particular block group ranks in the top 30 percent citywide across at least seven vulnerability factors. This threshold is above the mean (3.65) and more than one standard deviation (2.47) above the mean, placing these block groups in the upper tail of the distribution, where compounding social vulnerabilities are most concentrated.

This analysis sets the threshold for determining “very high” social vulnerability at the 70th percentile. Based on the characteristics of the Berkeley population, setting the threshold at this level ensures that areas exhibiting moderate to high vulnerability, which are important to present for policy considerations, are included on the map.

Table 2 Cumulative Vulnerability Classification Methodology

Number of indicators above 70 th percentile	Cumulative Social Vulnerability Score
0 - 2	Low
3 - 5	Moderate
6 - 8	High
9 - 11	Very High

Legend:

- Berkeley City Limits
- Census Tracts
- Social Vulnerability Score**
 - Low
 - Moderate
 - High
 - Highest

Scale: 0, 0.4, 0.8 Miles

North Arrow: N

23-15392 EPS Safety Element
Fig X Social Vulnerability Index

The map displays the city of Berkeley, California, with its city limits and census tracts. Areas of highest cumulative social vulnerability are highlighted in purple. The map includes major roads such as I-580, I-80, and I-205, and landmarks like San Francisco Bay. A legend in the bottom left corner defines the symbols: Berkeley City Limits (thick black line), Census Tracts (thin black line), Areas of Highest Cumulative Social Vulnerability (purple shading), and Social Vulnerability (pink shading). A scale bar and north arrow are also present.

23-15392 EPS Safety Element
Fig X Social Vulnerability Index

The Social Vulnerability Analysis map development process is iterative. Staff and community will continually refine the methodology to ensure that the final Social Vulnerability Analysis map included in the adopted Safety Element reflects community lived experience. To date, this draft Social Vulnerability Analysis map includes feedback received from the project Community Advisory Committee (CAC), facilitated by the Ecology Center. Additionally, the CAC members suggested the analysis be conducted at the Census Block Group-level, rather than the Census Tract-level. By analyzing each indicator at a smaller scale than originally envisioned, the final map provides a more fine-grained, nuanced picture of social vulnerability in the city. The existing conditions memo provides a more detailed summary of feedback received.

Connection to Environmental Justice

The purpose of the Cumulative Social Vulnerability Map is to assist the City and community in identifying areas in Berkeley that are particularly vulnerable to the impacts of climate change. This map has been prepared in close coordination with the Environmental Justice (EJ) Areas Map. The EJ Areas map identifies areas of the city that are low-income areas and are disproportionately impacted by pollution, socioeconomic vulnerability, and adverse health impacts. The EJ Areas Map includes this set of indicators as a separate layer to reflect social vulnerability as part of the EJ analysis. The Cumulative Social Vulnerability Map and EJ Areas Map work together to help prioritize equitable outcomes in projects and programs across the city, and reduce impacts from pollution exposure, especially in areas of the city that are most vulnerable.

Appendix B

Groundwater Rise and Contaminated Site Analysis



Groundwater Rise and Contaminated Site Analysis

February 2025

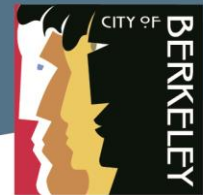
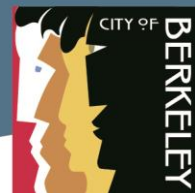


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Attachments

Figure 1a	Contaminated Sites Rankings - Current Conditions Northeast Berkeley
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Figure 1c	Contaminated Sites Rankings - Current Conditions East Berkeley
Figure 1d	Contaminated Sites Rankings - Current Conditions Southwest Berkeley
Figure 1e	Contaminated Sites Rankings - Current Conditions Southeast Berkeley
Figure 2a	Contaminated Sites Rankings - 0.8 feet (25 cm) SLR Scenario Northeast Berkeley
Figure 2b	Contaminated Sites Rankings - 0.8 feet (25 cm) SLR Scenario West Berkeley
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Figure 2d	Contaminated Sites Rankings - 0.8 feet (25 cm) SLR Scenario Southwest Berkeley
Figure 2e	Contaminated Sites Rankings - 0.8 feet (25 cm) SLR Scenario Southeast Berkeley
Figure 3a	Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario Northeast Berkeley
Figure 3b	Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario West Berkeley
Figure 3c	Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario East Berkeley
Figure 3d	Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario Southwest Berkeley
Figure 3e	Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario Southeast Berkeley
Table 1	Contaminated Sites Information and Rankings



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Introduction

Rincon Consultants, Inc. (Rincon) has prepared a Groundwater Rise and Contaminated Site Analysis (analysis) for the City of Berkeley (City). This analysis ranks known contaminated sites within the City based on the potential for new risks to people and the environment (i.e., human and ecological receptors) from projected groundwater rise (GWR) due to sea level rise (SLR). This report presents the background and purpose of the analysis; the relationship between SLR, GWR, and contaminated sites; the methodology and results of the analysis, and recommendations for mitigating the identified risks from GWR.

Background and Purpose

The City of Berkeley is updating the Disaster Preparedness and Safety Element and creating a new Environmental Justice Element of the General Plan. The General Plan serves as a guide for all policies, programs, and decisions related to how land is used. The Disaster Preparedness and Safety Element and the Environmental Justice Element aim to ensure that everyone in Berkeley is safe and healthy, especially underserved communities. One of the main goals in updating the General Plan is to identify how climate change and environmental justice issues affect the City and to create strategies that build a more inclusive and resilient community for everyone.

The purpose of this analysis is to rank known contaminated sites in the City based on the potential for new risks to human and ecological receptors from projected GWR due to SLR as a result of climate change. These rankings can help guide policy decisions presented within the Disaster Preparedness and Safety Element and Environmental Justice Element of the City's General Plan.

Relationship of Sea Level Rise, Groundwater Rise, and Contaminated Sites

SLR can cause GWR in coastal areas like the San Francisco Bay area and the City because rising sea levels exert pressure on the groundwater table, pushing it upwards (see the figure below). SLR can cause marine flooding (i.e., marine inundation) in coastal areas, and GWR can cause the groundwater table to rise towards the ground surface or can cause groundwater inundation at the ground surface (i.e., emergent groundwater) in low lying areas.

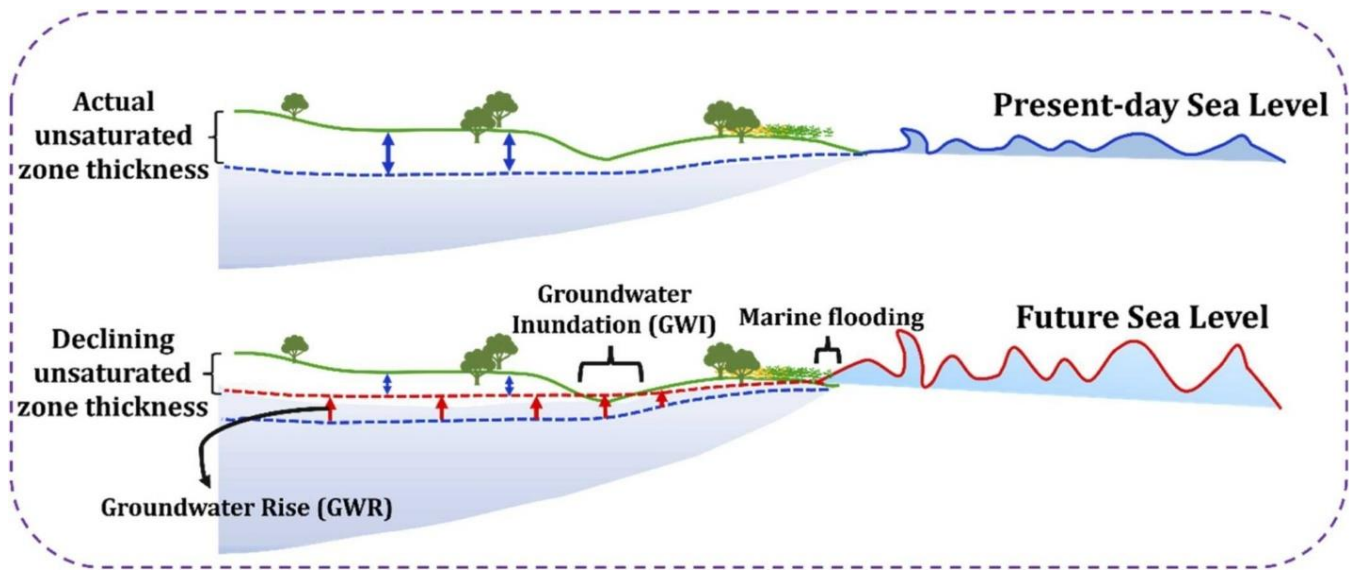


Figure from Visvalingam et al. 2024 (<https://www.sciencedirect.com/science/article/abs/pii/S2352485524000343>)

Rising groundwater can potentially mobilize contaminants at contaminated sites. The rising groundwater can dissolve contaminants into groundwater (depending on the solubility of the contaminant), and those contaminants may be transported with groundwater movement (i.e., flow). The potential pathways for contact between human and ecological receptors and contaminants in groundwater (i.e., exposure pathways) include:

- Rising groundwater can bring contaminants to the surface, potentially increasing the exposure for human and ecological receptors (e.g., aquatic life, ecosystems) through direct contact with the groundwater.
- Rising groundwater can bring contaminants closer to the surface or into building basements, potentially increasing the exposure for human receptors through inhalation of vapors and direct contact.
- Rising groundwater can flow through soil that has higher permeability than the surrounding soil (a preferential pathway), which allows contaminants to move more easily through the subsurface and migrate, potentially increasing the exposure for human receptors through inhalation of vapors or direct contact with the groundwater and for ecological receptors through direct contact. Preferential pathways in the City include:
 - The backfill material used for utility corridors (e.g., sewers, storm drains, creek culverts, oil and gas pipelines)
 - The utility itself (e.g., sewers, storm drains, creek culverts)
 - The historical creek alignments within the City.

- Rising groundwater may eventually flow and discharge into creeks and the San Francisco Bay, potentially increasing the exposure for human and ecological receptors through direct contact with the groundwater.

Methodology

Data Considered

Contaminated Site Inventory

Using GeoTracker¹ and EnviroStor² databases, Rincon mapped listed contaminated sites (open and closed) within the City limits in an ArcGIS database. GeoTracker is a database tool developed by the California State Water Resources Control Board (SWRCB) to track and manage data related to contaminated sites and other environmental assessments across the state of California. EnviroStor is another environmental database, developed by the California Department of Toxic Substances Control (DTSC), designed to provide comprehensive information about sites contaminated by hazardous substances and to facilitate the management of environmental cleanup and assessment efforts. From these databases, Rincon gathered the site name, site type, status, address, latitude, and longitude data for each site. In some cases, GeoTracker and EnviroStor listed the same contaminated site. In these cases, duplicate sites were removed from the final ArcGIS database. One site did not have latitude and longitude, nor was there enough information to determine the exact location of the site, so it was not included in the analysis.³ The contaminated sites downloaded from GeoTracker and EnviroStor included in the analysis are listed in Table 1 (attached to this report).

Projected Future Sea Level Rise

To determine projected future SLR in the City, we used SLR scenarios presented by the Ocean Protection Council (OPC) in the *State of California Sea Level Rise Guidance: 2024 Science and Policy Update*⁴ document. The SLR scenarios in this guidance document are based on the probabilistic projections developed by the Intergovernmental Panel on Climate Change (IPCC)

¹ <https://geotracker.waterboards.ca.gov/>

² <https://www.envirostor.dtsc.ca.gov/public/>

³ The site/facility name is the Berkeley Landfill Company. The EnviroStor database lists the site as between I-80, Frontage Road, and Marina. The U.S. Environmental Protection Agency website lists this site at Virginia Street and the foot of University (<https://cumulis.epa.gov/supercpad/CurSites/csitinfo.cfm?id=0902087>).

⁴ <https://opc.ca.gov/wp-content/uploads/2024/01/SLR-Guidance-DRAFT-Jan-2024-508.pdf>

Sixth Assessment Report (AR6)⁵ and reflect the most up-to-date scientific understanding of the physical drivers of SLR. Of the five probabilistic sea level scenarios modeled for California in the *2024 California Sea Level Rise Guidance* (i.e., Low, Intermediate-Low, Intermediate, Intermediate-High, and High), the guidance document recommended evaluating the Intermediate, Intermediate-High, and High scenarios to inform appropriate SLR planning and project decisions.

In the *2024 California Sea Level Rise Guidance*, SLR projections are provided for 14 active tide gauge stations along the California coastline. The Alameda tide gauge is the tide gauge nearest the City and is the tide station used to determine the SLR projections for this analysis (Table 7, Appendix 2 of the *California Sea Level Rise Guidance: 2024 Science and Policy Update*). Consistent with City direction, Rincon selected for this analysis Intermediate and Intermediate-High SLR scenarios from the *California Sea Level Rise Guidance* using the following time horizons:

- 0.9 feet (27 cm), which represents:
 - Year 2060 Intermediate scenario
 - Year 2050 Intermediate-High scenario
- 2.8 feet (85 cm), which represents:
 - Year 2100 Intermediate scenario
 - Year 2080 Intermediate-High scenario

Projected Future Groundwater Rise

To determine projected future GWR in the City, we used data from the Coastal Storm Modeling System (CoSMoS) groundwater model prepared by the U.S. Geological Service (USGS).⁶ According to the compendium prepared in November 2019⁷ comparing CoSMoS and the Pathways Climate Institute (Pathways) and San Francisco Estuary Institute (SFEI) model, CoSMoS offers projections of sea level and groundwater level rise that are more likely to lead to longer-term (e.g., weeks to months) or chronic emergent groundwater flooding, making it a more appropriate tool for informing long-term planning (e.g., General Plan), as well as for developing policies to help mitigate the negative impacts along the City's shoreline. In

⁵ <https://www.ipcc.ch/report/ar6/syr/>

⁶ <https://ourcoastourfuture.org/hazard-map/>

⁷ https://www.adaptingtorisingtides.org/wp-content/uploads/2020/03/GW_ModelComparison_Compendium_ADA.pdf

contrast, Pathways and SFEI data,⁸ while valuable for design purposes (such as foundations and stormwater systems), is less suitable for longer-term planning because the Pathways and SFEI data estimates the amount of sea level rise that is likely to result in emergent groundwater flooding on a temporary (e.g., hours to days), seasonal basis, not a longer-term basis. A summary of both model approaches is presented below.⁹

Pathways and SFEI Model	CoSMoS Groundwater Model
Predicts the annual high, wet weather groundwater conditions	Predicts daily groundwater conditions
Data-driven, based on 10,000+ well observation locations	Model-driven, validated by observations
Assumes linear response to sea level rise	Assumes homogenous sub-surface geology
San Francisco Bay Area coverage	California statewide coverage, including the San Francisco Bay Area

For the analysis, the SLR values listed above (i.e., 0.9 feet [27 cm] and 2.8 feet [85 cm]) were selected in CoSMoS. The CoSMoS groundwater model shows the predicted present day and future groundwater table depth with SLR from 0 to 9.8 feet (0 to 3 meters) for areas along the California coast, including the City. For a given SLR scenario, the CoSMoS groundwater model provides the following ranges of predictions:

- Marine inundation (mean higher high water [MHHW] sea level)
- Groundwater table at surface (emergent)
- Groundwater table between 0 and 1 meter (0 and approximately 3 feet) depth
- Groundwater table between 1 and 2 meters (approximately 3 and 6 feet) depth
- Groundwater table between 2 and 5 meters (approximately 6 and 15 feet) depth.

Rincon used the polygon layers from the CoSMoS groundwater model to map in ArcGIS the current groundwater level and projected future groundwater table levels across the City. Because SLR scenario values in the *California Sea Level Rise Guidance* and the CoSMoS groundwater model are not exactly equal, the closest values were chosen and considered equivalent. The following SLR scenarios in the CoSMoS groundwater model were used:

⁸ sfei.org/projects/shallowgroundwater-response-sea-level-rise

⁹ https://www.adaptingtorisingtides.org/wp-content/uploads/2020/03/GW_ModelComparison_Compndium_ADA.pdf

- 0 feet (0 cm) in CoSMoS – equivalent to current conditions to be used as a baseline
- 0.8 feet (25 cm) in CoSMoS – equivalent to 0.9 feet (27 cm) from the *California Sea Level Rise Guidance*
- 2.5 feet (75 cm) in CoSMoS – equivalent to 2.8 feet (85 cm) from the *California Sea Level Rise Guidance*.

Subsurface soil lithology plays a key role in determining how easily groundwater can move through connected pore spaces in the soil; this is a property known as hydraulic conductivity. For example, in more permeable materials like gravel, groundwater flows easily compared to less permeable materials like clay. The CoSMoS groundwater model has three options for conductivity values, which represent less permeable (0.1 meter/day), moderate (1 meter/day), and more permeable (10 meters/day) soil. Of these three, Rincon used the value of 1 meter/day, which is the default option in the CoSMoS groundwater model and represents a moderately permeable subsurface soil lithology, comparable to a fine- to medium-grained sand.

Exposure Pathways

The pathways through which human and ecological receptors may be exposed to contamination due to GWR considered in the analysis were:

- Marine inundation
- Groundwater inundation at the ground surface (i.e., emergent groundwater)
- Preferential pathways in the City: sewers, storm drains, creek culverts, historical creek alignments, and oil and gas pipelines.

Marine inundation (MHHW sea level) and emergent groundwater projections are provided in the CoSMoS groundwater model.

Rincon also relied on the following GIS layers provided by the City to inform our methodology:

- Sewers: laterals, maintenance holes, pump stations
- Storm drains: inlets, maintenance holes, culverts, discharge points
- Historical creek alignments.

Sewers and storm drain features are along most roads throughout the City. Therefore, most of the known contaminated sites in the City are adjacent to these features, which can be preferential pathways for contaminant migration. However, limited to no depth information was provided with the GIS layers from the City. Where there were depth data, primarily for the

sewer maintenance holes, the data were limited. For example, 94 out of 7,600 sewer maintenance holes had depth data (approximately 1 percent) and those depths ranged from 3 to 13 feet below ground surface (bgs).

Oil and gas pipeline locations were downloaded from the National Pipeline Mapping System.¹⁰ No depth information was available for the pipelines.

Because of the limited localized depth information available for sewers, storm drains, historical creek alignments, and oil and gas pipelines within the City, and because this analysis is a screening tool to be used by the City, we assumed utility corridors in the City were at a depth of 6 feet (approximately 2 meters) bgs. This assumption is based on the limited available depth data from the City (discussed above), general knowledge of typical utility corridor and basement depths,^{11 12} and the output of the CoSMoS groundwater model, which groups projections for less than 6 feet (approximately 2 meters) bgs and deeper than 6 feet (approximately 2 meters) bgs.

Method of Analysis

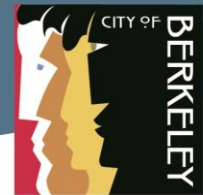
Using the available data, Rincon developed an approach for ranking contaminated sites in the City based on the potential for new risks to human and ecological receptors due to GWR. Using ArcGIS, we overlaid the known contaminated sites and the marine inundation and GWR projections from the CoSMoS groundwater model for baseline and the two SLR scenarios (0 feet [0 cm], 0.8 feet [25 cm], and 2.5 feet [75 cm]). As noted above, sewers and storm drain features are along most roads in the City; therefore, we made the conservative assumption that all known contaminated sites are adjacent to at least one of these features (preferential pathways). We also assumed that all utility corridor and basement depths are 6 feet (2 meters) bgs. Using this information and these assumptions, we developed the following ranking framework for contaminated sites in the City:

- **High Priority** – projected GWR at a contaminated site is at the ground surface (marine inundation, emergent groundwater) or within 6 feet (approximately 2 meters) of the ground surface (i.e., 0 to 6 feet [0 to 2 meters] bgs).
 - We assumed that exposure pathways exist at contaminated sites where projected groundwater rise is within 6 feet (approximately 2 meters) or less of the ground surface, and these contaminated sites are considered high priority in this analysis.

¹⁰ <https://www.npms.phmsa.dot.gov/>

¹¹ <https://www.pge.com/assets/pge/docs/account/service-requests/greenbook-manual-full.pdf>

¹² https://www.sfei.org/sites/default/files/biblio_files/Shallow%20Groundwater_Sea%20Level%20Rise_Pathways_SFEI_2022_v2.2.pdf



- **Medium Priority** - projected groundwater rise at a contaminated site is deeper than 6 feet (approximately 2 meters) from the ground surface (greater than 6 feet [2 meters] bgs).
 - While we assumed that exposure pathways exist at contaminated sites where projected groundwater rise is more than (deeper) 6 feet (approximately 2 meters) from the ground surface, these contaminated sites are considered medium priority in this analysis.
- **Low Priority** - closed Leaking Underground Storage Tank (LUST) sites, which consist almost entirely of fuel-(petroleum) contaminated LUST sites.¹³
 - Natural attenuation slows and limits the migration of dissolved petroleum plumes in groundwater and many petroleum release cases pose a low threat to human health and the environment;¹⁴ therefore, closed LUST sites are considered low priority due to the nature and fate of the contaminants.

It should be noted that this is a screening analysis and is appropriate for the available information and chosen assumptions.

Results

A total of 427 contaminated sites (open and closed) were identified within the City limits using the GeoTracker and EnviroStor databases (Table 1 attached to this report). Rincon used the site categories in the GeoTracker database to group the contaminated sites. The site categories, number of sites, and a brief description of the categories are:

- **Cleanup Program Sites** – 60 in the City. Cleanup Program Sites are from the GeoTracker database. These sites are all non-federally owned sites regulated under the SWRCB's Site Cleanup Program and/or similar programs conducted by each of the nine Regional Water Quality Control Boards in the State.
- **DTSC Cleanup Sites** – 46 in the City. DTSC Cleanup Sites are from the EnviroStor database. These sites include National Priorities List (NPL, aka Superfund), state response, voluntary cleanup, corrective action, school cleanup and investigation, evaluation, and tiered permit sites.
- **DTSC Hazardous Waste Sites** – 2 in the City. DTSC Hazardous Waste Sites are from the EnviroStor database.
- **LUST Cleanup Sites** – 239 in the City. LUST Cleanup Sites are from the GeoTracker database and consist almost entirely of fuel-contaminated LUST sites. These sites are underground storage tank (UST) sites that have had an unauthorized release (i.e., leak or

¹³ https://geotracker.waterboards.ca.gov/site_type_definitions

¹⁴ https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2012/rs2012_0016atta.pdf

spill) of a hazardous substance (usually fuel hydrocarbons) and are being (or have been) cleaned up.

- Land Disposal Site – 1 in the City. The Land Disposal Site in the City is the former Berkeley Landfill (now Cesar Chavez Park).
- Non-Case Information Sites – 42 in the City. Non-Case Information Sites are from the GeoTracker database. These are sites that either have no unauthorized release, had a release to the environment with minimal impact, or are currently being evaluated for impacts and may result in the activation of a new case.
- Permitted USTs – 33 in the City. Permitted UST sites are from the GeoTracker database. These sites are facilities that are associated with permitted USTs from the California Environmental Reporting System (CERS) database, which is managed by the California Environmental Protection Agency (CalEPA).
- Single-Walled UST Sites – 4 in the City. Single-Walled UST Sites are from the GeoTracker database. These sites are those identified with USTs constructed with non-exempt single-walled components and include both operating and recently closed sites. Single-walled USTs are required to be permanently closed on or before December 31, 2025.

Figures showing the contaminated sites rankings for 1) current conditions are presented on Figures 1a through 1e, 2) the 0.8 feet (25 cm) SLR scenario are presented on Figures 2a through 2e, and 3) the 2.5 feet (75 cm) SLR scenario are presented on Figures 3a through 3e (figures are attached to this report). Figures show the City limits, the GWR projections from the CoSMoS groundwater model for the SLR scenario (note that GWR projections where the water table is projected to be deeper than 6 feet bgs [2 meters] are not shown on the figures), the location of known contaminated sites, the category of contaminated site (e.g., Cleanup Program Sites, DTSC Cleanup Sites, etc.), and the contaminated site ranking (i.e., high, medium, low). Utility corridors (i.e., sewers, storm drains, and oil and gas pipelines) and historical creek alignments within the City (preferential pathways) are not shown on the figures because, as noted above, we made the conservative assumption that all known contaminated sites are adjacent to at least one of these features.

Table 1 (attached to this report) presents the ranking for each of the 427 contaminated sites identified within the City for current conditions and the two SLR scenarios. The table below summarizes the number of high, medium, and low priority sites by SLR scenario.

Projected Groundwater Depth from CoSMoS Groundwater Model	High Priority Contaminated Sites	Medium Priority Contaminated Sites	Low Priority Contaminated Sites
Current Conditions	100	100	227
0.8 feet (25 cm) SLR Scenario	102	98	227
2.5 feet (75 cm) SLR Scenario	102	98	227

Notes:

Low priority contaminated sites are LUST Cleanup Sites are from the GeoTracker database and consist almost entirely of fuel-contaminated LUST sites that are being, or have been, cleaned up.

cm – centimeter

CoSMoS – Coastal Storm Modeling System

SLR – sea level rise

Under current conditions, of the 427 contaminated sites within the City (open and closed), 100 are ranked as high priority, 100 as medium priority, and 227 as low priority (closed LUST sites). Going from current conditions to the 0.8 feet (25 cm) SLR scenario, only two sites change ranking from medium priority to high priority (the number of low priority sites remains the same). Going from the 0.8 feet (25 cm) SLR scenario to the 2.5 feet (75 cm) SLR scenario, no additional sites change ranking. As shown on Figures 1a through 1e, Figures 2a through 2e, and Figures 3a through 3e, the known contaminated sites are in areas where there is not projected to be a lot of change in GWR using the 0.8 feet (25 cm) and 2.5 feet (75 cm) SLR scenarios.

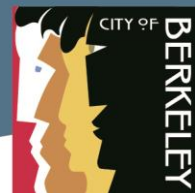
Recommendations

Recommended actions based on this analysis are:

- Refine high priority sites further, based on site specific information including contaminated matrices (e.g., soil, soil vapor, groundwater), contaminant type(s), and contaminant depth.
- Coordinate with oversight agencies by registering for database notifications for high priority sites.
- Consider mitigation measures (e.g., utility trench dams) for capital improvements projects adjacent to or near high priority sites to reduce the potential of preferential groundwater and soil vapor pathways.
- Reanalyze projected groundwater rise and contaminated site on a 5-year review cycle to capture:
 - The evolving data and tools for predicting SLR and GWR



- New contaminated sites or updates to inventoried contaminated sites
- Changes in contaminant classification and knowledge.
- Advocate for proactive planning and risk communication with interested parties (the City, residents, environmental oversight agencies) for high priority sites.



Attachment 1

Figures



Figure 1a Contaminated Sites Rankings - Current Conditions Northeast Berkeley

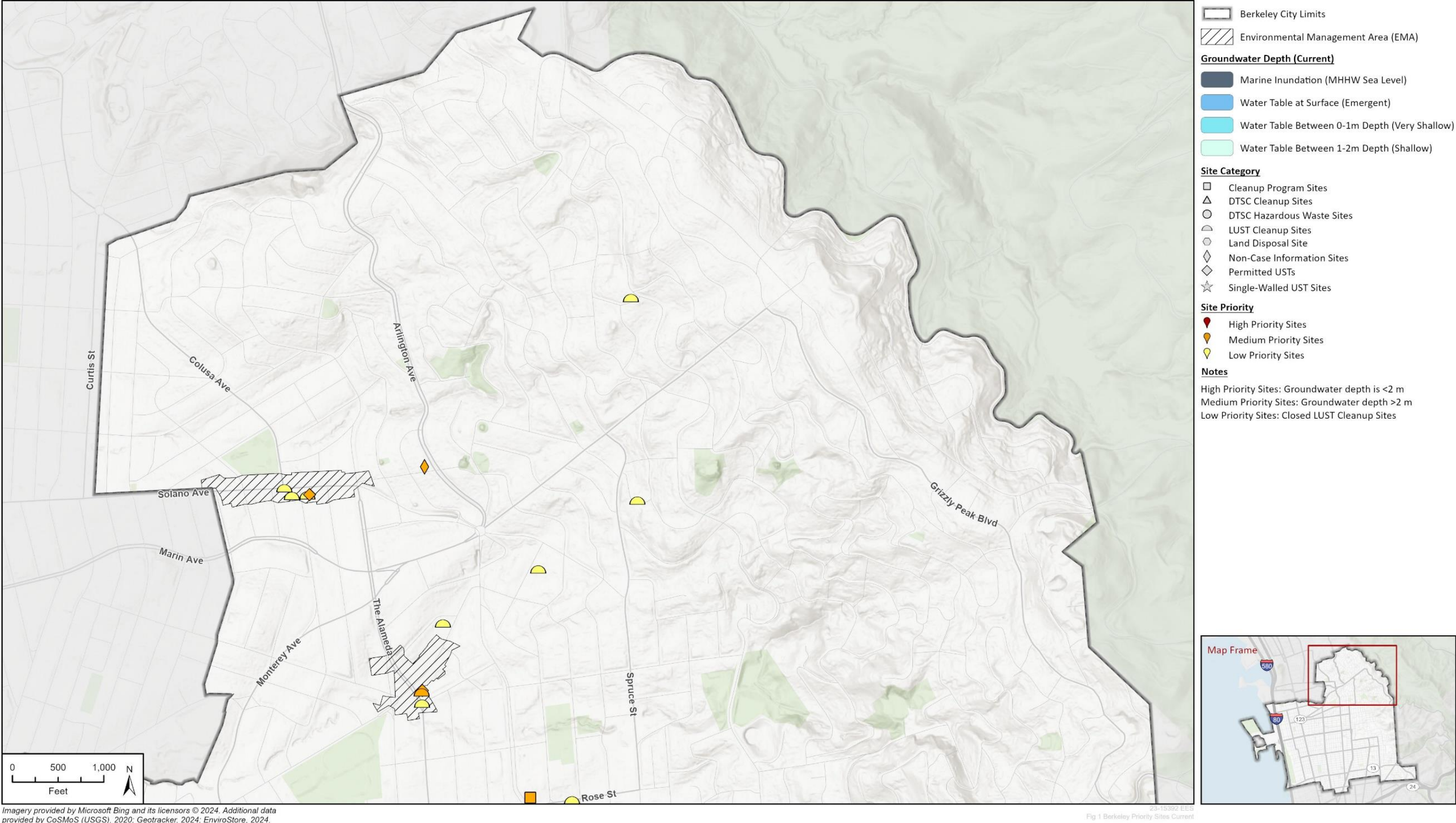
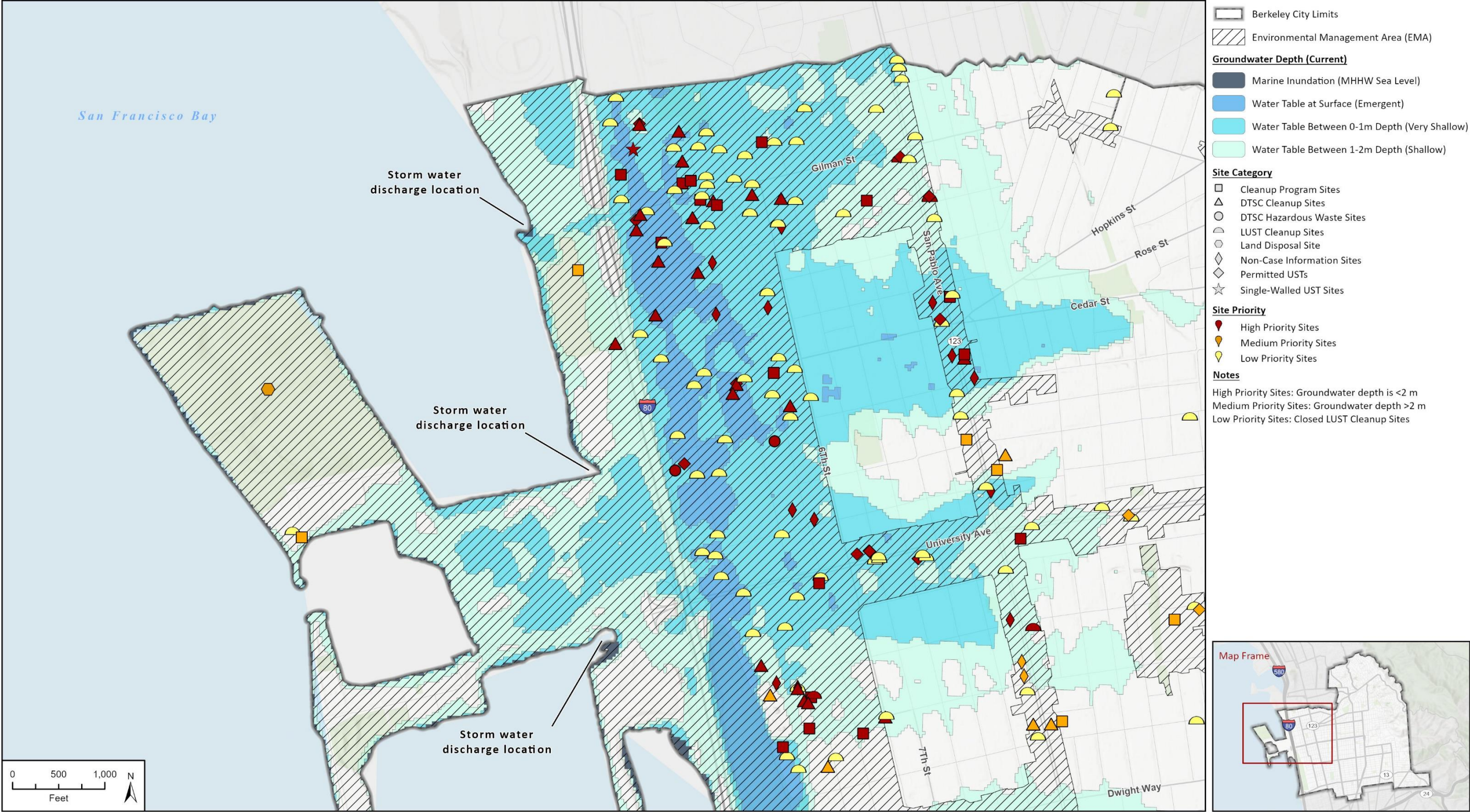




Figure 1b Contaminated Sites Rankings - Current Conditions West Berkeley



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23-15392 EES
Fig 1 Berkeley Priority Sites Current



Figure 1c Contaminated Sites Rankings - Current Conditions East Berkeley

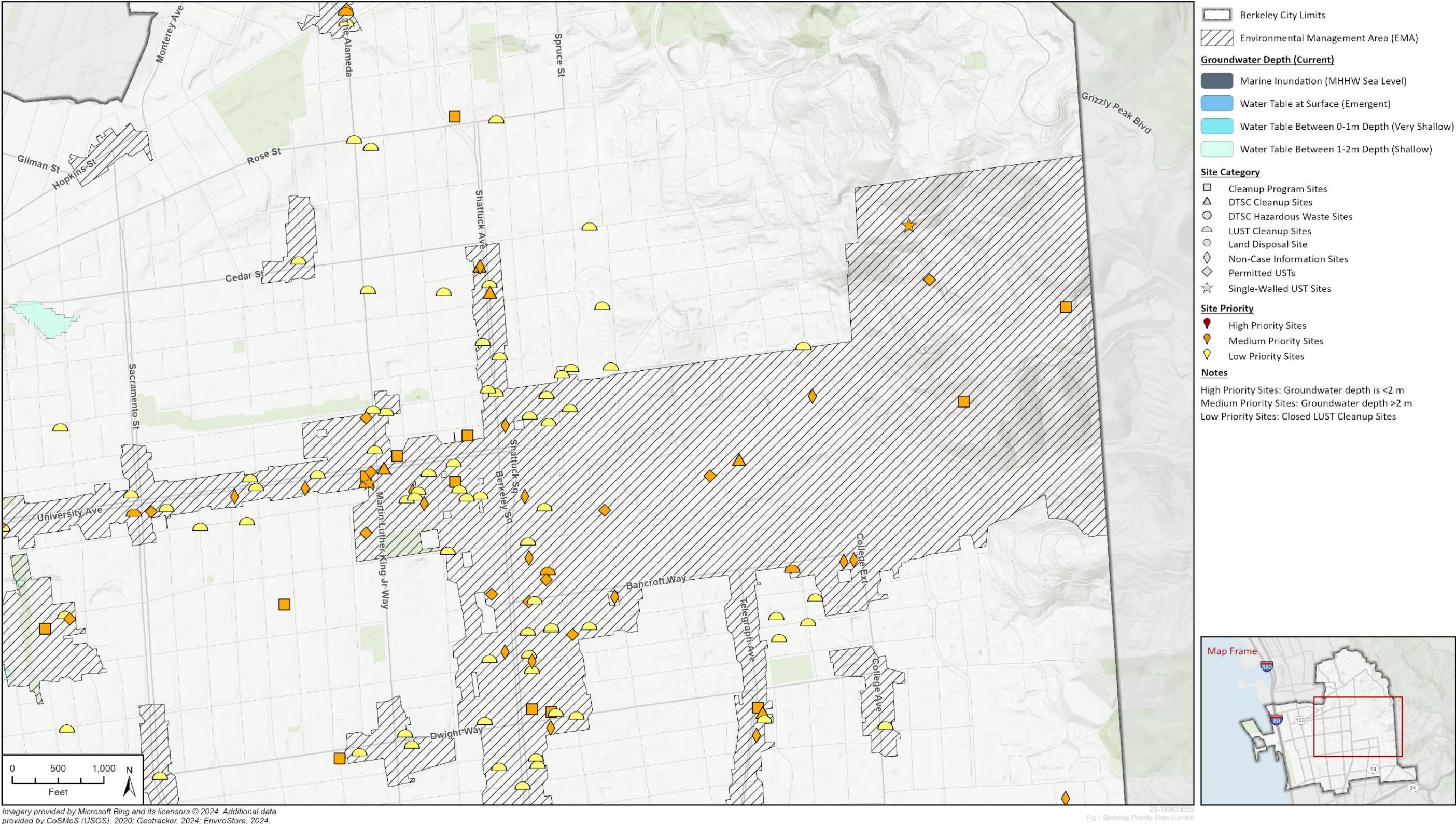
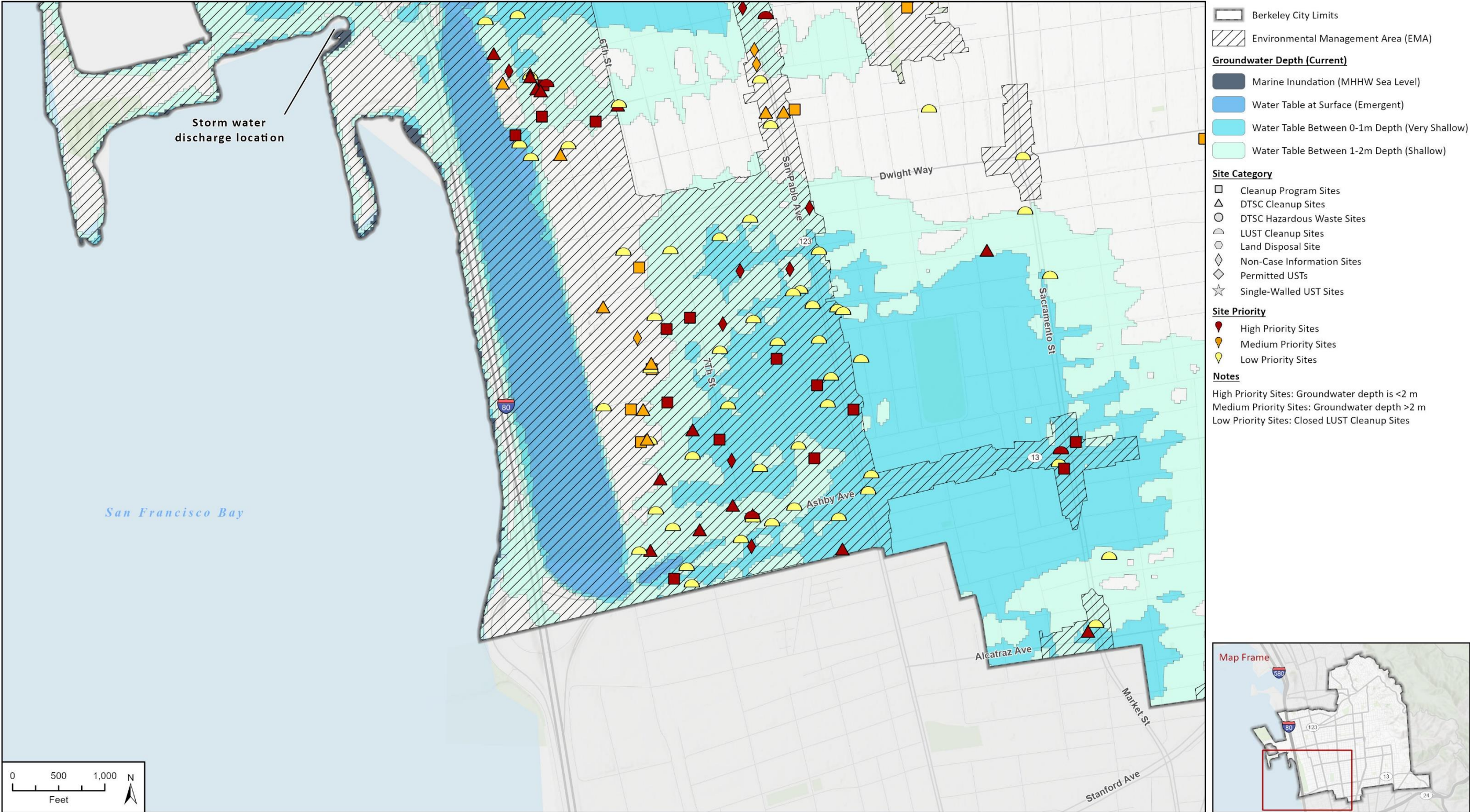




Figure 1d Contaminated Sites Rankings - Current Conditions Southwest Berkeley



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Figure 1e Contaminated Sites Rankings - Current Conditions Southeast Berkeley

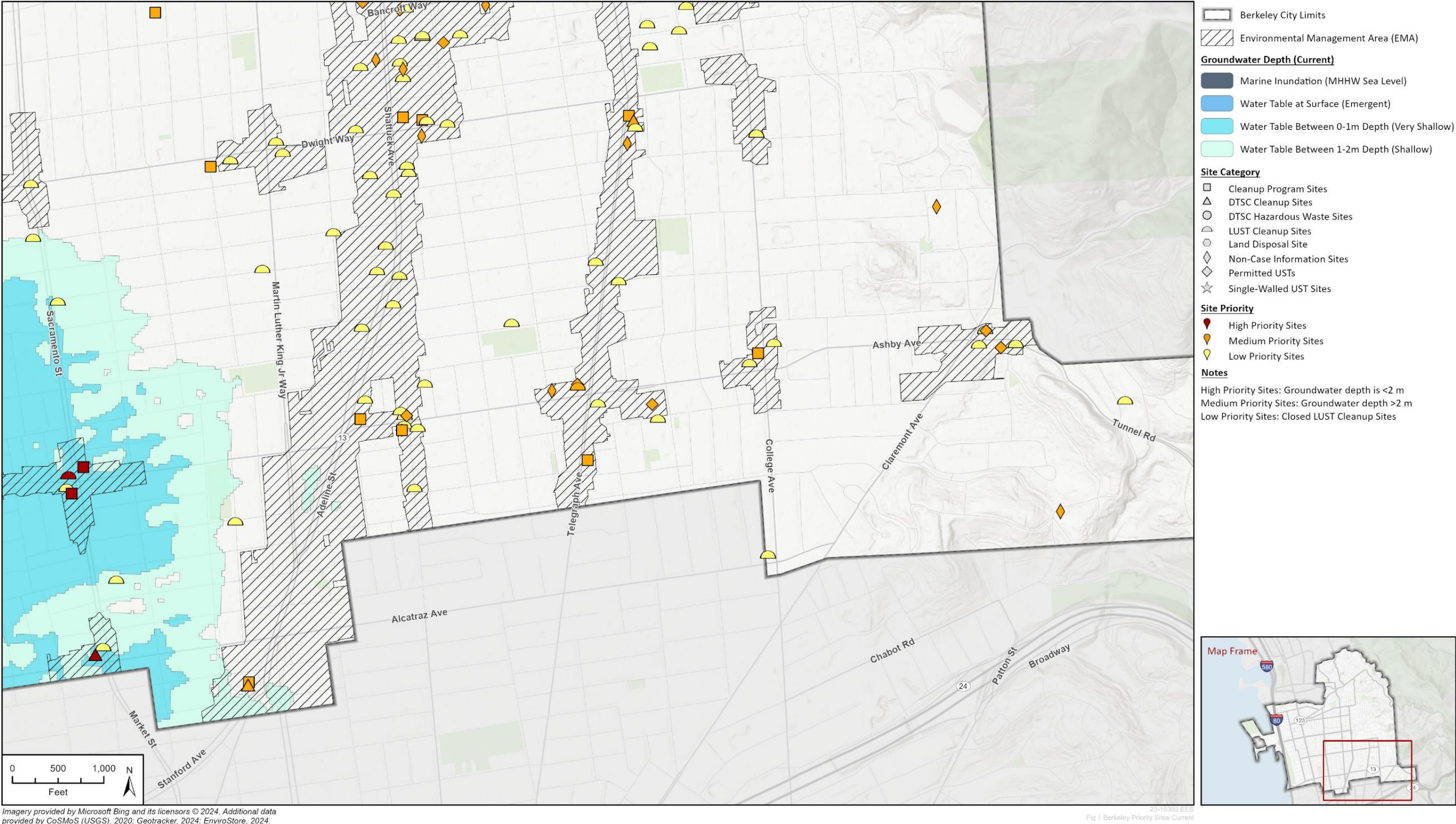




Figure 2a Contaminated Sites Rankings - 0.8 feet (25 cm) SLR Scenario Northeast Berkeley

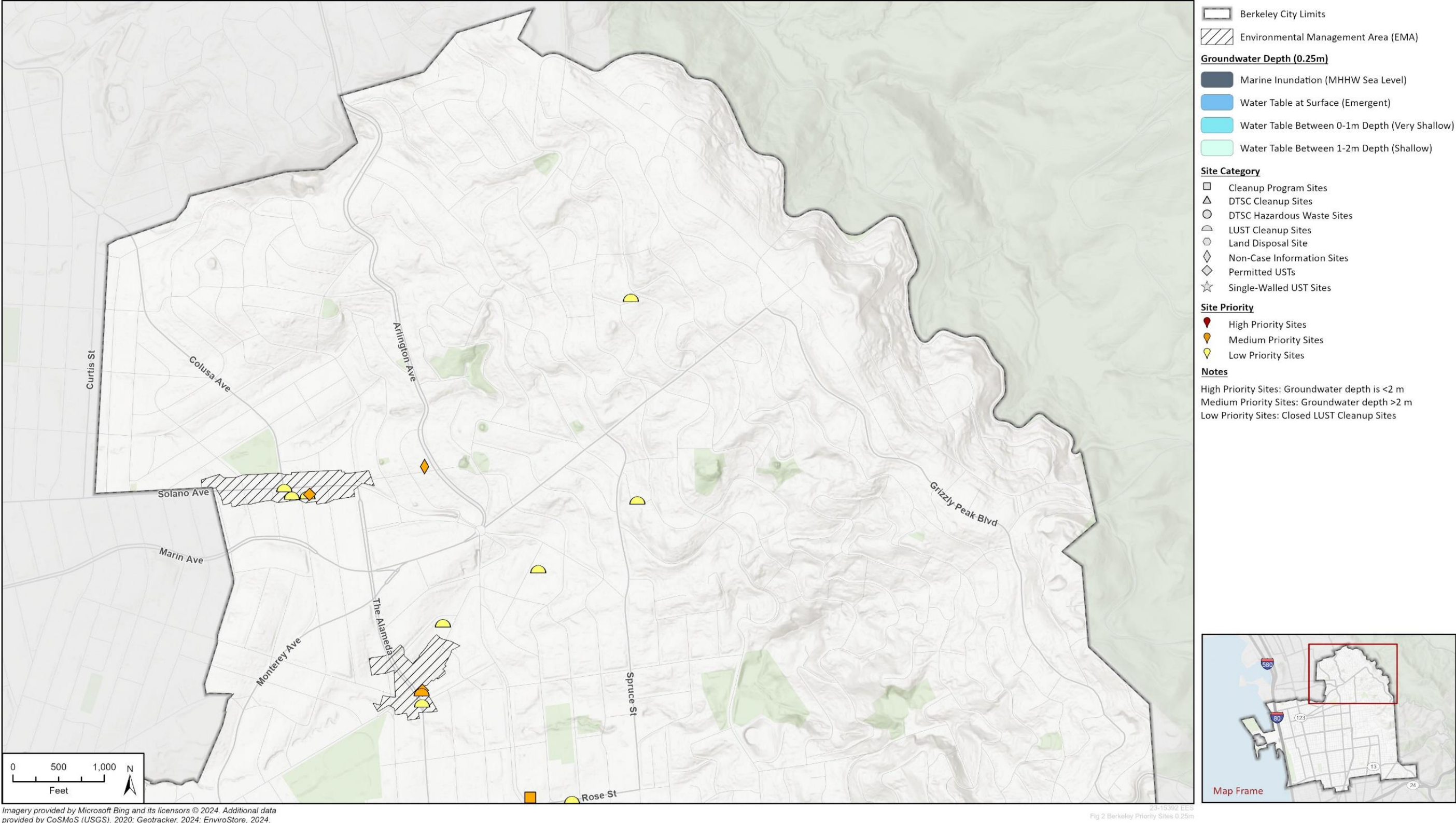




Figure 2b Contaminated Sites Rankings - 0.8 feet (25 cm) SLR Scenario West Berkeley

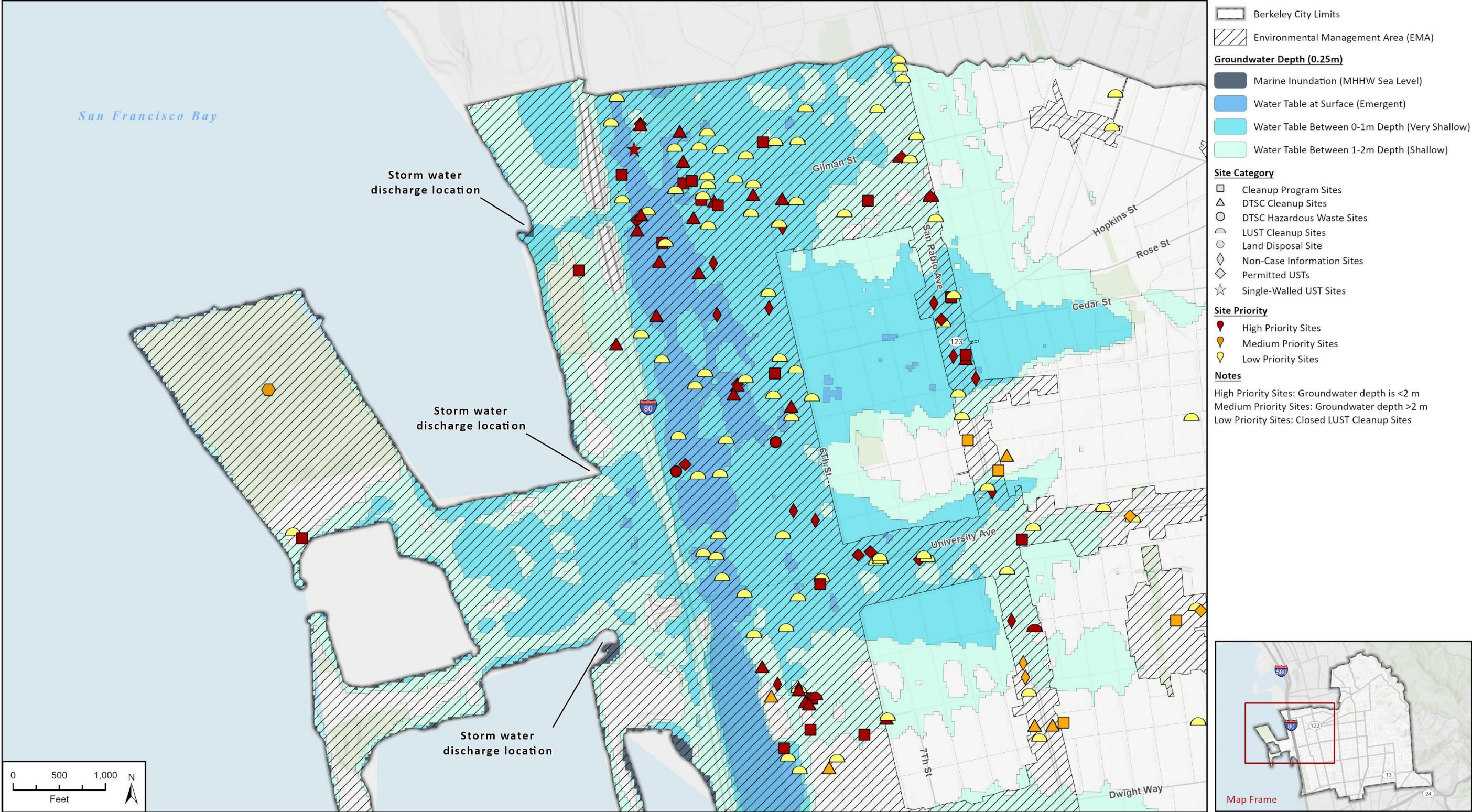
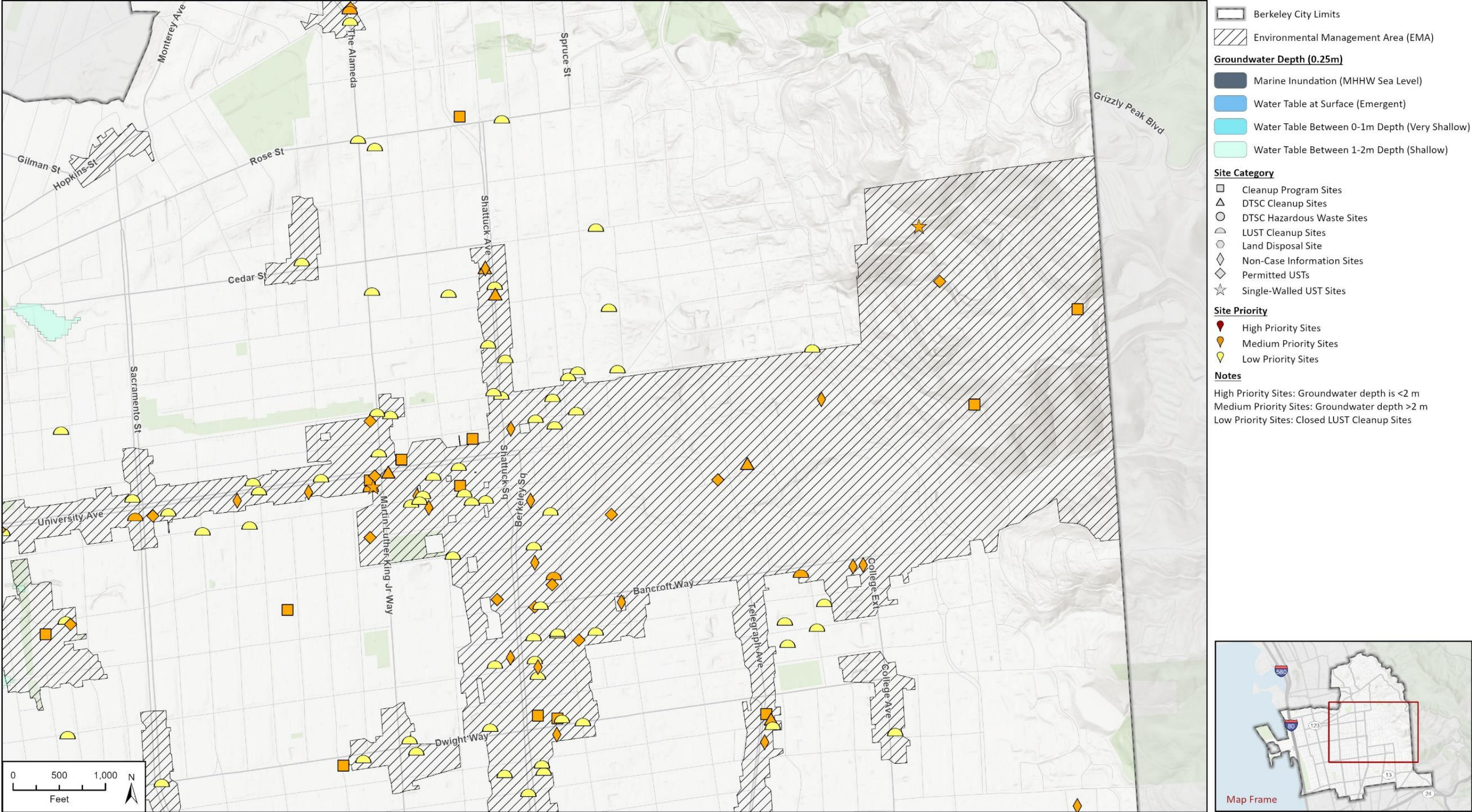




Figure 2c Contaminated Sites Rankings - 0.8 feet (25 cm) SLR Scenario East Berkeley

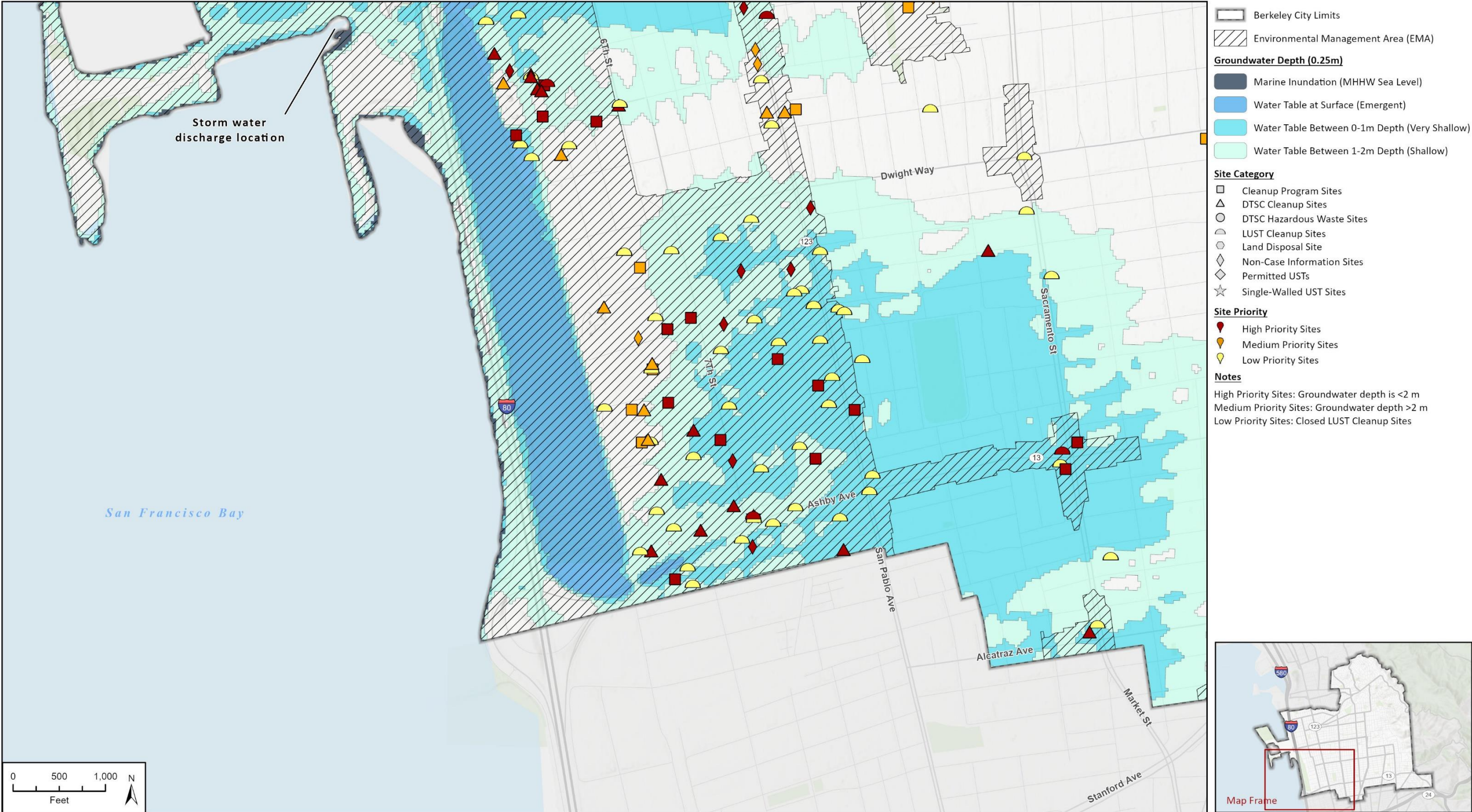


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23-15302 EES
Fig 2 Berkeley Priority Sites 0.25m



Figure 2d Contaminated Sites Rankings - 0.8 feet (25 cm) SLR Scenario Southwest Berkeley

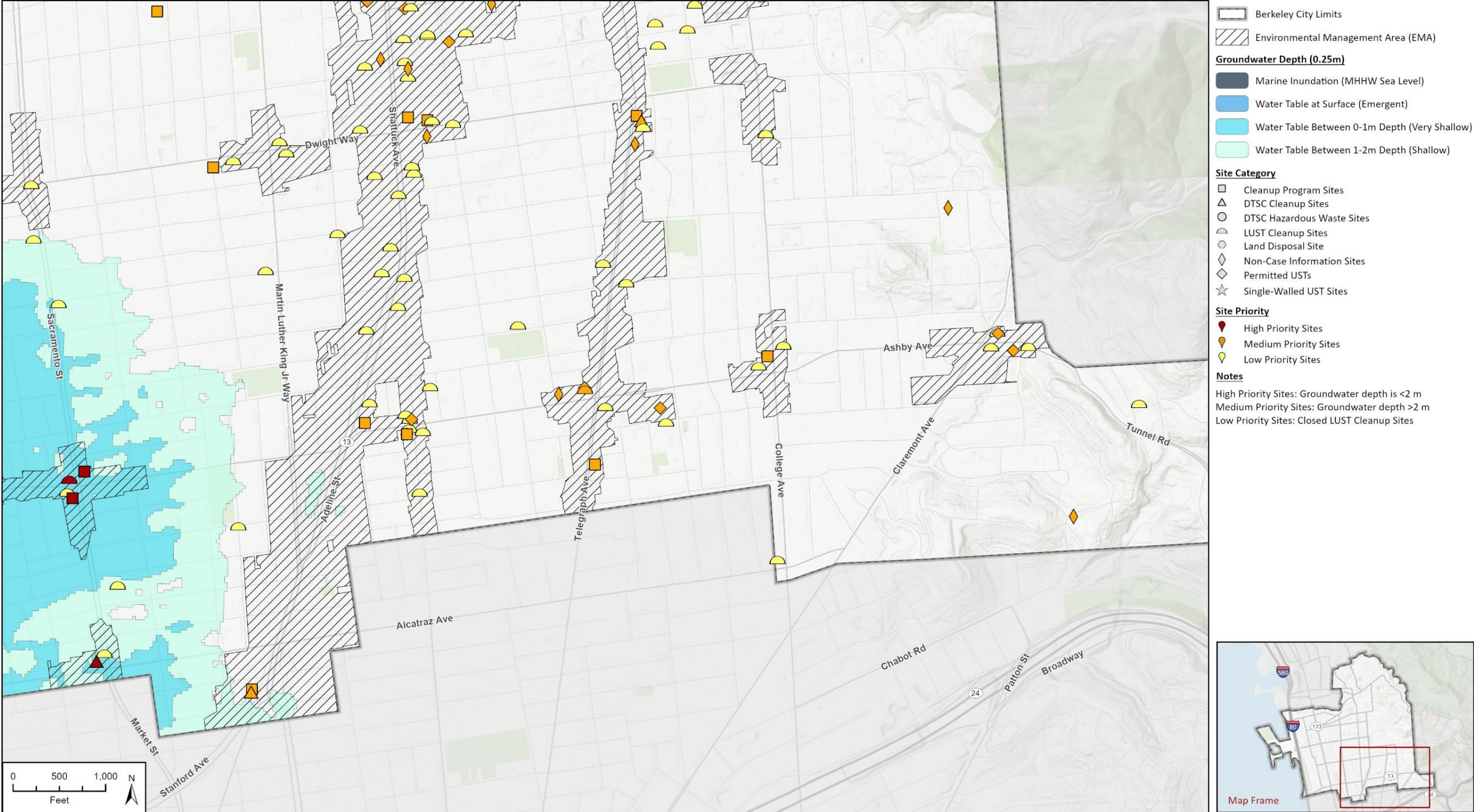


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23-15392 EES
Fig 2 Berkeley Priority Sites 0.25m



Figure 2e Contaminated Sites Rankings - 0.8 feet (25 cm) SLR Scenario Southeast Berkeley

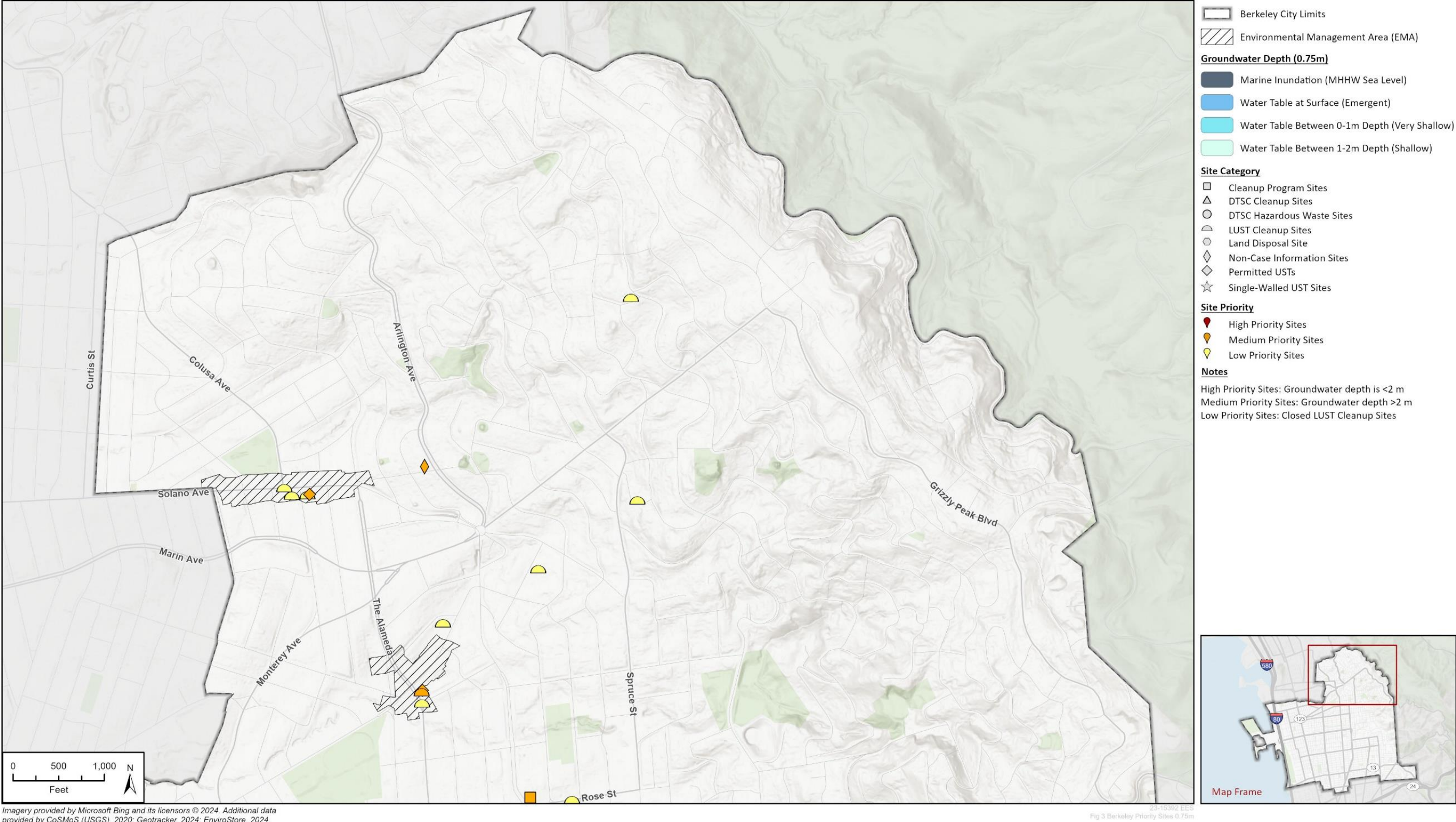


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23-15302 EES
Fig 2 Berkeley Priority Sites 0.25m



Figure 3a Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario Northeast Berkeley



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Figure 3b Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario West Berkeley

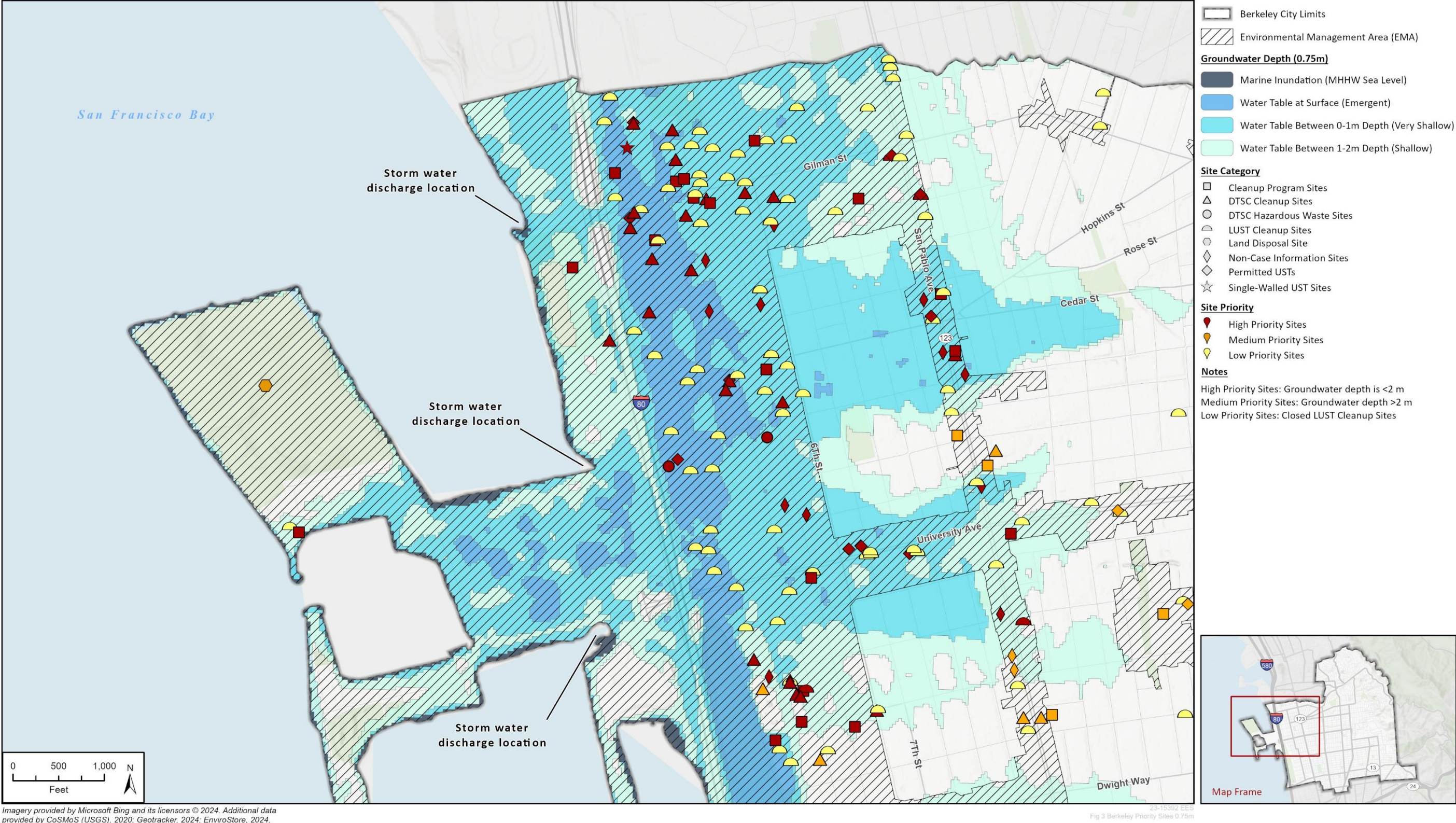
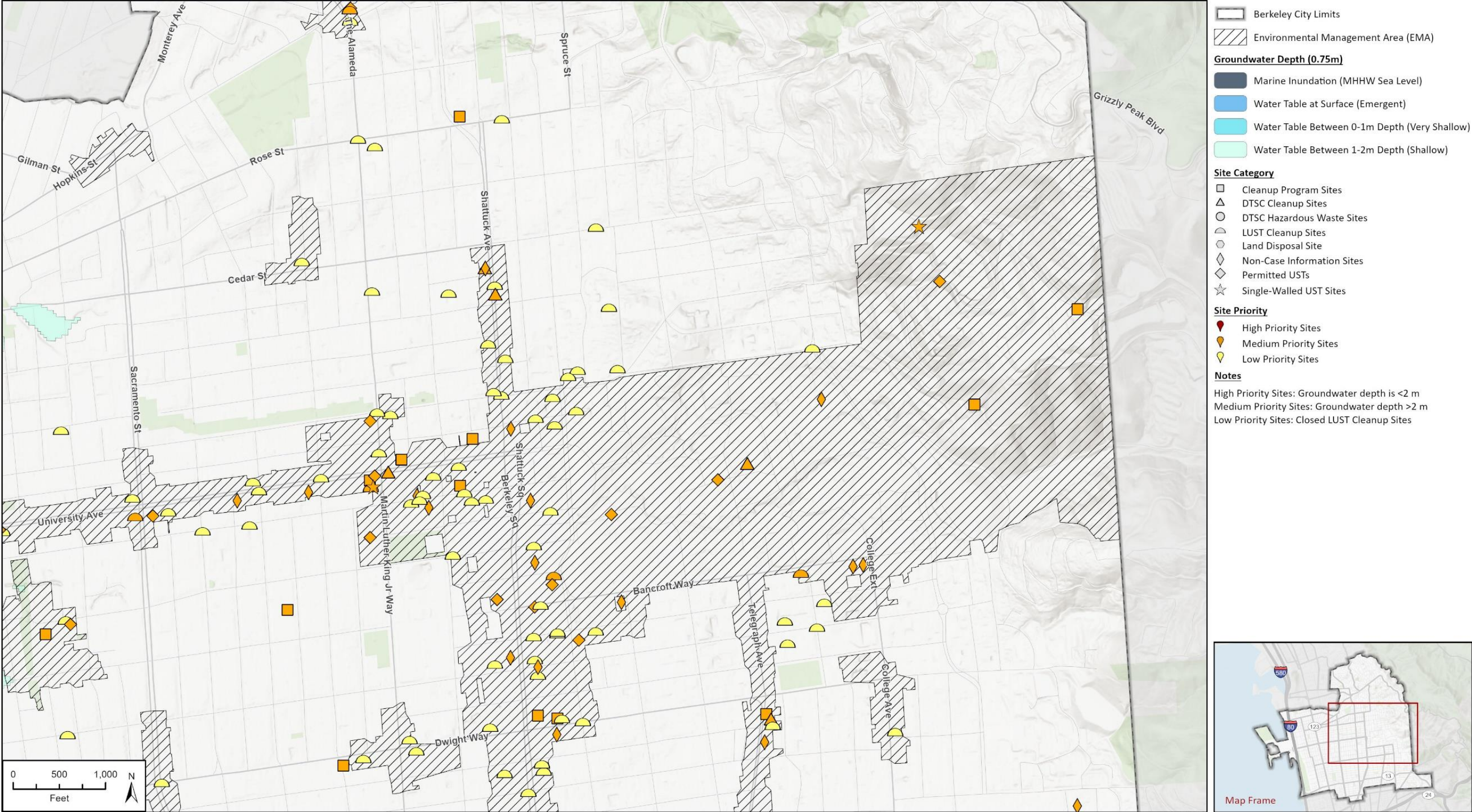




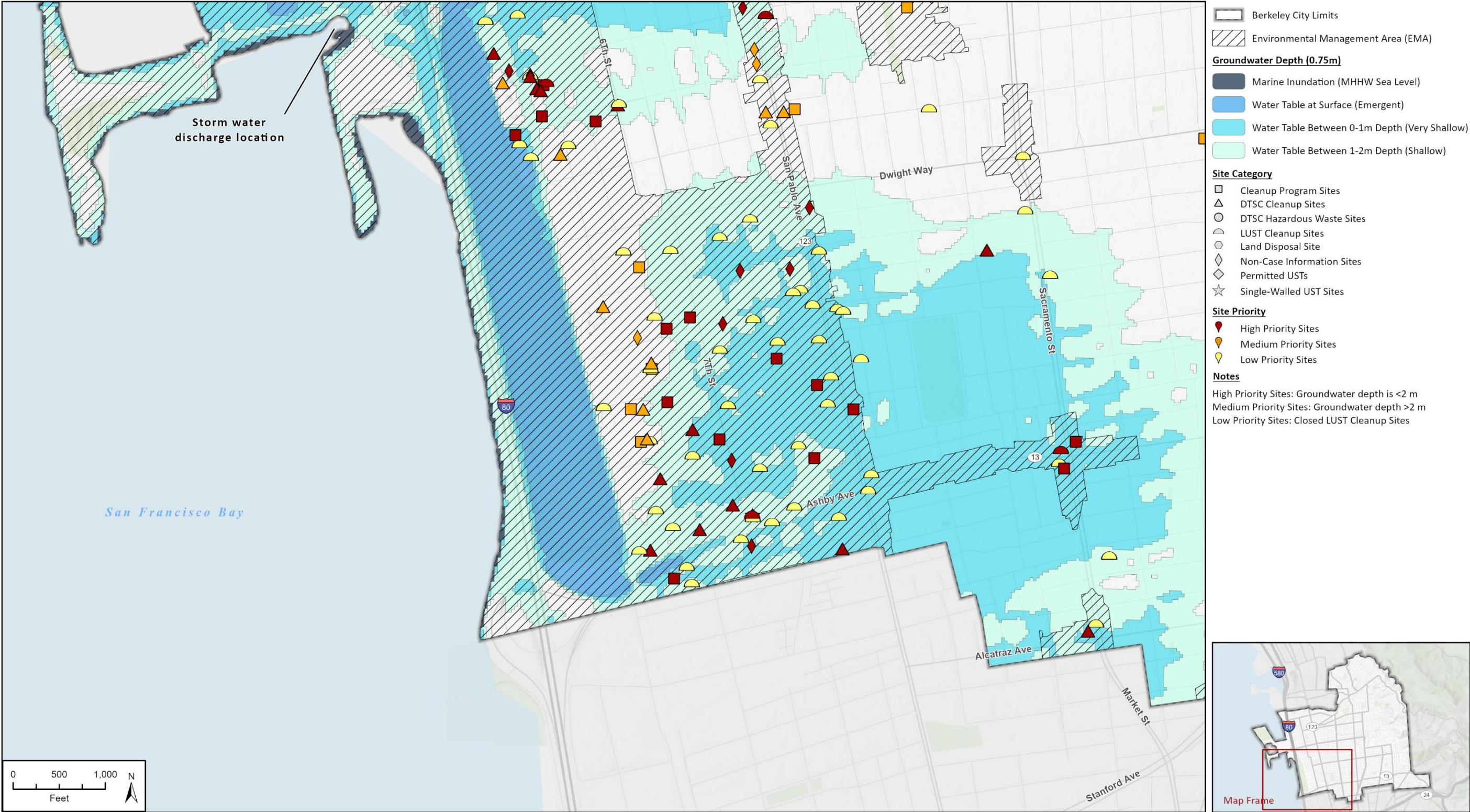
Figure 3c Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario East Berkeley



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23-15302 EES
Fig 3 Berkeley Priority Sites 0.75m

Figure 3d Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario Southwest Berkeley

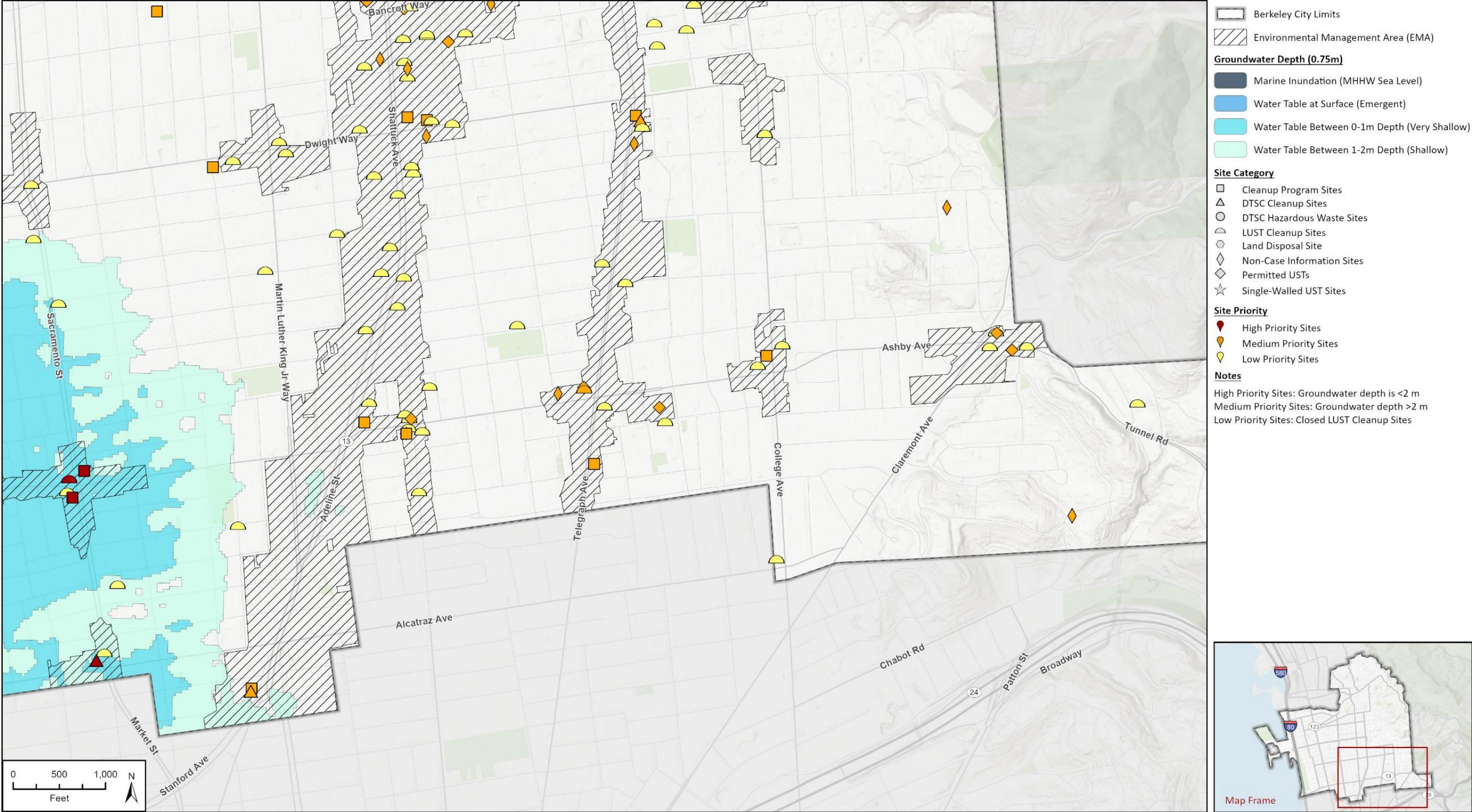


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23-15392 EES
Fig 3 Berkeley Priority Sites 0.75m



Figure 3e Contaminated Sites Rankings - 2.5 feet (75 cm) SLR Scenario Southeast Berkeley



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23-15302 EES
Fig 3 Berkeley Priority Sites 0.75m



Attachment 2

Table 1

Table 1. Contaminated Sites Information and Rankings

No	Site Name	Site Category	Site Type	Status	Address	City	Latitude	Longitude	Projected Groundwater Depth from CoSMoS			Site Ranking		
									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
1	1 RENTAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1501 EASTSHORE HWY	BERKELEY	37.874038	-122.304942	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
2	10TH AND PARKER STREETS	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1050 PARKER STREET	BERKELEY	37.8587	-122.28968	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
3	1255 EASTSHORE HIGHWAY (FORMER HAWKINS TRAFFIC SAFETY SUPPLY)	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - ELIGIBLE FOR CLOSURE	1255 EASTSHORE HIGHWAY	BERKELEY	37.87948	-122.30658	0-1 m; very shallow	0-1 m; very shallow	0 m; emergent	High Priority	High Priority	High Priority
4	1333 & 1335 SIXTH STREET	Non-Case Information Sites	NON-CASE INFORMATION	PENDING REVIEW	1333 & 1335 SIXTH STREET	BERKELEY	37.87801	-122.30051	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
5	1600 ADDISON STREET	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1600 ADDISON ST	BERKELEY	37.8696994	-122.2796561	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
6	1627 SAN PABLO	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	ACTIVE	1625 - 1627 SAN PABLO AVENUE	BERKELEY	37.87424	-122.29355	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
7	1655 FIFTH STREET LLC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1655 FIFTH STREET/801 VIRGINIA STREET	BERKELEY	37.87238	-122.30004	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
8	1776, 1782 AND 1790 UNIVERSITY AVENUE	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1790 UNIVERSITY AVENUE	BERKELEY	37.87092	-122.27571	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
9	1835 SAN PABLO AVE	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	1835 SAN PABLO AVENUE	BERKELEY	37.87090761	-122.292239	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
10	1950 MLK, LLC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1950 MARTIN LUTHER KING JR. WAY	BERKELEY	37.872122	-122.273102	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
11	2001 ASHBY REDEVELOPMENT	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	2001 ASHBY AVENUE	BERKELEY	37.85532	-122.26835	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
12	2009 TO 2015 ADDISON STREET	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - INACTIVE	2009 ADDISON STREET	BERKELEY	37.8712	-122.27003	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
13	2100 MILVIA STREET	Non-Case Information Sites	NON-CASE INFORMATION	PENDING REVIEW	2100 MILVIA STREET	BERKELEY	37.87053	-122.27119	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
14	2107 DWIGHT (AKA "THE DWIGHT")	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	2107 DWIGHT WAY	BERKELEY	37.86441218	-122.2669512	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
15	2127 - 2159 DWIGHT WAY	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	2127 - 2159 DWIGHT WAY	BERKELEY	37.86434	-122.26622	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
16	2246 SAN PABLO AVENUE	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2246 SAN PABLO AVENUE	BERKELEY	37.86478	-122.29108	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
17	2300 AND 2306 ELLSWORTH STREET	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2300 AND 2306 ELLSWORTH STREET	BERKELEY	37.86783	-122.2639	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
18	2300 COLLEGE AVENUE	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2300 COLLEGE AVENUE	BERKELEY	37.86907	-122.25486	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
19	2370 SHATTUCK AVENUE	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2370 SHATTUCK AVENUE	BERKELEY	37.86612	-122.26802	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
20	2371 SAN PABLO AVENUE	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	ACTIVE	2371 SAN PABLO AVENUE	BERKELEY	37.863399	-122.29003	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
21	2587 TELEGRAPH AVENUE	Non-Case Information Sites	NON-CASE INFORMATION	PENDING REVIEW	2587 TELEGRAPH AVENUE	BERKELEY	37.86375	-122.25843	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
22	2601 SAN PABLO AVENUE LLC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2601 SAN PABLO AVENUE	BERKELEY	37.8592683	-122.2886015	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
23	2601-2605 SAN PABLO AVENUE	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	26 SAN PABLO AVENUE	BERKELEY	37.8702761	-122.292454	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
24	2660 AND 2680 BANCROFT WAY	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2660 BANCROFT WAY	BERKELEY	37.86902	-122.25524	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
25	2711 CLAREMONT BLVD.	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2711 CLAREMONT	BERKELEY	37.862029	-122.246662	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
26	740 EUCLID AVE. RESIDENCE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	740 EUCLID	BERKELEY	37.8972369	-122.266855	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
27	742 GRAYSON STREET PROPERTY	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - ASSESSMENT & INTERIM REMEDIAL ACTION - LAND USE RESTRICTIONS	742 GRAYSON STREET	BERKELEY	37.85444	-122.29555	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
28	76 STATION 2218	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1830 SOLANO AVENUE	BERKELEY	37.89112493	-122.2789813	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
29	950 PARKER	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	950 PARKER STREET	BERKELEY	37.85862	-122.29155	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority

Table 1. Contaminated Sites Information and Rankings

No	Site Name	Site Category	Site Type	Status	Address	City	Latitude	Longitude	Projected Groundwater Depth from CoSMoS			Site Ranking		
									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
30	AAMCO TRANSMISSION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1177 SAN PABLO AVE	BERKELEY	37.883073	-122.296291	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
31	AAQA MEATS ALLSTAR STEAKS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1411 SAN PABLO AVE	BERKELEY	37.878375	-122.294779	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
32	AC PAPER	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1321 7TH ST	BERKELEY	37.8788095	-122.3000129	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
33	ADDISON STREET PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2040 ADDISON ST	BERKELEY	37.870806	-122.269062	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
34	ADMIRAL MOVING SYSTEMS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	830 CEDAR ST	BERKELEY	37.873807	-122.299909	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
35	AH THOMPSON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	695 CEDAR	BERKELEY	37.873647	-122.303313	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
36	ALAMEDA COUNTY COMPUTER RESOURCE CENTER	DTSC Cleanup Sites	INSPECTION	NO ACTION	620 PAGE STREET	BERKELEY	37.8766395	-122.30362	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
37	ALCAN INGOT & POWDERS	Permitted USTs		PROTECTIVE FILER	1069 SECOND STREET	BERKELEY	37.881008	-122.30592	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
38	ALCAN INGOT & POWDERS	DTSC Cleanup Sites	CORRECTIVE ACTION	NO FURTHER ACTION	1069 SECOND STREET	BERKELEY	37.881008	-122.30592	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
39	ALTA BATES HOSPITAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3001 COLBY STREET	BERKELEY	37.855504	-122.257073	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
40	ALTA BATES SUMMIT MEDICAL CENTER-ALTA BATES CAMPUS	Permitted USTs			2450 ASHBY AVE	BERKELEY	37.85593	-122.2573	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
41	AMERICAN RED CROSS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2116 ALLSTON WY	BERKELEY	37.869448	-122.267227	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
42	APARTMENT BUILDING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1846 SPRUCE ST	BERKELEY	37.8746859	-122.265709	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
43	APRO DISTRIBUTION 2204	Single-Walled UST Sites	SINGLE-WALLED UST	USTS PERMANENTLY CLOSED - REPORT PENDING	901 ASHBY AVE	BERKELEY	37.85135179	-122.2909015	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
44	APRO DISTRIBUTION 2204	Permitted USTs			901 ASHBY AVE	BERKELEY	37.85135	-122.2909	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
45	AQUATIC PARK SCIENCE CENTER	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	80 BOLIVAR DR.	BERKELEY	37.86189492	-122.2994828	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
46	AQUATIC PARK SCIENCE CENTER	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	NO FURTHER ACTION	2222 3RD STREET	BERKELEY	37.8649732	-122.30096	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
47	ARCO # 00414	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3000 SHATTUCK AVE	BERKELEY	37.85517764	-122.2666875	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
48	ARLINGTON RESIDENCE	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	892 ARLINGTON AVENUE	BERKELEY	37.89205	-122.27456	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
49	ASPHALT PRODUCT OIL CORP	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1001 ASHBY AVE	BERKELEY	37.8516385	-122.2893427	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
50	AT&T CALIFORNIA - Q2002	Permitted USTs			2116 BANCROFT WAY	BERKELEY	37.86764	-122.26715	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
51	ATLAS WELDING SUPPLY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1224 6TH ST	BERKELEY	37.88014	-122.301936	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
52	AUTOMOTIVE UNLIMITED	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2020 ADDISON ST	BERKELEY	37.870738	-122.26958	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
53	AVIS RENT A CAR	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1900 OXFORD ST	BERKELEY	37.873864	-122.266631	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
54	BAY EXPORT SERVICES	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	717 POTTER ST	BERKELEY	37.85145	-122.294537	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
55	BAYER FACILITY (FORMER MILES LABS CUTTER)	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	2550 7TH STREET	BERKELEY	37.85866402	-122.2953413	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
56	BAYER HEALTHCARE	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	790 CARLETON STREET	BERKELEY	37.85656673	-122.2953554	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
57	BAYER, FORMER MILES/CUTTER/BERKELEY UNIFIED SCHOOL DISTRICT	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	800 DWIGHT WAY	BERKELEY	37.85913115	-122.2959421	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
58	BEKINS VAN STORAGE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2721 SHATTUCK AVE	BERKELEY	37.8596534	-122.2669727	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
59	BERKELEY ADULT MENTAL HEALTH CLINIC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2640 MARTIN LUTHER KING JR. WAY	BERKELEY	37.85977608	-122.2721717	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
60	BERKELEY ASPHALT & READY MIX	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	699 VIRGINA ST	BERKELEY	37.8716704	-122.3024765	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority

Table 1. Contaminated Sites Information and Rankings

No	Site Name	Site Category	Site Type	Status	Address	City	Latitude	Longitude	Projected Groundwater Depth from CoSMoS			Site Ranking		
									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
61	BERKELEY AUTO REPAIR	DTSC Cleanup Sites	STATE RESPONSE OR NPL	CERTIFIED	2378/2366 SAN PABLO AVENUE	BERKELEY	37.8633839	-122.2907	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
62	BERKELEY BUSINESS CENTER (SCP)	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	2900 SAN PABLO AVENUE	BERKELEY	37.85308673	-122.2886205	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
63	BERKELEY BUSINESS CENTER (UST)	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2900 SAN PABLO AVE	BERKELEY	37.85346252	-122.2892308	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
64	BERKELEY CHEVRON	Permitted USTs			2996 TELEGRAPH AVE	BERKELEY	37.85649	-122.26015	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
65	BERKELEY CITY OF	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - ELIGIBLE FOR CLOSURE	1326 ALLSTON WAY	BERKELEY	37.86655184	-122.2854675	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
66	BERKELEY CITY OF CORP YARD	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1326 ALLSTON WY	BERKELEY	37.8669731	-122.2847237	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
67	BERKELEY COMMONS	Non-Case Information Sites	NON-CASE INFORMATION	PENDING REVIEW	2222 3RD STREET	BERKELEY	37.86443	-122.30037	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
68	BERKELEY DOWNTOWN HOTEL	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2129 SHATTUCK AVE	BERKELEY	37.8708	-122.26738	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
69	BERKELEY FIRE STATION #5	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2680 SHATTUCK AVE	BERKELEY	37.86055	-122.267515	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
70	BERKELEY FORMER OIL REFINING FACILITIES - BERKELEY WAREHOUSE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1920 2ND ST	BERKELEY	37.86759517	-122.3025249	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
71	BERKELEY FORMER OIL REFINING FACILITIES - DECANION IMPORT TILE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	611 HEARST AVE	BERKELEY	37.8683019	-122.3032441	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
72	BERKELEY FORMER OIL REFINING FACILITIES - IMPORT TILE SITE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1822 2ND ST	BERKELEY	37.8688307	-122.3026942	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
73	BERKELEY FORMER OIL REFINING FACILITIES - LI LIQUIDATION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	620 HEARST AVE	BERKELEY	37.868209	-122.302758	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
74	BERKELEY GAS & SMOG	Permitted USTs			3000 SHATTUCK AVE	BERKELEY	37.85501	-122.26677	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
75	BERKELEY GLASS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2011 ADDISON ST	BERKELEY	37.8709801	-122.2698686	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
76	BERKELEY HONDA	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2600 SHATTUCK	BERKELEY	37.862114	-122.267254	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
77	BERKELEY HOUSING AUTHORITY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1400 MARTIN LUTHER KING	BERKELEY	37.881429	-122.2741062	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
78	BERKELEY HOUSING AUTHORITY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1400 MARTIN LUTHER KING	BERKELEY	37.881219	-122.273469	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
79	BERKELEY HUMANE SOCIETY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2700 9TH ST	BERKELEY	37.857201	-122.291015	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
80	BERKELEY HYDRAULIC SERVICE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2734 SAN PABLO AVE	BERKELEY	37.856628	-122.288536	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
81	BERKELEY INDUSTRIAL COMPLEX	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	729 HEINZ ST	BERKELEY	37.853527	-122.29482	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
82	BERKELEY INDUSTRIAL COMPLEX	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	729 HEINZ AVE	BERKELEY	37.85347003	-122.2951467	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
83	BERKELEY INDUSTRIAL COURT	DTSC Cleanup Sites	STATE RESPONSE OR NPL	REFER: RWQCB	729 HEINZ AVENUE	BERKELEY	37.8535872	-122.29492	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
84	BERKELEY LANDFILL (CESAR CHAVEZ PARK)	Land Disposal Site	LAND DISPOSAL SITE	OPEN - VERIFICATION MONITORING	11 SPINNAKER WAY	BERKELEY	37.87288864	-122.3196747	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
85	BERKELEY LINCOLN MERCURY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2352 SHATTUCK AVE	BERKELEY	37.866744	-122.267167	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
86	BERKELEY MARINE CENTER	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1 SPINNAKER WY	BERKELEY	37.868688	-122.31865	2-5 m; moderate	2-5 m; moderate	1-2 m; shallow	Low Priority	Low Priority	Low Priority
87	BERKELEY MARINE CENTER	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	1 SPINNAKER WAY	BERKELEY	37.8685	-122.3183	2-5 m; moderate	1-2 m; shallow	1-2 m; shallow	Medium Priority	High Priority	High Priority
88	BERKELEY PROPERTIES	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	ACTIVE	2332 4TH STREET, 700 AND 710 BANCROFT WAY	BERKELEY	37.8620066	-122.29838	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
89	BERKELEY PUMP	DTSC Cleanup Sites	EVALUATION	NO FURTHER ACTION	829 BANCROFT WAY	BERKELEY	37.86351	-122.29626	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority

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No	Site Name	Site Category	Site Type	Status	Address	City	Latitude	Longitude	Projected Groundwater Depth from CoSMoS			Site Ranking		
									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
90	BERKELEY PUMP STATION	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1834 4TH ST	BERKELEY	37.869594	-122.299897	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
91	BERKELEY REDEVELOPMENT AGENCY SITE	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	CERTIFIED	1631 FIFTH STREET	BERKELEY	37.8727236	-122.30006	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
92	BERKELEY ROSEVILLE INC	Permitted USTs			950 UNIVERSITY AVE	BERKELEY	37.86822	-122.29514	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
93	BERKELEY SANTA FE TRACKBED TO PARK	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	ACTIVE	BLAKE TO WARD ALONG ACTON STREET	BERKELEY	37.8594	-122.2823	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
94	BERKELEY TOUCHLESS	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - REMEDIATION	2176 KITTREDGE STREET	BERKELEY	37.86857136	-122.2664541	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
95	BERKELEY TOUCHLESS CARWASH	Permitted USTs			2176 KITTREDGE ST	BERKELEY	37.86831	-122.26651	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
96	BERKELEY TRANSFER STATION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1101 2ND ST	BERKELEY	37.8817749	-122.3068217	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
97	BERKELEY UNIFIED SCHOOL DISTRICT TRANSPORTATION FACILITY	DTSC Cleanup Sites	EVALUATION	REFER: LOCAL AGENCY	1325 SIXTH STREET	BERKELEY	37.87889	-122.30055	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
98	BERKELEY VILLAGE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1663 SHATTUCK AVE	BERKELEY	37.8771628	-122.2688744	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
99	BERKELEY WAREHOUSE DRAYAGE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	636 UNIVERSITY AVE	BERKELEY	37.8671129	-122.3016746	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
100	BERKELEY YAMAHA	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	735 GILMAN	BERKELEY	37.879238	-122.303338	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
101	BERKELEY YMCA	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2001 ALLSTON ST	BERKELEY	37.869122	-122.270257	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
102	BERKLAND CLEANERS	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	2979 SACRAMENTO STREET	BERKELEY	37.85372	-122.27882	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
103	BERTINO FAMILY	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	160 THE UPLANDS	BERKELEY	37.85294	-122.24175	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
104	BLOCK PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	651 ADDISON ST	BERKELEY	37.8659152	-122.3012901	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
105	BRIDGE HOUSING CORPORATION	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	2012 BERKELEY WAY	BERKELEY	37.8725998	-122.2695998	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
106	BRIDGEWAY SERVICE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3009 ASHBY AVE	BERKELEY	37.858353	-122.244734	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
107	BRIDGEWAY SERVICE INC.	Permitted USTs			3009 ASHBY AVE	BERKELEY	37.85833	-122.2447	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
108	BUDGET RENT A CAR	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	600 GILMAN ST	BERKELEY	37.878416	-122.305581	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
109	BUDGET RENT A CAR SYSTEM, INC.	Permitted USTs			600 GILMAN ST	BERKELEY	37.87813	-122.30598	0-1 m; very shallow	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
110	CA DHS LABRATORY FACILITY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2151 BERKELEY WY	BERKELEY	37.8732348	-122.2672518	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
111	CA SCHOOL PROF PSYCHOLOGY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1900 ADDISON ST	BERKELEY	37.870646	-122.271857	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
112	CAL CLEANERS	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - INACTIVE	2531 TELEGRAPH AVENUE	BERKELEY	37.86458704	-122.2583901	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
113	CAL/ INK	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1404 4TH ST	BERKELEY	37.87691	-122.30308	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
114	CALDWELL ROLAND ROOFING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1635 4TH ST	BERKELEY	37.873034	-122.300734	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
115	CALIF UNIVERSITY, LAWRENCE BERKELEY LAB	DTSC Cleanup Sites	TIERED PERMIT	REFER: RCRA	1 CYCLOTRON ROAD/ MS75B-101	BERKELEY	37.8715926	-122.27274	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
116	CALIFORNIA CUNOCAR	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2020 STUART ST	BERKELEY	37.858068	-122.268362	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
117	CAMELIA STREET PROPERTIES (FORMER PERC-SERV, INC.)	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	1001 CAMELIA STREET	BERKELEY	37.87885058	-122.2973263	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
118	CAMP ASHBY	DTSC Cleanup Sites	FUDS	NO FURTHER ACTION		BERKELEY	37.8516666	-122.29166	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
119	CAMPUS MINIMART	Permitted USTs			2200 DURANT AVE	BERKELEY	37.86668	-122.26547	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
120	CARDUCCI PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2271 CEDAR ST	BERKELEY	37.8789484	-122.2651219	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
121	CARLETON BUSINESS CENTER	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	2700 7TH ST	BERKELEY	37.85565	-122.2948	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority

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									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
122	CARLETON BUSINESS CENTER	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2703 7TH AVE	BERKELEY	37.856266	-122.292252	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
123	CARLETON BUSINESS CENTER	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2700 7TH ST	BERKELEY	37.855649	-122.294839	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
124	CARLETON STREET CONVERSION	Non-Case Information Sites	NON-CASE INFORMATION	PENDING REVIEW	928 CARLETON STREET	BERKELEY	37.85703	-122.29216	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
125	CASE ENGINEERS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	801 CEDAR ST	BERKELEY	37.874138	-122.300524	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
126	CHASE PROPERTY	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	2366 78 SAN PABLO AVE	BERKELEY	37.863457	-122.289615	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
127	CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2401 SHATTUCK AVE	BERKELEY	37.865599	-122.266981	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
128	CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3250 SACRAMENTO ST	BERKELEY	37.8483255	-122.2779383	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
129	CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2995 SAN PABLO AVE	BERKELEY	37.852649	-122.286477	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
130	CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2500 MARTIN LUTHER KING	BERKELEY	37.863281	-122.271484	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
131	CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2199 BERKELEY WY	BERKELEY	37.873484	-122.265732	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
132	CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1500 UNIVERSITY AVE	BERKELEY	37.870246	-122.280957	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
133	CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - REMEDIATION	1300 SAN PABLO AVE	BERKELEY	37.8801257	-122.296134	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
134	CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1285 EASTSHORE HWY	BERKELEY	37.878759	-122.306549	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
135	CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1101 UNIVERSITY AVE	BERKELEY	37.869259	-122.290894	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
136	CHEVRON #9-0289	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3048 ASHBY AVE	BERKELEY	37.85795	-122.243562	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
137	CHEVRON SERVICE STATION	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - SITE ASSESSMENT	2996 TELEGRAPH AVE	BERKELEY	37.85642484	-122.2601321	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
138	CHEVRON STATION 9-1229	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1820 SOLANO AVENUE	BERKELEY	37.8911	-122.279571	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
139	CHRIS'S PAYLESS PLUMBING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1207 TENTH STREET	BERKELEY	37.881597	-122.297042	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
140	CHRONICLE DEPOT	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2817 7TH ST	BERKELEY	37.85462	-122.291902	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
141	CITY OF BERKELEY - CORPORATION YARD	Permitted USTs			1326 ALLSTON WAY	BERKELEY	37.866861	-122.284544	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
142	CITY OF BERKELEY CENTRAL LIBRARY	Permitted USTs			2031 BANCROFT WAY	BERKELEY	37.8678409	-122.2685623	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
143	CITY OF BERKELEY TRANSFER STATION	Single-Walled UST Sites	SINGLE-WALLED UST	SWT-NO PLAN RETURNED	1201 SECOND STREET	BERKELEY	37.88025093	-122.306132	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
144	CITY OF BERKELEY- PUBLIC SAFETY BUILDING	Permitted USTs			2100 MARTIN LUTHER KING JR. WAY	BERKELEY	37.86961	-122.27337	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
145	CLAREMONT CHEVRON STATION #0289	Permitted USTs			3048 ASHBY AVE	BERKELEY	37.85783	-122.24412	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
146	CLAREMONT CONTINENTAL GARAGE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2935 CLAREMONT AVE	BERKELEY	37.857914	-122.244957	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
147	CLEAR-COM	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	945 CAMELIA ST	BERKELEY	37.878468	-122.298198	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
148	CM SERVICE STATION	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - SITE ASSESSMENT	1441 ASHBY AVE	BERKELEY	37.85346807	-122.2793744	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
149	COBURN CONSTRUCTION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1006 PARDEE ST	BERKELEY	37.856541	-122.290089	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
150	COLGATE-PALMOLIVE	DTSC Cleanup Sites	EVALUATION	CERTIFIED	2700 7TH STREET	BERKELEY	37.8558495	-122.29482	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
151	COLLEGE CLEANERS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2942 COLLEGE AVE	BERKELEY	37.857848	-122.252734	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
152	COLLEGE CLEANERS (FORMER)	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	2942 COLLEGE AVENUE	BERKELEY	37.85752534	-122.2533229	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority

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No	Site Name	Site Category	Site Type	Status	Address	City	Latitude	Longitude	Projected Groundwater Depth from CoSMoS			Site Ranking		
									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
153	COMMERCIAL PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2201 DWIGHT WAY	BERKELEY	37.864248	-122.265261	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
154	CONSOLIDATED FREIGHTWAYS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2515 9TH ST	BERKELEY	37.860187	-122.291208	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
155	COOPER HAWKINS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2701 SAN PABLO AVE	BERKELEY	37.857569	-122.287868	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
156	CORE BERKELEY BANCROFT, LLC	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - SITE ASSESSMENT	2590 BANCROFT WAY	BERKELEY	37.86878	-122.25719	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
157	COSHELL LAUNDRY	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1634 SAN PABLO AVE	BERKELEY	37.874282	-122.294012	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
158	COURTAULDS AEROSPACE INC	Permitted USTs		CLOSED	1608 FOURTH ST	BERKELEY	37.873328	-122.30209	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
159	COURTAULDS AEROSPACE INC	DTSC Cleanup Sites	CORRECTIVE ACTION	REFER: RWQCB	1608 FOURTH ST	BERKELEY	37.873328	-122.30209	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
160	CSM PROPERTIES	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1890 ARCH ST	BERKELEY	37.874753	-122.264212	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
161	DAIR PROPERTY AKA SOUTHSIDE LOFTS	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - INACTIVE	3075 TELEGRAPH AVENUE	BERKELEY	37.854215	-122.259704	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
162	DAVLIN COATINGS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	700 ALLSTON WY	BERKELEY	37.864306	-122.299569	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
163	DAVLIN PAINT COMPANY	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	700 ALLSTON WY	BERKELEY	37.864306	-122.299569	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
164	DAVLIN PAINT COMPANY	DTSC Cleanup Sites	EVALUATION	NO ACTION REQUIRED	700 ALLSTON WAY	BERKELEY	37.8643053	-122.29957	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
165	DELTAN DIVERSIFIED INC.- CHEVRON STATION #91745	Permitted USTs			1300 SAN PABLO AVE	BERKELEY	37.88017	-122.2961	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
166	DESOTO	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1608 4TH ST	BERKELEY	37.873495	-122.3017911	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
167	DIESEL FUEL TANK AREA FORMER	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	722 FOLGER AVE	BERKELEY	37.8494237	-122.2938051	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
168	DINWIDDIE CONSTRUCTION COMPANY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1201 8TH ST	BERKELEY	37.8815721	-122.2997331	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
169	DON AUTO CLINIC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2555 COLLEGE AVE	BERKELEY	37.864123	-122.253543	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
170	DON REINHARDS INC	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1917 ADDISON ST	BERKELEY	37.870877	-122.271641	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
171	DON'S TIRE SERVICE, INC. (FORMERLY FRANK'S TIRE SERVICE)	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	820 GILMAN ST	BERKELEY	37.8792863	-122.3016403	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
172	DOVE CHEMICAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	707 PARK	BERKELEY	37.880322	-122.304619	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
173	DOVER SALES	DTSC Cleanup Sites	STATE RESPONSE OR NPL	CERTIFIED	707 PARK WAY	BERKELEY	37.8799459	-122.30429	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
174	DURKEE WAREHAM	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	700 HEINZ ST	BERKELEY	37.8531	-122.2932	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
175	EASTSHORE PARK - REMAINDER	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	BERKELEY, ALBANY, AND RICHMOND	BERKELEY	37.87661489	-122.3081195	2-5 m; moderate	1-2 m; shallow	1-2 m; shallow	Medium Priority	High Priority	High Priority
176	ELECTRO-COATINGS OF CA	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - VERIFICATION MONITORING	893 CARLETON ST	BERKELEY	37.8572	-122.2934	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
177	ELEMENTS PETROLEUM, INC.	Permitted USTs			833 UNIVERSITY AVE	BERKELEY	37.86832	-122.29744	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
178	EMERALD PACKAGING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2821 10TH ST	BERKELEY	37.855535	-122.28806	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
179	EMERALD PACKAGING	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	2821 10TH ST	BERKELEY	37.855262	-122.288578	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
180	ENGINEERING SCIENCE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	600 BANCROFT WAY	BERKELEY	37.862268	-122.299921	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
181	ENGINEERING SCIENCE INC	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - INACTIVE	600 BANCROFT WAY	BERKELEY	37.86253	-122.30008	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
182	ENTERPRISE CAR RENTAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3001 SHATTUCK AVE	BERKELEY	37.8550899	-122.266174	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
183	EPWORTH CHURCH	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1953 HOPKINS ST	BERKELEY	37.887353	-122.27375	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
184	ERNIE VAN AND STORAGE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1650 6TH ST	BERKELEY	37.8729781	-122.299287	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority

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185	EUROPEAN MOTORS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2396 SAN PABLO AVE	BERKELEY	37.862997	-122.290511	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
186	EYCHNER	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1120 2ND ST	BERKELEY	37.881036	-122.307019	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
187	EZ SERVE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1849 SHATTUCK AVE	BERKELEY	37.873905	-122.268552	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
188	FEREYDOON'S GARAGE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2598 SACRAMENTO ST	BERKELEY	37.860583	-122.280885	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
189	FERREIRA PLUMBING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1724 SAN PABLO AVE	BERKELEY	37.872508	-122.293646	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
190	FIRESTONE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1974 UNIVERSITY AVE	BERKELEY	37.87146	-122.271044	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
191	FLINT INK CORP.	DTSC Cleanup Sites	TIERED PERMIT	INACTIVE - NEEDS EVALUATION	750 GILMAN STREET	BERKELEY	37.8787829	-122.3031	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
192	FLINT INK CORPORATION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1350 FOURTH STREET	BERKELEY	37.878033	-122.303294	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
193	FLINT INK CORPORATION	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - ELIGIBLE FOR CLOSURE - LAND USE RESTRICTIONS	750 GILMAN STREET	BERKELEY	37.87863082	-122.3029516	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
194	FOLGER MURPHY PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1020 MURRAY ST	BERKELEY	37.851362	-122.287667	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
195	FOREIGN AUTO CENTER	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1197 SAN PABLO AVE	BERKELEY	37.8825069	-122.296107	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
196	FORMER BERKELEY GAS STATION	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2198 SAN PABLO AVENUE	BERKELEY	37.86645	-122.29164	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
197	FORMER CAL CLEANERS	DTSC Cleanup Sites	EVALUATION	REFER: 1248 LOCAL AGENCY	2529-2533 TELEGRAPH AVENUE	BERKELEY	37.8644698	-122.25821	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
198	FORMER CALIFORNIA THEATRE	Non-Case Information Sites	NON-CASE INFORMATION	PENDING REVIEW	2115 KITTREDGE STREET	BERKELEY	37.86895554	-122.2671748	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
199	FORMER CENTER FOR INDEPENDENT LIVING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2539 TELEGRAPH AVE	BERKELEY	37.86424	-122.25814	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
200	FORMER CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1797 SHATTUCK AVE	BERKELEY	37.87499736	-122.2684282	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
201	FORMER CHEVRON	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1900 SAN PABLO AVENUE	BERKELEY	37.870412	-122.292637	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
202	FORMER CO-OP GAS STATION	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - VERIFICATION MONITORING	1484 - 1498 UNIVERSITY AVENUE	BERKELEY	37.87009	-122.28219	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
203	FORMER EXXON 7-0200	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - ELIGIBLE FOR CLOSURE	1894 UNIVERSITY AVE	BERKELEY	37.87108219	-122.2733786	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
204	FORMER EXXON 7-8465	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2300 SAN PABLO AVE	BERKELEY	37.864336	-122.290937	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
205	FORMER GAS STATION	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2527 SAN PABLO AVE.	BERKELEY	37.86054	-122.28899	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
206	FORMER HOLLAND SERVICE GARAGE	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - SITE ASSESSMENT	2201 SAN PABLO AVENUE	BERKELEY	37.86625	-122.29077	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
207	FORMER MCNEVIN CADILLAC	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1500 SAN PABLO AVE	BERKELEY	37.87585	-122.29478	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
208	FORMER MOBIL OIL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2489 MARTIN LUTHER KING JR. WAY	BERKELEY	37.863612	-122.271747	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
209	FORMER MONSEN'S PLATING & SILVERSMITHS	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	3370 ADELINE STREET	BERKELEY	37.84735	-122.27239	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
210	FORMER NORGE LAUNDRY AND DRY CLEANING VILLAGE	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - INACTIVE	2089-2091 ROSE STREET	BERKELEY	37.88216963	-122.2703126	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
211	FORMER PACIFIC STEEL CASTING COMPANY - BERKELEY PROPERTIES, LLC	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - INACTIVE	1314 2ND ST, 1320 2ND ST, 1421 2ND ST, 1310 3RD ST, 1305 EASTSHORE HWY, 1401 EASTSHORE HWY, 1420 EASTSHORE HWY, 648 PAGE ST, 690 GILMAN ST	BERKELEY	37.877482	-122.305009	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority

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212	FORMER SERVICE STATION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1801 SOLANO AVENUE	BERKELEY	37.891324	-122.279862	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
213	FORMER SHELL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2996 SHATTUCK AVE	BERKELEY	37.85544448	-122.2666743	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
214	FORMER SHELL SERVICE STATION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2747 ADELINE ST	BERKELEY	37.858789	-122.26719	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
215	FORMER SHELL SERVICE STATION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1580 SAN PABLO AVE	BERKELEY	37.87526305	-122.2944208	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
216	FORMER VICTOR LAUNDRY LLC	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - INACTIVE	1625 SAN PABLO AVENUE	BERKELEY	37.87433	-122.29355	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
217	FRANK AUTO	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1245 UNIVERSITY AVE	BERKELEY	37.869869	-122.288278	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
218	FUKUNAGA PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2227 OREGON ST	BERKELEY	37.858298	-122.262687	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
219	FVA/DELICOR	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	705 BANCROFT WAY	BERKELEY	37.8631	-122.2991	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
220	GANNET OUTDOOR	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1695 EASTSHORE HWY	BERKELEY	37.87177	-122.304266	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
221	GARY STEEL COMPANY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2560 7TH ST	BERKELEY	37.85920547	-122.2941797	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
222	GENERAL TRANSMISSIONS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1187 SAN PABLO AVE	BERKELEY	37.882834	-122.296214	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
223	GERMANY BEST INC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1931-1935 ADDISON ST	BERKELEY	37.870907	-122.271421	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
224	GILMAN IMPORTS REPAIR	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1320 GILMAN ST	BERKELEY	37.881187	-122.288226	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
225	GLM REAL ESTATE SERVICES	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2029 CHANNING WY	BERKELEY	37.865904	-122.268601	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
226	GOSS ROSS DOYLE TRUST	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2140 DURANT AVE	BERKELEY	37.866844	-122.266278	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
227	GREEN CHEMICAL COMPANY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	801 GILMAN ST	BERKELEY	37.879435	-122.302322	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
228	GREEN VALLEY PLANT RENTAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1475 EASTSHORE HWY	BERKELEY	37.8747597	-122.3057358	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
229	GRING PEST CONTROL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	741 FOLGER AVE	BERKELEY	37.84979	-122.293339	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
230	HADJIAN PROPERTY	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	1840/1894 UNIVERSITY AVENUE	BERKELEY	37.87130977	-122.2734218	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
231	HARRISON STREET PLAYING FIELDS	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	REFER: RWQCB	FOURTH AND HARRISON STREETS	BERKELEY	37.8808333	-122.30444	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
232	HEINZ/GRAYSON PLUME	DTSC Cleanup Sites	STATE RESPONSE OR NPL	REFER: RWQCB	7TH STREET AND GRAYSON STREET	BERKELEY	37.8538894	-122.29322	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
233	HENRY CHIN'S AUTO CARE	Non-Case Information Sites	NON-CASE INFORMATION	PENDING REVIEW	2132 DWIGHT WAY	BERKELEY	37.86386	-122.26623	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
234	HENRY'S SERVICE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1321 GILMAN ST	BERKELEY	37.882185	-122.288123	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
235	HERRICK HOSPITAL ALTA BATES	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2001 DWIGHT WY	BERKELEY	37.864029	-122.268734	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
236	HOLETT MACHINE WORKS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	746 FOLGER AVENUE	BERKELEY	37.849298	-122.293136	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
237	HOTEL DURANT	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2600 DURANT AVE	BERKELEY	37.867925	-122.256292	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
238	HUB PAINT CENTER	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2917 ADELINE ST	BERKELEY	37.8559119	-122.268188	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
239	INTER MOUNTAIN TRADING CORP	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1451 5TH ST	BERKELEY	37.875607	-122.300963	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
240	JACKSON PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2131 DURANT AVE	BERKELEY	37.8668897	-122.2662753	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
241	JANCO CHEMICAL CORP	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1235 FIFTH STREET	BERKELEY	37.880301	-122.3029	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority

Table 1. Contaminated Sites Information and Rankings

No	Site Name	Site Category	Site Type	Status	Address	City	Latitude	Longitude	Projected Groundwater Depth from CoSMoS			Site Ranking		
									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
242	JETTON CONSTRUCTION	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1117 VIRGINIA STREET	BERKELEY	37.87363	-122.29316	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
243	JIFFY LUBE #889	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	960 UNIVERSITY AVE	BERKELEY	37.868277	-122.294838	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
244	JIM DOTEN HONDA	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2000 5TH ST	BERKELEY	37.8676292	-122.2987907	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
245	JWP MECHANICAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	999 ANTHONY ST	BERKELEY	37.852771	-122.29066	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
246	K & S MANAGEMENT	DTSC Cleanup Sites	STATE RESPONSE OR NPL	CERTIFIED	1138 DELAWARE ST	BERKELEY	37.8713888	-122.29194	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
247	KAHN SCRAPYARD	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	803 HEARST AVE	BERKELEY	37.86932264	-122.2990707	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
248	KAISER BIOMEDICAL FACILITY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1795 2ND ST	BERKELEY	37.8706699	-122.302677	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
249	KAISER PERMANENTE BERKELEY REGIONAL LAB - 1705	DTSC Hazardous Waste Sites	LOWER TIER	CLOSED	1705 EASTSHORE HWY	BERKELEY	37.870702	-122.30432	0-1 m; very shallow	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
250	KAISER REGIONAL LABORATORY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1725 EASTSHORE HWY	BERKELEY	37.8706	-122.3035	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
251	KALMAR PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2034 BLAKE ST	BERKELEY	37.862662	-122.268161	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
252	KAPLAN PROPERTY	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2234 SAN PABLO AVE	BERKELEY	37.865206	-122.291173	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
253	KAYO OIL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1900 MARTIN LUTHER KING	BERKELEY	37.873265	-122.2727	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
254	KRENZ LIMITED	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	750 POTTER ST	BERKELEY	37.850967	-122.2938889	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
255	LAWRENCE BERKELEY LAB - FACILITY WIDE	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	1 CYCLOTRON RD	BERKELEY	37.8739	-122.2508	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
256	LAWRENCE BERKELEY NATIONAL LABORATORY	Single-Walled UST Sites	SINGLE-WALLED UST	SAFE SUCTION PIPING VERIFIED BY CUPA	1 CYCLOTRON RD	BERKELEY	37.879162	-122.253006	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
257	LAWRENCE BERKELEY NATIONAL LABORATORY	Permitted USTs			1 CYCLOTRON RD	BERKELEY	37.87754	-122.25219	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
258	LBL BUILDING 50	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	1 CYCLOTRON RD	BERKELEY	37.8767916	-122.2470012	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
259	LBL BUILDING 62	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	1 CYCLOTRON RD	BERKELEY	37.8767916	-122.2470012	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
260	LBL BUILDING 69	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	1 CYCLOTRON RD	BERKELEY	37.8739	-122.2508	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
261	LBL BUILDING 74	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	1 CYCLOTRON RD	BERKELEY	37.8739	-122.2508	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
262	LBL BUILDING 76	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	1 CYCLOTRON RD	BERKELEY	37.8739	-122.2508	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
263	LBL BUILDING 7E	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	1 CYCLOTRON RD	BERKELEY	37.8739	-122.2508	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
264	LIFELONG MEDICAL CARE	DTSC Cleanup Sites	CALMORTGAGE	NO ACTION REQUIRED	3250 SACRAMENTO STREET	BERKELEY	37.8481181	-122.27823	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
265	LINOLEUM SALES	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1706 SAN PABLO AVE	BERKELEY	37.87317918	-122.2938001	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
266	LONESTAR INDUSTRIES	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	808 GILMAN ST	BERKELEY	37.8784319	-122.301706	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
267	LONGFELLOW MIDDLE SCHOOL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1500 DERBY ST	BERKELEY	37.85868	-122.279906	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
268	MACAULAY FOUNDRY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	811 CARLETON	BERKELEY	37.857211	-122.294725	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
269	MACAULAY FOUNDRY INC	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	811 CARELTON ST	BERKELEY	37.85685066	-122.2942686	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
270	MACBETH HARDWARE COMPANY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	930 ASHBY AVE	BERKELEY	37.851164	-122.290168	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
271	MALCOM X SCHOOL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1734 PRINCE ST	BERKELEY	37.85218	-122.273016	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
272	MANASSE-BLOCK TANNING COMPANY	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - INACTIVE	1300 4TH ST	BERKELEY	37.87878	-122.30358	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority

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273	MARCHANT CORPORATION SITE	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	ACTIVE	6701 SAN PABLO AVENUE	BERKELEY	37.8504292	-122.28751	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
274	MARIPOSA PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1028 MARIPOSA	BERKELEY	37.889032	-122.270174	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
275	MAXWELL CAMERON PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1336 CHANNING WY	BERKELEY	37.8635657	-122.2845711	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
276	MCKEVITT VOLVO	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2700 SHATTUCK AVE	BERKELEY	37.859781	-122.267824	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
277	MEADOWS PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1440 ASHBY AVE	BERKELEY	37.85308999	-122.2794411	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
278	MERCHANT PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	18 ALVARADO RD	BERKELEY	37.856316	-122.239378	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
279	MEYER SOUND	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - INACTIVE	2835 SAN PABLO AVE	BERKELEY	37.85456037	-122.2871923	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
280	MEYER SOUND	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2832 SAN PABLO AVE	BERKELEY	37.8547269	-122.288163	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
281	MIKE AUTO SERVICE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1699 UNIVERSITY AVE	BERKELEY	37.871191	-122.277804	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
282	MOBIL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1299 SAN PABLO AVE	BERKELEY	37.880801	-122.295553	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
283	MONSEN PLTG & SILVERSMITHS	DTSC Cleanup Sites	TIERED PERMIT	INACTIVE - NEEDS EVALUATION	3370 ADELINE STREET	BERKELEY	37.847292	-122.27242	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
284	MOORE PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3155 SACRAMENTO ST	BERKELEY	37.850358	-122.277487	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
285	MOTOR CITY AUTOMOTIVE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3058 SHATTUCK AVE	BERKELEY	37.8532851	-122.2662518	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
286	MUSSEN PROPERTY	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1450 4TH ST	BERKELEY	37.875377	-122.302905	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
287	NATIONAL STARCH & CHEM COMPANY	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	742 AND 800 GRAYSON ST	BERKELEY	37.85466568	-122.2941836	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
288	NATIONAL STARCH AND CHEMICAL COMPANY	DTSC Cleanup Sites	STATE RESPONSE OR NPL	REFER: RWQCB	742 AND 800 GRAYSON AVENUE	BERKELEY	37.8544669	-122.29509	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
289	NEWBERRY STATION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2929 SHATTUCK AVE	BERKELEY	37.856424	-122.265931	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
290	NIRP BERKELEY	DTSC Cleanup Sites	FUDS	NO FURTHER ACTION		BERKELEY	37.8502777	-122.29472	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
291	NOMURA BROS INC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2720 SAN PABLO AVE	BERKELEY	37.857496	-122.287652	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
292	NUMBER 1 GAS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1900 MARTIN LUTHER KING JR. WAY	BERKELEY	37.873326	-122.273197	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
293	NUMBER ONE GAS	Permitted USTs			1900 MARTIN LUTHER KING JR WAY	BERKELEY	37.87307	-122.27345	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
294	O.H. OLSEN	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	2220 FOURTH STREET	BERKELEY	37.86403	-122.29906	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
295	OLIVER COMPANY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1035 CARLETON ST	BERKELEY	37.8581069	-122.289271	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
296	OSCARS CAFE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1890 SHATTUCK AVE	BERKELEY	37.8739984	-122.2688447	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
297	PACIFIC BELL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2116 BANCROFT WY	BERKELEY	37.8676853	-122.2669311	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
298	PACIFIC COAST CHEMICALS CO.	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2424 FOURTH STREET	BERKELEY	37.8688788	-122.3002756	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
299	PACIFIC STEEL CASTING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	650 CEDAR ST	BERKELEY	37.87327	-122.3036758	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
300	PACIFIC STEEL CASTING	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	ACTIVE	1316/1333/1420/1421 2ND STREET, 648 PAGE STREET	BERKELEY	37.87787	-122.30596	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
301	PACIFIC STEEL PLANT #2	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1333 2ND ST	BERKELEY	37.8774919	-122.304895	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
302	PAHLMEYER FAMILY TRUST	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2700 SAN PABLO AVE	BERKELEY	37.85766	-122.288803	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
303	PE-BERKELEY, INC.	Permitted USTs			1 FRANK SCHLESSINGER WAY	BERKELEY	37.87043	-122.26434	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority

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304	PEERLESS ELECTRIC	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	INACTIVE - ACTION REQUIRED	2220 4TH STREET	BERKELEY	37.8639473	-122.29932	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
305	PEERLESS LIGHTING	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - REMEDIATION	2220 FOURTH STREET	BERKELEY	37.86410205	-122.2989595	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
306	PG&E 7TH STREET CONSTRUCTION SITE	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2891 7TH STREET	BERKELEY	37.85297	-122.29173	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
307	PG&E POLE 4279	Non-Case Information Sites	NON-CASE INFORMATION	PENDING REVIEW	2301 ASHBY	BERKELEY	37.85628	-122.26111	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
308	PODLESAK PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1241 6TH ST	BERKELEY	37.880557	-122.300848	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
309	PQ CORP	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	801 GRAYSON ST	BERKELEY	37.8544902	-122.2965712	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
310	PRC-DESOTO INTERNATIONAL	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	1608 4TH ST	BERKELEY	37.873666	-122.300693	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
311	PRIVATE RESIDENCE	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	PRIVATE RESIDENCE	BERKELEY	37.867415	-122.276416	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
312	PRIVATE RESIDENCE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	PRIVATE RESIDENCE	BERKELEY	37.891155	-122.266464	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
313	PROEN PRODUCTS COMPANY	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	2777 9TH ST	BERKELEY	37.85602587	-122.290116	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
314	PROPEL FUELS, INC. (202018)	Permitted USTs			849 UNIVERSITY AVE STE B	BERKELEY	37.86842	-122.296989	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
315	R STRONG HANDBLOWN ARTGLASS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1235 4TH ST	BERKELEY	37.879495	-122.30338	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
316	READ INVESTMENTS BERKELEY LLC SITE (FORMER JIM DOTEN HONDA SITE)	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	2001 4TH STREET	BERKELEY	37.86743	-122.29884	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
317	REGAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1801 UNIVERSITY AVE	BERKELEY	37.8713461	-122.2752524	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
318	RIPSTEEN PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3170 COLLEGE AVE	BERKELEY	37.851483	-122.252803	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
319	RVEECO INC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1335 6TH ST	BERKELEY	37.87812343	-122.3006468	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
320	SAFETY-KLEEN CORP	DTSC Hazardous Waste Sites	RCRA	CLOSED	1717 FOURTH ST	BERKELEY	37.871629	-122.30061	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
321	SALES BUILDING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1310 SAN PABLO AVE	BERKELEY	37.8801212	-122.2957817	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
322	SAN PABLO MINI-MART	Permitted USTs			1580 SAN PABLO AVE	BERKELEY	37.87536	-122.29449	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
323	SBC FACILITY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1206 FIFTH STREET	BERKELEY	37.880376	-122.303697	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
324	SHATTUCK, LLC	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1951 SHATTUCK AVENUE	BERKELEY	37.87292	-122.26817	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
325	SHELL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1752 SHATTUCK AVE	BERKELEY	37.875419	-122.269082	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
326	SHELL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2200 DURANT AVE	BERKELEY	37.866946	-122.264843	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
327	SHELL BRANDED SERVICE STATION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1200 ASHBY AVENUE	BERKELEY	37.852166	-122.286583	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
328	SHELL STATION	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1250 UNIVERSITY AVENUE	BERKELEY	37.86956985	-122.2871635	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
329	SHIELD HEALTHCARE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2567 SHATTUCK AVE	BERKELEY	37.862751	-122.266697	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
330	SIERRA DESIGNS LILY WONG	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2039 4TH ST	BERKELEY	37.8670325	-122.2996624	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
331	SOUTHERN PACIFIC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	UNKNOWN DELAWARE & VIRGINIA	BERKELEY	37.872612	-122.285038	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
332	SOUTHSIDE PLAZA	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2399 SHATTUCK AVE	BERKELEY	37.8660629	-122.267108	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
333	SOUTHWICK CHRYSLER PLYMOUTH	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2900 SHATTUCK AVE	BERKELEY	37.855587	-122.266832	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
334	STAN ANDERSON SERVICE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1745 CEDAR ST	BERKELEY	37.87776	-122.276129	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority

Table 1. Contaminated Sites Information and Rankings

No	Site Name	Site Category	Site Type	Status	Address	City	Latitude	Longitude	Projected Groundwater Depth from CoSMoS			Site Ranking		
									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
335	STANLEY HALL	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	317 UNIVERSITY HALL, #1150	BERKELEY	37.87397263	-122.256546	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
336	STEAD BUILDING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1960 ADDISON ST	BERKELEY	37.8707352	-122.2715451	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
337	STUDIO COMPLEX	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1025 CARLETON ST	BERKELEY	37.85802	-122.289542	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
338	SUPER 7	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	950 UNIVERSITY AVE	BERKELEY	37.868366	-122.294981	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
339	SUPER 7	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	901 ASHBY AVE	BERKELEY	37.85127024	-122.2908944	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
340	SVENSSON AUTOMOTIVE	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	1740 SAN PABLO AVE	BERKELEY	37.87179	-122.29341	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
341	TAKARA SAKE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	708 ADDISON ST	BERKELEY	37.8661225	-122.3000878	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
342	TANNERY THE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1300 4TH ST	BERKELEY	37.8789106	-122.3035225	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
343	TEMESCAL BUSINESS CENTER	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	2850 7TH ST	BERKELEY	37.85358943	-122.2921996	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
344	TEMESCAL BUSINESS CENTER	DTSC Cleanup Sites	STATE RESPONSE OR NPL	REFER: RWQCB	2850 7TH STREET	BERKELEY	37.853889	-122.29322	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
345	TERMINAL MANUFACTURING, LLC	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - VERIFICATION MONITORING	707 GILMAN ST	BERKELEY	37.87926	-122.30426	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
346	TERMINAL MANUFACTURING, LLC	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	707 GILMAN ST	BERKELEY	37.87906533	-122.3045518	0 m; emergent	0 m; emergent	0 m; emergent	Low Priority	Low Priority	Low Priority
347	TEXACO	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	833 UNIVERSITY AVE	BERKELEY	37.868146	-122.296758	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
348	TEXACO	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1899 OXFORD ST	BERKELEY	37.874496	-122.266059	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
349	TEXACO	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	840 ASHBY AVE	BERKELEY	37.850648	-122.291325	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
350	TIME OIL COMPANY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2748 SAN PABLO AVE	BERKELEY	37.856084	-122.286943	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
351	TOLTEC PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2148 CENTER ST	BERKELEY	37.870489	-122.2666254	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
352	TONY & JOHN'S FOREIGN CARS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2730 TELEGRAPH AVE	BERKELEY	37.860183	-122.259546	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
353	TOSCO - FACILITY #0852	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3001 TELEGRAPH AVE	BERKELEY	37.85593123	-122.2593571	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
354	TOSCO - FACILITY #1700	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1499 UNIVERSITY AVE	BERKELEY	37.8706379	-122.2823096	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
355	TOSCO - FACILITY #3185	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	849 UNIVERSITY AVE	BERKELEY	37.868194	-122.296598	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
356	TOWER CLEANERS	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - ASSESSMENT & INTERIM REMEDIAL ACTION	1110 UNIVERSITY AVENUE	BERKELEY	37.86887415	-122.2913074	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
357	TOYOTA FLYNN TRUST	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2555 SHATTUCK AVE	BERKELEY	37.862965	-122.266766	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
358	TOYOTA OF BERKELEY	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	2400 SHATTUCK AVE	BERKELEY	37.865854	-122.266984	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
359	TPMG REGIONAL LABORATORY (KAISER)	Permitted USTs			1725 EASTSHORE HWY	BERKELEY	37.87091	-122.30399	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
360	TRANSAMERICA DEVAUAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	829 BANCROFT WAY	BERKELEY	37.8635299	-122.2962185	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
361	TRIANGLE COATINGS	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	REFER: LOCAL AGENCY	2222 THIRD STREET	BERKELEY	37.8640996	-122.3006	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
362	TROUT PLUMBING	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	812 PAGE ST	BERKELEY	37.876074	-122.300995	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
363	TRUST SECURITY MANAGEMENT	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2321 4TH ST	BERKELEY	37.862268	-122.298088	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
364	TUNE UP MASTERS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1698 UNIVERSITY STREET	BERKELEY	37.870929	-122.277571	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority

Table 1. Contaminated Sites Information and Rankings

No	Site Name	Site Category	Site Type	Status	Address	City	Latitude	Longitude	Projected Groundwater Depth from CoSMoS			Site Ranking		
									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
365	TUTTLE GALVANIZING	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	725 GILMAN ST	BERKELEY	37.87934	-122.303953	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
366	U-HAUL #710-52	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2100 SAN PABLO AVENUE	BERKELEY	37.867948	-122.291843	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
367	U.C. BERKELEY ANNA HEAD HOUSING PROJECT	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2536 CHANNING WAY	BERKELEY	37.86668897	-122.2576404	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
368	U.S. SMOG AND GAS	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	3000 SHATTUCK AVENUE	BERKELEY	37.85501	-122.266767	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
369	UC BERKELEY	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	UNKNOWN MURRY ST & FOLGER ST & 7TH ST	BERKELEY	37.850434	-122.290921	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
370	UC BERKELEY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2515 CHANNING WY	BERKELEY	37.867349	-122.257759	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
371	UC BERKELEY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	UNKNOWN JEFFERSON & ADDISON	BERKELEY	37.8699	-122.2779	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
372	UC BERKELEY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	777 HARRISON STREET	BERKELEY	37.8808	-122.3034	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
373	UC BERKELEY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1750 ARCH ST	BERKELEY	37.876573	-122.264576	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
374	UC BERKELEY - DINING FACILITY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2401 BOWDITCH STREET	BERKELEY	37.867183	-122.256548	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
375	UC BERKELEY - MAIN CAMPUS	Permitted USTs			200 CALIFORNIA HALL	BERKELEY	37.87152	-122.26037	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
376	UC BERKELEY CORP YARD	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2000 MILVIA ST	BERKELEY	37.871765	-122.2701	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
377	UC BERKELEY HEARST MINING BLDG	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	UNKNOWN HEARST STREET	BERKELEY	37.87547851	-122.2569209	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
378	UC BERKELEY PHYSICAL PLANT	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2000 CARLETON ST	BERKELEY	37.8609189	-122.2695059	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
379	UC BERKELEY SITE GARAGE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1952 OXFORD ST	BERKELEY	37.873047	-122.266528	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
380	UC GAS&FOOD	Permitted USTs			1894 UNIVERSITY AVE	BERKELEY	37.87144	-122.27324	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
381	UNITED #5616	Permitted USTs			1830 SOLANO AVE	BERKELEY	37.89115	-122.2789	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
382	UNITED PACIFIC # 2204AD	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - ASSESSMENT & INTERIM REMEDIAL ACTION	901 ASHBY AVE	BERKELEY	37.85137	-122.29092	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
383	UNIVERSITY ASSOCIATES	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	901 21 UNIVERSITY AVE	BERKELEY	37.8682717	-122.2966308	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
384	UNIVERSITY CHEVRON #90877	Permitted USTs			1500 UNIVERSITY AVE	BERKELEY	37.87013	-122.28153	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
385	UNIVERSITY LAUNDROMAT	Non-Case Information Sites	NON-CASE INFORMATION	PENDING REVIEW	1652 UNIVERSITY AVENUE	BERKELEY	37.87063	-122.27838	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
386	UNIVERSITY OF CALIFORNIA, BERKELEY - MAIN CAMPUS	DTSC Cleanup Sites	TIERED PERMIT	INACTIVE - NEEDS EVALUATION	317 UNIVERSITY HALL, MC 1150	BERKELEY	37.87205	-122.25928	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
387	UNIVERSITY SHELL #100	Permitted USTs			1250 UNIVERSITY AVE	BERKELEY	37.86963	-122.28727	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
388	UNIVERSITY VALERO # 7200	Single-Walled UST Sites	SINGLE-WALLED UST	SWT-NO PLAN RETURNED	1894 UNIVERSITY AVE	BERKELEY	37.87111862	-122.2732878	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
389	UNIVERSITY VALERO-BERKELEY	Permitted USTs			849 UNIVERSITY AVE	BERKELEY	37.86841	-122.29697	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
390	UNKNOWN	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1149 THE ALAMEDA _ MARTIN LUTHER KING	BERKELEY	37.884934	-122.2744847	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
391	UNKNOWN	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1649 MARTIN LUTHER KING	BERKELEY	37.876922	-122.273476	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
392	UNKNOWN	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2167-2183 DWIGHT WY	BERKELEY	37.864327	-122.26605	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
393	UNOCAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2101 ROSE ST	BERKELEY	37.882114	-122.268728	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
394	UNOCAL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2501 SACRAMENTO ST	BERKELEY	37.8622005	-122.2810075	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Low Priority	Low Priority	Low Priority
395	URBAN DESIGNS	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	1800 DWIGHT WY	BERKELEY	37.86281816	-122.2742105	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority
396	URBAN DESIGNS	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1800 -1812 DWIGHT WAY	BERKELEY	37.86302224	-122.273464	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
397	UTILITY BODY COMPANY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	901 GILMAN ST	BERKELEY	37.880592	-122.300011	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority

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									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
398	VACANT BUILDING/ FRED'S MARKET	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	1929 UNIVERSITY AVENUE	BERKELEY	37.871943	-122.27225	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
399	VERIFLO	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - VERIFICATION MONITORING	800 BANCROFT WAY	BERKELEY	37.86298095	-122.2970779	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
400	VIRGINIA CLEANERS	DTSC Cleanup Sites	VOLUNTARY AGREEMENT	ACTIVE	1650 SHATTUCK AVENUE	BERKELEY	37.877718	-122.26926	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
401	VIRGINIA CLEANERS	Non-Case Information Sites	NON-CASE INFORMATION	INFORMATIONAL ITEM / REVIEW COMPLETE	1650 SHATTUCK AVENUE	BERKELEY	37.87767	-122.26924	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
402	VIRGINIA CLEANERS	DTSC Cleanup Sites	STATE RESPONSE OR NPL	NO FURTHER ACTION	1667 SHATTUCK AVENUE	BERKELEY	37.8769423	-122.26885	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
403	WALKER ESTATE	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - VERIFICATION MONITORING	1507 SAN PABLO AVENUE	BERKELEY	37.876031	-122.294134	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
404	WAREHAM PROPERTIES	DTSC Cleanup Sites	STATE RESPONSE OR NPL	CERTIFIED	700 HEINZ AVENUE	BERKELEY	37.8524104	-122.2944	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
405	WEATHERFORD BMW (FORMER NAVAL INDUSTRIAL RESERVE PLANT BERKELEY)	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	735 ASHBY AVENUE	BERKELEY	37.85024241	-122.2951298	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	Low Priority	Low Priority	Low Priority
406	WEST COAST PROPERTY MANAGEMENT	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2547 8TH ST	BERKELEY	37.859627	-122.29234	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
407	WHITTIER SCHOOL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1645 MILVIA ST	BERKELEY	37.876903	-122.2706	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
408	WILLARD SCHOOL	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2425 STUART ST	BERKELEY	37.8596141	-122.2586631	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
409	WILLIAM BYRON RUMFORD SR PLAZA	Cleanup Program Sites	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	3000 SACRAMENTO ST	BERKELEY	37.85292051	-122.2792437	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
410	WRE/COLORTECH	Cleanup Program Sites	CLEANUP PROGRAM SITE	OPEN - VERIFICATION MONITORING	1225 6TH STREET	BERKELEY	37.88053	-122.30131	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
411	WRIGHT'S AUTOMOTIVE	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2629 ASHBY AVE	BERKELEY	37.857224	-122.253643	>5 m; deep	>5 m; deep	>5 m; deep	Low Priority	Low Priority	Low Priority
412	XTRA OIL CO - SHATTUCK DBA CHEVRON	Permitted USTs			2996 SHATTUCK AVE	BERKELEY	37.85545	-122.2666	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
413	XTRA OIL CO.- THE ALAMEDA DBA CHEVRON	Permitted USTs			1201 THE ALAMEDA	BERKELEY	37.88533	-122.27448	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
414	XTRA OIL COMPANY	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - SITE ASSESSMENT	1201 THE ALAMEDA	BERKELEY	37.88527108	-122.2745088	>5 m; deep	>5 m; deep	>5 m; deep	Medium Priority	Medium Priority	Medium Priority
415	XTRA OIL COMPANY	LUST Cleanup Sites	LUST CLEANUP SITE	OPEN - SITE ASSESSMENT	1399 SAN PABLO AVE	BERKELEY	37.87896782	-122.2949681	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
416	XTRA OIL COMPANY DBA CHEVRON	Permitted USTs			1399 SAN PABLO AVE	BERKELEY	37.87901	-122.29498	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
417	ZAITLEIAN PROPERTY	LUST Cleanup Sites	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1507 SAN PABLO AVE	BERKELEY	37.87610562	-122.2940454	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	Low Priority	Low Priority	Low Priority
418	ALAMEDA COUNTY COMPUTER RESOURCE CENTER	DTSC Cleanup Sites	INSPECTION	NO ACTION	620 PAGE STREET	BERKELEY	37.87534891	-122.3051806	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
419	BERKELEY FORGE DEVELOPMENT PROJECT	DTSC Cleanup Sites	VOLUNTARY CLEANUP	ACTIVE	EASTSHORE HIGHWAY/GILMAN ST/3RD ST/PAGE ST, 631-643 CAMELIA ST.	BERKELEY	37.87695168	-122.305113	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
420	CALTRANS WEST FRONTAGE RD BERKELEY	DTSC Cleanup Sites	HISTORICAL	REFER: OTHER AGENCY	W. OF HWY 80 APPROX. VIRGINIA TO GILMAN	BERKELEY	37.87447569	-122.3066691	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
421	DESOTO INCORPORATED	DTSC Cleanup Sites	HISTORICAL	REFER: RWQCB	1608 4TH STREET	BERKELEY	37.87305556	-122.3022222	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
422	FRANK'S TIRE SERVICE	DTSC Cleanup Sites	HISTORICAL	REFER: OTHER AGENCY	820 GILMAN STREET	BERKELEY	37.8789915	-122.3016417	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
423	KRENZ INC	DTSC Cleanup Sites	HISTORICAL	REFER: OTHER AGENCY	ASHBY AT 6TH STREET	BERKELEY	37.85092004	-122.2928822	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority
424	MANASSE - BLOCK TANNING COMPANY	DTSC Cleanup Sites	HISTORICAL	REFER: OTHER AGENCY	1300 4TH STREET	BERKELEY	37.878272	-122.303864	0-1 m; very shallow	0-1 m; very shallow	0-1 m; very shallow	High Priority	High Priority	High Priority
425	MILES INC CUTTER BIOLOGICAL FACILITY #38	DTSC Cleanup Sites	HISTORICAL	REFER: OTHER AGENCY	4TH AND PARKER STREETS	BERKELEY	37.8575	-122.2966667	2-5 m; moderate	2-5 m; moderate	2-5 m; moderate	Medium Priority	Medium Priority	Medium Priority

Table 1. Contaminated Sites Information and Rankings

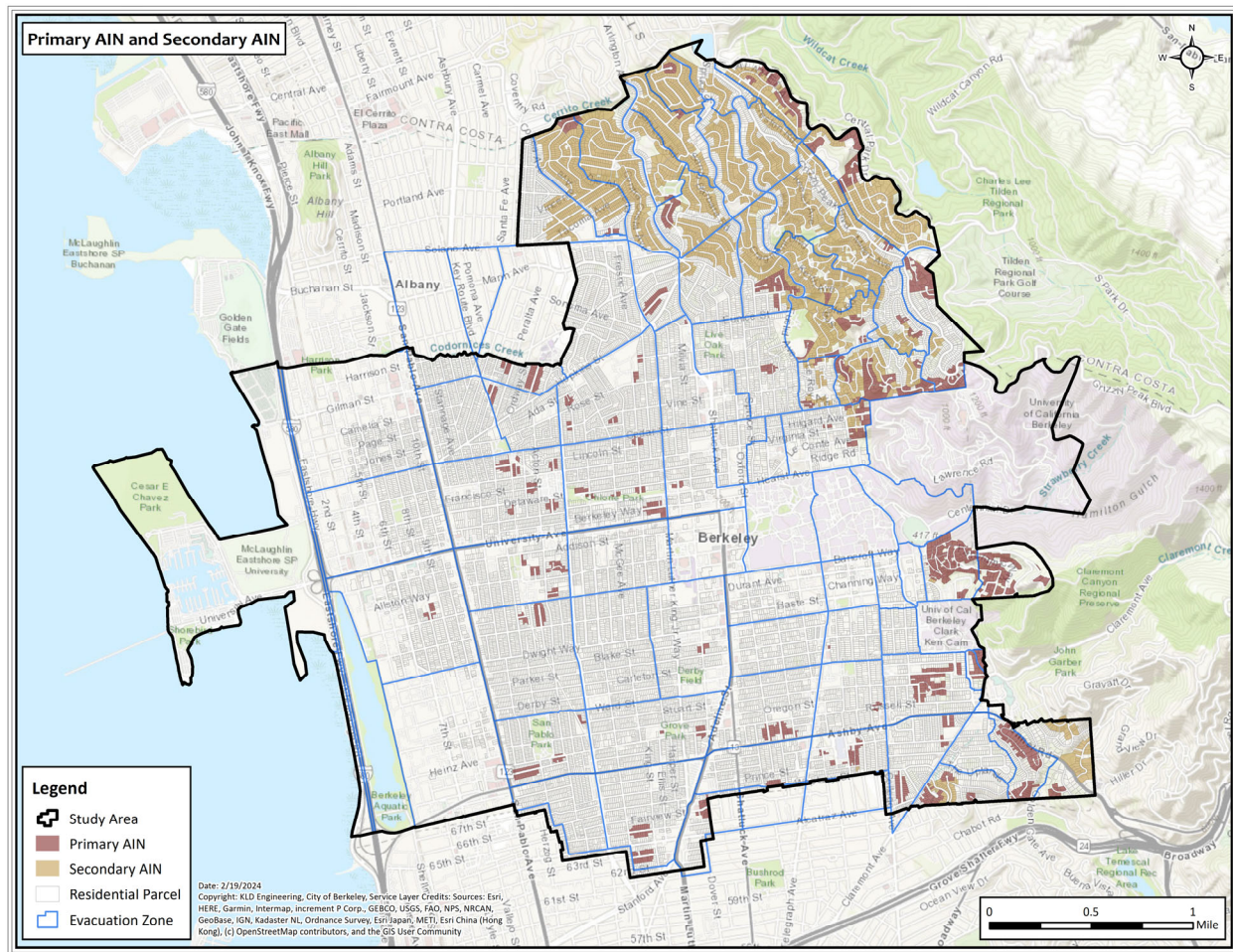
No	Site Name	Site Category	Site Type	Status	Address	City	Latitude	Longitude	Projected Groundwater Depth from CoSMoS			Site Ranking		
									Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario	Current Conditions	0.8 feet (25 cm) SLR Scenario	2.5 feet (75 cm) SLR Scenario
426	SOLID WASTE MANAGEMENT CENTER	DTSC Cleanup Sites	HISTORICAL	REFER: OTHER AGENCY	2ND AND GILMAN STREETS	BERKELEY	37.87833333	-122.3058333	0 m; emergent	0 m; emergent	0 m; emergent	High Priority	High Priority	High Priority
427	TERMINEX-PEERLESS	DTSC Cleanup Sites	HISTORICAL	REFER: OTHER AGENCY	2240 4TH STREET	BERKELEY	37.863889	-122.299167	1-2 m; shallow	1-2 m; shallow	1-2 m; shallow	High Priority	High Priority	High Priority

Notes:
cm - centimeter
CoSMoS - Coastal Storm Modeling System
DTSC - Department of Toxic Substances Control
LUST - leaking underground storage tank
m - meter
SLR - sea level rise
UST - underground storage tank

Appendix C

Access Impaired Neighborhood Analysis

City of Berkeley, California
Access Impaired Neighborhood Analysis
Senate Bill 99 Requirement



Work performed for the City of Berkeley, by:

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Islandia, NY 11749
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Introduction

Number five (5) of item G of Section 1 of Section 65302 of Senate Bill 99 stipulates that a safety element for the protection of the community “shall be reviewed and updated to identify residential developments in any hazard area identified in the safety element that do not have at least two emergency evacuation routes.”

The City of Berkeley, California has contracted KLD Engineering, P.C. to help identify residential developments, or neighborhoods, that are in a hazard area with limited means of egress. These neighborhoods may experience more challenges evacuating and should be given special consideration when planning for emergencies that require evacuation. This memo describes the data, assumptions, analysis and results of these Access Impaired Neighborhoods (AIN) within the City of Berkeley.

Data Sources

- The latest parcel data from the city Open Data portal¹ was used as the base data for the AIN analysis.
- Fire Hazard Severity Zones (FHSZ) data obtained from the City of Berkeley. FHSZ are scored based on factors that influence fire likelihood and fire behavior. Fire Zones 2 and 3 were considered at-risk in this study.
- Federal Emergency Management Agency’s (FEMA) 500-year flood zones². This data identifies areas that have a 0.2% chance of flooding in any given year.
- California Department of Conservation tsunami zones³. This dataset includes all populated areas that are at risk of tsunamis.
- California Department of Conservation³ earthquake zones and the United States Geological Survey (USGS) Hayward Fault Scenario⁴. This dataset includes areas that are at risk for seismic hazards which includes:
 - deep-seated landslide susceptibility based on estimates of rock strength and steepness of slopes,
 - liquefaction,
 - surface fault rupture,
 - and ground shaking.
- The street centerline data was provided by the city and was used to identify dead ends, narrow roads, and winding roads. In addition, the dead-end data provided by the city and those obtained from the road survey were also considered in this analysis.

¹ <https://data.cityofberkeley.info/City-Government/Parcels/bhxd-e6up>

² <https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd>

³ <https://maps.conservation.ca.gov/cgs/#datalist>

⁴ <https://earthquake.usgs.gov/education/shakingsimulations/hayward/M7.0.php#>

Assumptions

An additional consideration of risk is the distance of a neighborhood from safety resources, like fire stations. To analyze this risk, the following assumptions must be made:

- A threshold of 5 minutes for urban and suburban areas is assumed to be the maximum drive time from a fire station⁵. A 5-minute service area for each fire station was generated using ArcGIS Network Analyst extension. The service area for this analysis represents an area that can be driven by a fire truck from the fire station within a defined period of travel time.
- The maximum dimensions for fire trucks within the city are 11.25 feet high, 60 feet long and 9.25 feet wide⁶.

For the analysis on pavement width (narrow roadways), the following assumptions were made:

- Parking stalls are 8 feet wide. Using the city's curb data for parking information, pavement width was reduced by 8 feet to account for roadways with street parking (or 16 feet if parking is permitted on both sides of the road).
- A minimum of 10 feet is necessary for large vehicles (delivery trucks, buses, etc.) to evacuate.

Analysis

To identify the hazardous areas within the city that meet the SB 99 criteria, the residential parcel layer was overlaid, in ArcGIS, with the hazard area layers for wildfire, flooding, earthquake, tsunami, liquefaction, and landslide. Figure 1. Hazards affecting the City of Berkeley shows all the different hazard areas that can affect the city that were considered in this study.

In addition, residential parcels outside of the service areas of fire stations are considered vulnerable in this analysis. As such, an additional analysis was performed to assess the serviceability of the neighborhoods within the city based on their distances from fire stations. Figure 2. Fire Station Service Area shows an overview of the service areas of all the fire stations within the city. Although this analysis is not designed to address responder ingress, it is presumed that if responders cannot quickly access an area, then that area is at a higher risk in an emergency.

It should be noted that the entire city falls within at least one hazard area. For this reason, the entire city was considered *at-risk* and was included in this analysis. Although every hazard is not included in this analysis, inclusion of additional hazards would not affect the outcome as the entire city was analyzed for one way in/out to meet the SB 99 requirement.

Next, ESRI's ArcGIS was used to identify all the dead-end roadways within the street network. These dead-end roadways were supplemented with the dead-end roadways provided by the city and those identified during the road survey. The dead ends in this analysis include natural dead ends (e.g., cul-de-sacs, etc.) and man-made barriers (e.g., bollards, gates, traffic calming islands, etc.). Each dead end was verified using aerial imagery. Residential parcels that are within any

⁵ Based on the city's recent Standards of Coverage assessment.

⁶ This represents the largest truck (ladder truck) that the city owns. The height does not include antenna.

hazard area, as well as are located outside of the fire station 5-minute service area and are located along dead-end roadways are considered as the AIN. Those areas are shown in Figure 3. Primary Access Impaired Neighborhoods. Since all of these neighborhoods are within a hazard zone and have only one evacuation route available, these are Berkeley's AIN as defined using SB99 criteria.

Once the primary AIN were identified, they were inspected for man-made barriers (e.g., bollards, gates, traffic calming islands, etc.) that could be lifted in an emergency to provide additional evacuation routes out of the neighborhood. These AIN were flagged as having emergency exits since they could have multiple ways out in an emergency if the man-made barrier was removed (or vehicles with high clearance could traverse the barrier in the case of the traffic calming bollards). Figure 4. Primary Access Impaired Neighborhoods with Removeable/Traversable Barriers highlights the primary AIN that have more than one way in/out if a barrier was removed, or a vehicle is high enough to clear a low-profile bollard. These AIN are flagged in Table 1. Access Impaired Neighborhoods as having a "potential emergency exit".

In addition to the risk factors considered above, narrow and/or winding roadways were also considered. These roadways pose their own risks and can significantly impede evacuation. For this reason, a second level of analysis was completed for those neighborhoods that have more than one evacuation route, but one or more of those routes is narrow and/or winding leaving one *viable* evacuation route. These *secondary* neighborhoods are not considered single lane egress AIN but are within a hazard risk area and only have one *viable* way out. As such, they are identified as *Secondary AIN*. These are additional neighborhoods to those that meet the SB99 criteria.

The city centerline dataset was utilized to determine which roadways were narrow (with a travel lane of less than 10 feet wide⁷). Those roadways which meet or exceed 10 feet wide⁸ were not considered in the analysis. To identify the winding roads, the curvature of the roadway was calculated based on its geometry. Each roadway segment within the city's centerline data is made up of vertices defined by longitude and latitude. Three sequential vertices along a roadway segment were utilized to create a triangle. The distances of the sides of the triangle (x, y, and z) were computed based on the longitude and latitude of the three sequential vertices. The radius of the circumscribed circle⁹, or circumcircle radius, was then computed using Equation 1. This circumcircle radius corresponds to the curvature of the roadway at the middle of the three sequential vertices and is assigned to that vertex, or point. A larger radius corresponds to a straighter segment; a smaller radius corresponds to a more curved segment. This process is repeated for every three sequential vertices along the roadway centerline. The curvature of the roadway segment between vertices is computed as the average of the circumcircle radii of the

⁷ Based on discussions with staff from the City's Public Works and Fire Departments, a viable evacuation travel lane width of 10 feet was chosen to account for larger vehicles (8 feet wide) and sideview mirrors. It is assumed that even larger vehicles (10 feet wide) are operated by professional drivers with a higher degree of skill to reduce or eliminate driver error.

⁸ Pavement width was utilized (with modifications made for side street parking). Eight feet of parking was removed from the pavement width for single side street parking and 16 feet was removed for street parking on both sides of the road. Eight feet was used since the typical width for a standard parking space is 8 feet. Although a width of 7.5 feet has been used to provide a balance among users, eight feet was used as vehicles are not always parked well, may not be parked in contact with the face of the curb or vegetation, and throughout the day, large vehicles may be parked on the side of the street. Overhanging vegetation was not accounted for.

⁹ Circle that passes through all three vertices of a triangle.

two vertices that it connects. This methodology is illustrated in Figure 5. Curvature Radius Example.

Equation 1

$$r = \frac{xyz}{\sqrt{(x+y+z)(y+z-x)(z+x-y)(x+y-z)}}$$

Using a minimum radius of 81 feet¹⁰, roadway segments with tight turns (radii less than 81 feet) are flagged for review. Figure 6. Narrow and Winding Roads displays all of the roadways that were considered narrow and/or winding. The narrow roadways are color coded by tiers. Red roadways are considered severely constrained (6 feet or less wide), yellow roadways are considered moderately constrained (7 to 8 feet wide) and green roadways are considered constrained (9 to 10 feet wide).

A secondary analysis was then conducted on the residential parcels that have more than one way out but have exit paths along narrow and/or winding roadways (that are shown in Figure 6. Narrow and Winding Roads). If a residential parcel has access to multiple exits, but only one *viable* exit, it was flagged as a Secondary AIN. Since all parts of the city are considered to be within a hazard area, all the neighborhoods that were flagged were included as Secondary AINs. Figure 7. Secondary Access Impaired Neighborhoods shows the Secondary AINs. The primary and secondary AIN are shown together in Figure 8. Primary and Secondary Access Impaired Neighborhoods and are also listed in Table 1. Access Impaired Neighborhoods by priority, evacuation zone (Zonehaven), and street name. Table 1. Access Impaired Neighborhoods also provides the number of parcels that are within each AIN.

Results and Recommendations

In total, there are 141 primary AIN (1,461 residential parcels) and 195 secondary AIN (3,687 residential parcels) within the City of Berkeley.

Evacuation Zones E013 and E058 (Panoramic Way neighborhood) have the most AIN parcels. This entire neighborhood has only one access point to the nearest evacuation route (at a stop-controlled intersection at Panoramic Way and Prospect St/Canyon Rd). There are some removable or traversable barriers, but these additional exits will not expedite the evacuation of these neighborhoods since they are located so far up the mountain and do not provide additional access points to Prospect St/Canyon Rd. This neighborhood is within Fire Zones 2 and 3 and is at risk of landslides. The neighborhood also is at risk of violent ground shaking. Most of this neighborhood is also outside of a 5-minute drive from the nearest fire station. Many of the roadways within this area are less than 10 feet across and do not have side street parking.

¹⁰ Table 3-7 of the 2018 AASHTO Policy on Geometric Design of Highways and Streets indicates the minimum radii for a curve with a design speed of 20mph is 81 feet. Based on the data collected during the road survey, the speed travelled on these curves was 20mph or less.

The vast majority of secondary AIN are in Berkeley Hills and Thousand Oaks due to the narrow and winding roadways in this area, as shown in Figure 7. Secondary Access Impaired Neighborhoods. Berkeley Hills and this part of Thousand Oaks are at risk of violent ground shaking. They are within Fire Zone 2 but are within a 5-minute drive of the nearest fire station. Parts of these areas are also at risk of landslides.

Depending on the hazard, these neighborhoods may require early notification to have sufficient time to evacuate before their safety is at risk. It is recommended that plans be put into place to ensure 100% notification of these areas and to notify these areas of an emergency even before they may be at risk.

Table 1. Access Impaired Neighborhoods

Priority	Evacuation Zone	Neighborhood	Potential Emergency Exit?	Number of Parcels
Primary	ALB-E006	Acton St	No	29
	ALB-E006	Tevlin St	No	14
	BER-E002	Vincente Ave	No	2
	BER-E003	San Mateo Rd	No	1
	BER-E004	Florida Ave	No	6
	BER-E005	Vermont Ave	No	11
	BER-E007	My Way	No	8
		Rochdale Way	No	5
		Vistamont Ave	No	20
		Woodmont Ct	No	5
	BER-E010	San Mateo Rd	No	26
	BER-E011	Station Pl	No	5
		Vincente Ave	No	12
	BER-E013	Dwight Pl	No	11
		Dwight Way	No	27
		Panoramic Place	No	2
		Panoramic Place	Yes	2
		Panoramic Way	No	21
		Panoramic Way	Yes	5
	BER-E014	Carleton St	No	2
	BER-E016	Martin Ave	No	4
		Middlefield Rd	No	6
		Overlook Rd	No	10
		The Spiral	No	8
		Woodhaven Rd	No	11
		Woodmont Ave	No	1
	BER-E017	Stoddard Way	No	6
	BER-E018	Private Dr Off of Keith Ave	No	3
	BER-E019	Corona Ct	No	17
		Crystal Way	No	7
		High Ct	No	27
		Laurel St	No	6
		Oak St	No	1
	BER-E021	Napa Ave	Yes	26
	BER-E025	Northside Ave	No	13
	BER-E026	Berryman St	No	3
		Buena Ave	No	6
		Grant St	No	4
		Miramonte Ct	No	9

Priority	Evacuation Zone	Neighborhood	Potential Emergency Exit?	Number of Parcels
		North St	No	7
	BER-E027	Eunice St	No	1
	BER-E028	Private Drive Off of Arch St	No	4
		Spring Way	No	10
	BER-E029	Codornices Rd	No	8
		El Portal Ct	No	5
		Northgate Ave	No	14
		Ross St	No	3
	BER-E030	Columbia Cir	No	8
		Private Dr Off of Fairlawn Dr	No	5
	BER-E031	Ajax Pl	No	11
		Grizzly Peak Blvd	No	3
		Hill Rd	No	16
		Olympus Ave	No	6
		Private Driveway Off of Summit Rd	No	4
		Summit Rd	No	21
	BER-E032	Buena Vista Way	No	25
		Campus Dr	No	22
		Cedar St	No	1
		Harvard Cir	No	5
		Maybeck Twin Dr	No	19
		Olympus Ave	No	8
		Parnassus Ct	No	12
	BER-E033	Greenwood Commons	No	4
		Hill Ct	No	10
		Ross St	No	2
	BER-E036	Francisco St	No	14
		Lincoln St	No	15
		Short St	No	24
		Virginia Gardens	No	13
		West St	No	2
	BER-E037	Berkeley Way	Yes	17
		California St	No	5
		Delaware St	No	9
		Grant St	No	8
		Grant St	Yes	10
		Mc Gee Ave	No	5
	BER-E038	Bonita Ave	Yes	5
	BER-E040	Cedar St	No	2
		Higard Ave	No	9

Priority	Evacuation Zone	Neighborhood	Potential Emergency Exit?	Number of Parcels
		La Vereda Rd	No	7
		Le Conte Ave	No	6
		Leroy Ave	No	4
		Virginia St	No	3
	BER-E046	Acroft Court	No	11
		Action Circle	No	20
		Noth Valley St	No	14
		West St	No	4
	BER-E047	8Th St	No	10
	BER-E051	Poe St	No	5
		Valley St	No	30
	BER-E053	Milvia St	Yes	5
	BER-E058	Arden Rd	No	14
		Canyon Rd	No	8
		Dwight Way	No	2
		Fernwald Rd	No	6
		Hillside Ct	No	7
		Mosswood Ln	No	3
		Mosswood Rd	No	14
		Panoramic Place	No	3
		Panoramic Way	No	63
		Private Drive Off of Panoramic Way	No	4
	BER-E062	Burnett St	Yes	36
		Russell St	No	10
		Sojourner Truth Way	No	3
	BER-E063	Grant St	No	2
		Russell St	Yes	10
	BER-E064	Deakin St	Yes	15
		Ellsworth St	Yes	6
		Fulton St	Yes	16
	BER-E065	Russell St	No	6
	BER-E066	Garber St	No	4
		Tanglewood Rd	Yes	5
	BER-E067	Bateman St	No	16
		Colby St	No	3
		Dana St	Yes	5
		Regent St	No	10
		Webster St	No	6
	BER-E068	Woolsey St	Yes	11
	BER-E069	Fairview St	No	21

Priority	Evacuation Zone	Neighborhood	Potential Emergency Exit?	Number of Parcels
	BER-E070	63Rd St	Yes	24
		Harmon St	Yes	19
	BER-E072	Elmwood Ct	No	10
		Lewiston Ave	Yes	27
		Webster St	No	6
	BER-E073	Avalon Ave	No	12
		Claremont Blvd	Yes	10
		Garber St	No	28
		Kelsey St	Yes	14
		Palm Ct	No	6
		Stuart St	Yes	8
	BER-E078	El Camino Real	No	15
		Hillcrest Rd	No	6
		Oak Ridge Rd	No	31
		Private Drive Off of The Uplands	No	7
	OKL-E004	Tanglewood Rd	Yes	7
	OKL-E017	Eton Ct	No	6
		Mystic Ct	No	6
	OKL-E018	Brookside Ave	No	15
		Hillcrest Ct	No	8
		Roslyn Ct	No	7
	OKL-E019	Roble Ct	No	7
Total Primary AIN		141	Total Primary AIN Parcels	1,461
Secondary	BER-E001	Capistrano Ave	N/A	42
		Colusa Ave		2
		Vincente Ave		22
		San Lorenzo Ave		25
		Tacoma Ave		34
		Ensenada Ave		15
		Miramar Ave		1
		Solano Ave		1
	BER-E002	Arlington Ave		5
		Capistrano Ave		6
		Contra Costa Ave		70
		Mendocino Ave		35
		San Antonio Ave		29
		San Fernando Ave		16
		San Juan Ave		22
		San Ramon Ave		31
		Santa Clara Ave		24

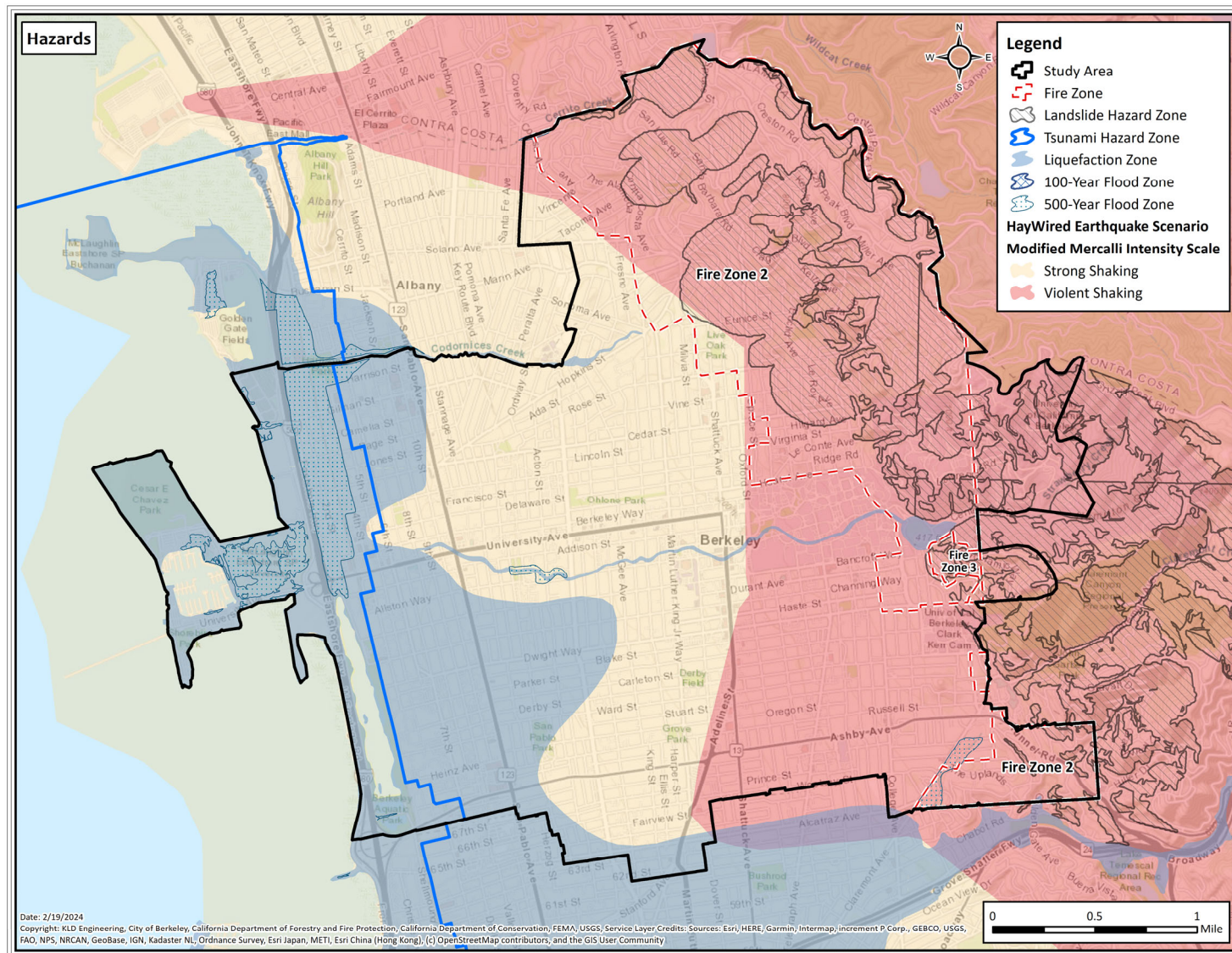
Priority	Evacuation Zone	Neighborhood	Potential Emergency Exit?	Number of Parcels
		The Alameda		45
		Thousand Oaks Blvd		31
		Vallejo St		7
		Yosemite Rd		60
	BER-E003	Arlington Ave		3
		Avis Rd		10
		San Antonio Ave		22
		San Diego Rd		10
		San Luis Rd		21
		Somerset Pl		1
		Southampton Ave		29
	BER-E004	Arlington Ave		2
		Boynton Ave		54
		Florida Ave		8
		Montrose Rd		5
		Northampton Ave		27
		San Luis Rd		32
		Santa Barbara Rd		73
		Southampton Ave		7
		Spruce St		5
		Vermont Ave		1
	BER-E005	Colorado Ave		9
		Kentucky Ave		40
		Maryland Ave		15
		Michigan Ave		42
		Spruce St		2
		Vassar Ave		23
		Vermont Ave		40
		Rugby Ave		3
	BER-E006	Acacia Ave		3
		Alta Rd		7
		Cragmont Ave		36
		Creston Rd		1
		Euclid Ave		1
		Grizzly Peak Blvd		1
		Rosemont Ave		1
		Spruce St		2
		Vassar Ave		25
	BER-E007	Rochdale Way		1
		Rosemont Ave		6
		Sunset Ln		3

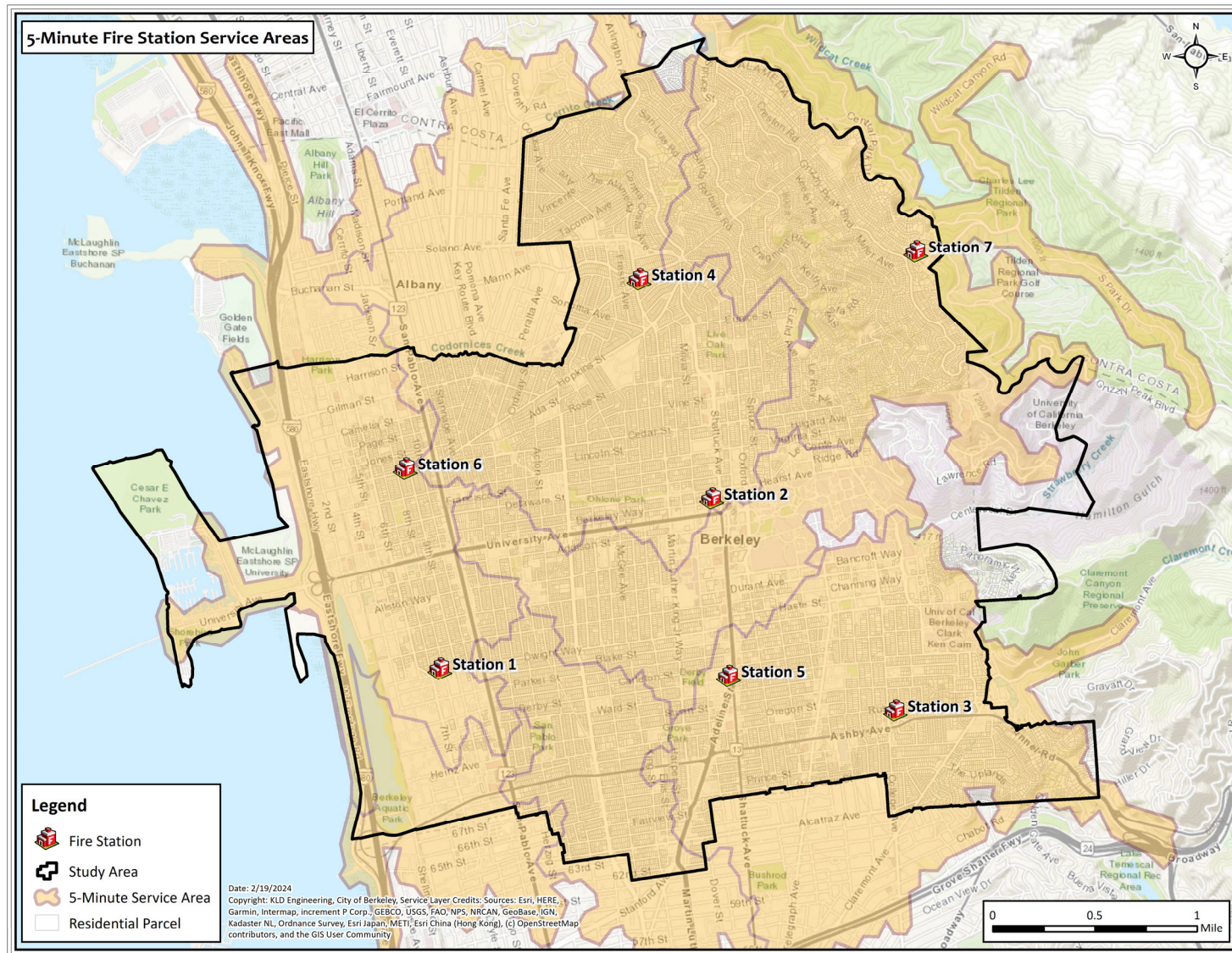
Priority	Evacuation Zone	Neighborhood	Potential Emergency Exit?	Number of Parcels
		Vistamont Ave		21
		Woodmont Ave		51
	BER-E008	Bonnie Ln		22
		Creston Rd		52
		Grizzly Peak Blvd		3
		Hilldale Ave		58
		Keeler Ave		46
		Marin Ave		6
		Poplar St		10
		Rosemont Ave		1
		Sunset Ln		1
	BER-E009	Acacia Ave		7
		Alamo Ave		24
		Cragmont Ave		79
		Euclid Ave		1
		Halkin Ln		6
		Marin Ave		1
		Poplar St		10
		Regal Rd		18
		Rock Ln		25
		Spruce St		4
	BER-E010	Indian Rock Ave		4
		Marin Ave		17
		Montrose Rd		8
		Oxford St		32
		San Diego Rd		16
		San Luis Rd		27
		San Mateo Rd		1
		Santa Barbara Rd		37
		Shattuck Ave		17
		Spruce St		1
	BER-E011	Capistrano Ave		31
		Colusa Ave		3
		Menlo Pl		26
		San Miguel Ave		12
		Santa Rosa Ave		47
		The Alameda		45
		Thousand Oaks Blvd		19
		Vincente Ave		67
		Visalia Ave		18
		San Lorenzo Ave		25

Priority	Evacuation Zone	Neighborhood	Potential Emergency Exit?	Number of Parcels
		San Pedro Ave		30
		Tacoma Ave		32
	BER-E015	Creston Rd		58
		Forest Ln		29
		Grizzly Peak Blvd		5
		Hilldale Ave		36
		Keeler Ave		37
		Latham Ln		2
		Marin Ave		7
		Miller Ave		30
		Poppy Ln		15
		Regal Rd		26
		Sunset Ln		2
	BER-E016	Hillview Rd		19
		Latham Ln		2
		Middlefield Rd		25
		Muir Way		1
		Overlook Rd		31
		Park Gate		1
		Park Hills Rd		53
		Shasta Rd		4
		Sunset Ln		3
		The Crescent		18
		The Crossways		2
		The Shortcut		1
		Wildcat Canyon Rd		4
		Woodhaven Rd		19
		Woodside Rd		27
	BER-E017	Creston Rd		21
		Grizzly Peak Blvd		7
		Keeler Ave		32
		Latham Ln		5
		Miller Ave		47
		Muir Way		3
		Private Drive Off of Whitaker Ave		3
		Shasta Rd		11
		Sterline Ave		52
		Sterling Ave		3
		Stevenson Ave		8
		Twain Ave		5

Priority	Evacuation Zone	Neighborhood	Potential Emergency Exit?	Number of Parcels
	BER-E018	Whitaker Ave		7
		Bret Harte Rd		19
		Cragmont Ave		70
		Euclid Ave		22
		Keeler Ave		21
		Keith Ave		64
		Shasta Rd		8
		Tamalpais Rd		2
	BER-E019	Cragmont Ave		56
		Euclid Ave		37
		Keith Ave		47
		Marin Ave		6
		Regal Rd		15
		Santa Barbara Rd		14
		Spruce St		3
	BER-E020	Del Norte St		17
		Marin Ave		8
		Oxford St		44
		San Benito Rd		23
		Santa Barbara Rd		2
		Shattuck Ave		30
		Spruce St		3
	BER-E029	Campus Dr		6
		Euclid Ave		10
		Le Roy Ave		6
		Northgate Ave		14
		Rose St		2
		Shasta Rd		53
		Tamalpais Rd		43
	BER-E030	Campus Dr		27
		Queens Rd		21
		Shasta Rd		7
	BER-E031	Avenida Dr		17
		Hill Rd		1
	BER-E032	Buena Vista Way		39
		Campus Dr		1
		Cedar St		1
		Del Mar Ave		14
		La Vereda Rd		12
		Olympus Ave		26
		Parnassus Rd		19

Priority	Evacuation Zone	Neighborhood	Potential Emergency Exit?	Number of Parcels
	BER-E033	Queens Rd		1
		Buena Vista Way		14
		Greenwood Terrace		3
		Le Roy Ave		24
	BER-E040	Hilgard Ave		2
		La Vereda Rd		10
		Le Loma Ave		2
		Virginia St		4
	BER-E058	Hillside Ave		3
	BER-E067	Bateman St		3
	OKL-E008	Alvarado Rd		14
	OKL-E009	Alvarado Rd		5
	OKL-E010	Vicente Rd		22
	OKL-E015	Vicente Rd		3
	OKL-E018	Hillcrest Rd		31
Total Secondary AIN		195	Total Secondary AIN Parcels	3,687





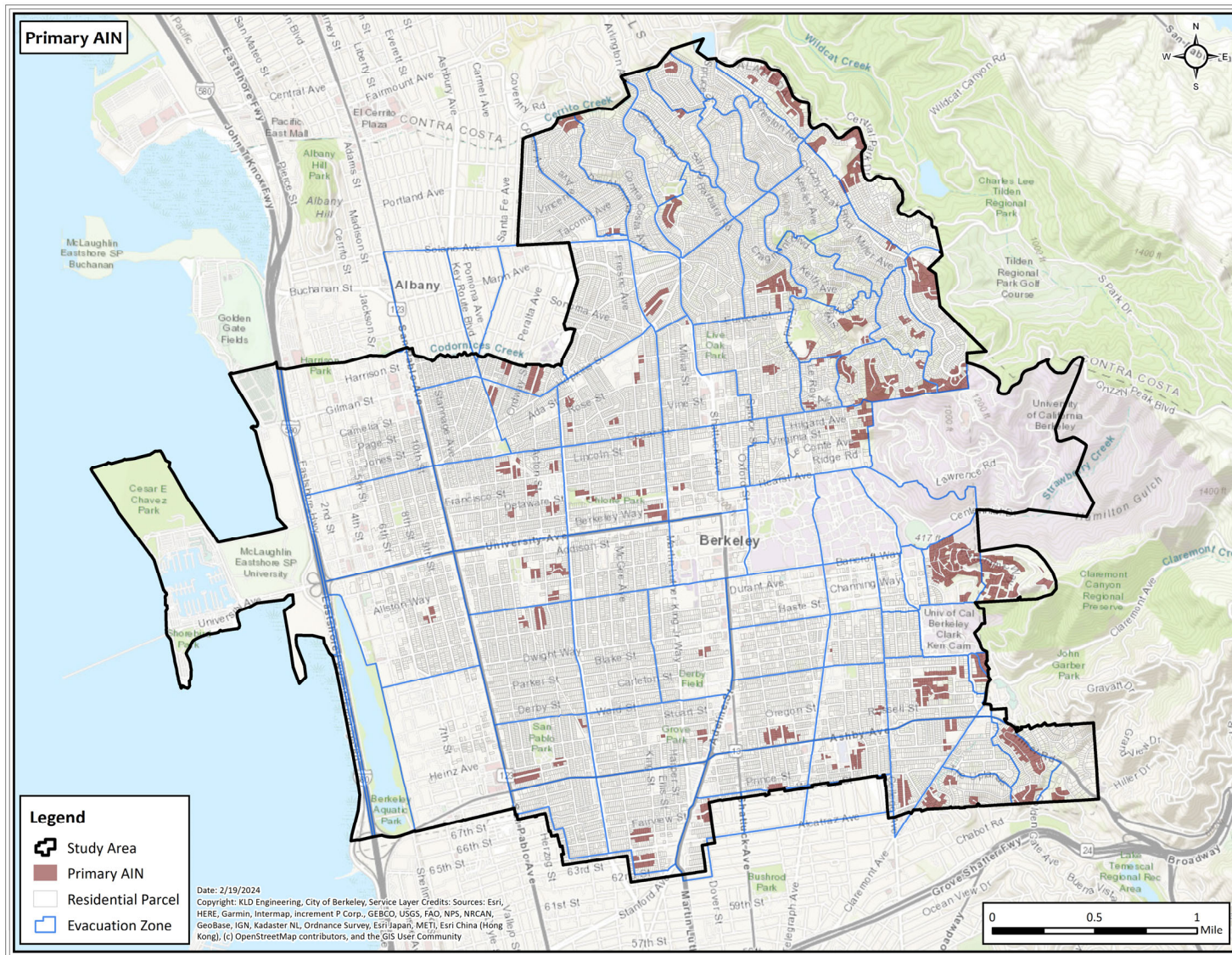


Figure 3. Primary Access Impaired Neighborhoods

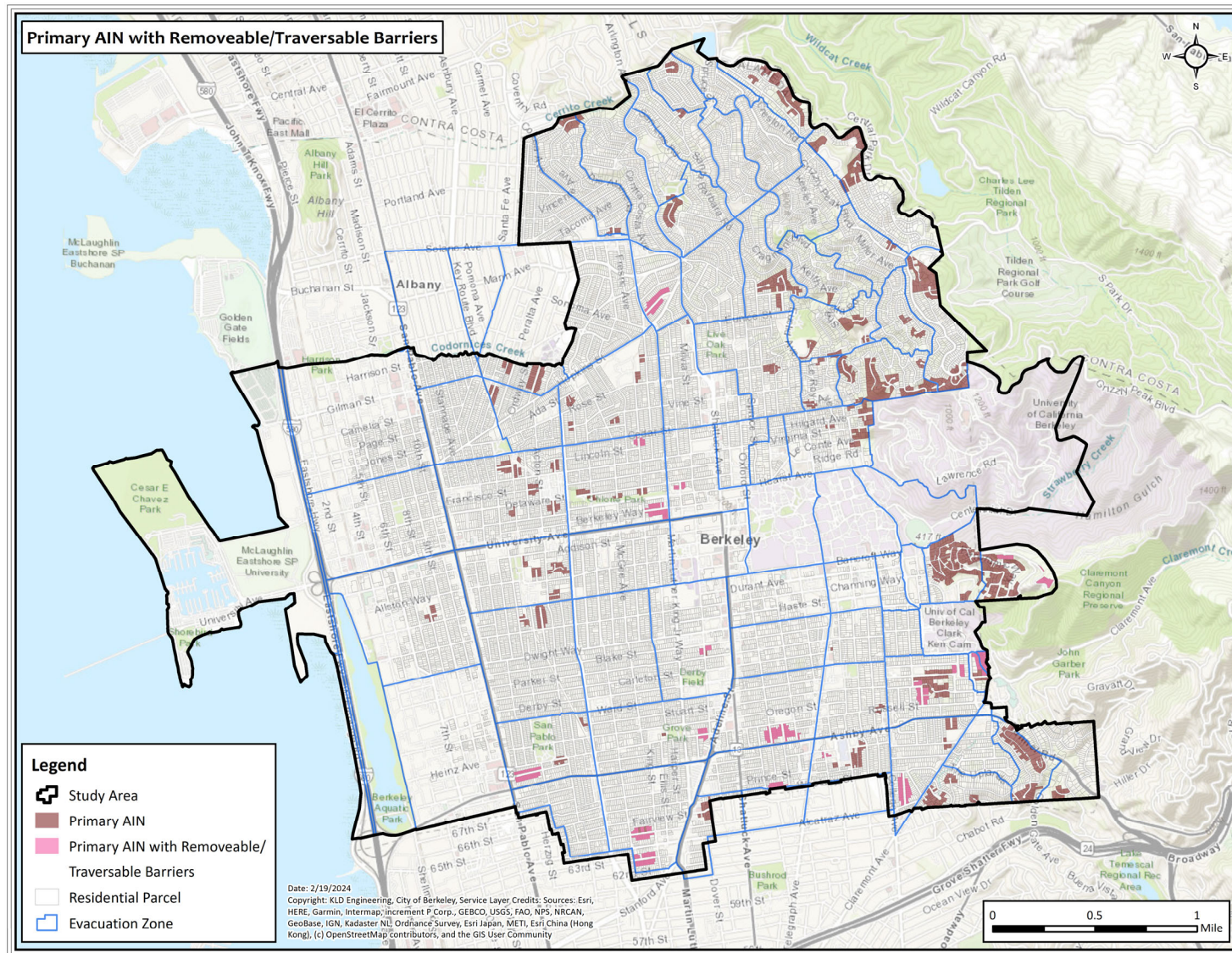


Figure 4. Primary Access Impaired Neighborhoods with Removeable/Traversable Barriers



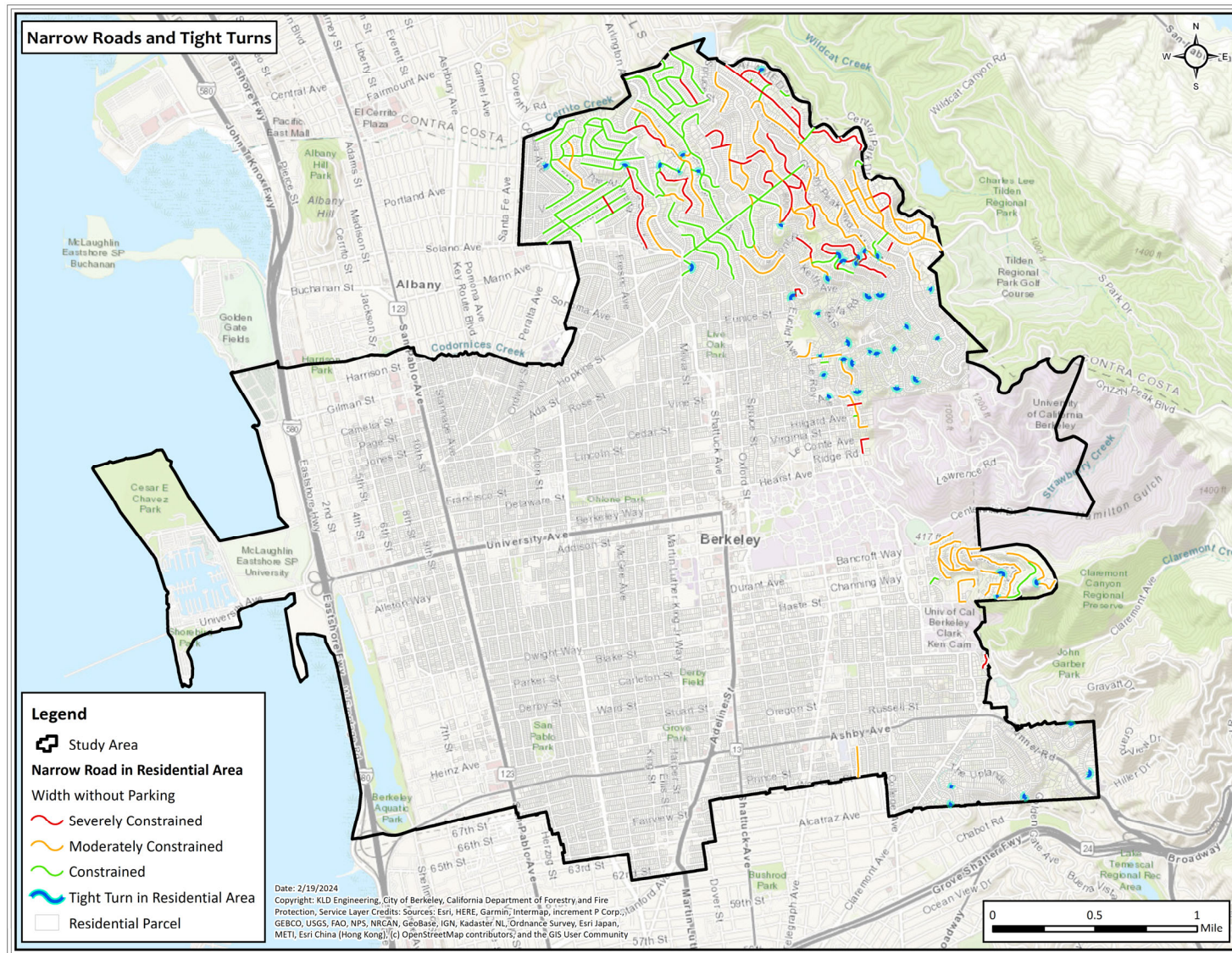


Figure 6. Narrow and Winding Roads

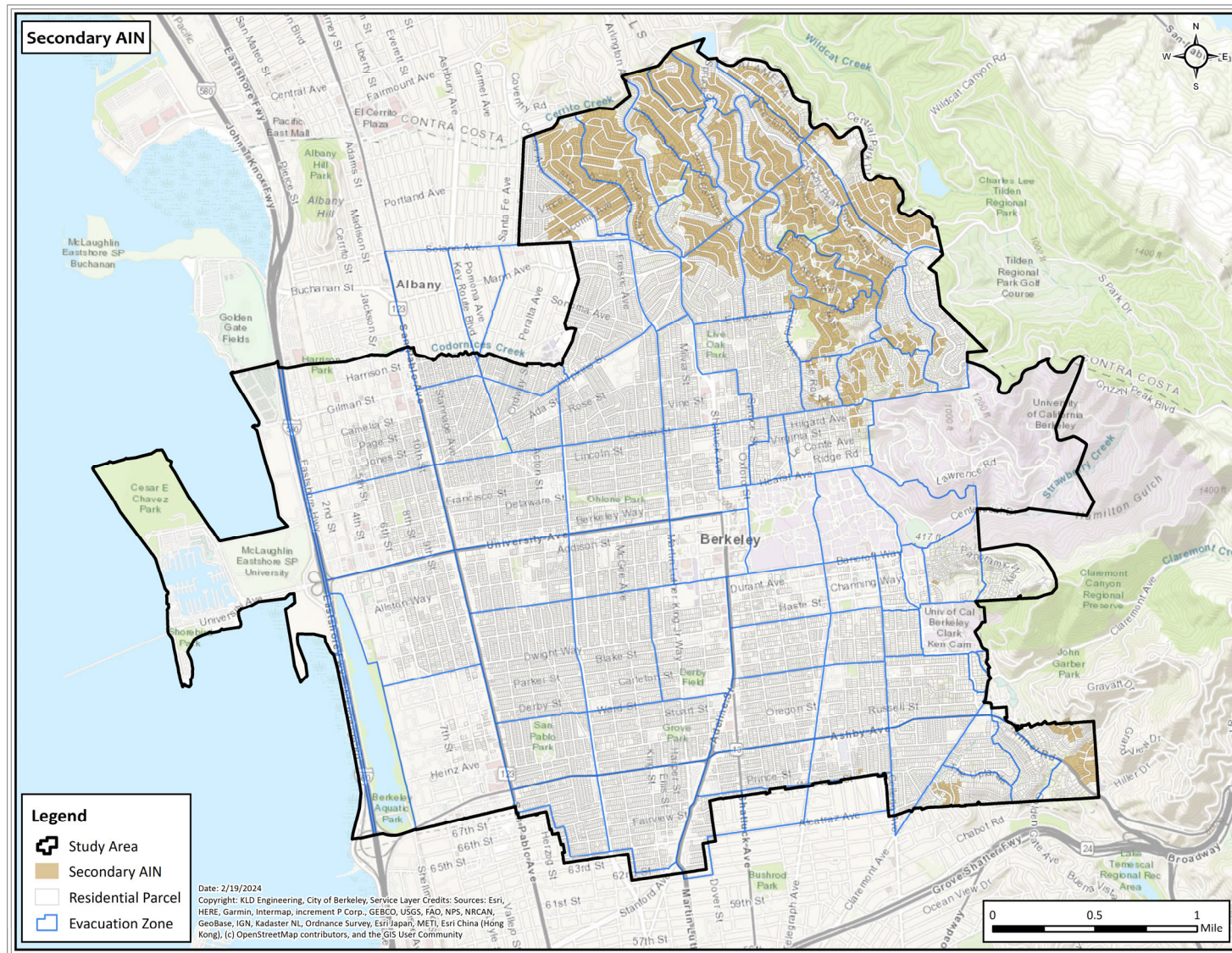


Figure 7. Secondary Access Impaired Neighborhoods

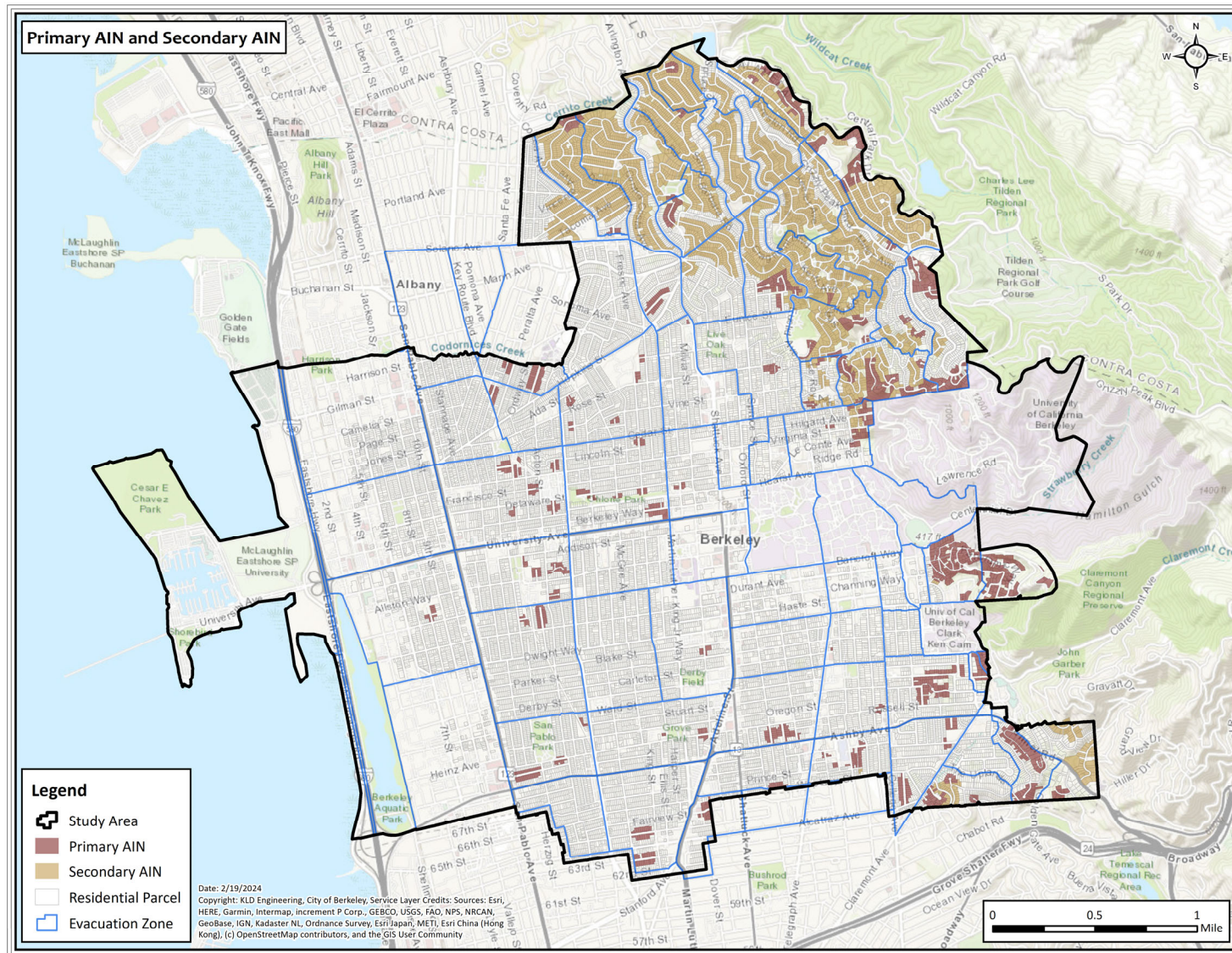
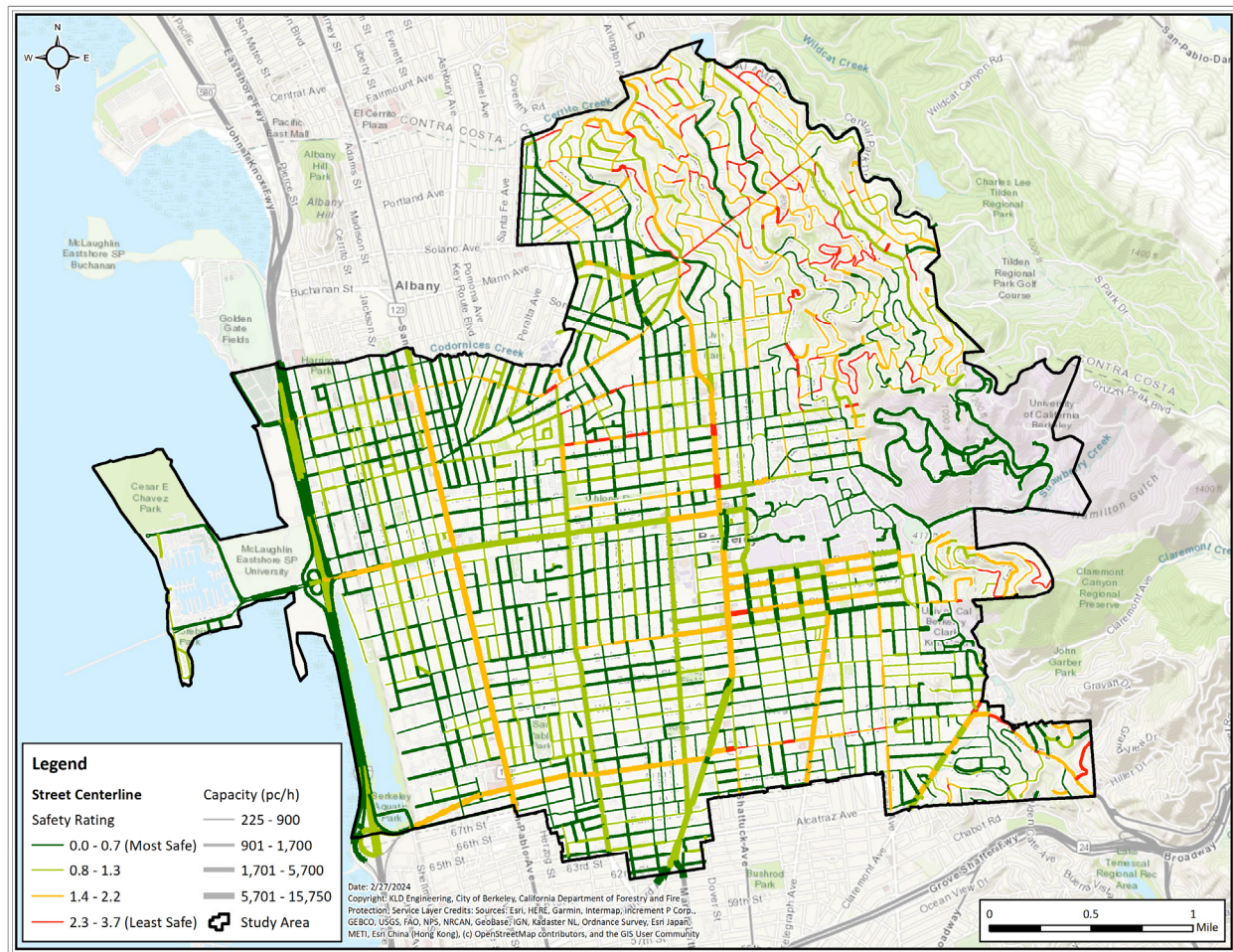


Figure 8. Primary and Secondary Access Impaired Neighborhoods

Appendix D

Evacuation Route Safety, Capacity, and Viability Analysis

City of Berkeley, California
Evacuation Route Safety, Capacity, and Viability Analysis
Assembly Bill 747 Requirement



Work performed for the City of Berkeley, by:

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Introduction

Section 65302.15 of Assembly Bill (AB) 747, dated October 9, 2019, states that the safety element, as described in subdivision (g) of Section 65302, shall “identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios”.

The City of Berkeley has contracted KLD Engineering, P.C. to analyze the capacity, safety, and viability of the evacuation routes within the city limits. The results of the analysis will help the City of Berkeley identify which evacuation routes are safest, have the largest capacity, and are the most viable under a variety of circumstances, as well as identify which evacuation routes may underserve the evacuating population. This report describes the data, assumptions, analysis, and results of the safety, capacity, and viability of the roadways within the City of Berkeley.

Data Sources

- The city street centerline dataset was provided by the city and is used as the basis for this analysis.
- The following datasets were utilized to analyze the safety of each evacuation route:
 - Crash data from the City of Berkeley Vision Zero high collision corridors within the city.
 - The street centerline data was provided by the city and was used to identify dead ends, narrow roads, and winding roads. In addition, the dead-end data provided by the city and those obtained from the road survey were also considered in this analysis.
 - The Pavement Conditions Index (PCI) was utilized to determine pavement quality on the roadways within the city. This data was provided by the city. Roadways with missing PCI data were supplemented with aerial imagery using data from neighboring roadways with similar characteristics/pavement conditions.
 - The International Roughness Index¹ (IRI) data from the Federal Highway Administration² (FHWA) was used to determine pavement quality on I-80.
 - National bridge and tunnel inventory from the Bureau of Transportation Statistics (BTS). The inventory includes information on bridge/ tunnel location, structure condition, year of construction, average daily traffic, etc.
 - Federal Emergency Management Agency’s (FEMA) 100-year and 500-year flood zones³. The 100-year and 500-year flood zones identify areas that have a 1% and 0.2% chance of flooding, respectively, in any given year.

¹[https://www.fhwa.dot.gov/policyinformation/pubs/hf/pl11028/chapter7.cfm#:~:text=The%20International%20Roughness%20Index%20\(IRI,or%20very%20good%20ride%20quality](https://www.fhwa.dot.gov/policyinformation/pubs/hf/pl11028/chapter7.cfm#:~:text=The%20International%20Roughness%20Index%20(IRI,or%20very%20good%20ride%20quality)

² <https://geodata.bts.gov/datasets/highway-performance-monitoring-system-hpms-2020/about>

³ <https://www.fema.gov/flood-maps>

- California Department of Conservation⁴ earthquake zones and the United States Geological Survey (USGS) HayWired Scenario⁵. This dataset includes areas that are at risk for seismic hazards which include the following risks:
 - deep-seated landslide susceptibility based on estimates of rock strength and steepness of slopes,
 - liquefaction,
 - surface fault rupture,
 - and ground shaking.
- California Department of Conservation tsunami zones⁴. This dataset includes all populated areas that are at risk of tsunamis.
- Fire Hazard Severity Zones (FHSZ) data obtained from the City of Berkeley. FHSZ are scored based on factors that influence fire likelihood and fire behavior. Fire Zones 2 and 3 were considered at-risk in this study.
- The following datasets were utilized to analyze the viability of each evacuation route:
 - Number and location of electric charging stations were obtained via PlugShare as referenced on the City's Electric Mobility website⁶.
 - Google Places was utilized to determine the number and location of gas stations throughout the city.
 - Freeway ramps only exist within the city along I-80. The ramp locations are included in the street centerline data provided by the city.
- The following datasets were utilized to estimate the demand that would utilize each evacuation route:
 - The latest census tract data from the U.S. Census Bureau.
 - The permanent resident population is based on the 2020 U.S. Census population from the Census Bureau website extrapolated to April 2023 using annual growth rates that are computed from the 2022 Census population estimates.
 - Data from the U.S. Census Longitudinal Employer-Household Dynamics (LEHD) from the OnTheMap Census analysis tool is used to estimate the number of employees commuting into the city.
 - Data for Alameda County from the Highway Performance Monitoring System⁷ (HPMS) 2020 was utilized to estimate the volumes on I-80 within the city limits.
 - Total enrollment at UC Berkeley from 2019 to 2020⁸ was utilized to estimate the number of student vehicles that would evacuate from the campus.
- The following datasets were utilized to analyze the demographics⁹ of the neighborhoods surrounding each evacuation route:

⁴ <https://maps.conservation.ca.gov/cgs/#datalist>

⁵ <https://earthquake.usgs.gov/education/shakingsimulations/hayward/M7.0.php#>

⁶ <https://berkeleyca.gov/city-services/getting-around/electric-mobility>

⁷ <https://geodata.bts.gov/datasets/highway-performance-monitoring-system-hpms-2020/about>

⁸ <https://opa.berkeley.edu/campus-data/common-data-set>

⁹ The population demographics along each evacuation route can predict additional risks to people living along the route. For example, people living along evacuation routes in areas with higher rates of poverty may be at a higher risk than people living along evacuation routes in areas with lower rates of poverty due to the resources that are available to higher income people.

- ESRI's ACS poverty status variables by census tract¹⁰. This dataset estimates the percentage of population with income lower than the federal poverty level at census tract level. The data is provided by the U.S. Census Bureau's ACS 2017-2021 5-year estimates.
- ESRI's American Community Survey (ACS) vehicle availability variables by census tract¹¹. This dataset shows the percentage of households without vehicles at census tract level. The data is provided by the U.S. Census Bureau's ACS 2017 – 2021 5-year estimates of household size by number of vehicles available.
- California Department of Transportation housing and transportation affordability index¹². This dataset measures the percentage of income devoted to housing and transportation for the regional typical household at the census tract level.
- ESRI's ACS disability by type variables by census tract¹³. This dataset shows the percentage of the population with a disability at census tract level. The data is provided by the U.S. Census Bureau's ACS 2017-2021 5-year estimates of six different types of disability¹⁴.

Assumptions

- Jenks Method of Natural Breaks¹⁵ is used to develop the scaling factors, where applicable.
- Link centroids (midpoint) are used when applying factors of safety, demographics, and viability.
- For the analysis on pavement width (narrow roadways), the following assumptions were made:
 - Parking stalls are 8 feet wide. Using the city's curb data for parking information, pavement width was reduced by 8 feet to account for roadways with street parking (or 16 feet if parking is permitted on both sides of the road).
 - A minimum of 10 feet is necessary for large vehicles (delivery trucks, buses, etc.) to evacuate.
- For the viability analysis, the connectivity score is based on the following assumptions:
 - The centroid (geometric center) of each Census block group was utilized as the representative trip origin.
 - Shortest path chosen from each centroid to each exit leaving the city along a major evacuation route. (Some examples of exits leaving the city along a major

¹⁰ <https://www.arcgis.com/home/item.html?id=0e468b75bca545ee8dc4b039cbb5aff6>

¹¹ <https://www.arcgis.com/home/item.html?id=9a9e43ec1603446880c50d4ed1df2207>

¹² https://caltrans-gis.dot.ca.gov/arcgis/rest/services/CHHqcore/Economic_Opportunity/FeatureServer/0

¹³ <https://livingatlas-dcdev.opendata.arcgis.com/maps/esri::acs-disability-by-type-variables-boundaries/about>

¹⁴ The following disabilities are included: hearing, vision, cognitive, ambulatory, self-care, and independent living difficulties.

¹⁵ The Natural Breaks (Jenks) identify class breaks as groups with similar values and maximize differences between classes. <https://pro.arcgis.com/en/pro-app/latest/help/mapping/layer-properties/data-classification-methods.htm>

evacuation route are I-80 eastbound at exit 13A/Buchanan Street and I-80 westbound at the junction with SR 13/Ashby Avenue.)

- For the viability analysis, the following assumptions were utilized to estimate the vehicular demand on a link:
 - The 2020 Census data, extrapolated to 2023, and 2020 employee estimates from OnTheMap, as well as 5-year ACS aggregate number of vehicles by block group, are used to determine the number of vehicles that are likely to use a given roadway segment.
 - Tourist vehicles are not included.
 - Employee and commuting student vehicle occupancies are assumed to be 1 employee per vehicle.
 - Public transit was not considered.
 - It was assumed that on campus students are included in the census data.
 - It was conservatively assumed that off campus students live within the City of Berkeley.
 - No reduction in commuters is considered for remote work and learning.

Analysis

Safety

There are several considerations when determining how safe a roadway is. For example, crash history can be a good indication of how well a roadway was designed. If an intersection is prone to side-impact collisions, it could be an indication of poor sight distance and, therefore, an unsafe roadway. Narrow and/or winding roadways were also considered a safety risk. These roadways can significantly impede evacuation since drivers often need to slow down to safely traverse these sections of roadway.

The safety factors were utilized to determine the overall safety of the evacuation routes within the city. Table 1 shows the safety factors, their associated scaling system (using Jenk's Law of Natural Breaks where appropriate), the weight applied (if any), and the description of each factor that was utilized in this study. Scales that ranged beyond 1 were normalized to fall between 0 and 1. **The higher the safety rating, the more unsafe a roadway segment is.** An overall safety rating was computed by summing each safety factor (multiplied by its weight, if applicable).

Figure 1 through Figure 6 show the various factors that were applied for the safety analysis and the results that were obtained.

Hazards

In addition to the roadway characteristics, roadways can be more or less unsafe than other roadways under different circumstances. For example, in rainy weather, a roadway that is in an area with a high landslide probability is likely to be more unsafe than a roadway in an area with low landslide probability. It should be noted that even if a route is exposed to one or more hazards, it may still need to be used to evacuate areas of the city. As such, the hazard factors are presented separately from the safety factors and were excluded in the overall safety rating.

Table 1 also presents the hazard factors, their associated scaling system (using Jenk's Law of Natural Breaks where appropriate), the weight applied (if any), and the description of each factor that was utilized in this study. Figure 7 through Figure 11 show the various factors that were applied for the hazard analysis and the results that were obtained.

Capacity

The ability of the road network to service vehicle demand is a major factor in determining how rapidly an evacuation can be completed. The capacity of a road is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane of roadway during a given time period under prevailing roadway, traffic and control conditions, as stated in the 2022 Highway Capacity Manual (HCM). This section discusses how the capacity of the roadway network was estimated.

For the purposes of this analysis, capacity is estimated along sections of roadway, rather than at intersections or ramp junctions. The capacity of roadway sections¹⁶ is a function of roadway geometrics (e.g. number of lanes, grade, etc.), traffic composition (e.g., percent heavy trucks and buses in the traffic stream) and, of course, motorist behavior. The source material for the capacity estimates presented herein is contained in:

2022 Highway Capacity Manual (HCM)
Transportation Research Board
National Research Council
Washington, D.C.

The evacuation route system in the city consists primarily of three categories of roads:

- Two-Lane roads: Local, State
- Multilane Highways/Roadways (at-grade)
- Freeways

Each of these classifications will be discussed. The roadway classifications, and resulting estimated capacities, are based on field observations, including number of lanes, collected during the road survey which was conducted in May 2023.

¹⁶ This analysis is based on computed capacity alone and does not consider the time-varying demand impact on actual capacity.

Two-Lane Roads

Ref: HCM Chapter 15

Two lane roads (one lane in each direction) comprise the majority of roadways within the city. The per-lane capacity of a two-lane roadway is based on its speed. The speeds¹⁷ and corresponding estimated roadway capacities for two lane roads are provided in Table 2. These estimates are essentially independent of the directional distribution of traffic volume. The HCM procedures then estimate LOS and Average Travel Speed.

Based on the field survey, aerial imagery, and on expected traffic operations associated with evacuation scenarios:

- Most sections of two-lane roads within the study area are classified as “Class I”, with “level terrain”; some are “rolling terrain”.
- “Class II” highways/roadways are mostly those within urban and suburban centers.

Multilane Roadways

Ref: HCM Chapter 12

Exhibit 12-8 of the HCM presents a set of curves that indicate a per-lane capacity ranging from approximately 1,900 to 2,300 pc/h, for free-speeds of 45 to 70 mph, respectively. Based on observation and estimation, the multilane roadways within the city service traffic with free-speeds in this range. Once again, for purposes of this analysis on multilane roadways, the actual time-varying speeds, the demand and capacity relationship, and the impact of control at intersections are ignored due to their dynamic nature. A conservative estimate of per-lane capacity of 1,900 pc/h is adopted for this study for multilane roadways within the city.

Freeways

Ref: HCM Chapters 10, 12, 13, 14

Chapter 12 of the HCM presents procedures for estimating capacity and LOS for “Basic Freeway Segments”. Exhibit 12-37 of the HCM presents capacity vs. free speed estimates, which are provided below.

Free Speed (mph):	55	60	65	70+
Per-Lane Capacity (pc/h):	2,250	2,300	2,350	2,400

The inputs to the estimation of capacity are roadway geometrics and free-speeds. A conservative estimate of per-lane capacity of 2,250 pc/h is adopted for this study for freeways.

¹⁷ Free flow speeds and number of lanes, as driven during the road survey in May 2023, were utilized to compute capacity. The impact of traffic control devices on free flow speeds is considered for two lane roadways within the City.

Chapter 13 of the HCM presents procedures for estimating capacity, speed, density and LOS for freeway weaving sections. Chapter 14 of the HCM presents procedures for estimating capacities of ramps and of "merge" areas. There are three significant factors to the determination of capacity of a ramp-freeway junction: The capacity of the freeway immediately downstream of an on-ramp or immediately upstream of an off-ramp; the capacity of the ramp roadway; and the maximum flow rate entering the ramp influence area. In most cases, the freeway capacity is the controlling factor. Values of this merge area capacity are presented in Exhibit 14-10 of the HCM and depend on the number of freeway lanes and on the freeway free speed. Ramp capacity is presented in Exhibit 14-12 and is a function of the ramp's free flow speed. Concepts in these chapters are utilized to estimate the capacity of freeway ramps within the city.

Viability

Viability is defined as the ability to function adequately. It is also defined as the ability to succeed or be sustained. As such, the viability of an evacuation route can be defined in several different ways. The following scores have been developed for this study to assess the viability of the roadways within the city. Table 3 presents each of the viability scores, their scales, and their descriptions.

Connectivity score: How well does a roadway connect you to an area of refuge or nearby city? Roadways that directly connect evacuees to places of safety are more *connected* and are considered more viable than roadways that do not. To determine how well connected each roadway is, ArcGIS's network analyst was utilized to find the shortest path from each trip origin (Census block centroid) to each trip destination (city exit along a major evacuation route). Once each route was computed from each origin (O) to each destination (D), the routes were spatially joined with each roadway link to determine the total number of origin-destination paths that traversed each segment. Roadway segments with more paths are more connected, and more viable, than roadway segments with less paths.

Accessibility score: How accessible is a roadway to evacuees? A freeway usually has a very high capacity and great connectivity, but if the ramps that give access to the freeway are 10 miles apart, it may not be the most viable evacuation route. For this reason, the number of connections, or intersections/ramp junctions, was considered in the accessibility score. To determine the number of connections or intersections for each route, the number of other links (roadway segments) that are connected to each link was computed. Nodes were created at the intersections of links. A spatial join was done to count the number of links that connect each node. Finally, a spatial join was conducted to assign the total number of connected links from connected nodes to their corresponding links. In addition, aerial imagery was used to verify the link and node connection. For ramps, if a roadway is a ramp or has a ramp connection, it was assigned a value of 5 for appropriate weight in the accessibility score. The accessibility score is the sum of the number of ramps and the number of connected links. The more intersections/connections/ramps a roadway has, the higher the accessibility score and the more viable the roadway is considered.

Service score: Does the roadway have the necessary commodities or services to sustain evacuees, like gas stations and/or electric charging stations? Roadways that have these types of commodities facilitate evacuation and, therefore, are more viable evacuation routes than roadways that do not have these types of commodities.

ArcGIS's network analyst was utilized to determine how far a roadway was from a service (gas or charging) station. For example, a roadway with a gas station score of 2 and a charging station score of 4 is a 2 minute drive from the nearest gas station and a 4 minute drive from the nearest charging station. The service rating is the sum of these two values.

Congestion score: A good way to measure the viability of an evacuation route is to determine if the population demand (residents, employees, students, and pass through traffic) that is expected to utilize the route will exceed the estimated capacity. For example, can the route service the demand in an evacuation, or will it operate below capacity and have bottlenecks and operational constraints?

The best way to answer these questions is with a traffic simulation model that uses algorithms to simulate real traffic behavior under a variety of circumstances. Currently, the City of Berkeley is conducting an evacuation time estimate (ETE) study to compute how long it would take to evacuate the city under different temporal and spatial conditions. This study utilizes a traffic simulation model. As part of this work effort, the congestion during evacuation conditions along each evacuation route can be assessed. This project is still ongoing, and as a result, the results of the project cannot be utilized to assess the congestion score, or viability, of the evacuation routes within the city at this time.

In the meantime, the evacuating vehicular demand can be estimated based on trip origins and this demand can be compared to the capacity¹⁸ of the roadway segments within the vicinity of each origin.

The evacuating vehicular demand for each route was computed from Census data (population data extrapolated to 2023 and employment data from LEHD) in the proximity of the route. Resident and employee datapoints (converted to vehicles using assumed occupancies) within a quarter mile buffer of the roadway segment were assigned to each roadway segment as the vehicular demand to be serviced. In addition, pass through traffic along I-80 was estimated from annual average daily traffic counts collected by the US Department of Transportation along I-80.

This demand can fluctuate depending on the time of year, day of week, and time of day. For this reason, a minimum and maximum demand was estimated using scenario percentages for varying temporal conditions. For example, employees within the city peak between 9am and 5pm on weekdays and only about 10% of employees may be present on weekends and in the evening. It should be noted that the minimum demand represents when UC Berkeley is not in session; the maximum demand represents when UC Berkeley is in session.

¹⁸ As computed in the *Capacity* section of this report.

Since vehicles will load onto the roadway network over time, rather than all at once, the mobilization distribution¹⁹ was computed from an online demographic survey of residents and employees/commuting students within the City of Berkeley. Figure 12 shows the mobilization curve that was utilized. The maximum demand (volume) was computed for each roadway segment based on the highest hourly mobilization percentage (57% for residents [between 45 minutes and 1 hour and 45 minutes after the order to evacuate] and 100% for employees and commuting students [in the first hour]).

The volume was then divided by the total roadway capacity to compute the volume-to-capacity (v/c) ratio for each roadway segment. The v/c ratio was utilized as the congestion score for the maximum and minimum demand, the higher the congestion score, the lower the viability.

Vulnerability

Although not specifically a roadway safety, capacity or viability consideration, the demographics of the neighborhoods that surround the roadway could be indicative of areas that are more vulnerable and may face challenges when evacuating. For example, areas with less vehicle availability are likely to require public transit and may face more challenges than those areas with enough vehicles to sufficiently evacuate the household in a personal vehicle. These factors were considered separately from the safety, capacity or viability factors but were included in this analysis for a complete picture. The vulnerability factors and their scaling system (using Jenk's Law of Natural Breaks where appropriate), the weight applied (if any), and their description are included in Table 4. **The higher the vulnerability rating, the greater vulnerability of the population living along a roadway segment.** An overall vulnerability rating was computed by summing each factor (multiplied by its weight, if applicable).

through show the various factors that were applied for the vulnerability analysis and the results that were obtained.

Results

Appendix A provides a summary (sorted by street name²⁰) of the average²¹ overall safety rating, capacity, viability score and vulnerability rating by roadway name. Each of the various components and factors that were utilized to compute the safety, capacity, and viability of each roadway segment, as well as the overall safety, capacity, and viability scores of each roadway segment, were provided to the City in electronic format.

While the safety, capacity, viability, and vulnerability varies somewhat within individual street segments on a particular roadway, the following evacuation routes have the highest capacity, are relatively safe, and are the most viable across the entire length of the roadway, see Figure 17:

- University Ave

¹⁹ The notification distribution was assumed over a 30-minute period due to the presence of wireless emergency alerts within the city and based on survey responses.

²⁰ The City's naming conventions within the centerline dataset were adopted with minimal changes.

²¹ Each value shown is the average of all roadway segments that share that street name.

- Adeline St
- Ashby Ave (SR13)
- Cedar St
- Interstate 80 (I-80)
- San Pablo Ave (SR 123)
- Sacramento St
- Claremont Ave
- Marin Ave

Safety

Each of the safety risk scores were summed (with specified weights, if necessary) to obtain an overall safety rating for each roadway segment. Those roadway segments that have the highest overall score are the most unsafe roadway segments. Those with lower scores are safer. Figure 18 shows the overall evacuation safety ratings for each of the roadway segments within the city. Jenk's Law of Natural Breaks was used to develop the 4 thresholds of overall safety. Those roadways with the highest safety score (2.3 - 3.7) are shown in red and represent the roadways with the highest exposure to traffic fatalities, narrowest width, tightest turns, steepest slopes, poorest pavement condition and/or are located above or below a bridge or tunnel. The least safe roadways are within the hills and along Panoramic Way. These roadways are extremely narrow, winding, and steep. Many of the roadways within the flats, including San Pablo Ave, have poor or very poor pavement conditions, giving them a higher *unsafe* rating. The safest roadways are Frontage Rd, University Ave, and Adeline St.

Hazards

Each of the hazard risk scores were summed (with specified weights, if necessary) to obtain an overall hazard rating for each roadway segment. Those roadway segments that have the highest overall score have the highest exposure to flooding, landslides, earthquakes, tsunamis, wildfires. Those with lower scores are less exposed. Figure 19 shows the overall hazard ratings for each of the roadway segments within the city. The safest roadways are in central Berkeley between San Pablo Ave and the foothills of the mountains, including Hopkins St, Shattuck Ave, Adeline St, as well as parts of Cedar St, University Ave, and Ashby Ave. Roadways west of San Pablo Ave are exposed to water related hazards like flooding and tsunamis. Roadways in the mountains are exposed to fires, landslides, and more severe ground shaking.

Capacity

Figure 20 shows the capacity of each roadway segment within the City of Berkeley based on the field observations collected in May 2023, including the number of moving lanes on each roadway. I-80 has the highest capacity, followed by multilane major arterials like San Pablo Ave, University Ave, Shattuck Ave/Adeline St, Sacramento St, Telegraph Ave, and Claremont Ave. The vast majority of roadways within the city are single-lane collectors with a free flow speed of 45mph or less and a capacity of approximately 1,700 passenger cars per hour or less. In the hills, free flow speeds are 20 mph or less and capacities are 900 passenger cars per hour or less.

Viability

Figure 21 displays the connectivity score for the roadways within the city. In the figure, thicker roadways provide more origin-destination connections than thinner roadways and are, therefore, more connected. The most connected roadways are Sacramento St, Ashby Ave (SR 13), Martin Luther King Jr Way, Monterey Ave, Piedmont Ave (in Oakland), and Marin Ave. University Ave, Dwight Way and Cedar St are very connected as well.

Figure 22 displays the results of the accessibility score. Most of the roadways between I-80 and San Pablo Ave, South Berkeley, parts of central and north Berkeley, and I-80 are very accessible. Berkeley Hills and the eastern part of the city are not very accessible since they have limited connections to major roadways and very limited connections to the east of the city due to the mountainous terrain. Some of the most accessible roadways are I-80, Marin Ave, Shattuck Ave/Adeline St, and University Ave.

Figure 23 displays the results of the service score. Roadways west of San Pablo Ave, in the vicinity of University Ave, and in the vicinity of Shattuck Ave and Adeline St have the highest scores due to the density of gas and electric charging stations along these roadways.

Figure 24 and Figure 25 display the congestion scores²² (v/c) for the maximum and minimum estimated effective demand during an evacuation event (respectively) converted to Level-of-Service (LOS), which is a term used to describe the operating conditions of a roadway. The LOS shown in these figures is based on the Highway Capacity Manual (HCM) rounded to the nearest tenth. As shown in these figures, during an evacuation, many of the roadways within the city will operate at LOS F and experience significant congestion. In both cases, the major arterials, like San Pablo Ave (SR 123), Sacramento St, University Ave, Adeline St, Ashby Ave (SR13), and Claremont Ave can better service the evacuating demand than the smaller, local streets within the heart of the city. As such, these roadways are more viable evacuation routes. During the case with minimal demand, and less pass-through traffic on I-80 (at night, for example), I-80 becomes one of the most viable evacuation routes as shown in Figure 25.

Vulnerability

Each of the vulnerability risk scores were summed (with specified weights, if necessary) to obtain an overall vulnerability rating for each roadway segment. Those roadway segments that have the highest overall score are the areas that could potentially have the most difficulty and/or challenges evacuating. Those with lower scores are less likely to have difficulty and/or challenges evacuating. Figure 26 shows the overall vulnerability ratings for each of the roadway segments within the city. Jenk's Law of Natural Breaks was used to develop the 4 thresholds of overall vulnerability. Those roadways with the highest vulnerability score (2.8 – 3.8) are shown in red and represent the roadways that are within areas with the most poverty, the least amount of income spent on transportation, the lowest vehicle availability and the highest population with disabilities.

²² It should be noted that this methodology treats the evacuation of the city in a vacuum ignoring possible, simultaneous evacuation in areas adjacent to the city.

Table 1. Safety and Hazard Factors

Factor	Scale	Description
Safety Factors		
Collisions	0 - No	The City of Berkeley Vision Zero collisions data was utilized to determine corridors with high collision rates. This data was spatially joined with the roadway segments to identify which roadways had the most, or any, collisions. Roadways with more collisions may be indicative of poor roadway design. Those roadways with high collision rates were assigned a value of 1; those corridors that did not have high collision rates were assigned a value of 0. See Figure 1.
	1 - Yes	
Pavement Width	0 – Not Constrained	The city centerline dataset was utilized to determine which roadways were narrow/constrained (with a travel lane of less than 10 feet wide ²³). Roadways that were considered not constrained (less than 10 feet wide) were assigned a value of 0. Those roadways which are considered constrained (meet or exceed 10 feet wide ²⁴) were assigned a value of 1. See Figure 2.
	1 – Constrained	
Curvature	0 – greater than or equaled to 81 feet	The curvature of the roadway was calculated based on its geometry. The radius of the circumscribed circle of three sequential points was computed and assigned to the midpoint of those three points. The roadway segment between two points was assigned the average of the two radii of the points in which it connects. A threshold of 81 feet ²⁵ was selected as the minimum radius. See Figure 3.
	1 – less than 81 feet	
Slope	0.0 – 2.3	The slope of the roadway was also considered. Slopes are represented as a percentage (rise/run x 100). Roadways with steep slopes can be more dangerous than roadways with shallow slopes. As such, larger slopes were assigned a higher value than smaller slopes. A weight of 0.33 is applied to this factor to normalize the results between 0 and 1. See Figure 4.
	2.4 – 7.0	
	7.1 – 15.2	
	15.3 – 37.1	

²³ Based on discussions with staff from the City's Public Works and Fire Departments, a viable evacuation travel lane width of 10 feet was chosen to account for larger vehicles (8 feet wide) and sideview mirrors. It is assumed that even larger vehicles (10 feet wide) are operated by professional drivers with a higher degree of skill to reduce or eliminate driver error.

²⁴ Pavement width was utilized (with modifications made for side street parking). Eight feet of parking was removed from the pavement width for single side street parking and 16 feet was removed for street parking on both sides of the road. Eight feet was used since the typical width for a standard parking space is 8 feet. Although a width of 7.5 feet has been used to provide a balance among users, eight feet was used as vehicles are not always parked well, may not be parked in contact with the face of the curb or vegetation, and throughout the day, large vehicles may be parked on the side of the street. Overhanging vegetation was not accounted for.

²⁵ Table 3-7 of the 2018 AASHTO Policy on Geometric Design of Highways and Streets indicates the minimum radii for a curve with a design speed of 20mph is 81 feet. Based on the data collected during the road survey, the speed travelled on these curves was 20mph or less.

Factor	Scale	Description
Pavement Quality	0 – Very Good	Roadways with poor pavement quality can be more unsafe than roadways with good pavement quality. As such, the quality of the pavement was also considered in the safety analysis. Pavement quality was rated as unpaved, poor, fair/acceptable, and good. Unpaved and poorly rated roadways were rated higher than fair and good rated roadways. A weight of 0.33 is applied to this factor to normalize the results between 0 and 1. See Figure 5.
	1 - Good	
	2 - Poor	
	3 – Very Poor	
Bridges and Tunnels	0 - No	Bridges and tunnels are at risk of collapsing, making the roadways that traverse under or over them unsafe. The roadway segments that contained a bridge or tunnel were given a factor one 1. The remaining roadway segments were assigned a value of 0. Since all bridges (5) and tunnels (1) within the city are currently rated as ‘fair’, this factor was given a weight of 0.5. See Figure 6.
	1 - Yes	
Hazard Factors (excluded from overall safety rating)		
FEMA 100-Year and 500-Year Flood Hazard Areas	0 - not within a flood zone	The data depicts the FEMA 100-year and 500-year flood risk zones for Alameda County. The 100-year flood plain is the area with a 1% chance of flooding in any given year, while the 500-year flood plain is the area with a 0.2% chance of flooding in any given year. Roadways within a 100-year flood plain are at a higher risk, and are more unsafe, than roadways within a 500-year flood plain. It should be noted that none of the roadways within the city are within the 100-year flood zone. See Figure 7.
	0.2 - 500-year flood zone	
	1 - 100-year flood zone	
Landslide Hazard Areas	0 – 0.04 – Very low or none	The statewide landslide inventory shows many of the landslides mapped by CGS and others over the past 50 years. The database focuses on deep-seated landslides. Rock strength and slope are combined to create classes of landslide susceptibility. These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weaker rocks. Higher rates of landslide susceptibility include very steep slopes in hard rocks, and moderate to very steep slopes in weak rocks. Roadways with medium or high landslide susceptibility are less safe than roadways with low or very low (or no) landslide susceptibility. See Figure 8.
	0.05 – 0.12 - Low	
	0.13 – 0.22 - Medium	
	0.23 – 0.34 - High	

Factor	Scale	Description
Earthquake Hazard Risk	0.67 - Severe	HAZUS ²⁶ results of an earthquake scenario on the Hayward Fault. These results include impacts due to ground shaking, landslide, and liquefaction. The results are measured in Modified Mercalli Intensity (MMI) which is composed of twelve levels that increase from imperceptible shaking to catastrophic destruction. The MMI rating is divided by 12 to scale the results from 0 to 1. The entire city falls either in severe (8) or violent (9) ground shaking. See Figure 9.
	0.75 - Violent	
Tsunami Hazard Areas	0 - No	The Tsunami hazard areas are developed for all populated areas at risk to tsunamis in California and represent a combination of the maximum considered tsunamis for each area. "No" indicates the roadway is not within a tsunami hazard area. "Yes" indicates the roadway is within a tsunami hazard area. See Figure 10.
	1 - Yes	
Fire Hazard Severity Zone	0 – Zone 1	FHSZ are scored based on factors that influence fire likelihood and fire behavior. Fire Zones 2 and 3 were considered at-risk in this study. Roadways that were not within Zones 2 or 3 are assigned a value of 0. Roadways within Zone 2 are assigned a value of 0.5 and those roadways within Zone 3 are assigned a value of 1. See Figure 11.
	0.5 – Zone 2	
	1 – Zone 3	

Table 2. Capacity for Two Lane Roads

Speed (mph)	Capacity (pc/h)
5	225
10	450
15	675
20	900
25	1,125
30	1,350
35	1,575
40+	1,700

²⁶ Hazards US software developed by the Federal Emergency Management Agency (FEMA).

Table 3. Viability Scores

Score	Scale	Description
Connectivity	1 - 187	Roadways that directly connect evacuees to places of safety are more connected and are considered more viable than roadways that do not. The scale of this score is based on the number of origin-destination connections that are made.
	188 – 519	
	520 – 1,023	
	1,024+	
Accessibility	0 - 3	The more intersections/connections/ramps a roadway has, the higher the accessibility score and the more viable the roadway is considered. Ramps were assigned a value of 5 for weighting purposes.
	4 - 5	
	6 - 7	
	8 - 11	
Service	2 - 4	Roadways that have gas stations and/or charging stations readily accessible help evacuees maintain their evacuation and, therefore, are more viable evacuation routes than roadways that do not have these types of commodities. The scores represent the sum of the driving time to the nearest gas station and charging station. Roadways that are furthest from a gas or charging station have a higher score and are less viable.
	5 - 8	
	9 - 12	
	13 - 17	
Congestion	LOS A (0 – 0.1)	The congestion score compares the demand (volume) against the capacity to see how the roadways will operate under evacuation conditions. This metric is called the v/c ratio. The Highway Capacity Manual provides an equivalent Level-of-Service (LOS) that ranges from A (free flow conditions) to F (bumper to bumper traffic) based on the characteristics of the roadway. This concept was used to develop general thresholds for the congestion score, rather than Jenk’s Law of Natural Breaks.
	LOS B (0.1 – 0.2)	
	LOS C (0.2 – 0.4)	
	LOS D (0.4 – 0.6)	
	LOS E (0.6 – 0.95)	
	LOS F (0.95+)	

Table 4. Vulnerability Factors

Factor	Scale	Description
Poverty	Low (0.6% - 7.9%)	The poverty data estimates the percentage of population with income lower than the federal poverty level at the census tract level. The data is provided by the U.S. Census Bureau's American Community Survey (ACS) 2017-2021 5-year estimates. Areas with high percentages of poverty are more likely to have evacuation challenges and, therefore, have a higher vulnerability rating. See Figure 13.
	Medium (8.0% - 15.3%)	
	High (15.4% - 26.9%)	
	Very High (27.0% - 64.3%)	
Housing and Transportation Income	Low (0.0%)	The H+T income indicator measures the percentage of income devoted to housing plus (+) transportation for the regional typical household at the census tract level. The latest data (as of 2017) for this indicator were collected directly from the Housing and Transportation Costs (H+T) Index webpage. Areas with higher H+T have dedicated a higher percent of their income to housing and transportation and are not likely to have evacuation difficulties. As such, areas with low H+T percentages have a higher vulnerability rating. See Figure 14.
	Medium (0.1% - 45.0%)	
	High (45.1% - 58.0%)	
	Very High (58.1% - 76.0%)	
Vehicle Availability	Low (0.0% - 5.1%)	The data shows the percentage of households with no vehicles at the census tract level. The data is provided by the U.S. Census Bureau's ACS 2017-2021 5-year estimates of household size by number of vehicles available. These individuals are more likely to depend on public transit or need transportation assistance in an evacuation. As such, areas with high percentages of households with no vehicles are assigned a higher vulnerability rating than those with lower percentages. See Figure 15.
	Medium (5.2% - 14.0%)	
	High (14.1% - 25.5%)	
	Very High (25.6% - 71.0%)	
Population with Disabilities	Low (3.8% - 7.8%)	The data shows the percentage of population with a disability at the census tract level. The data is provided by the U.S. Census Bureau's ACS 2017-2021 5-year estimates of six different types of disability (hearing, vision, cognitive, ambulatory, self-care, and independent living difficulties). Individuals with disabilities are more likely to have difficulty evacuating. Areas with higher populations with disabilities are given a higher vulnerability rating. Since this factor has such low scaling, a weight of 2 was applied to this factor. See Figure 16.
	Medium (7.9% - 9.6%)	
	High (9.7% - 14.6%)	
	Very High (14.7% - 18.7%)	

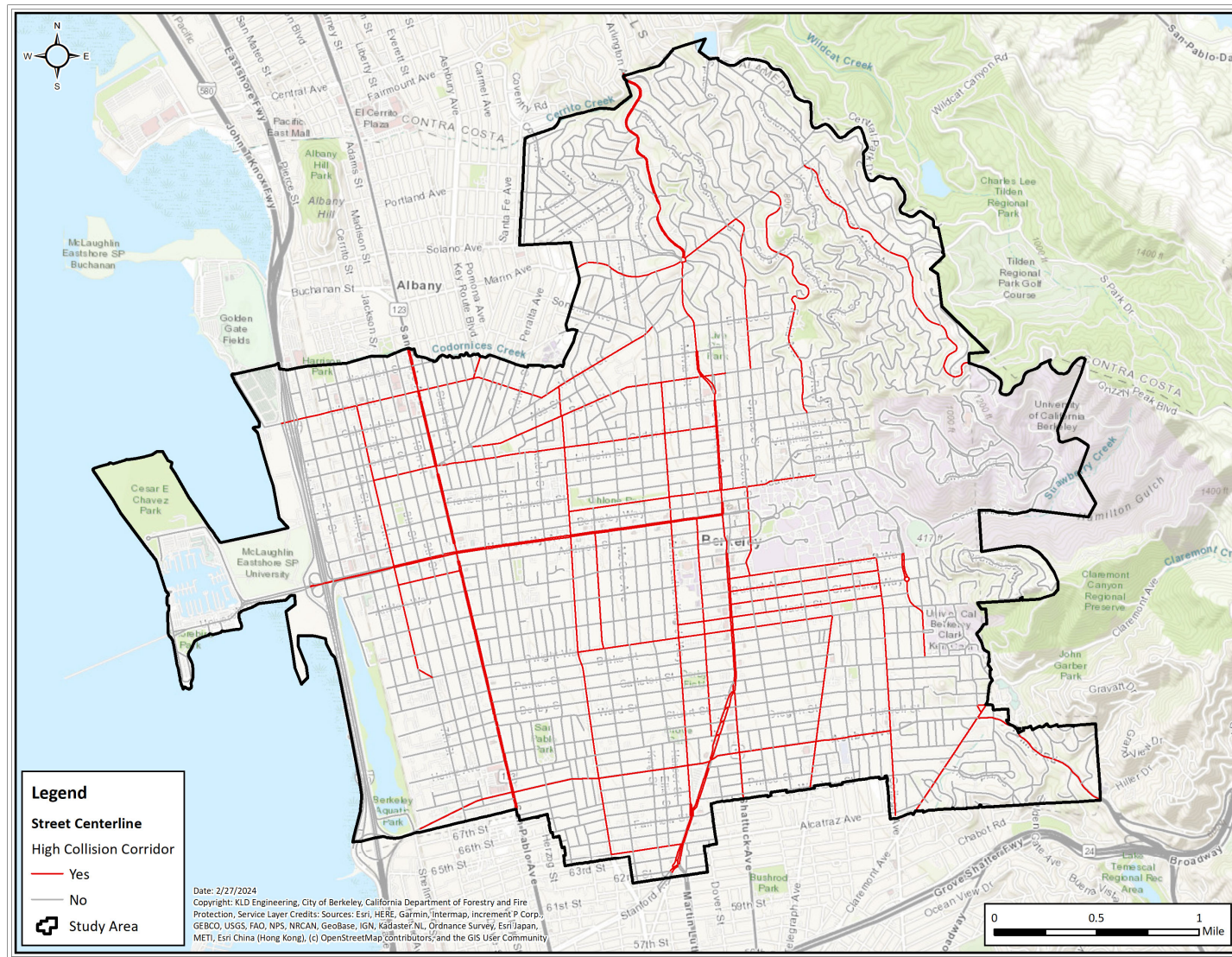


Figure 1. Collision Factor

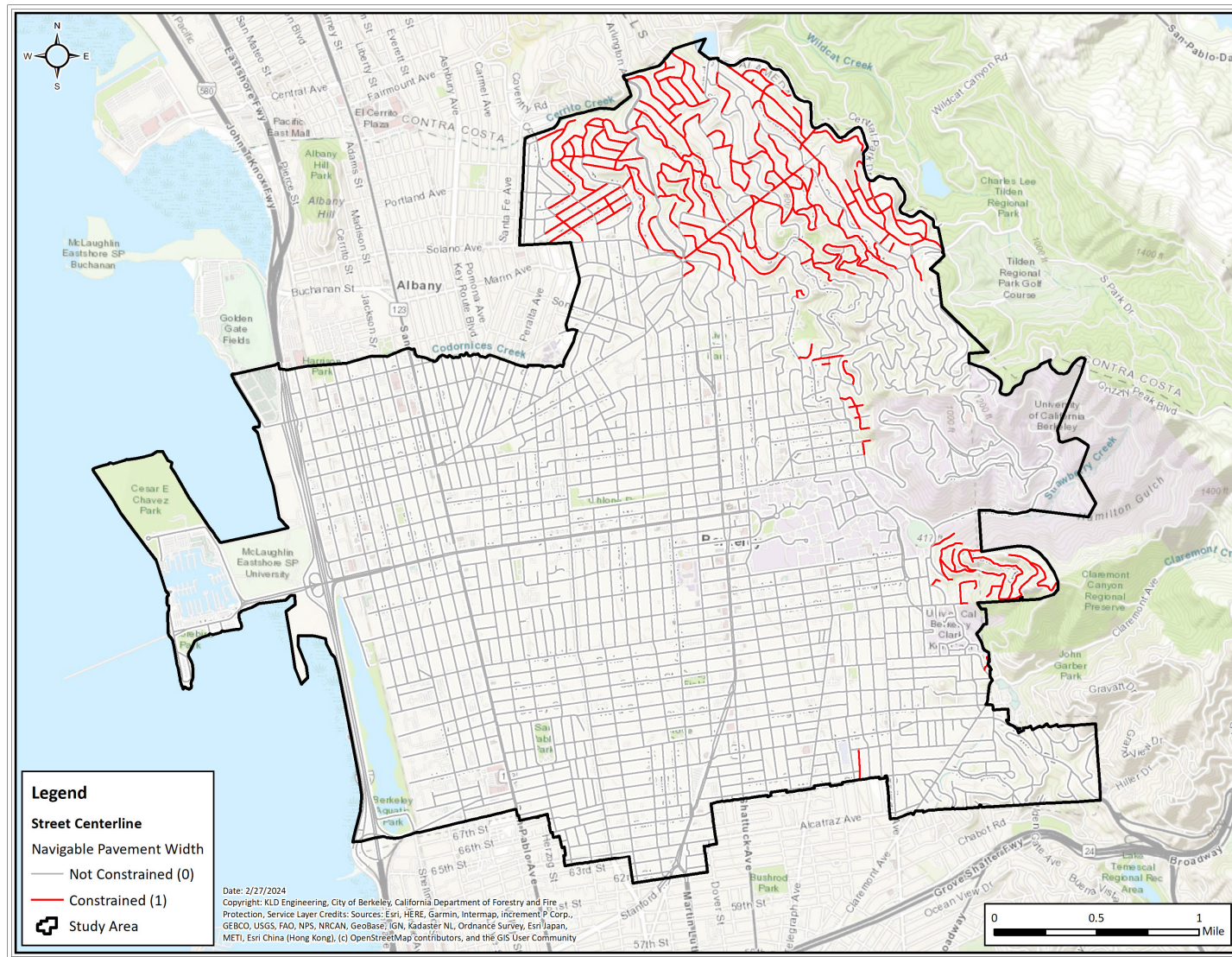


Figure 2. Navigable Pavement Width

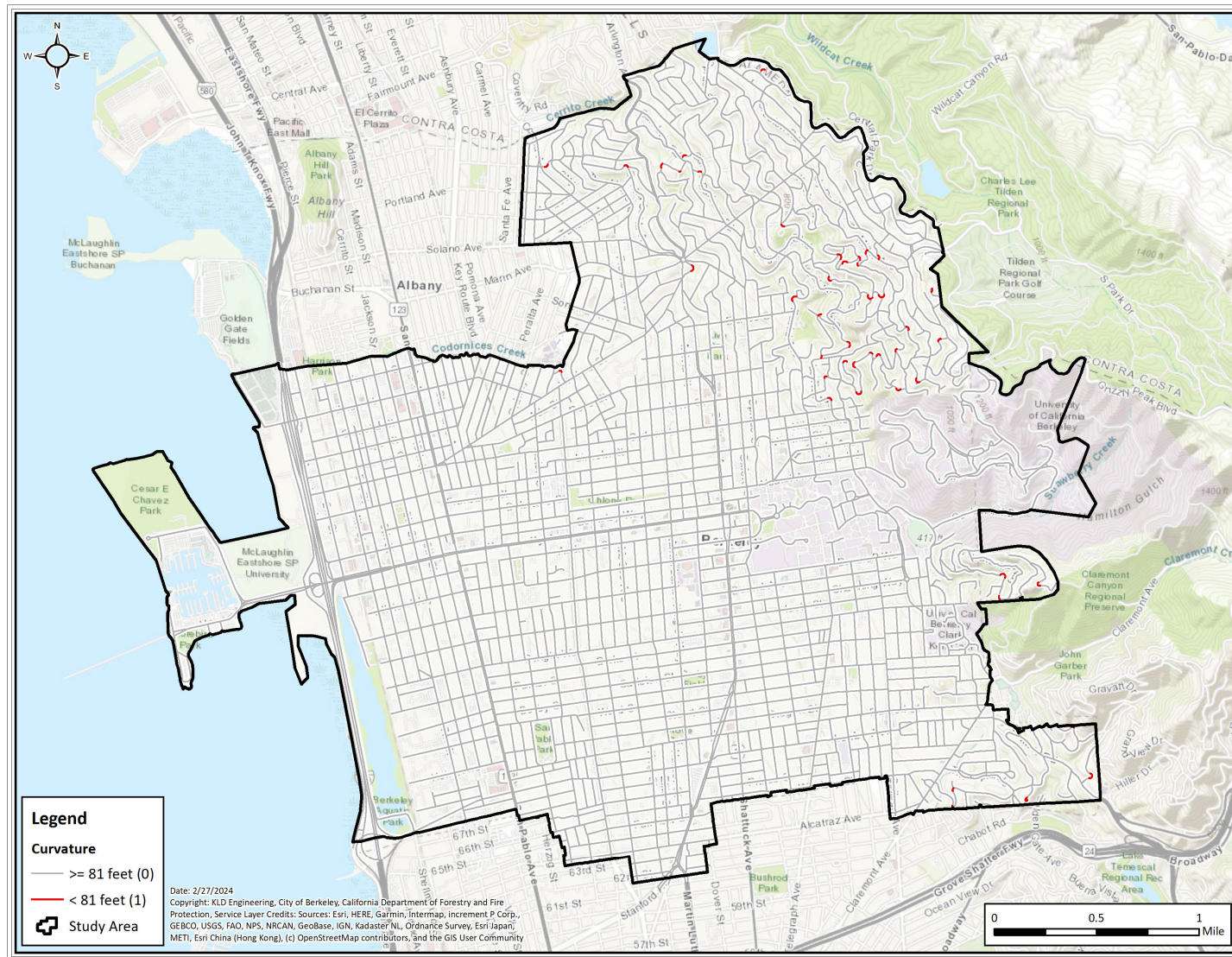


Figure 3. Roadway Curvature

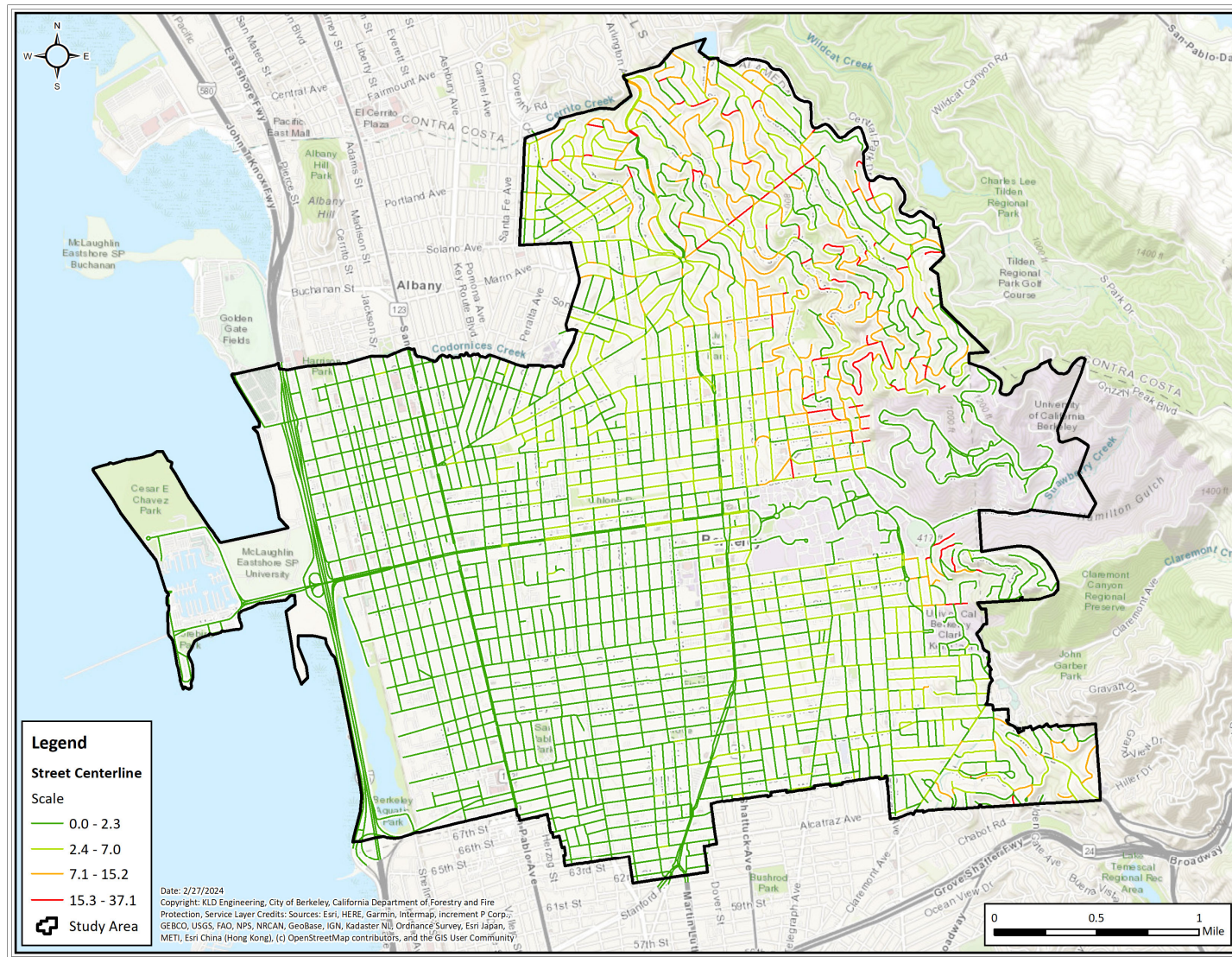


Figure 4. Roadway Slope

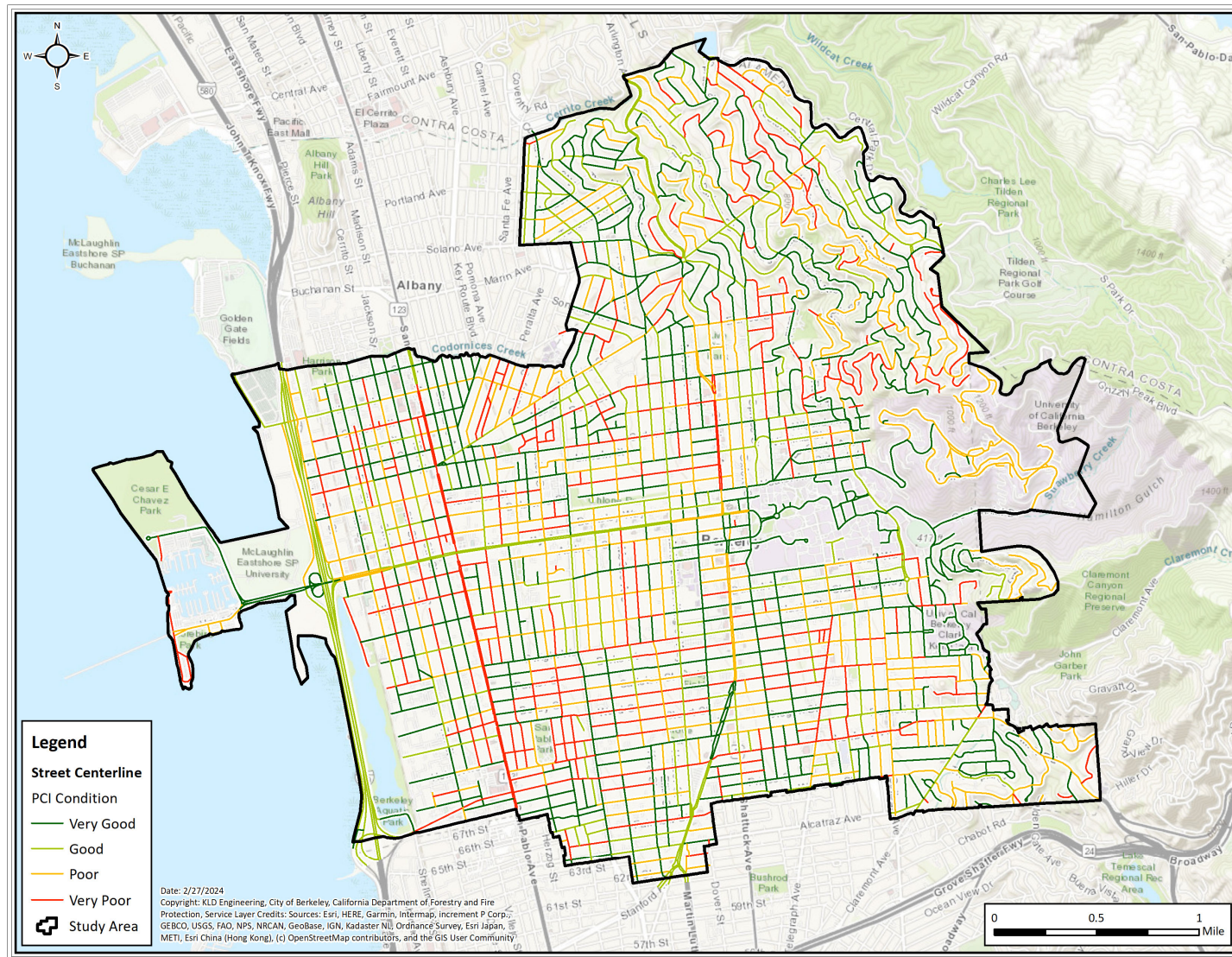


Figure 5. Pavement Condition Index

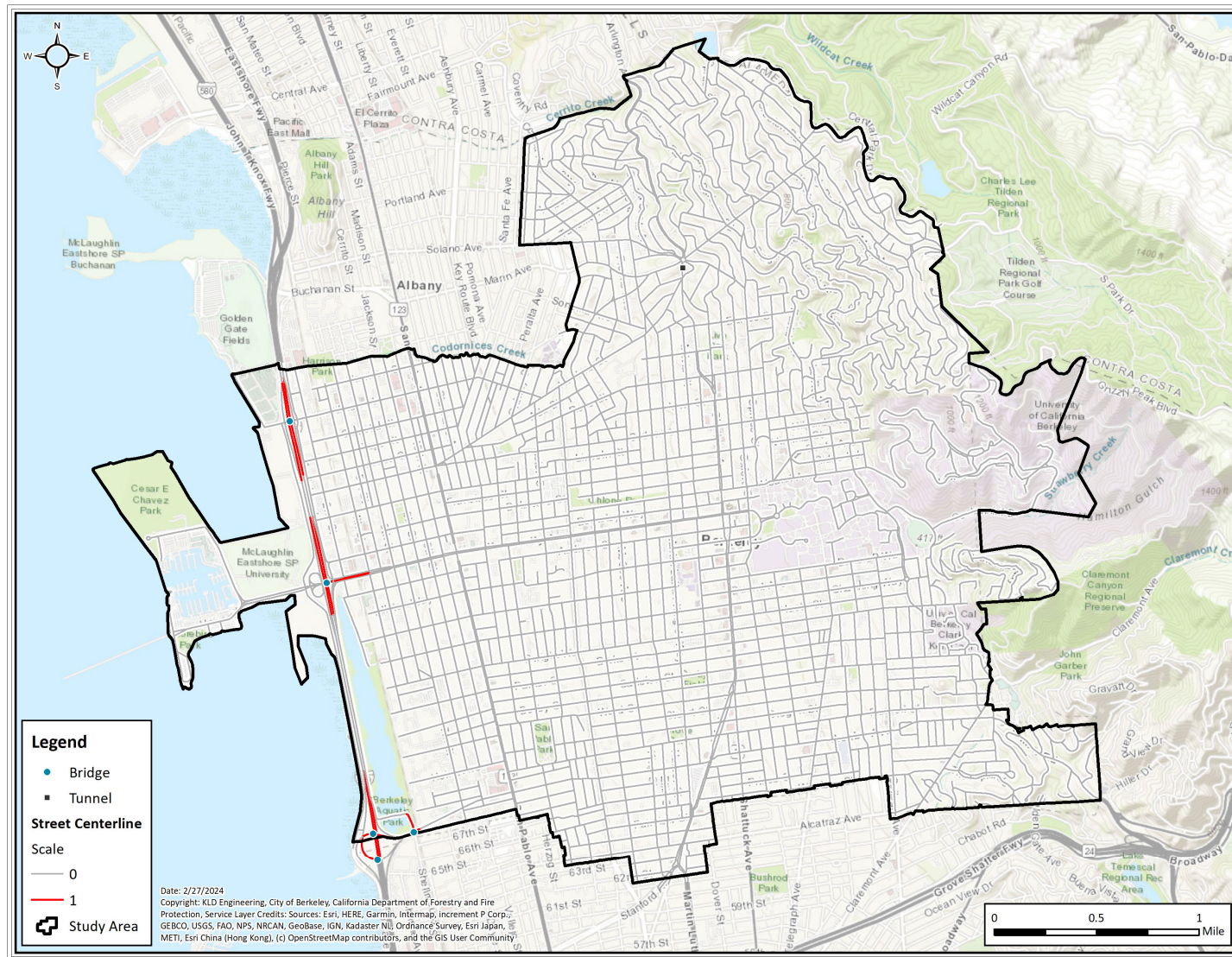


Figure 6. Bridges and Tunnels

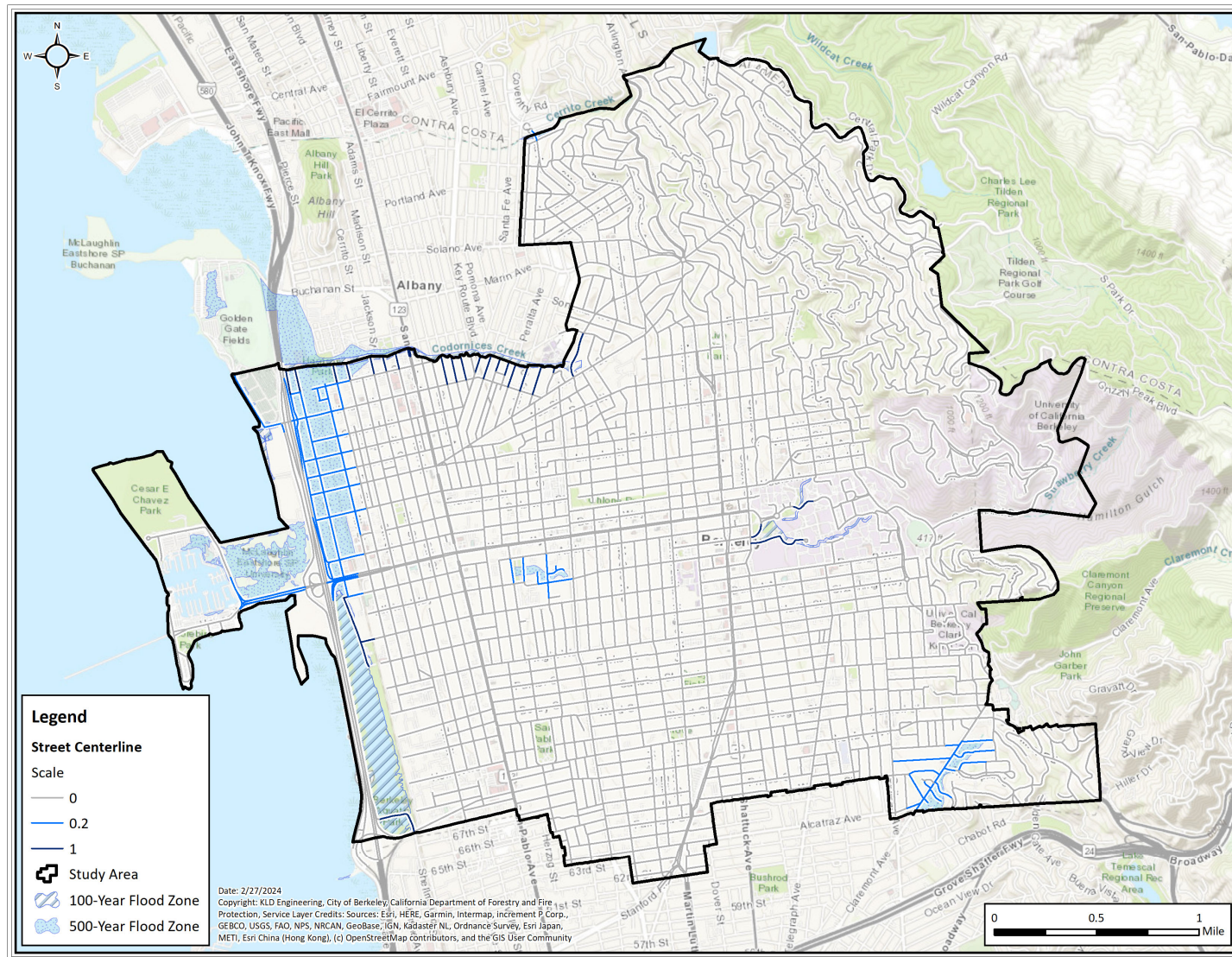


Figure 7. Flood Hazard Areas

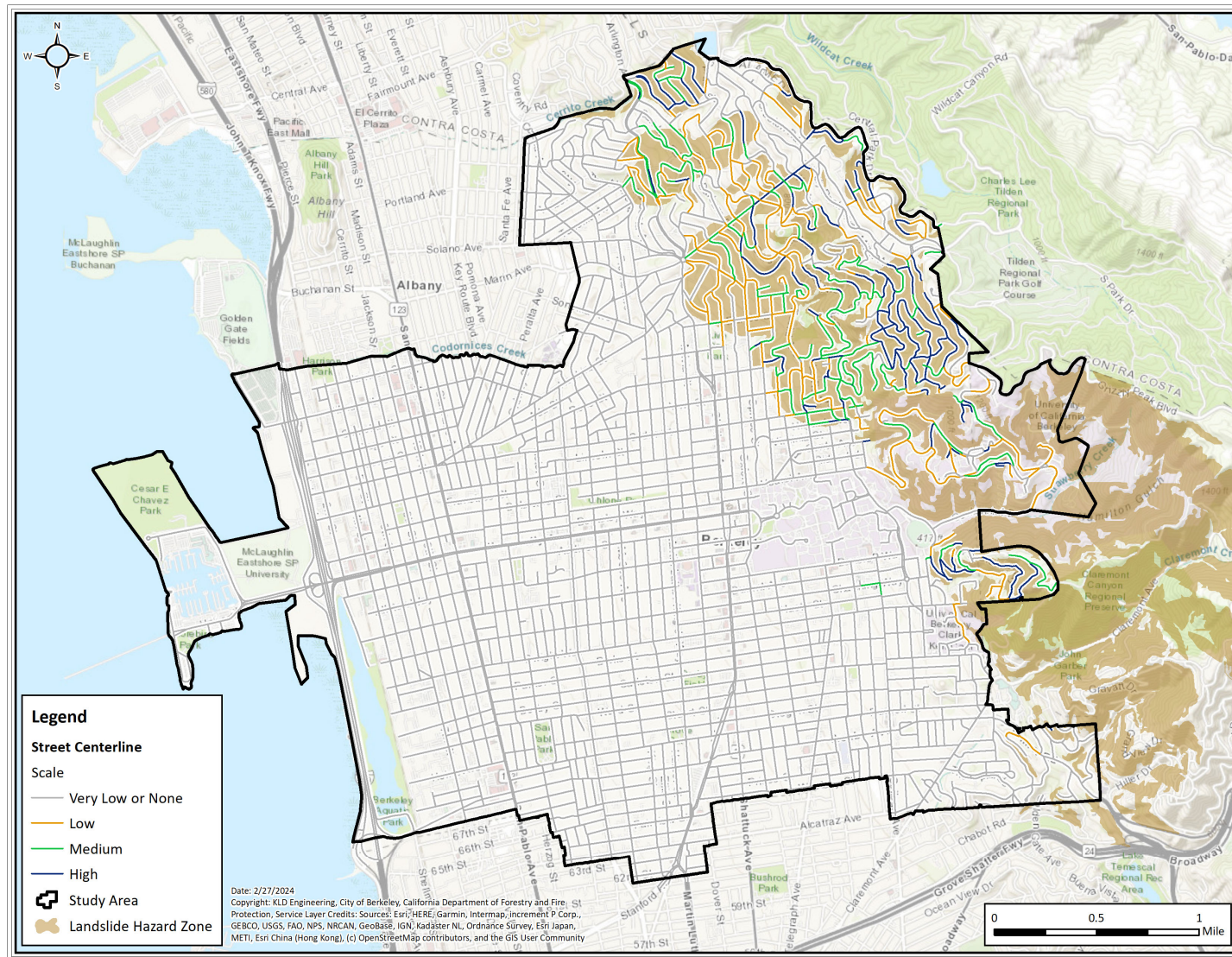


Figure 8. Landslide Hazard Areas

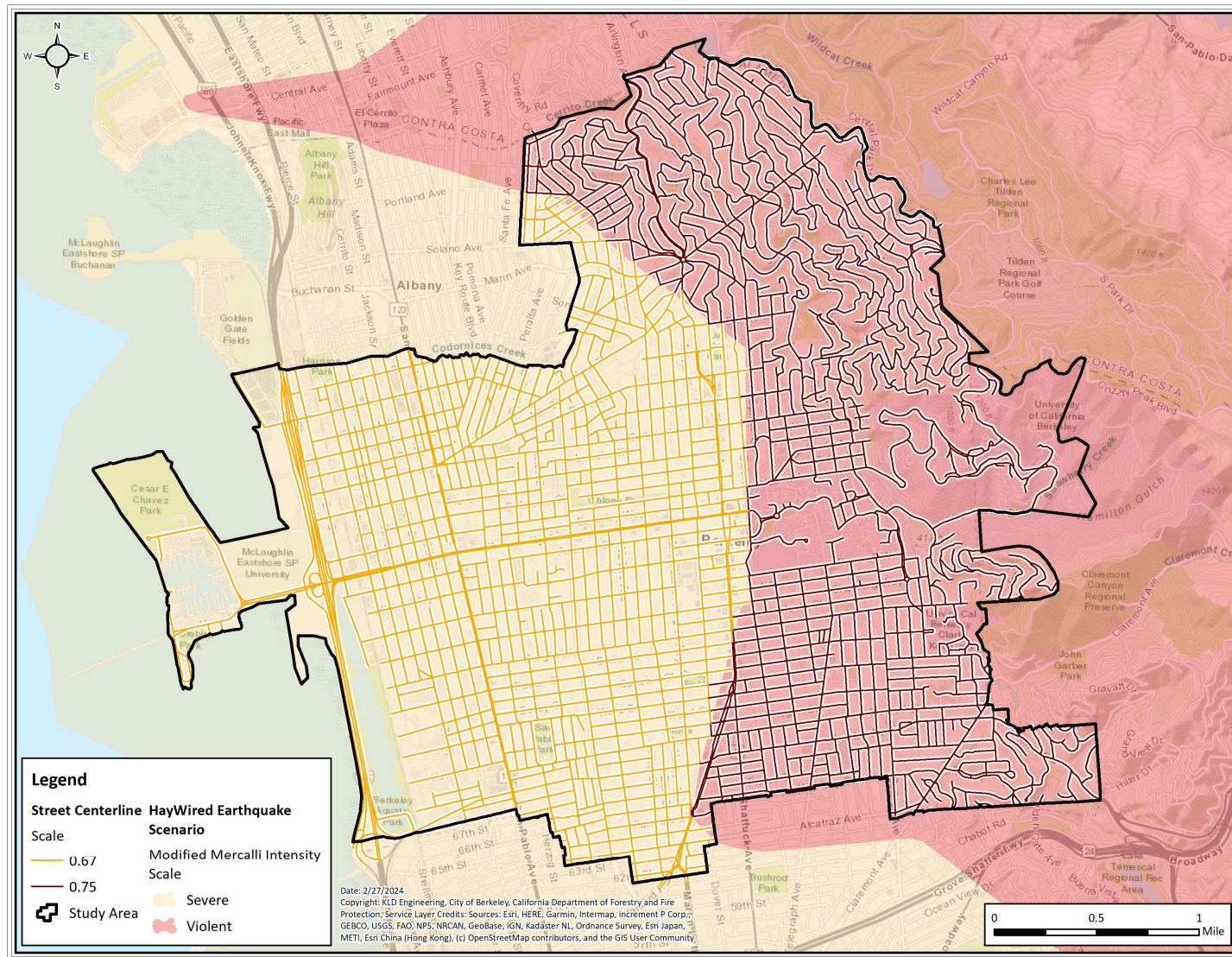


Figure 9. Earthquake ShakeMap

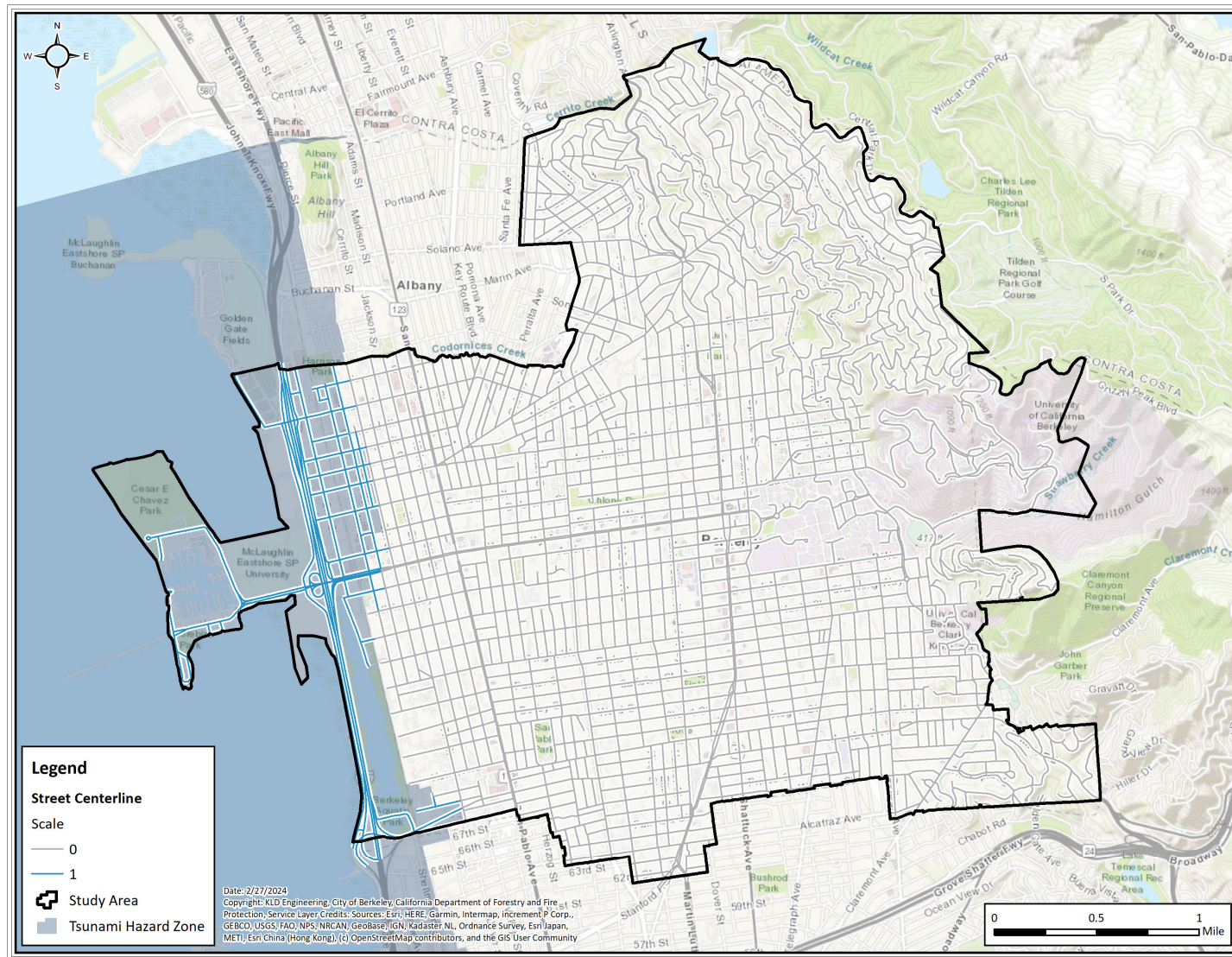


Figure 10. Tsunami Hazard Zone

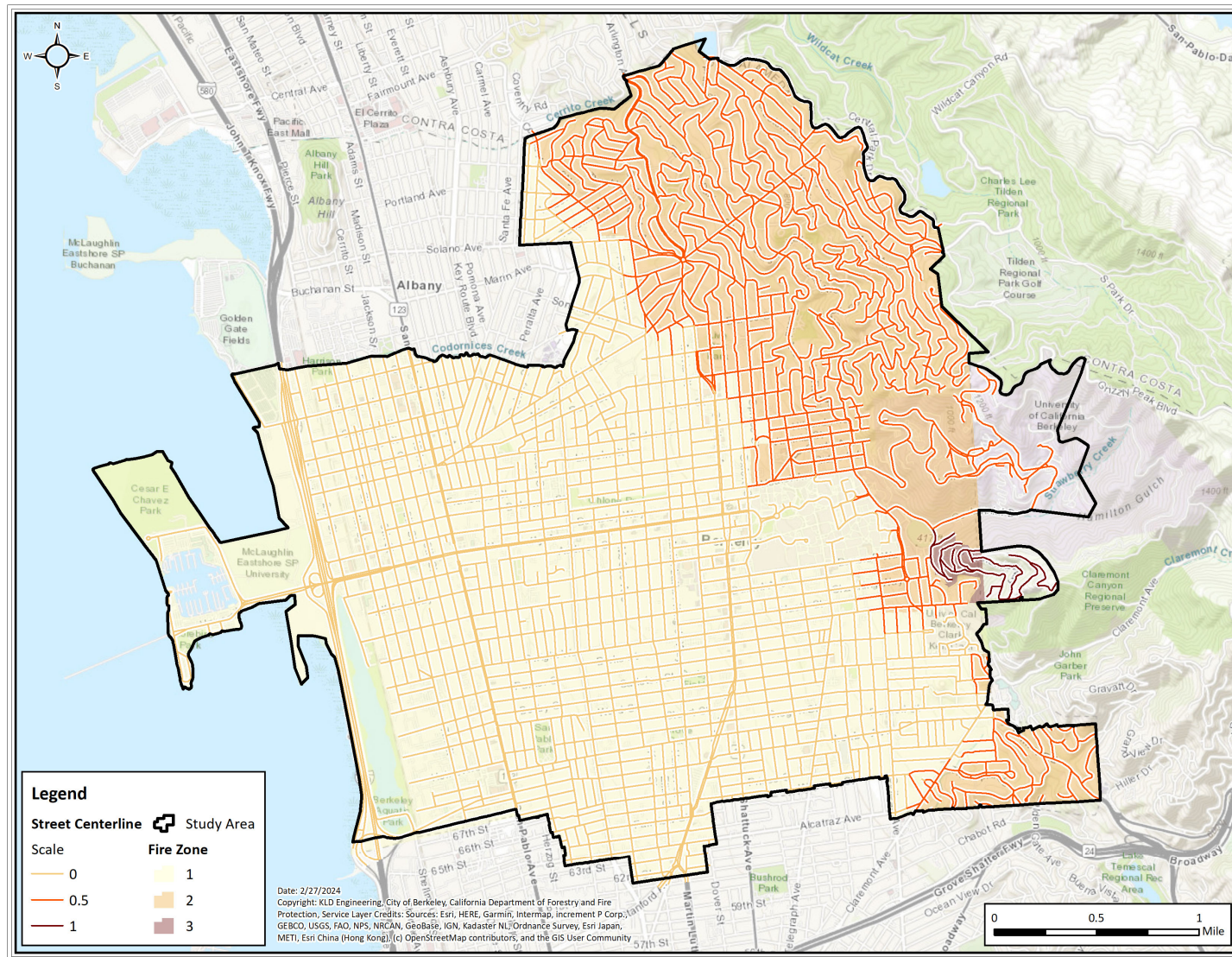


Figure 11. Fire Hazard Severity Zones

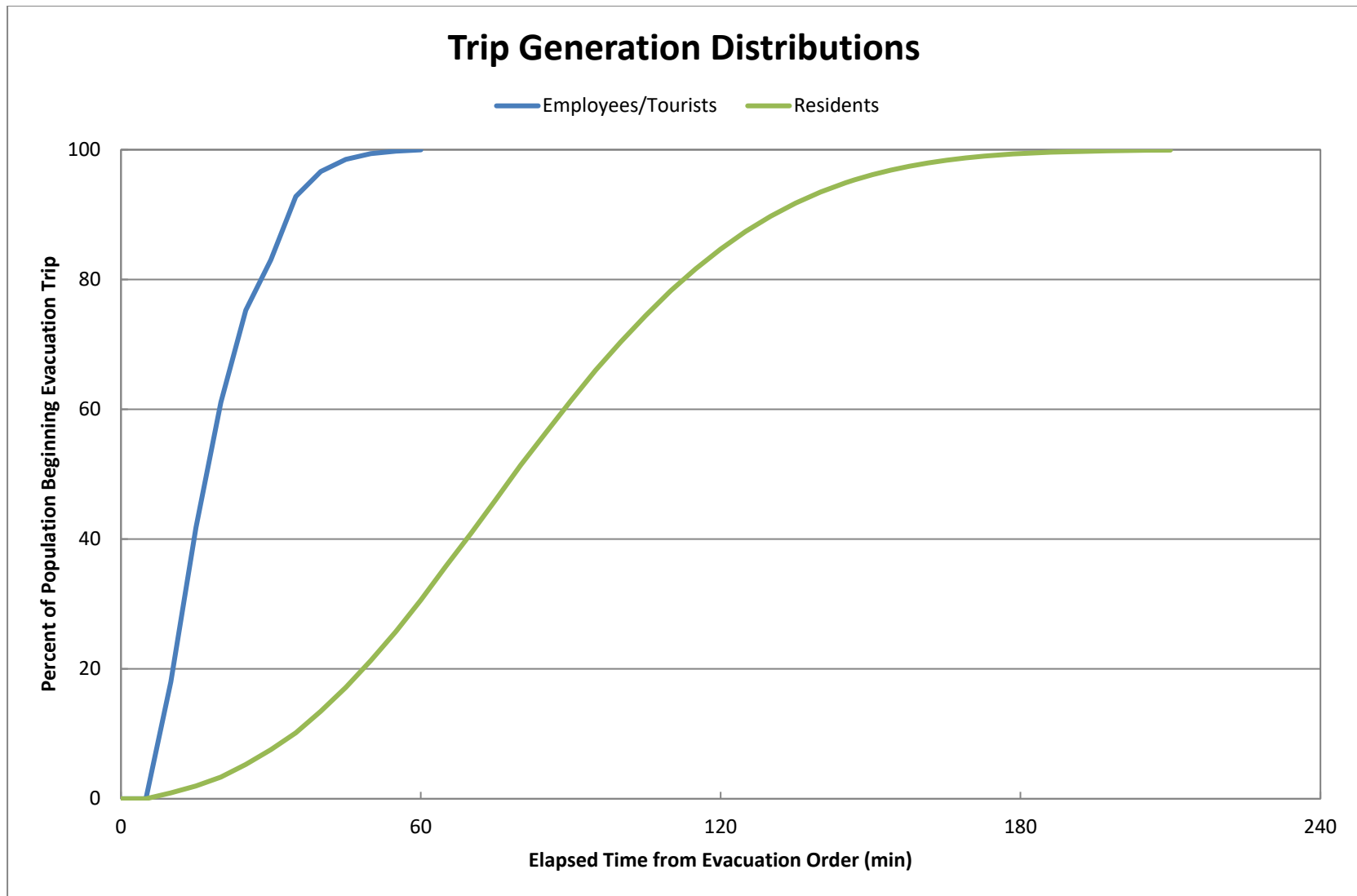


Figure 12. Mobilization Times

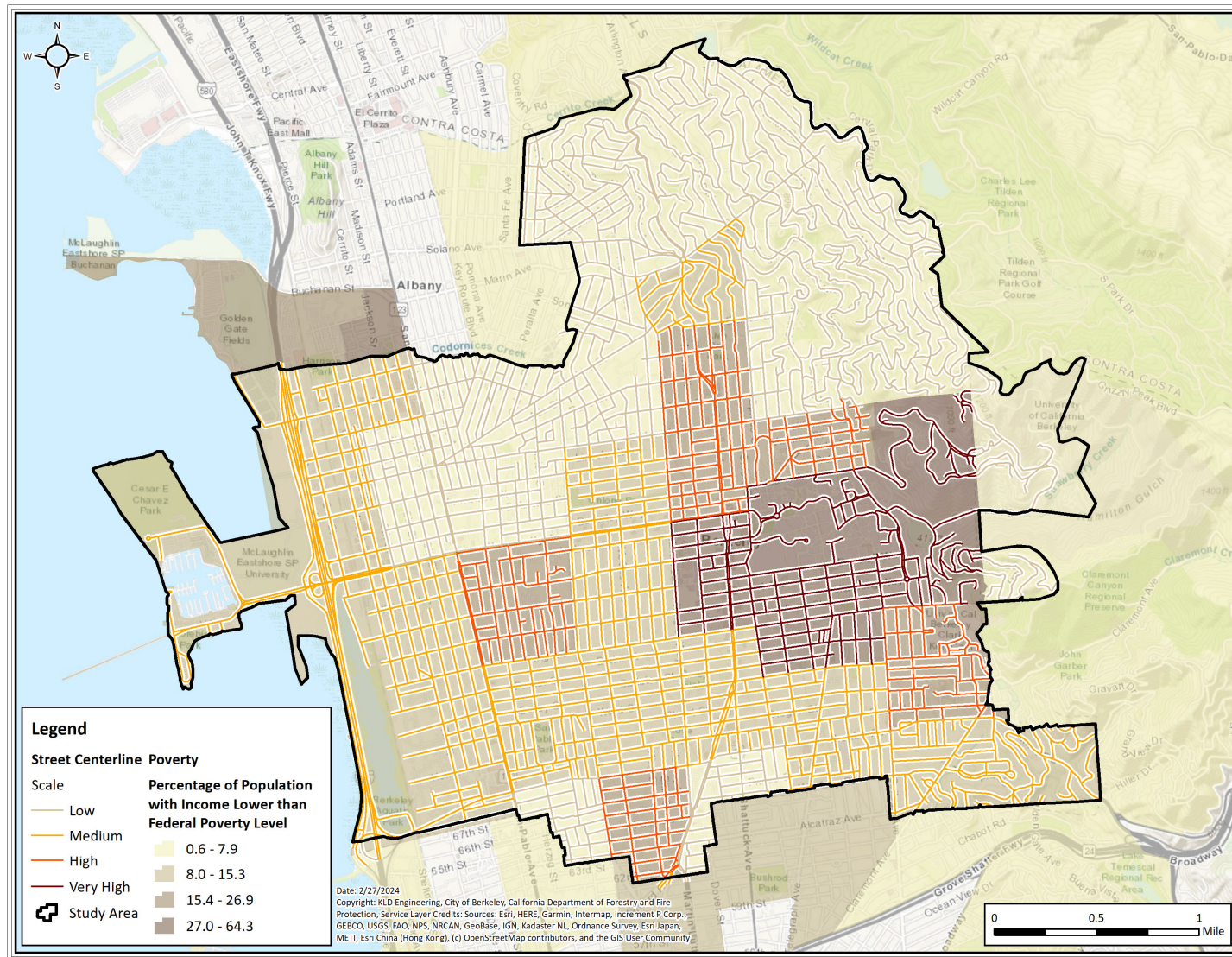


Figure 13. Poverty

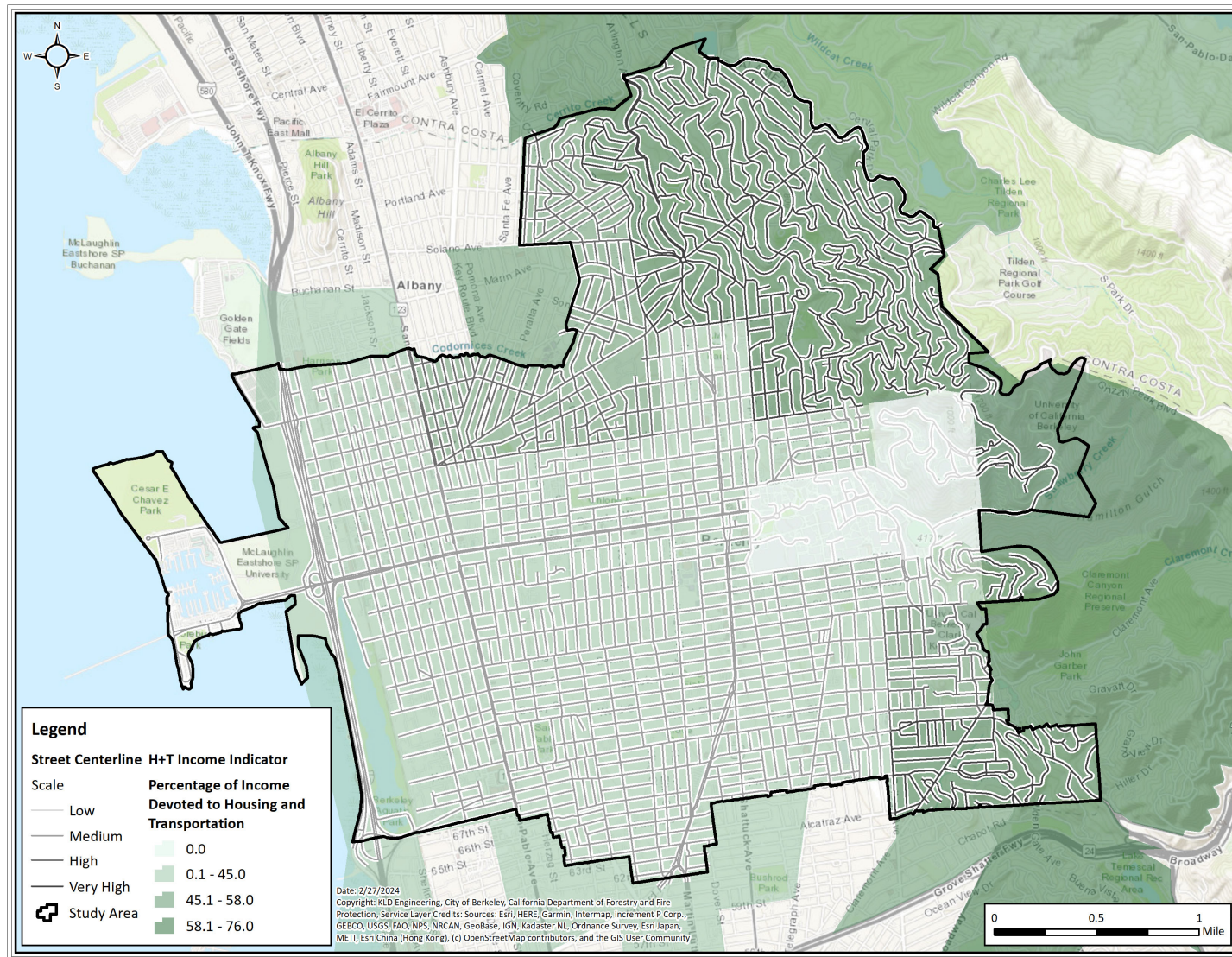


Figure 14. H+T Household Indicator

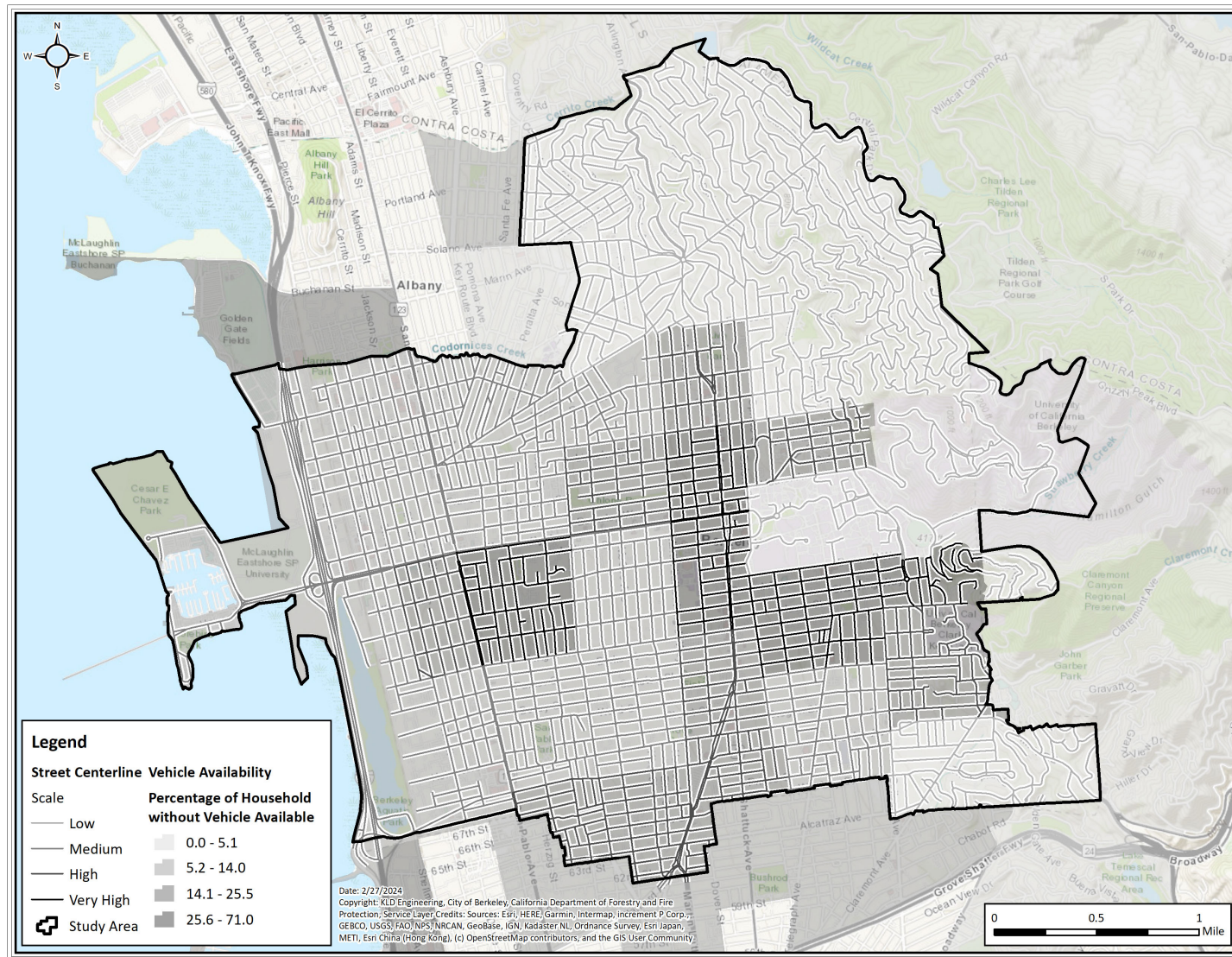


Figure 15. Vehicle Availability

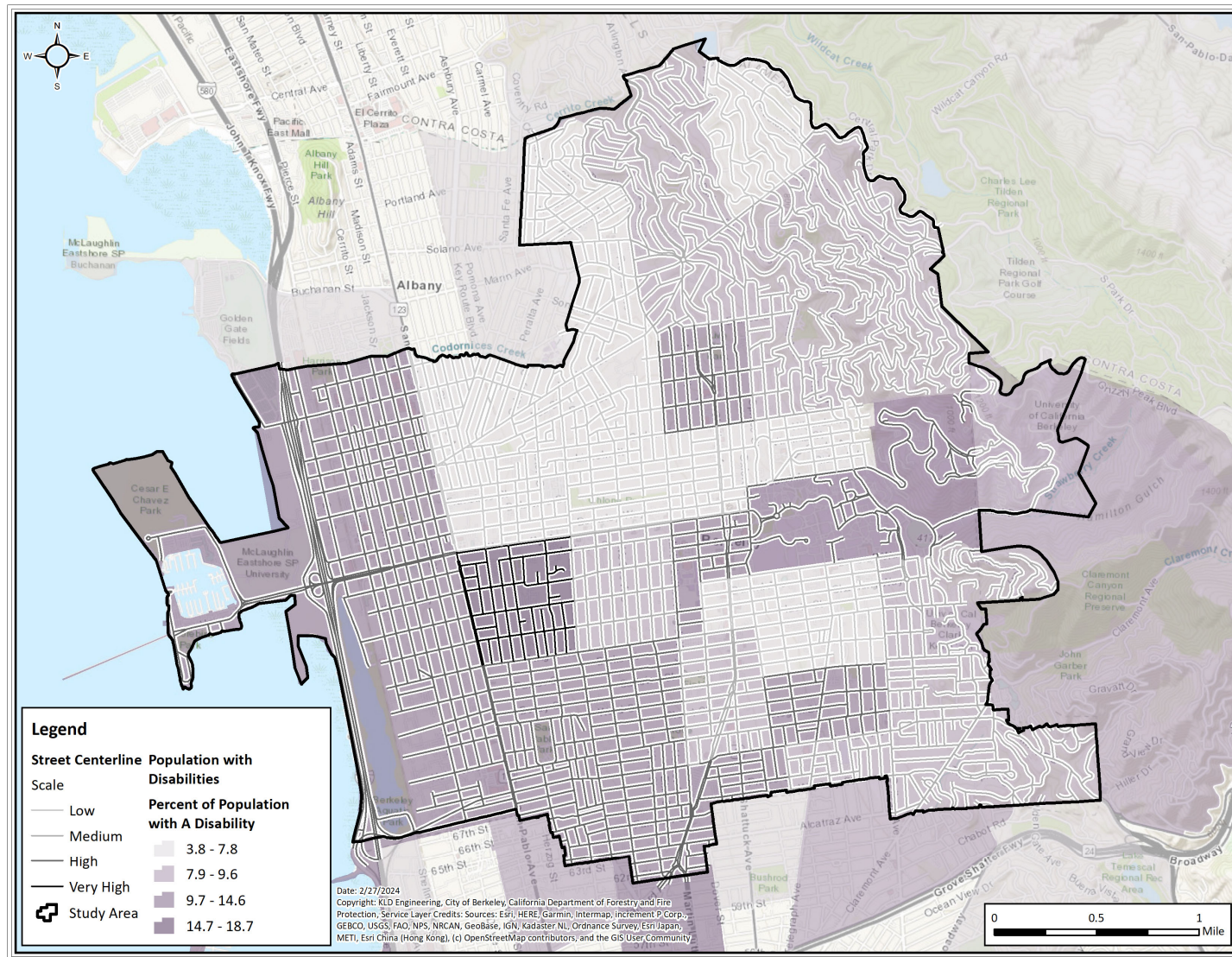


Figure 16. Population with Disabilities

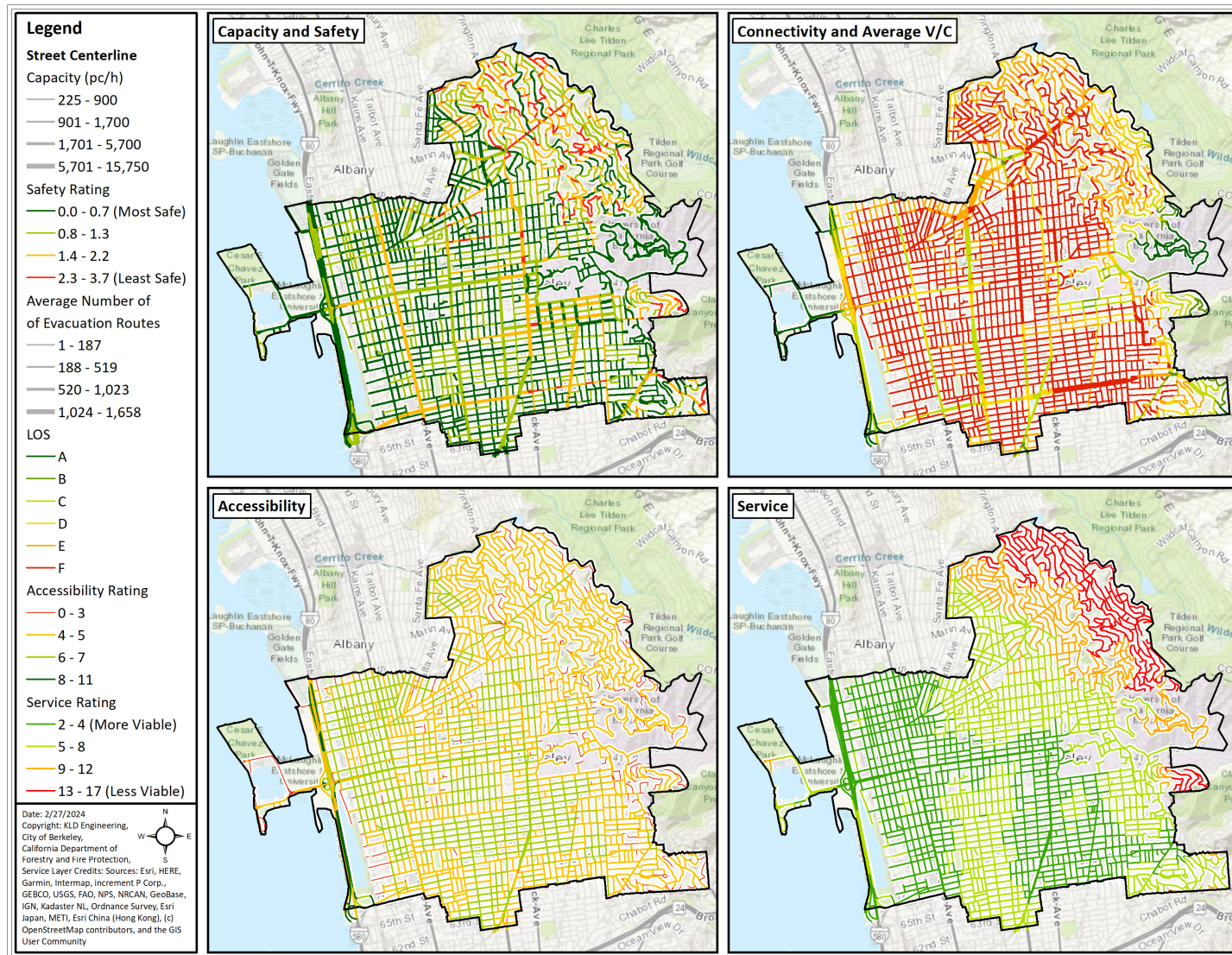


Figure 17. Overview of Capacity, Safety, and Viability

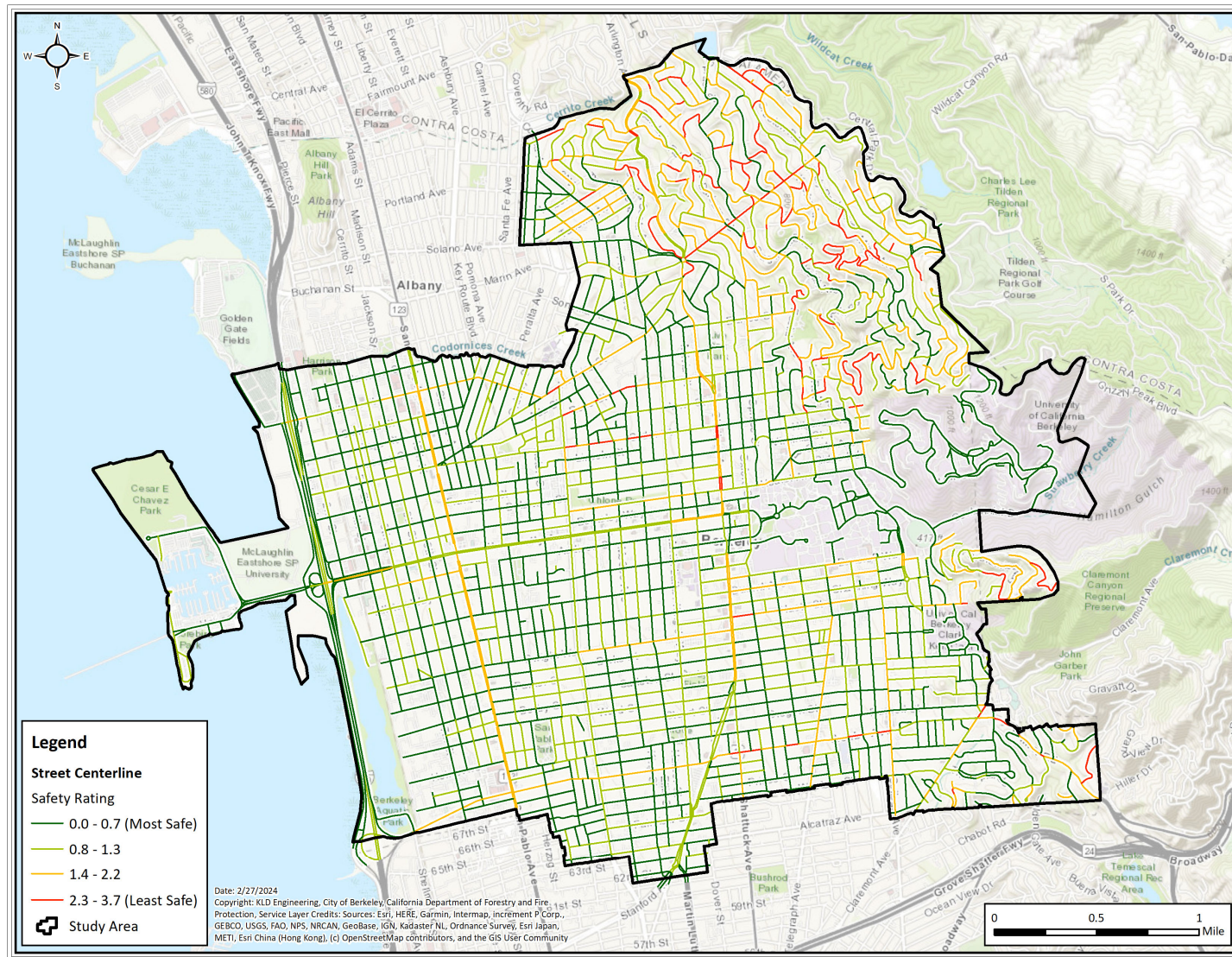


Figure 18. Overall Evacuation Safety Rating

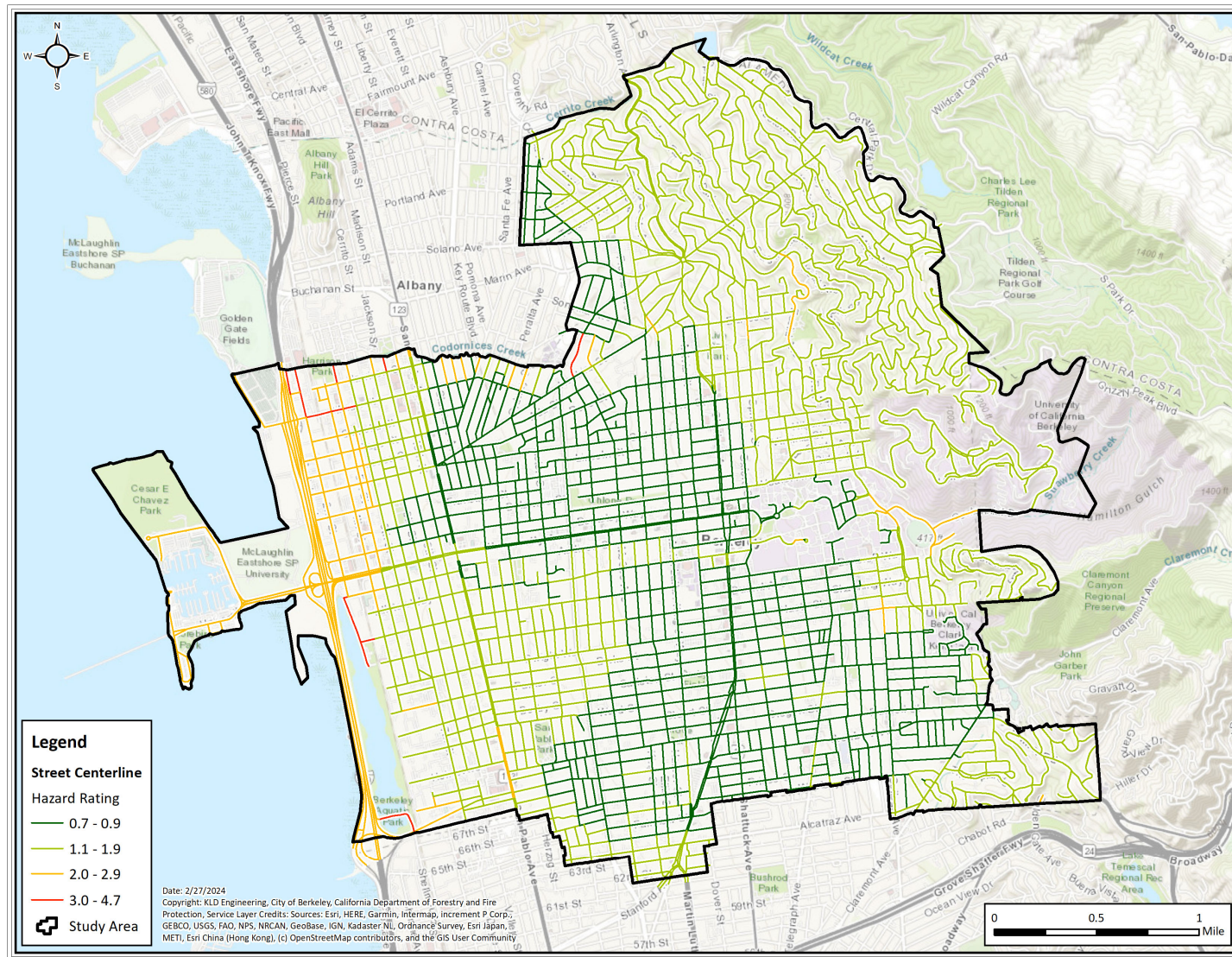


Figure 19. Hazard Rating

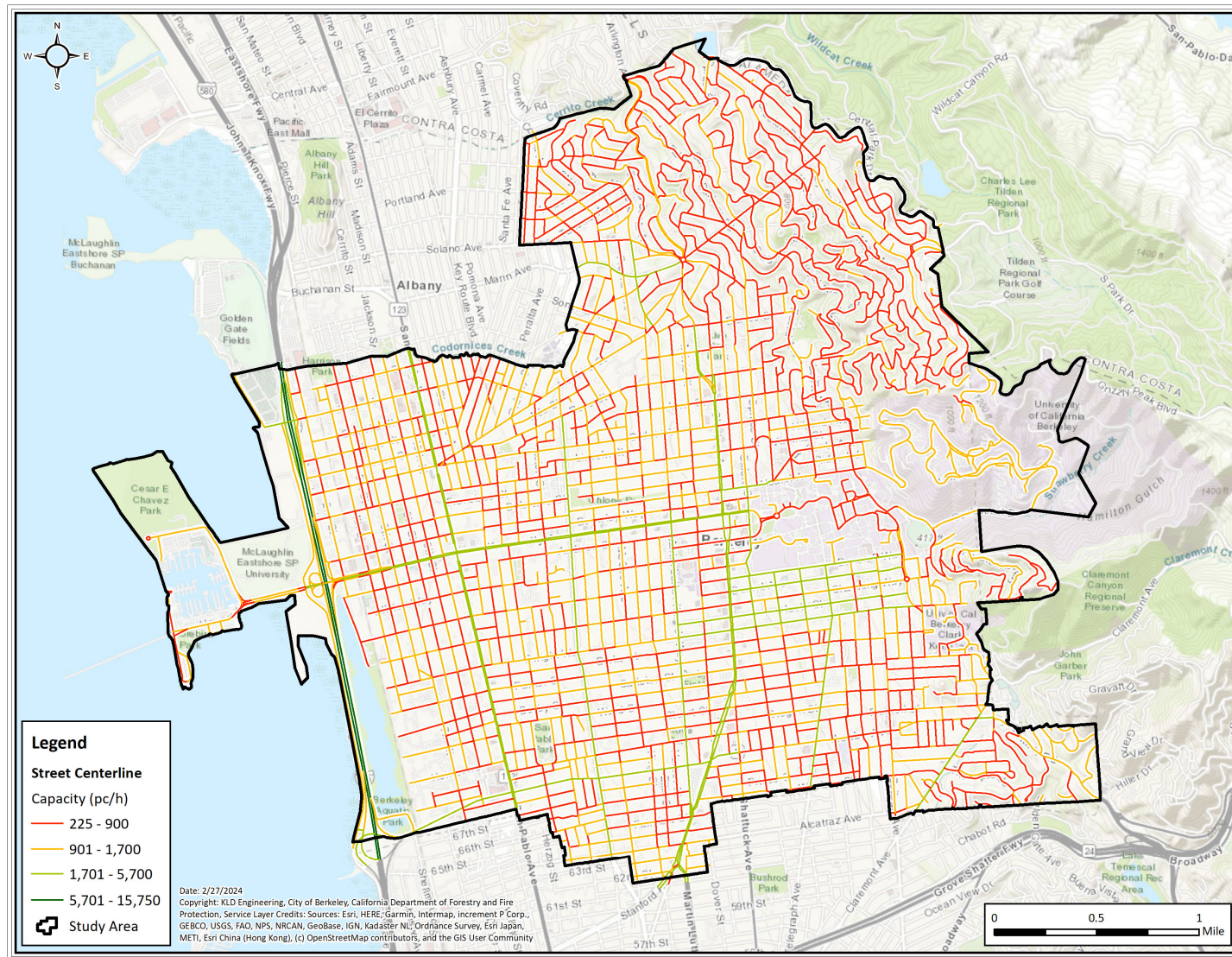


Figure 20. Capacity

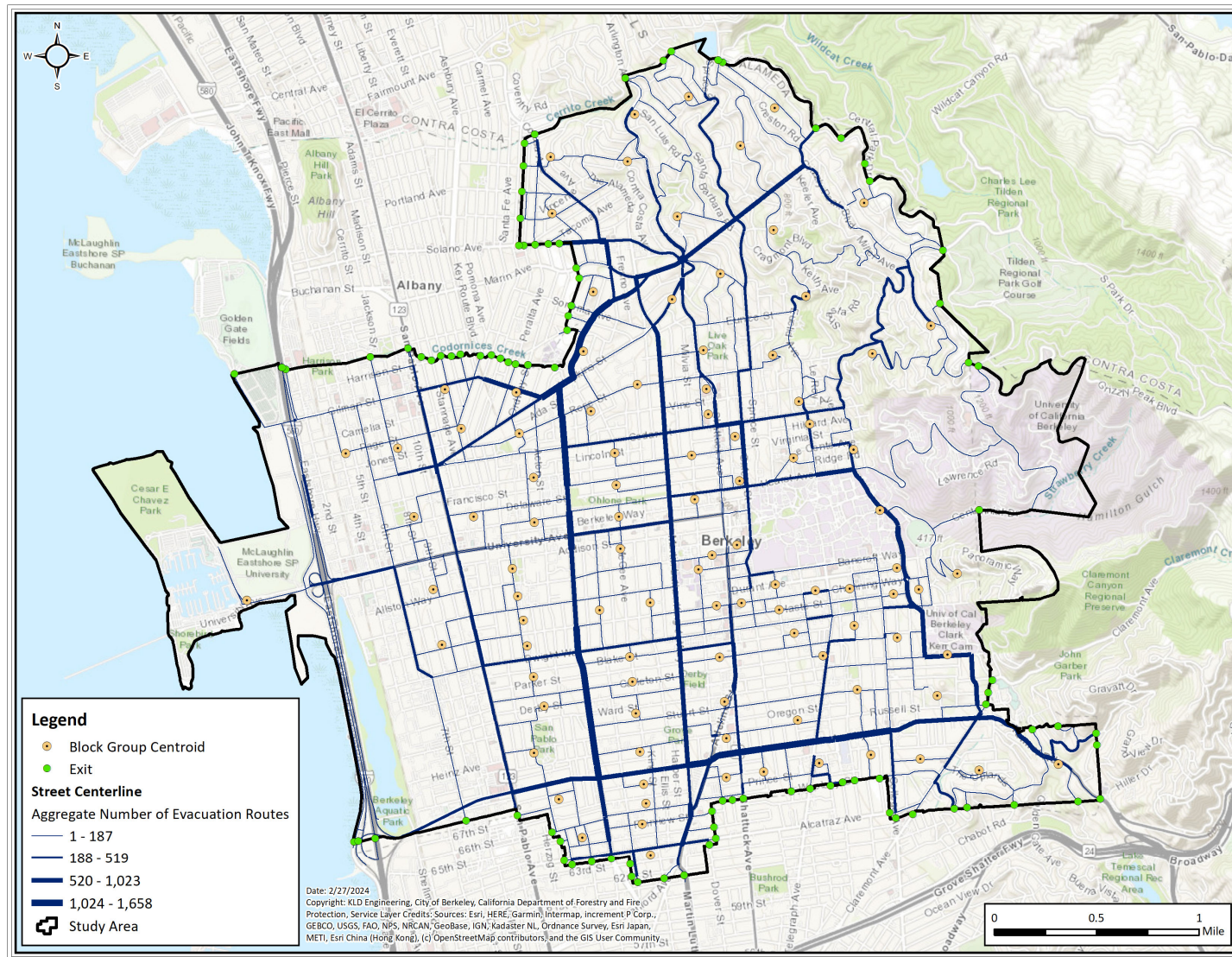


Figure 21. Connectivity

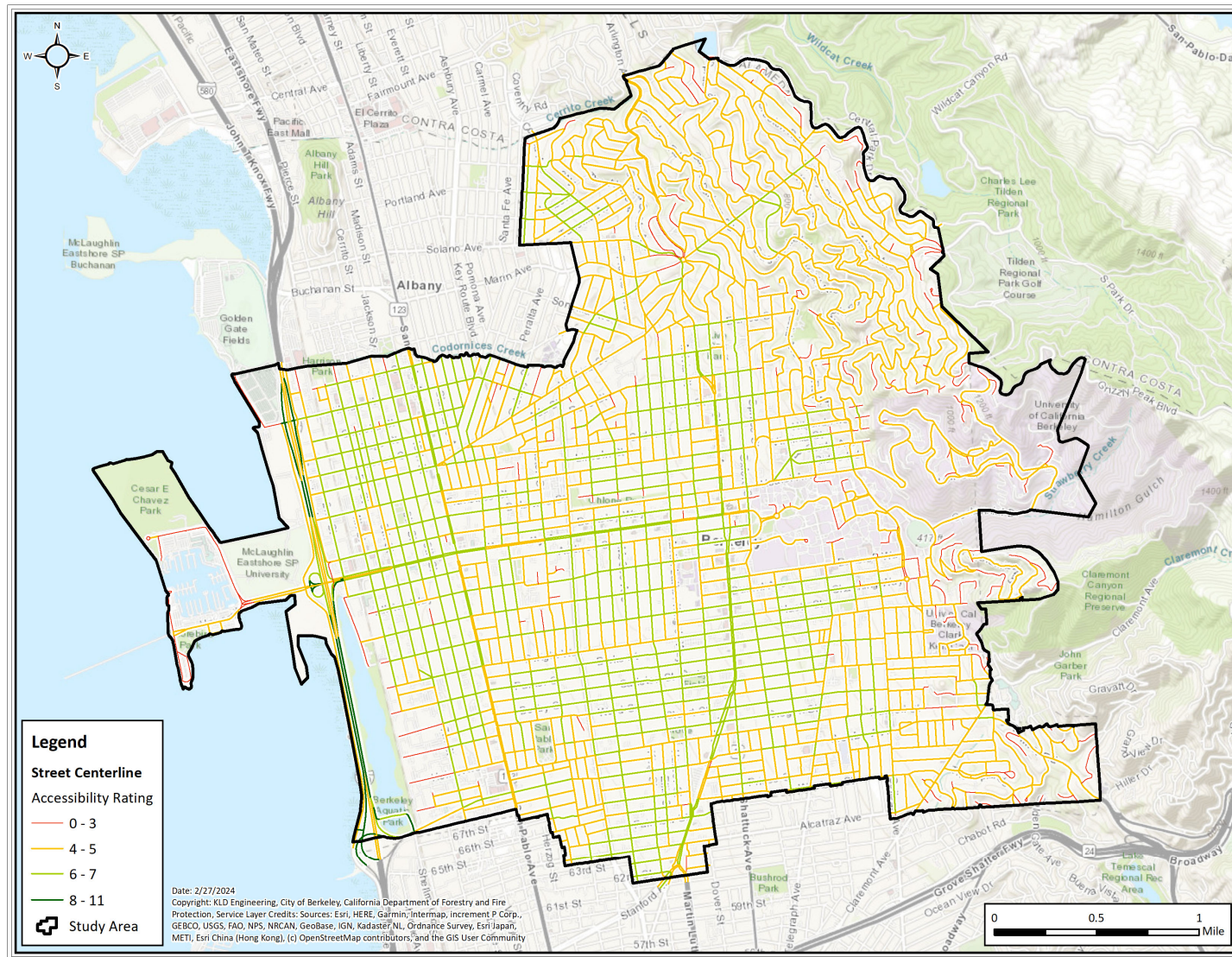


Figure 22. Accessibility Score

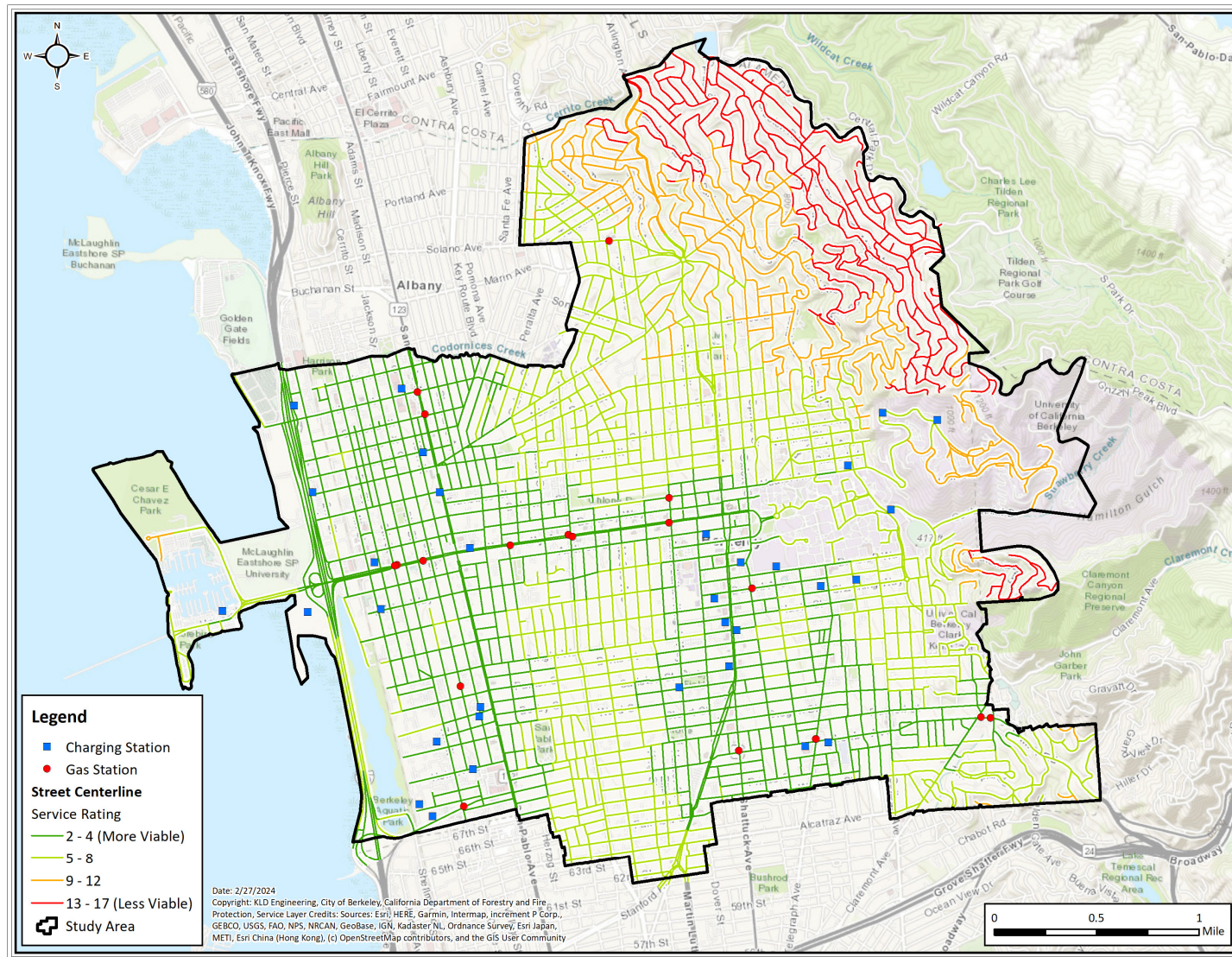


Figure 23. Service Score

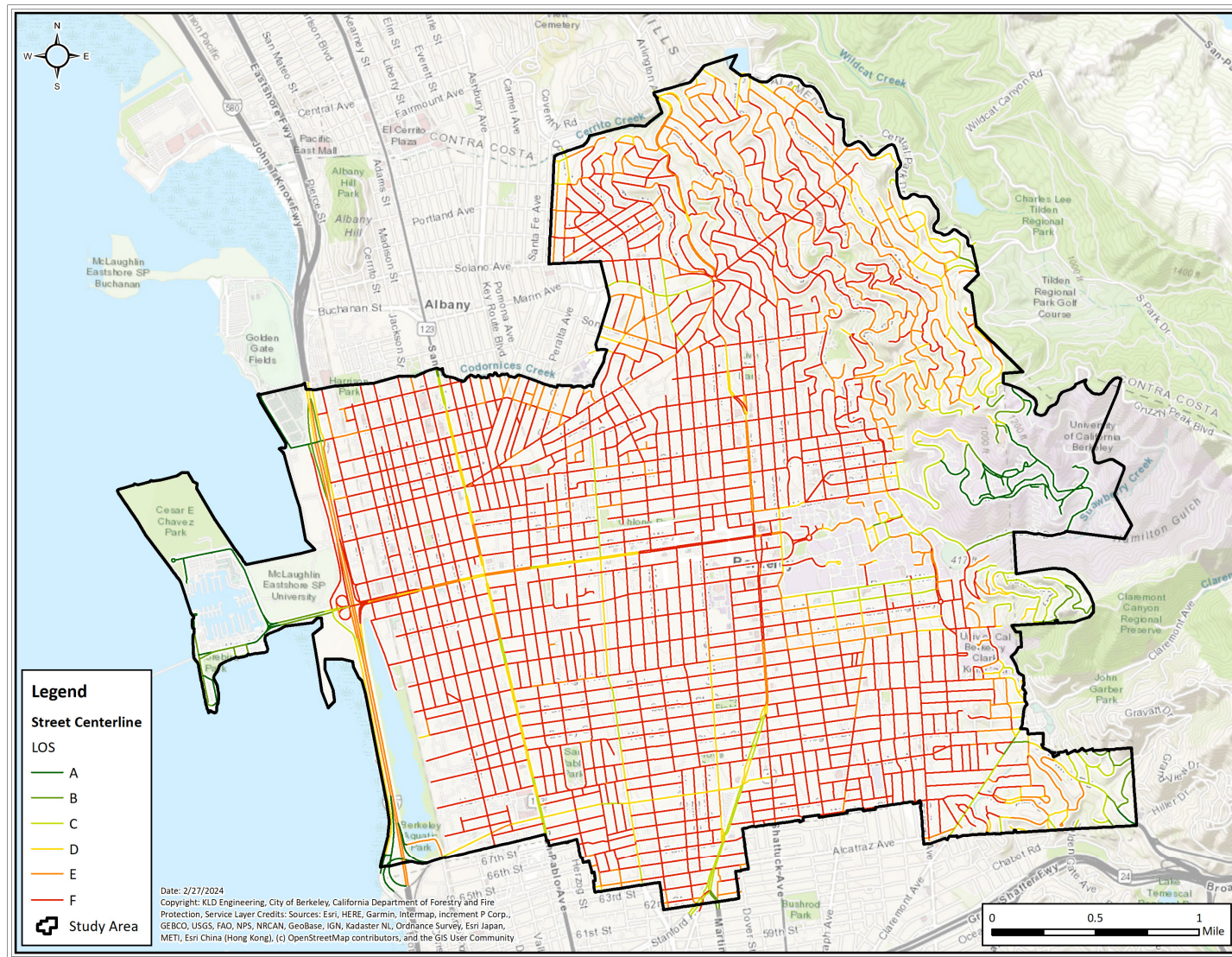


Figure 24. Maximum Demand During an Evacuation Event

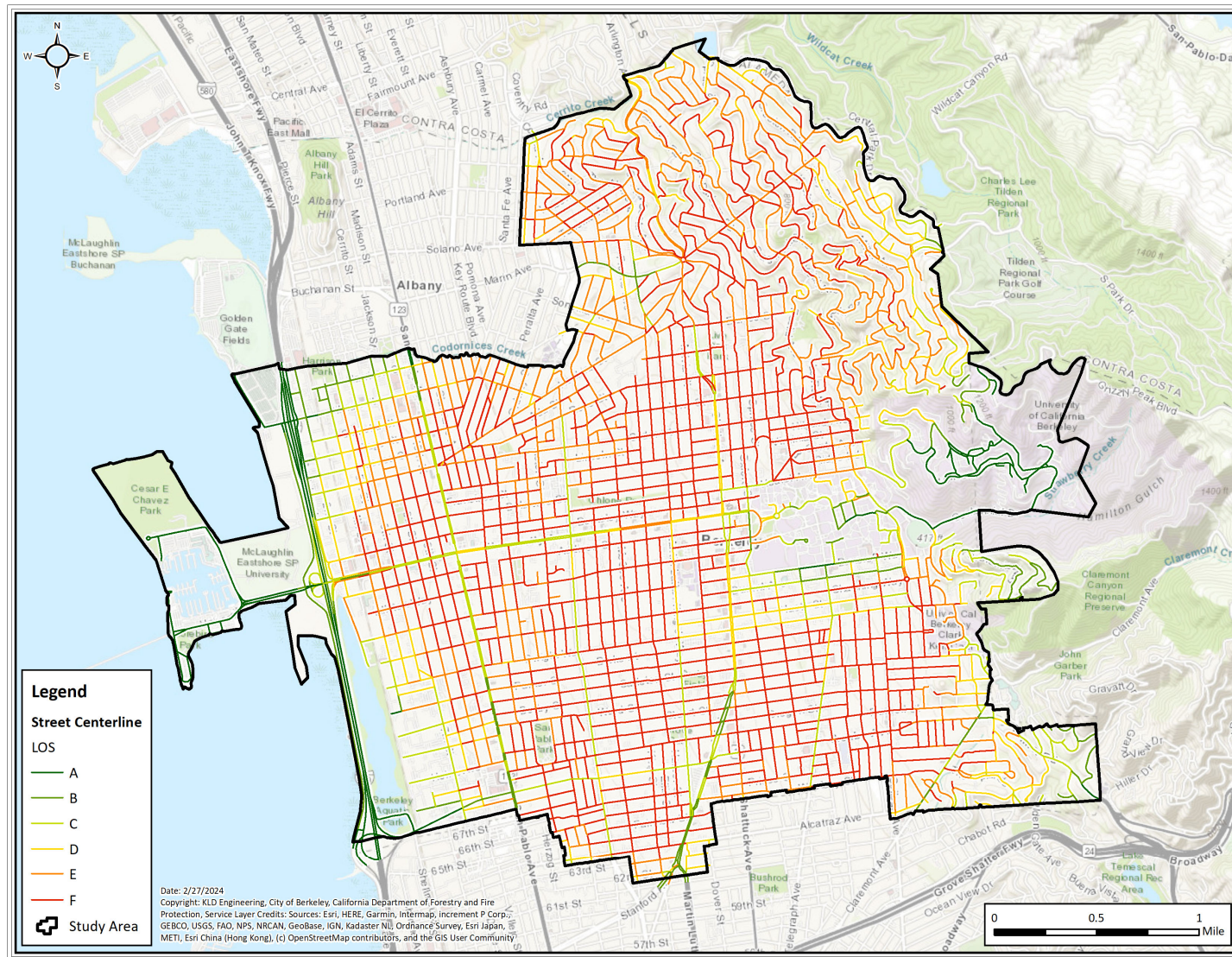


Figure 25. Minimum Demand During an Evacuation Event

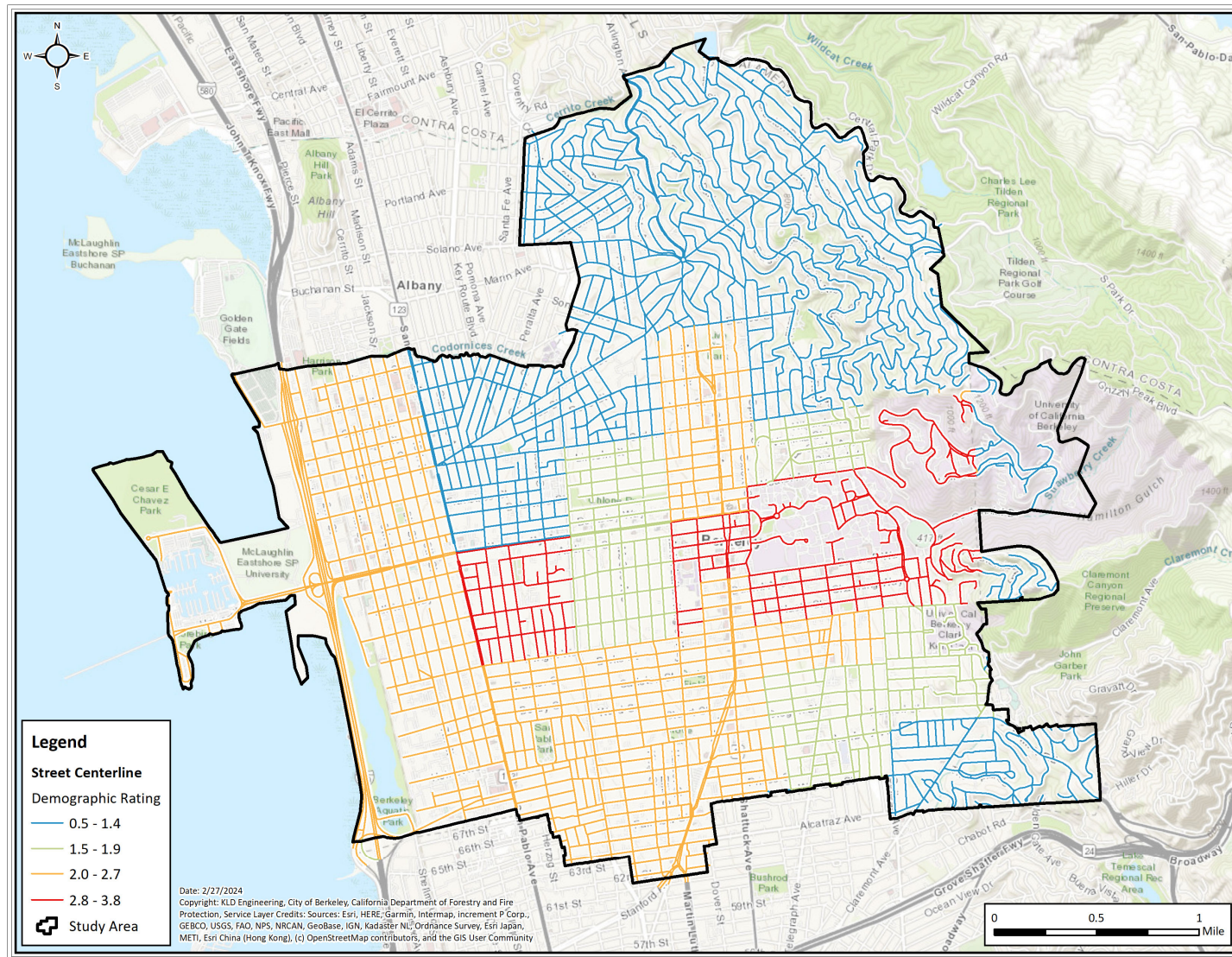


Figure 26. Demographic Vulnerability Rating

Appendix A

Table A-1. Summary of Safety, Capacity, Viability, and Vulnerability Scores

Street Name	Average ²¹ of								
	Total Capacity (vph)	Safety Score	Hazard Score	Connectivity	Accessibility	Congestion Score (Max)	Congestion Score (Min)	Service Score	Vulnerability Score
	 	 	 	 	 	 	 	 	 
10TH ST	986	0.46	1.57	5.95	5.95	2.24	1.07	2.62	2.11
2ND ST	994	0.64	3.10	5.33	5.33	1.91	0.38	3.75	2.11
4TH ST	1,024	0.18	2.51	5.50	5.50	1.95	0.55	3.40	2.11
5TH ST	936	0.67	2.31	5.37	5.37	2.39	0.72	3.05	2.11
62ND ST	1,163	0.89	1.67	5.17	5.17	0.96	0.56	6.83	2.23
63RD ST	1,215	0.80	1.67	5.00	5.00	1.11	0.69	5.80	2.18
65TH ST	1,125	0.67	1.67	4.00	4.00	0.71	0.56	7.00	2.12
66TH ST	1,050	0.33	1.33	4.17	4.17	1.19	0.99	6.67	2.12
67TH ST	750	0.00	1.33	5.33	5.33	2.11	1.79	6.00	2.12
6TH ST	1,167	0.90	1.73	5.63	5.63	1.84	0.69	3.31	2.13
7TH ST	1,058	0.52	1.63	5.67	5.67	2.25	0.73	2.85	2.11
8TH ST	879	0.68	1.62	5.62	5.62	2.85	1.08	3.00	2.11
9TH ST	881	0.14	1.67	5.50	5.50	2.68	1.09	2.58	2.11
ACACIA AVE	900	2.00	1.25	4.00	4.00	0.92	0.84	15.00	0.89
ACROFT CT	1,125	0.33	0.67	2.00	2.00	1.33	0.92	5.00	3.26
ACTON CIR	1,125	0.78	0.87	2.67	2.67	1.53	1.05	5.00	3.26
ACTON ST	955	0.67	0.98	5.00	5.00	1.61	1.28	5.11	2.08
ADA ST	990	0.40	0.67	5.20	5.20	1.32	0.95	6.20	1.34
ADDISON ST	892	0.86	1.23	5.52	5.52	4.78	1.62	3.03	2.48
ADELIN ST	5,454	1.17	1.14	5.51	5.51	0.32	0.18	3.94	2.10
ALAMO AVE	675	2.00	1.25	4.00	4.00	1.35	1.25	13.00	0.89
ALCATRAZ AVE	1,073	0.51	1.66	5.23	5.23	1.16	0.78	5.92	1.95
ALLSTON WAY	852	0.51	1.25	5.57	5.57	4.04	1.67	3.86	2.53
ALTA RD	675	1.67	1.25	4.00	4.00	0.82	0.77	14.00	0.89
ALVARADO RD	1,125	0.81	1.25	3.86	3.86	0.27	0.24	6.71	1.20
AMADOR AVE	788	0.67	1.25	4.00	4.00	1.41	1.13	8.00	1.27
ANTHONY ST	563	0.83	1.67	5.00	5.00	4.14	0.78	2.00	2.11
ARCADE AVE	900	1.00	1.25	4.00	4.00	0.60	0.56	13.00	1.24
ARCH ST	859	0.97	1.25	4.27	4.27	1.95	1.59	8.00	1.40

Street Name	Average ²¹ of								
	Total Capacity (vph)	Safety Score	Hazard Score	Connectivity	Accessibility	Congestion Score (Max)	Congestion Score (Min)	Service Score	Vulnerability Score
	 	 	 	 	 	 	 	 	 
ARDEN RD	788	1.50	1.75	2.00	2.00	0.55	0.52	11.00	2.82
ARLINGTON AVE	1,133	1.65	1.25	4.36	4.36	0.70	0.63	11.25	1.02
ASHBY AVE	2,477	1.78	0.99	5.11	5.21	1.48	0.67	3.15	1.82
ASHBY PL	1,125	0.33	0.75	4.00	4.00	1.59	1.10	4.00	1.20
ATHERTON ST	1,125	1.00	0.75	4.00	4.00	2.56	1.43	4.00	3.39
ATLAS PL	450	1.00	1.25	4.00	4.00	0.98	0.93	14.00	1.24
AVALON AVE	990	1.20	0.75	3.00	3.00	1.07	0.77	4.60	1.74
AVENIDA DR	750	0.89	1.25	4.67	4.67	0.67	0.65	13.83	1.24
AVIS RD	900	1.33	1.25	4.00	4.00	0.86	0.77	12.00	1.06
BAKER ST	1,013	0.33	1.67	5.25	5.25	1.06	0.87	7.25	2.12
BANCROFT PL	450	1.67	1.75	2.00	2.00	0.25	0.22	17.00	1.14
BANCROFT STEPS WAY	675	1.00	1.25	4.00	4.00	1.30	0.86	7.00	2.82
BANCROFT WAY	1,872	0.78	1.30	5.02	5.02	1.66	0.87	4.44	2.70
BARROWS LN	1,125	0.33	0.75	4.00	4.00	0.95	0.27	5.00	3.30
BATAAN AVE	1,125	1.00	1.67	4.00	4.00	1.60	0.79	3.00	1.98
BATEMAN ST	675	1.00	0.75	4.00	4.00	5.34	1.63	4.00	1.68
BAY ST	1,125	0.50	3.67	3.00	8.00	0.84	0.10	2.00	2.11
BAYTREE LN	450	2.00	1.25	1.00	1.00	0.68	0.63	13.00	1.24
BAYVIEW PL	675	0.67	1.25	4.00	4.00	1.68	1.41	10.00	1.24
BELROSE AVE	1,125	0.00	1.25	5.00	5.00	0.64	0.46	4.00	1.74
BELVEDERE AVE	1,013	0.50	0.67	5.00	5.00	1.60	1.14	4.00	1.37
BENVENUE AVE	956	0.67	0.75	5.50	5.50	3.50	1.66	4.38	2.02
BERKELEY SQ	3,800	0.67	0.67	6.00	6.00	1.58	0.38	3.00	3.31
BERKELEY WAY	916	0.60	0.67	5.36	5.36	6.89	2.09	3.50	1.82
BERRYMAN PATH	900	0.67	1.17	5.00	5.00	1.90	1.29	8.00	2.14
BERRYMAN ST	996	0.48	0.81	5.57	5.57	1.57	1.07	8.43	1.91
BEVERLY PL	1,200	0.56	1.00	5.33	5.33	0.75	0.61	6.67	1.20
BLAKE ST	970	0.85	1.07	5.63	5.63	2.29	1.56	4.25	2.38
BOISE ST	1,125	0.33	1.67	4.00	4.00	1.10	0.92	7.00	2.12
BOLIVAR DR	788	1.00	3.67	2.50	2.50	1.98	0.46	5.50	2.11
BONAR ST	1,050	0.00	1.53	5.67	5.67	1.41	0.99	4.00	3.26

Street Name	Average ²¹ of								
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BONITA AVE	950	0.33	0.72	5.00	5.00	6.00	1.99	5.89	2.16
BONNIE LN	675	1.67	1.25	4.00	4.00	1.57	1.41	12.00	0.89
BOWDITCH ST	844	1.00	0.75	5.50	5.50	2.92	1.64	5.00	3.39
BOYNTON AVE	863	1.83	1.25	4.00	4.00	0.61	0.57	14.50	1.06
BREAKWATER DR	1,125	1.00	2.67	2.00	2.00	0.00	0.00	9.00	2.11
BRET HARTE PATH	1,125	3.00	1.25	4.00	4.00	0.67	0.59	14.00	1.10
BRET HARTE RD	788	2.50	1.25	4.00	4.00	1.12	1.01	13.00	1.10
BRIDGE RD	1,125	0.67	1.25	4.00	4.00	0.34	0.29	6.00	1.20
BROOKSIDE AVE	675	0.00	1.45	2.00	2.00	1.41	1.02	6.00	1.20
BROOKSIDE CT	1,125	0.00	0.75	2.00	2.00	1.03	0.77	6.00	1.20
BROOKSIDE DR	1,013	0.00	1.35	4.00	4.00	1.08	0.81	6.00	1.20
BROWNING ST	1,125	0.00	1.67	5.75	5.75	1.46	0.93	4.00	3.26
BUCHANAN ST	1,350	0.33	2.87	2.00	2.00	0.02	0.00	6.00	2.11
BUENA AVE	731	0.33	0.67	4.75	4.75	1.84	1.35	6.75	1.33
BUENA VISTA WAY	731	2.00	1.25	4.50	4.50	1.07	1.00	9.13	1.24
BURNETT ST	900	0.50	1.17	4.75	4.75	1.96	1.41	3.75	2.32
BYRON ST	1,069	0.25	1.17	4.50	4.50	1.99	1.08	3.50	3.26
CAL SAILING LOOP	1,125	0.67	2.67	4.00	4.00	0.11	0.04	5.00	2.11
CALIFORNIA ST	956	0.38	1.00	5.72	5.72	1.79	1.49	5.61	1.94
CAMELIA ST	953	0.65	1.64	5.76	5.76	1.97	0.76	3.00	1.89
CAMPUS DR	900	0.70	1.25	4.18	4.18	0.70	0.66	12.00	1.24
CANYON RD	1,125	2.00	2.75	2.00	2.00	0.61	0.37	8.00	3.30
CAPISTRANO AVE	900	1.72	1.04	5.00	5.00	1.24	0.88	8.17	1.18
CARLETON ST	956	0.75	1.19	5.60	5.60	2.15	1.22	3.85	2.30
CARLOTTA AVE	1,125	0.50	2.17	4.00	4.00	1.16	0.87	8.00	1.27
CARRISON ST	900	0.00	1.00	5.00	5.00	1.88	1.53	4.67	2.12
CATALINA AVE	1,125	0.17	1.25	4.00	4.00	1.04	0.69	8.00	1.20
CATHERINE DR	1,125	1.33	0.67	4.00	4.00	0.94	0.69	6.00	1.35
CEDAR ST	1,082	1.20	1.14	5.23	5.23	1.51	1.05	4.98	1.59
CEDARWOOD LN	1,125	0.67	2.87	4.00	4.00	0.88	0.11	4.00	2.11
CENTENNIAL DR	1,200	0.59	1.36	3.78	3.78	0.08	0.06	11.11	1.86

Street Name	Average ²¹ of								
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CENTER ST	844	0.08	0.67	5.75	5.75	9.26	1.99	3.25	3.31
CHABOLYN TER	675	0.00	1.25	3.00	3.00	0.55	0.48	9.00	1.20
CHANNING WAY	940	0.72	1.29	5.54	5.54	2.35	1.43	4.67	2.68
CHAUCER ST	900	1.00	1.67	4.00	4.00	1.41	1.10	4.00	3.26
CHERRY ST	675	0.33	0.75	4.00	4.00	2.63	1.98	4.00	1.74
CHESTNUT ST	928	0.96	0.67	5.50	5.50	1.74	1.23	3.50	1.39
CHILTON WAY	900	1.00	0.75	4.00	4.00	2.43	1.62	4.00	2.68
CLAREMONT AVE	3,429	1.59	1.15	4.33	4.33	0.25	0.18	4.89	1.28
CLAREMONT BLVD	964	0.71	0.82	4.86	4.86	0.76	0.55	4.86	1.74
CLAREMONT CRES	675	0.00	0.75	4.00	4.00	1.18	0.92	3.00	1.20
CODORNICES RD	1,125	1.67	1.25	2.00	2.00	0.84	0.78	9.00	1.10
COLBY ST	731	0.08	0.75	4.50	4.50	5.88	1.65	2.75	1.68
COLLEGE AVE	1,057	1.49	1.10	4.78	4.78	2.16	1.36	5.22	1.93
COLORADO AVE	675	2.17	1.25	4.00	4.00	1.14	1.06	15.00	1.06
COLUMBIA CIR	1,125	0.00	1.25	2.00	2.00	0.50	0.47	14.00	1.24
COLUSA AVE	1,054	0.54	1.01	5.00	5.00	0.95	0.70	7.32	1.19
COMSTOCK CT	1,350	0.00	0.67	4.00	4.00	0.91	0.76	7.00	1.33
CONTRA COSTA AVE	700	1.04	1.25	4.56	4.56	1.26	1.05	8.67	1.06
CORNELL AVE	1,029	0.00	0.95	5.86	5.86	1.51	1.02	2.57	1.35
CORONA CT	675	1.33	1.25	2.00	2.00	1.36	1.19	10.00	1.10
COURT ST	1,125	0.00	0.75	2.00	2.00	0.82	0.70	7.00	1.74
COWPER ST	900	0.00	0.67	4.00	4.00	2.50	1.25	4.00	3.26
CRAGMONT AVE	783	1.30	1.25	4.07	4.07	1.05	0.95	12.59	1.00
CRESCENT DR	900	0.00	0.75	4.50	4.50	2.43	0.79	3.50	3.30
CRESCENT RD	788	0.00	0.75	4.00	4.00	1.86	0.49	4.00	3.30
CRESTON RD	900	1.52	1.25	4.44	4.44	0.80	0.75	13.67	1.01
CROSS CAMPUS RD	1,125	0.00	1.75	4.00	4.00	1.70	0.47	4.00	3.30
CRYSTAL WAY	1,125	2.33	1.25	2.00	2.00	0.61	0.54	10.00	1.10
CURTIS ST	830	0.56	1.10	5.56	5.56	2.42	1.49	3.19	2.08
CUTTER WAY	1,125	0.00	1.67	4.00	4.00	1.90	0.52	4.00	2.11
CYCLOTRON RD	1,125	0.48	1.25	4.00	4.00	0.15	0.14	9.29	3.30

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CYPRESS ST	900	0.00	0.67	3.00	3.00	1.47	1.13	7.00	1.33
DANA ST	1,648	0.48	0.89	5.29	5.29	3.32	1.26	3.71	2.47
DEAKIN ST	990	0.00	0.75	5.20	5.20	2.22	1.01	2.80	1.73
DEL MAR AVE	675	2.00	1.25	4.00	4.00	0.90	0.85	11.00	1.24
DEL NORTE ST	975	0.78	1.25	4.00	4.00	0.96	0.84	8.00	1.27
DELAWARE ST	1,017	0.46	0.75	5.13	5.13	3.31	1.50	3.91	1.73
DELMAR AVE	900	2.11	1.25	4.00	4.00	0.67	0.64	11.67	1.24
DERBY ST	870	0.82	0.93	5.10	5.10	2.32	1.63	4.73	1.99
DOHR ST	1,013	0.75	0.92	4.50	4.50	1.77	1.51	6.00	2.27
DOMINGO AVE	900	0.19	1.18	4.29	4.29	0.72	0.57	4.29	1.27
DOVER ST	1,125	1.00	1.67	4.00	4.00	0.89	0.42	5.00	2.05
DOWLING PL	900	0.33	0.75	4.00	4.00	4.87	1.34	2.00	1.68
DURANT AVE	4,573	1.43	0.88	5.50	5.50	1.08	0.45	3.70	3.12
DWIGHT CIR	1,125	1.00	1.67	6.00	6.00	1.90	0.58	3.00	2.31
DWIGHT PL	450	1.33	1.75	2.00	2.00	0.50	0.47	15.00	1.14
DWIGHT WAY	1,724	1.04	1.36	4.55	4.55	1.24	0.84	5.13	2.19
EAST GATE DR	563	0.00	1.25	4.00	4.00	0.62	0.46	6.00	3.30
EASTSHORE HWY	1,254	0.62	2.98	4.14	4.14	0.89	0.14	3.86	2.11
EASTWAY DR	1,125	0.17	0.75	4.00	4.00	0.46	0.37	6.00	1.74
EDITH ST	1,125	0.60	0.67	4.80	4.80	2.13	1.18	6.60	1.46
EDWARDS ST	1,013	0.33	1.67	5.00	5.00	1.58	1.25	5.00	3.26
EL DORADO AVE	900	1.17	1.21	5.00	5.00	1.13	1.00	8.00	1.27
EL PORTAL CT	1,125	2.00	1.25	2.00	2.00	0.52	0.48	10.00	1.24
ELLIS ST	825	0.11	0.83	5.67	5.67	2.56	1.66	5.17	2.27
ELLSWORTH ST	1,664	0.02	0.82	5.71	5.71	2.70	1.39	3.86	2.56
ELMWOOD AVE	1,125	1.00	0.75	4.00	4.00	1.46	1.02	4.00	1.20
ELMWOOD CT	450	0.33	0.75	2.00	2.00	2.23	1.61	3.00	1.20
EMERSON ST	1,050	0.44	0.75	4.67	4.67	2.15	1.11	3.00	2.05
ENCINA PL	675	0.33	1.45	4.00	4.00	1.33	1.04	5.00	1.20
ENSENADA AVE	868	1.05	0.68	5.71	5.71	1.43	0.98	7.57	1.20
EOLA ST	675	1.00	0.67	4.00	4.00	1.53	1.40	6.00	1.65

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ESHLEMAN DR	1,125	0.33	0.75	2.50	2.50	0.63	0.15	6.00	3.30
ESPLANADE DR	900	0.00	0.75	4.00	4.00	0.41	0.15	7.00	3.30
ESSEX ST	975	0.44	0.75	5.33	5.33	2.13	1.10	3.00	2.05
ETNA ST	1,125	1.00	1.00	5.00	5.00	1.96	1.61	7.50	1.74
ETON AVE	1,125	0.00	1.45	5.00	5.00	1.13	0.82	5.00	1.20
ETON CT	1,125	1.00	1.45	3.00	3.00	0.78	0.55	6.00	1.20
EUCALYPTUS RD	1,013	1.17	1.25	4.00	4.00	0.35	0.31	8.00	1.25
EUCLID AVE	961	1.46	1.44	4.68	4.68	1.05	0.94	10.03	1.17
EUCLID ST	900	1.33	2.25	4.00	4.00	1.09	0.95	9.00	1.10
EUNICE ST	825	1.30	1.18	5.33	5.33	1.41	1.11	8.56	1.19
EVELYN AVE	900	0.00	1.67	5.50	5.50	1.08	0.91	3.00	1.35
FAIRLAWN DR	716	0.36	1.25	4.00	4.00	0.86	0.81	13.45	1.24
FAIRVIEW ST	868	0.90	0.82	5.71	5.71	2.37	1.54	5.86	2.22
FERNWALD RD	1,125	2.00	1.25	2.00	2.00	0.62	0.54	8.00	2.82
FLORENCE ST	900	1.00	0.75	4.00	4.00	5.11	1.53	2.00	1.93
FLORIDA AVE	900	1.83	1.25	3.00	3.00	0.90	0.82	15.00	1.06
FOLGER AVE	1,125	0.11	2.00	2.67	2.67	1.40	0.31	2.33	2.11
FOREST AVE	900	1.00	0.75	5.00	5.00	2.13	1.73	6.00	1.74
FOREST LN	675	2.33	1.25	4.00	4.00	0.97	0.92	13.00	1.10
FOUNTAIN WALK	1,125	1.67	1.25	7.00	7.00	0.82	0.71	8.00	1.27
FRANCISCO ST	1,050	1.17	0.67	5.50	5.50	2.75	1.34	4.83	1.63
FRANKLIN ST	1,181	0.00	0.67	5.50	5.50	1.02	0.83	4.25	1.39
FRESNO AVE	1,275	0.89	0.67	4.67	4.67	0.98	0.75	6.33	1.20
FRONTAGE RD	1,350	0.33	2.67	1.50	1.50	0.51	0.05	4.00	2.11
FULTON ST	1,918	0.07	0.88	5.60	5.60	2.40	1.46	3.33	2.62
GARBER ST	900	1.11	0.92	4.67	4.67	1.54	1.15	5.00	1.74
GAYLEY RD	900	0.33	1.75	4.50	4.50	0.46	0.22	5.83	3.30
GILMAN AVE	1,013	1.67	1.67	6.00	6.00	1.39	0.51	2.00	2.11
GILMAN ST	1,823	1.59	1.85	5.39	6.19	0.86	0.43	3.19	1.77
GLASER RD	1,125	0.00	1.25	3.00	3.00	0.05	0.05	11.00	3.30
GLEN AVE	788	1.33	1.25	4.33	4.33	1.32	1.08	9.00	1.22

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GLENDAL AVE	975	1.33	1.25	4.00	4.00	0.70	0.66	10.67	1.24
GOLDEN GATE AVE	1,125	0.67	2.25	0.00	0.00	0.26	0.23	8.00	1.20
GRANT ST	832	0.48	0.71	5.57	5.57	4.96	2.14	4.96	1.83
GRAYSON ST	945	0.33	1.67	5.20	5.20	2.57	0.62	2.80	2.11
GREENWOOD TER	600	1.33	1.25	4.00	4.00	1.13	1.04	9.33	1.24
GRIZZLY PEAK BLVD	1,085	1.29	1.25	4.00	4.00	0.57	0.53	13.56	1.11
HALCYON CT	900	0.00	0.75	4.00	4.00	4.73	1.39	2.00	1.68
HALKIN LN	675	2.33	1.25	4.00	4.00	1.25	1.17	12.50	0.89
HARDING CIR	450	2.33	1.25	2.00	2.00	0.81	0.78	14.00	1.24
HARMON ST	900	0.63	1.04	5.50	5.50	1.98	1.36	6.38	2.18
HAROLD WAY	1,125	0.67	1.67	4.00	4.00	6.90	1.64	3.00	3.31
HARPER ST	788	0.25	0.67	5.00	5.00	2.64	1.64	4.25	2.27
HARRISON ST	917	0.15	2.05	5.23	5.23	1.32	0.27	3.15	2.00
HARVARD CIR	675	1.67	1.25	3.00	3.00	0.76	0.73	14.00	1.24
HASKELL ST	900	0.00	1.33	4.67	4.67	1.55	1.28	5.33	2.12
HASTE ST	3,800	1.77	0.83	5.40	5.40	0.81	0.48	4.20	3.17
HAVILAND RD	900	0.00	0.75	3.00	3.00	0.92	0.67	5.00	3.30
HAWTHORNE TER	900	0.53	1.25	3.80	3.80	1.41	1.28	8.20	1.24
HAZEL RD	900	0.00	1.45	4.00	4.00	1.13	0.85	5.00	1.20
HEARST AVE	1,398	1.02	1.17	5.05	5.05	2.92	1.20	3.54	2.17
HEARST MINING CIR	675	0.00	0.75	4.00	4.00	0.57	0.41	7.00	3.30
HEINZ AVE	945	0.27	1.67	4.00	4.00	2.62	0.65	2.60	2.11
HENRY ST	2,463	1.00	0.83	5.33	5.33	1.73	0.92	6.83	2.15
HIGH CT	563	1.33	1.25	4.00	4.00	1.54	1.40	10.50	1.10
HIGHLAND PL	1,125	1.17	1.25	4.00	4.00	0.44	0.42	6.00	1.79
HILGARD AVE	1,093	0.71	1.25	4.57	4.57	1.13	0.99	7.43	1.79
HILGARD WAY	1,125	0.00	0.75	1.00	1.00	1.18	0.54	5.00	3.30
HILL CT	900	0.00	1.25	2.00	2.00	1.47	1.36	7.00	1.24
HILL RD	720	1.60	1.25	3.00	3.00	0.75	0.71	13.80	1.24
HILLCREST CT	450	2.00	1.25	2.00	2.00	1.72	1.40	6.00	1.20
HILLCREST RD	850	1.41	1.27	3.56	3.56	0.68	0.55	7.56	1.20

Street Name	Average ²¹ of								
	Total Capacity (vph)	Safety Score	Hazard Score	Connectivity	Accessibility	Congestion Score (Max)	Congestion Score (Min)	Service Score	Vulnerability Score
	 	 	 	 	 	 	 	 	 
HILDALE AVE	816	2.25	1.25	4.25	4.25	1.07	0.99	12.88	1.00
HILLEGASS AVE	872	0.21	0.75	5.38	5.38	4.27	1.75	3.63	2.03
HILLSIDE AVE	1,125	0.00	1.25	3.33	3.33	0.86	0.73	7.00	2.82
HILLSIDE CT	1,125	1.67	1.25	2.00	2.00	0.90	0.74	6.00	2.82
HILLVIEW RD	900	1.00	1.25	4.00	4.00	0.40	0.38	14.50	1.10
HOLLY ST	675	0.17	0.67	5.00	5.00	2.08	1.58	5.50	1.33
HOPKINS ST	1,001	1.25	0.86	4.52	4.52	1.28	0.91	5.66	1.29
HOWE ST	900	1.00	0.75	4.00	4.00	5.28	1.63	2.00	1.93
I80 EAST (OFF RAMP) GILMAN HWY	3,400	0.33	2.87	4.00	9.00	0.25	0.04	4.00	2.11
I80 EAST (ON RAMP) ASHBY HWY	1,700	0.33	2.67	2.33	7.33	0.01	0.00	4.67	2.11
I80 EAST (ON RAMP) GILMAN HWY	3,400	0.33	2.87	4.00	9.00	0.15	0.02	4.00	2.11
I80 EAST HWY	11,250	0.65	2.67	4.00	5.25	0.74	0.08	4.13	2.11
I80 W FRONTAGE RD	1,294	0.42	2.69	5.00	5.00	0.58	0.12	4.00	2.11
I80 WEST (OFF RAMP) ASHBY HWY	3,000	0.38	2.67	3.25	8.25	0.00	0.00	4.00	2.07
I80 WEST (OFF RAMP) GILMAN HWY	3,400	0.33	2.67	4.00	9.00	0.12	0.02	4.00	2.11
I80 WEST (ON RAMP) ASHBY HWY	2,700	0.71	2.67	3.00	8.00	0.01	0.00	4.50	2.11
I80 WEST (ON RAMP) GILMAN HWY	3,400	0.33	2.67	4.00	9.00	0.19	0.03	4.00	2.11
I80 WEST HWY	11,925	0.63	2.67	4.00	5.00	0.68	0.07	4.10	2.11
IDAHO ST	900	0.75	1.67	4.50	4.50	0.94	0.75	6.25	2.12
INDIAN ROCK AVE	825	1.33	1.25	4.00	4.00	1.07	0.96	9.83	1.06
JAYNES ST	1,125	0.17	0.67	4.50	4.50	1.03	0.90	6.50	1.33
JEFFERSON AVE	1,170	0.53	1.27	5.60	5.60	1.76	1.49	4.80	1.70
JONES ST	1,029	0.19	2.01	5.71	5.71	1.54	0.70	3.14	1.95
JOSEPHINE ST	1,061	0.33	0.74	5.14	5.14	1.95	1.21	7.14	1.34
JUANITA WAY	675	1.17	0.67	4.00	4.00	1.68	1.34	5.00	1.35
JULIA ST	1,125	0.00	0.67	5.00	5.00	1.80	1.43	5.50	2.26
KAINS AVE	932	0.05	0.81	5.71	5.71	1.70	0.95	2.14	1.35
KEELER AVE	816	1.54	1.25	4.31	4.31	0.90	0.82	13.81	1.09
KEITH AVE	720	0.57	1.25	4.20	4.20	1.08	0.97	12.20	1.10
KELSEY ST	1,125	0.33	0.75	4.00	4.00	1.25	0.94	5.00	1.74
KENTUCKY AVE	750	1.89	1.25	3.33	3.33	0.88	0.81	15.67	1.06

Street Name	Average ²¹ of								
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KEONCREST DR	900	1.25	0.67	3.50	3.50	1.18	0.91	5.00	1.35
KING ST	859	0.00	1.03	5.45	5.45	2.32	1.59	5.45	2.27
KITTREDGE ST	900	0.89	0.67	4.67	4.67	7.43	2.08	2.33	3.31
LA LOMA AVE	881	0.94	1.25	4.58	4.58	0.92	0.86	7.50	1.61
LA VEREDA RD	1,125	1.67	1.25	4.00	4.00	0.64	0.60	8.50	1.65
LASSEN ST	900	0.67	1.25	4.00	4.00	0.95	0.78	8.00	1.27
LATHAM LN	675	2.00	1.25	4.00	4.00	0.92	0.85	13.00	1.10
LAUREL LN	788	1.83	1.25	5.00	5.00	1.52	1.12	9.00	1.20
LAUREL ST	1,125	1.33	1.25	4.00	4.00	0.72	0.66	10.00	1.10
LE CONTE AVE	900	0.48	1.25	4.89	4.89	1.16	1.00	5.89	1.79
LE ROY AVE	1,125	0.67	1.25	3.00	3.00	0.78	0.71	8.00	1.24
LEROY AVE	750	0.85	1.25	4.56	4.56	1.37	1.24	7.11	1.55
LEWISTON AVE	1,125	0.00	0.75	4.00	4.00	1.06	0.74	6.00	1.20
LINCOLN ST	1,069	0.50	0.67	4.75	4.75	1.35	1.09	5.50	1.62
LINDEN AVE	900	0.67	0.75	4.00	4.00	1.65	1.19	3.00	1.20
LORINA ST	450	0.33	0.75	4.00	4.00	5.14	2.76	3.00	2.10
LOS ANGELES AVE	1,097	0.63	1.25	3.88	3.88	0.95	0.82	8.00	1.19
MABEL ST	813	0.51	1.44	5.38	5.38	1.66	1.32	4.54	2.26
MADERA ST	1,050	0.89	0.67	4.00	4.00	0.77	0.52	6.33	1.20
MAGNOLIA ST	675	0.67	0.75	4.00	4.00	1.91	1.40	3.00	1.20
MARIN AVE	2,033	2.01	1.10	4.88	4.88	0.74	0.66	9.04	1.09
MARINA BLVD	1,238	0.00	2.77	2.25	2.25	0.03	0.02	5.75	2.11
MARIPOSA AVE	1,125	0.17	1.25	4.00	4.00	0.98	0.84	9.00	1.27
MARTIN LUTHER KING JR WAY	3,059	1.17	0.91	5.32	5.32	1.94	0.70	4.43	2.33
MARYLAND AVE	675	2.50	1.25	4.00	4.00	0.85	0.78	16.50	1.06
MATHEWS ST	996	0.57	1.67	5.71	5.71	1.68	0.96	4.00	2.32
MAYBECK TWIN DR	450	3.00	1.25	2.00	2.00	1.55	1.44	8.00	1.24
MC GEE AVE	1,021	0.72	0.71	5.46	5.46	2.90	1.56	5.62	1.77
MC KINLEY AVE	1,069	0.67	0.92	5.50	5.50	5.46	1.82	4.25	1.70
MCMILLIAN RD	1,141	0.67	1.25	4.00	4.00	0.05	0.04	10.07	2.69
MENDOCINO AVE	788	2.50	1.25	3.00	3.00	1.35	1.09	9.00	1.06

Street Name	Average ²¹ of								
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MENLO PL	788	1.42	1.25	4.00	4.00	0.99	0.90	11.25	1.20
MERCED ST	1,125	1.00	0.67	5.00	5.00	0.88	0.66	7.00	1.20
MICHIGAN AVE	900	1.58	1.25	4.00	4.00	0.96	0.89	15.25	1.06
MIDDLEFIELD RD	844	1.42	1.25	3.25	3.25	0.56	0.52	15.25	1.10
MILLER AVE	798	2.09	1.25	4.36	4.36	0.98	0.89	13.64	1.10
MILLER RD	675	1.67	1.25	4.00	4.00	0.91	0.84	13.00	1.10
MILVIA ST	885	0.80	0.75	5.48	5.48	5.94	2.03	4.77	2.30
MINING CIR	600	0.00	0.75	4.00	4.00	0.56	0.41	6.33	3.30
MIRAMAR AVE	675	0.67	0.67	4.00	4.00	1.40	0.92	7.00	1.20
MIRAMONTE CT	1,125	0.67	0.67	2.00	2.00	0.98	0.71	6.00	1.33
MODOC ST	1,125	0.00	0.67	4.00	4.00	1.07	0.66	6.00	1.20
MONTEREY AVE	1,041	0.29	1.17	5.50	5.50	0.85	0.72	6.88	1.21
MONTROSE RD	788	3.00	1.25	5.00	5.00	1.20	1.06	12.00	1.06
MOSSWOOD RD	990	1.60	1.75	2.00	2.00	0.57	0.37	7.80	2.92
MUIR WAY	900	1.67	1.25	4.00	4.00	0.56	0.51	13.00	1.10
MURRAY ST	900	0.00	1.67	4.00	4.00	2.04	0.65	2.50	2.11
MY WAY	450	1.67	1.25	2.00	2.00	0.92	0.84	17.00	0.89
MYSTIC ST	1,125	0.00	1.45	2.00	2.00	0.63	0.44	6.00	1.20
NAPA AVE	1,125	1.00	1.17	4.00	4.00	1.04	0.88	9.00	1.27
NEILSON ST	844	0.75	0.81	5.13	5.13	1.06	0.90	6.38	1.27
NEWBURY ST	675	0.33	0.75	4.00	4.00	3.28	1.71	3.00	2.10
NOGALES ST	1,125	0.00	1.25	4.00	4.00	0.56	0.45	6.00	1.20
NOGALES ST PATH	1,125	1.00	1.25	4.00	4.00	0.48	0.38	6.00	1.20
NORTH ST	1,125	0.00	0.96	2.00	2.00	0.94	0.86	7.00	1.54
NORTH VALLEY ST	1,125	0.00	1.87	2.00	2.00	1.31	0.85	5.00	3.26
NORTHAMPTON AVE	900	2.67	1.25	4.00	4.00	1.15	1.06	13.00	1.06
NORTHGATE AVE	788	1.00	1.25	3.00	3.00	0.85	0.77	12.00	1.24
NORTHSIDE AVE	1,125	0.78	0.67	3.33	3.33	1.05	0.92	4.67	1.35
OAK KNOLL TER	1,013	1.00	0.75	3.50	3.50	0.75	0.54	6.00	1.74
OAK ST	525	1.78	1.25	4.00	4.00	1.54	1.36	10.33	1.10
OAKRIDGE RD	675	0.33	1.25	2.00	2.00	0.81	0.62	4.67	1.20

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OAKVALE AVE	788	0.00	1.20	4.00	4.00	1.71	1.34	5.00	1.20
OLYMPUS AVE	675	2.00	1.25	3.60	3.60	0.64	0.62	14.40	1.41
ORDWAY ST	1,013	0.67	1.17	5.25	5.25	1.26	0.98	5.00	1.35
OREGON ST	853	0.74	0.90	5.53	5.53	2.66	1.57	4.16	2.20
OTIS ST	675	0.67	0.67	4.00	4.00	3.28	1.74	3.00	2.10
OVERLOOK RD	975	1.56	1.25	3.33	3.33	0.57	0.53	13.67	1.10
OXFORD ST	2,957	0.91	1.01	5.42	5.42	1.33	0.90	5.58	2.44
PAGE ST	1,035	0.38	1.92	5.93	5.93	1.68	0.67	3.20	1.91
PALM CT	1,125	0.67	0.75	2.00	2.00	1.03	0.82	5.00	1.74
PANORAMIC PL	1,125	1.67	1.75	2.00	2.00	0.20	0.19	15.00	2.80
PANORAMIC WAY	888	1.16	1.80	3.68	3.68	0.55	0.39	10.58	2.47
PARDEE ST	788	1.00	1.67	5.50	5.50	2.69	0.69	2.50	2.11
PARK HILLS RD	855	1.30	1.25	4.20	4.20	0.63	0.60	14.20	1.10
PARK ST	750	1.00	1.00	4.00	4.00	2.03	1.70	5.33	2.32
PARK WAY	1,125	0.67	2.87	3.00	3.00	0.97	0.12	3.00	2.11
PARKER ST	931	0.44	1.12	5.59	5.59	2.34	1.50	4.34	2.30
PARKSIDE DR	996	0.05	1.25	3.57	3.57	0.65	0.55	6.71	1.20
PARNASSUS CT	900	0.17	1.25	2.00	2.00	0.50	0.48	12.50	1.24
PARNASSUS RD	750	1.11	1.25	4.00	4.00	0.68	0.66	13.00	1.24
PERALTA AVE	765	0.27	0.89	5.00	5.00	1.35	1.00	7.20	1.23
PIEDMONT AVE	900	0.96	1.09	4.16	4.16	1.47	1.05	5.60	2.50
PIEDMONT CIR	1,013	1.00	1.25	4.00	4.00	1.61	1.34	5.50	2.28
PINE AVE	1,013	0.83	0.75	5.00	5.00	1.17	0.89	3.00	1.47
POE ST	1,125	0.00	1.67	2.00	2.00	0.94	0.62	5.00	3.26
POPLAR ST	750	2.67	1.25	4.00	4.00	1.26	1.11	12.67	0.89
POPPY LN	675	1.78	1.25	4.67	4.67	1.08	0.99	12.67	1.10
PORTLAND AVE	1,013	0.58	0.85	6.25	6.25	0.95	0.73	8.00	1.20
POSEN AVE	1,013	1.08	0.67	4.75	4.75	0.80	0.61	6.25	1.16
POTTER ST	1,181	0.00	2.67	3.50	4.75	1.40	0.22	3.25	2.11
PRINCE ST	817	0.44	0.73	4.95	4.95	3.08	1.51	4.47	1.95
PROSPECT ST	1,050	0.44	1.25	4.00	4.00	1.15	0.88	7.00	2.82

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QUAIL AVE	788	1.00	1.25	5.00	5.00	0.91	0.83	12.00	1.24
QUEENS RD	638	1.00	1.25	3.83	3.83	1.05	1.00	12.67	1.24
REGAL RD	900	2.00	1.25	5.00	5.00	1.07	0.97	11.25	1.00
REGENT ST	923	0.70	0.75	5.00	5.00	4.15	1.51	3.60	1.99
RIDGE RD	1,013	0.42	1.25	6.00	6.00	1.11	0.93	5.00	1.79
RIMWAY RD	825	0.00	2.42	4.67	4.67	0.52	0.25	6.33	3.30
ROANOKE RD	900	1.17	1.25	5.00	5.00	0.46	0.42	8.00	1.20
ROBLE CT	1,125	1.67	1.25	2.00	2.00	0.22	0.19	10.00	1.20
ROBLE RD	788	0.33	1.25	3.00	3.00	0.25	0.20	7.50	1.20
ROCHDALE WAY	900	3.00	1.25	2.00	2.00	0.33	0.32	17.00	0.89
ROCK LN	600	2.33	1.25	4.00	4.00	1.54	1.38	12.33	0.89
ROOSEVELT AVE	956	0.75	0.92	5.50	5.50	6.58	2.56	5.50	1.70
ROSE ST	999	1.48	0.85	4.74	4.74	1.55	1.12	6.88	1.48
ROSEMONT AVE	675	2.00	1.25	5.00	5.00	0.76	0.69	16.50	0.89
ROSLYN CT	675	0.00	1.25	2.00	2.00	0.56	0.49	9.00	1.20
RUGBY AVE	900	1.00	1.25	4.00	4.00	0.44	0.39	17.00	1.06
RUSSELL ST	846	0.58	0.78	4.59	4.59	2.85	1.55	3.96	2.08
SACRAMENTO ST	3,595	1.09	0.94	5.32	5.32	0.44	0.36	5.16	1.94
SAN ANTONIO AVE	1,050	2.00	1.25	4.67	4.67	0.78	0.70	13.00	1.06
SAN BENITO RD	675	1.67	1.25	4.00	4.00	1.84	1.63	10.00	1.27
SAN DIEGO RD	855	1.80	1.25	3.60	3.60	0.97	0.87	12.40	1.06
SAN FERNANDO AVE	675	1.50	1.25	4.50	4.50	1.35	1.23	11.50	1.06
SAN JUAN AVE	1,125	1.33	1.25	4.00	4.00	0.85	0.79	12.00	1.06
SAN LORENZO AVE	771	1.29	0.90	5.29	5.29	1.35	0.97	8.29	1.20
SAN LUIS RD	825	1.63	1.25	4.00	4.00	0.91	0.83	13.11	1.06
SAN MATEO RD	750	2.00	1.25	2.00	2.00	1.18	1.02	10.00	1.06
SAN MIGUEL AVE	675	1.33	1.25	4.00	4.00	1.21	1.12	10.00	1.20
SAN PABLO AVE	3,800	1.95	1.60	5.02	5.02	0.44	0.23	2.70	2.15
SAN PEDRO AVE	788	1.33	1.25	4.00	4.00	1.47	1.00	8.00	1.20
SAN RAMON AVE	750	1.56	1.25	4.00	4.00	1.00	0.91	13.67	1.06
SAN ROSA AVE	1,125	1.00	1.25	2.00	2.00	0.76	0.70	10.00	1.20

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SANTA BARBARA RD	802	1.50	1.25	4.69	4.69	1.07	0.96	12.38	1.08
SANTA CLARA AVE	900	1.33	1.25	4.00	4.00	0.85	0.77	11.00	1.06
SANTA FE AVE	900	0.33	1.00	5.50	5.50	1.27	1.05	3.17	1.35
SANTA ROSA AVE	900	1.25	1.25	4.50	4.50	1.04	0.95	9.50	1.20
SCENIC AVE	788	1.04	1.25	5.25	5.25	1.98	1.70	7.50	1.51
SEAWALL DR	844	1.00	2.67	2.63	2.63	0.08	0.03	6.63	2.11
SENIOR AVE	900	1.67	1.25	5.00	5.00	0.57	0.55	14.00	1.24
SHASTA RD	844	0.83	1.25	4.06	4.06	0.74	0.68	13.00	1.17
SHATTUCK AVE	3,060	1.47	0.82	5.71	5.71	1.17	0.63	4.12	2.26
SHATTUCK PL	3,800	1.47	0.97	5.40	5.40	0.55	0.36	7.00	2.14
SHATTUCK SQ	3,800	0.00	0.67	5.00	5.00	1.22	0.34	3.00	3.31
SHORT ST	788	0.50	0.67	4.00	4.00	1.42	1.17	4.00	1.39
SIERRA ST	900	0.67	0.67	4.00	4.00	1.15	0.82	7.00	1.20
SMYTH RD	1,125	2.00	1.25	2.00	2.00	0.39	0.35	9.00	2.82
SOJOURNER TRUTH WAY	1,125	0.33	0.67	2.00	2.00	1.25	1.07	6.00	2.32
SOLANO AVE	935	0.28	0.81	5.08	5.08	1.16	0.73	6.54	1.18
SOMERSET PL	1,013	1.00	1.25	2.75	2.75	0.75	0.69	11.25	1.06
SONOMA AVE	868	0.10	0.81	4.71	4.71	1.05	0.93	7.00	1.20
SOULE RD	1,125	0.00	0.75	2.50	2.50	0.75	0.49	5.50	3.30
SOUTH DR	675	0.00	1.25	4.00	4.00	0.90	0.33	6.50	3.30
SOUTH HALL RD	675	0.00	0.75	3.50	3.50	0.70	0.23	6.50	3.30
SOUTH ST	450	0.00	0.75	4.00	4.00	1.72	1.44	6.00	1.74
SOUTHAMPTON AVE	868	1.95	1.25	3.86	3.86	0.81	0.74	12.29	1.06
SOUTHWEST ST	675	0.00	0.75	4.00	4.00	1.68	1.38	6.00	1.74
SPAULDING AVE	1,181	0.67	1.67	5.50	5.50	1.51	1.26	4.50	1.70
SPINNAKER WAY	1,125	0.00	2.67	3.25	3.25	0.00	0.00	8.25	2.11
SPORTS LN	675	0.00	1.00	4.00	4.00	1.09	0.94	7.50	1.74
SPRING WAY	675	0.33	1.25	2.00	2.00	1.74	1.55	10.00	1.24
SPRUCE ST	1,118	0.83	1.31	4.19	4.19	1.01	0.83	10.63	1.09
STANFORD AVE	3,800	0.33	1.67	4.67	4.67	0.23	0.12	7.00	2.23
STANNAGE AVE	1,125	0.05	0.67	5.43	5.43	1.46	0.89	2.43	1.35

Street Name	Average ²¹ of								
	Total Capacity (vph)	Safety Score	Hazard Score	Connectivity	Accessibility	Congestion Score (Max)	Congestion Score (Min)	Service Score	Vulnerability Score
	 	 	 	 	 	 	 	 	 
STANTON ST	1,050	0.33	0.67	4.00	4.00	1.90	1.65	6.00	2.25
STATION PL	1,125	0.67	1.25	2.00	2.00	0.91	0.61	7.00	1.20
STERLING AVE	725	2.30	1.25	4.00	4.00	1.05	0.94	13.67	1.10
STEVENSON AVE	788	2.83	1.25	4.00	4.00	0.75	0.67	13.00	1.10
STODDARD WAY	1,125	2.67	1.25	2.00	2.00	0.56	0.51	14.00	1.10
STUART ST	875	0.69	0.84	5.33	5.33	2.34	1.49	4.00	2.00
SUMMER ST	675	1.33	1.25	4.00	4.00	1.71	1.41	9.00	1.24
SUMMIT RD	816	1.33	1.25	3.13	3.13	0.48	0.45	13.50	1.19
SUNSET LN	731	1.67	1.25	4.00	4.00	0.71	0.66	13.50	0.97
SUNSET TRAIL	1,125	0.67	1.25	2.00	2.00	0.19	0.16	7.00	1.01
SUTTER ST	1,200	1.78	1.19	5.00	5.00	1.00	0.79	8.00	1.27
SW PL	900	0.00	0.75	4.00	4.00	0.91	0.76	6.00	1.74
TACOMA AVE	900	1.67	1.08	5.50	5.50	1.35	0.92	7.50	1.20
TALBOT AVE	900	0.00	1.33	6.00	6.00	1.61	1.26	3.00	1.35
TAMALPAIS PATH	1,125	2.00	1.25	2.00	2.00	0.52	0.47	15.00	1.10
TAMALPAIS RD	619	2.00	1.25	4.00	4.00	1.10	1.01	12.00	1.14
TANGLEWOOD RD	1,125	0.75	1.25	3.50	3.50	0.48	0.35	5.25	1.74
TELEGRAPH AVE	3,800	1.65	1.10	5.35	5.35	0.83	0.32	2.85	2.30
TERMINAL PL	1,125	1.00	0.67	2.00	2.00	3.39	0.79	3.00	3.31
TEVLIN ST	1,125	1.11	1.00	3.00	3.00	0.79	0.71	4.33	1.35
THE PLAZA DR	731	0.08	1.30	4.00	4.00	0.97	0.82	6.50	1.20
THE UPLANDS PATH	1,125	1.00	1.25	4.00	4.00	0.44	0.40	6.00	1.20
THOUSAND OAKS BLVD	839	1.55	1.11	5.27	5.27	0.88	0.83	9.55	1.16
TOMLEE DR	675	1.33	0.67	4.00	4.00	1.72	1.39	6.00	1.35
TREMONT ST	956	1.00	0.75	5.00	5.00	1.72	0.93	4.25	2.05
TULARE AVE	1,125	0.33	0.67	4.00	4.00	0.80	0.50	6.75	1.20
TUNNEL RD	1,414	2.05	1.25	4.29	4.29	0.29	0.24	5.43	1.20
TWAIN AVE	675	3.67	1.25	4.00	4.00	1.21	1.09	14.00	1.10
TYLER ST	1,125	1.00	0.67	5.00	5.00	2.01	1.61	5.50	2.27
UNIVERSITY AVE	2,814	0.98	1.61	5.08	5.15	1.14	0.39	3.27	2.19
UNIVERSITY DR	844	0.00	0.75	4.00	4.00	0.28	0.15	6.50	3.30

Street Name	Average ²¹ of								
	Total Capacity (vph)	Safety Score	Hazard Score	Connectivity	Accessibility	Congestion Score (Max)	Congestion Score (Min)	Service Score	Vulnerability Score
	 	 	 	 	 	 	 	 	 
UNNAMED UC BERKELEY PATH	844	0.00	0.75	2.75	2.75	1.19	0.56	5.25	3.30
VALLEJO ST	900	2.67	1.25	4.00	4.00	0.71	0.64	12.00	1.06
VALLEY ST	1,013	0.67	1.67	4.00	4.00	1.31	1.02	5.00	3.26
VASSAR AVE	750	1.44	1.25	3.33	3.33	0.78	0.72	15.67	1.06
VERMONT AVE	765	1.60	1.25	3.20	3.20	0.66	0.60	16.40	1.06
VICENTE RD	1,125	1.67	1.25	2.00	2.00	0.15	0.13	7.00	1.20
VINCENTE AVE	750	1.22	1.14	4.67	4.67	1.26	1.02	9.17	1.17
VINE ST	948	0.93	0.87	5.86	5.86	2.10	1.51	7.21	1.72
VIRGINIA GDNS	675	0.00	0.67	2.00	2.00	1.55	1.39	5.00	1.39
VIRGINIA ST	905	0.46	1.10	5.09	5.09	2.35	1.29	4.76	1.77
VISALIA AVE	900	1.67	1.08	4.00	4.00	0.51	0.49	10.00	1.15
VISTAMONT AVE	619	1.83	1.25	3.00	3.00	0.80	0.74	16.50	0.89
WALKER ST	1,125	0.67	0.75	4.00	4.00	1.69	0.92	3.00	2.10
WALLACE ST	1,125	1.00	1.67	4.00	4.00	1.53	0.89	4.00	2.32
WALNUT ST	968	0.83	0.93	5.10	5.10	2.37	1.53	6.70	1.98
WARD ST	979	0.70	1.09	5.05	5.05	1.79	1.19	4.00	2.21
WARRING ST	1,029	1.00	1.04	4.14	4.14	1.58	1.31	6.00	2.05
WEBSTER ST	840	0.42	0.76	4.20	4.20	4.46	1.58	3.07	1.52
WEST CIR	720	0.00	0.75	4.00	4.00	1.31	0.35	5.00	3.30
WEST CRESCENT DR	900	0.00	1.75	5.00	5.00	2.41	0.64	3.00	3.30
WEST ST	950	0.37	1.16	4.89	4.89	1.58	1.18	3.78	2.22
WHEELER ST	765	0.20	0.75	4.80	4.80	2.74	1.46	3.00	2.06
WHITAKER AVE	563	3.50	1.25	4.00	4.00	1.14	1.03	14.00	1.10
WHITNEY ST	675	0.00	0.75	4.00	4.00	1.70	1.00	3.00	2.05
WICKSON RD	750	0.00	1.08	4.00	4.00	0.77	0.27	6.00	3.30
WILDCAT CANYON RD	1,125	0.30	1.25	4.00	4.00	0.31	0.30	15.67	1.01
WILLOW WALK	1,125	0.67	1.25	2.00	2.00	0.22	0.20	7.00	1.20
WILSON CIR	225	1.67	1.25	2.00	2.00	1.29	1.25	15.00	1.24
WOODHAVEN RD	675	1.33	1.25	4.00	4.00	0.54	0.52	15.00	1.10
WOODHAVEN ST	450	1.33	1.25	2.00	2.00	0.51	0.50	16.00	1.10
WOODMONT AVE	872	1.46	1.31	3.75	3.75	0.60	0.55	15.38	0.87

Street Name	Average ²¹ of								
	Total Capacity (vph)	Safety Score	Hazard Score	Connectivity	Accessibility	Congestion Score (Max)	Congestion Score (Min)	Service Score	Vulnerability Score
	 	 	 	 	 	 	 	 	 
WOODMONT CT	1,125	2.00	1.25	2.00	2.00	0.46	0.41	17.00	0.89
WOODSIDE RD	825	1.78	1.25	4.67	4.67	0.52	0.49	14.00	1.10
WOOLSEY ST	779	0.41	1.06	4.88	4.88	3.12	1.38	4.58	1.83
YOLO AVE	1,050	0.33	1.17	4.00	4.00	1.12	0.90	8.00	1.27
YOSEMITE RD	844	2.08	1.25	4.00	4.00	1.12	1.03	10.25	1.06
I80 EAST (OFF RAMP) UNIV	1,433	0.33	2.80	3.00	7.44	1.34	0.34	3.89	2.11
UNIVERSITY AVE OVERPASS	3,393	1.56	2.65	4.48	4.91	0.66	0.18	3.26	2.11
I80 WEST (OFF RAMP) UNIV	1,438	0.08	2.67	2.50	7.50	1.05	0.20	3.50	2.11
RAMP	1,700	0.33	2.67	2.50	7.50	0.55	0.15	4.00	2.11
NORTHBRAE TUNNEL	750	0.33	1.25	7.00	7.00	1.27	1.13	8.00	1.13
I80 EAST (ON RAMP) UNIV	1,700	0.33	2.87	2.00	7.00	1.33	0.33	4.00	2.11
UNNAMED ALLEY	825	1.00	2.00	4.44	4.44	2.78	0.97	3.11	2.07
THE UPLANDS	875	0.85	1.27	4.33	4.33	0.76	0.64	6.11	1.20
EL CAMINO REAL	675	0.67	1.25	3.83	3.83	0.66	0.56	6.50	1.20
SPINNAKER CIRCLE	563	0.00	2.67	3.00	3.00	0.00	0.00	10.00	2.11
I80 WEST (ON RAMP) UNIV	1,350	0.00	2.67	3.33	8.33	1.01	0.19	4.00	2.11
UNNAMED LBL ROAD	1,125	0.33	1.25	4.00	4.00	0.31	0.29	8.00	3.30
EASTSHORE	1,125	0.67	2.87	4.00	4.00	2.08	0.44	3.00	2.11
THE CIRCLE	611	1.48	1.25	4.00	4.00	1.28	1.18	8.00	1.17
THE ALAMEDA	1,712	0.52	1.30	4.56	4.56	0.77	0.65	8.56	1.12
UNNAMED	1,044	0.28	1.21	2.72	2.72	0.57	0.29	8.20	2.92
REGAL	675	1.67	1.25	4.00	4.00	1.18	1.06	12.50	1.10
ROANE	450	1.67	1.25	4.00	4.00	1.57	1.36	12.00	1.10
UNNAMED UC BERKELEY	788	0.06	1.08	3.17	3.17	0.60	0.23	6.50	3.30
I80 EAST	12,375	0.58	2.67	4.00	4.00	0.63	0.06	4.00	2.11
PARK GATE	788	0.67	1.25	4.50	4.50	0.59	0.54	14.00	1.10
GREENWOOD COMMONS	675	1.00	1.25	2.00	2.00	1.06	0.97	9.00	1.24
THE CRESCENT	788	1.17	1.25	4.50	4.50	0.51	0.49	15.50	1.10
THE SHORT CUT	675	2.00	1.25	4.00	4.00	0.69	0.64	15.00	1.10
THE CROSSWAYS	675	2.33	1.25	4.00	4.00	0.68	0.63	14.00	1.10
THE SPIRAL	1,125	2.00	1.25	2.00	2.00	0.27	0.26	16.00	1.10

Street Name	Average ²¹ of								
	Total Capacity (vph)	Safety Score	Hazard Score	Connectivity	Accessibility	Congestion Score (Max)	Congestion Score (Min)	Service Score	Vulnerability Score
	 	 	 	 	 	 	 	 	 
EASTWAY	1,125	0.00	0.75	4.00	4.00	0.44	0.35	6.00	1.74
CHILTON ALLEY	675	1.00	0.75	4.00	4.00	2.96	1.87	4.00	2.68
EASTSHORE OFF I80	1,125	0.33	2.87	3.00	3.00	1.75	0.40	4.00	2.11
MASONIC AVE	900	0.00	0.67	6.00	6.00	0.90	0.80	4.00	1.35
ALBINA AVE	1,125	0.67	1.17	4.00	4.00	0.93	0.65	6.00	1.35
WATKINS ST	1,125	1.00	0.67	4.00	4.00	0.79	0.71	4.00	1.35
HOPKINS CT	1,125	1.67	0.67	4.00	4.00	0.92	0.64	6.00	1.35

Appendix E

Evacuation Time Study



Office of the City Manager

July 15, 2025

To: Honorable Mayor and Members of the City Council
From: Paul Buddenhagen, City Manager
Re: Evacuation Time Study

The purpose of this memo is to present the City Council with key findings from the Evacuation Time Study ("the Study").

In July 2025, KLD Associates, Inc. finished an Evacuation Time Study contracted by the City of Berkeley predicting evacuation dynamics during a wildfire, tsunami, or other major emergency. It estimates evacuation times for different parts of Berkeley, considering the time of day, day of the week, and season. It includes a series of "what-if" analyses that test strategies to improve evacuation times for Berkeley households and ingress times for emergency responders. The study also examines how future development or zoning changes that increase housing density in the Berkeley Hills may impact evacuation times. The impact of congestion patterns and traffic calming devices on traffic flow during evacuations is also analyzed. Finally, the Study offers recommendations for the City to consider to improve evacuation performance and enhance public safety during emergencies.

Memo Overview

This memo provides an overview of the Evacuation Time Study and presents key findings relevant to public safety and emergency planning. It begins by introducing the Study and summarizing evacuation time estimates across various hazard scenarios. Staff then offer a high-level analysis comparing these estimates with the expected arrival times of wildfire and tsunami threats, to better understand the implications for community safety.

The memo highlights evacuation behavior patterns specific to the Berkeley community, including projected transportation needs during a large-scale evacuation. These findings underscore the City's reliance on regional partners to provide mass transportation support during major emergencies. Community members should use these and other key study findings when creating or updating their household evacuation plans. The most important recommendations:

- Connect with neighbors and plan to help each other evacuate;

- Carpool when evacuating to reduce traffic and assist neighbors without vehicles;
- Berkeley Hills residents, especially those needing extra time or support, should plan to leave early during extreme fire weather; and
- People in Berkeley's tsunami zone (generally west of 7th Street) should include walking or biking in their tsunami evacuation plans when possible.

The memo then reviews the Study's findings on traffic flow and roadway use during evacuations. It emphasizes that all city roadways may be needed as evacuation routes and details areas where traffic congestion is expected. The Study finds that while parking restrictions may not significantly improve evacuation times for residents, they may support emergency responder access. The Study also notes that traffic congestion is expected in many areas during large-scale evacuations, and four areas consistently show congestion that is likely exacerbated by pre-timed traffic signals and street designs that slow or limit vehicle movement.

Next, the memo outlines Study findings about the impacts on evacuation times from increased density in the Berkeley Hills. Broadly speaking, adding people to the Berkeley Hills increases evacuation times for the area. Maximum permissible development of Accessory Dwelling Units (ADUs) and Junior Accessory Dwelling Units (JADUs) increases evacuation times for a 1923 Fire Repeat by 102% on average, and for a Panoramic Hill Fire by 52% on average. The model suggests that land use changes similar to the recently-approved Middle Housing Zoning could result in increases in evacuation times of up to 6% for a 1923 Fire Repeat. The percentage increases for Middle Housing are lower than ADU/JADU development because there are considerably fewer parcels likely to develop Middle Housing by 2031 as compared to maximum permissible ADU/JADU development. The memo details that even when new residents are assumed to use transit to evacuate, the additional density from maximum permissible development could increase evacuation times by as much as 70%. The memo then reports on Study findings about how a secondary egress route from Panoramic Hill could reduce evacuation times for the area, primarily benefitting Oakland residents.

Finally, the memo outlines key recommendations from the Study for City consideration. These include actions related to emergency response strategies, housing development policy, community alerting and education, traffic calming devices, traffic signal improvements, and parking and roadway design. City officials support the Study's findings and are working to incorporate these recommendations into future planning and operational efforts.

Introduction to the Evacuation Time Study

Evacuating people from hazardous areas is one of the most critical strategies for protecting the Berkeley community during wildfires, tsunamis, and other emergencies. Berkeley's roadway network is designed to balance the need for vehicle movement with safety goals—such as reducing speeds to lower the risk of severe or fatal traffic

crashes. During an emergency evacuation, this same network may be called upon to support the rapid, large-scale movement of tens of thousands of people, including:

- Residents, visitors, employees, and college students evacuating in personal vehicles and via public transit;
- Medical facilities, K-12 schools, preschools and daycares needing transit support;
- Residents without access to a vehicle requiring transit support, including specialized vehicles like wheelchair-accessible vans and ambulances; and
- Residents, employees, and college students who plan to evacuate on foot or bicycle.

These complex demands from a variety of users require a deep understanding of Berkeley's alerting systems, anticipated evacuee behaviors, estimated transportation resource needs, and roadway capacity and design. To support this understanding, the City of Berkeley contracted KLD Associates, Inc. to conduct a comprehensive Evacuation Time Study. The Study models how evacuation might unfold during a wildfire, tsunami, or other emergency, and analyzes factors such as roadway capacity, transportation resource needs, and expected evacuee behavior.

By examining each element individually and then analyzing how they interact during a large-scale evacuation, the Study provides valuable insights to guide disaster response planning, roadway design, land use and development decisions, and household-level evacuation preparation.

Evacuation Time Estimates (Section 7)

The Study groups areas of Berkeley into 14 different Evacuation Regions, each designed to answer a specific planning question—such as “How long will it take to evacuate people during a current-day repeat of the 1923 Berkeley Fire?” and “What patterns of traffic congestion could occur when Berkeley's roadway network is overtaxed?”

The Study models evacuations for both wildfire and tsunami scenarios, as well as areas likely to evacuate simultaneously. Evacuation time estimates vary based on the time of day, day of the week and season, as well as how quickly evacuees are able to prepare and get on the road (known as mobilization time).

Key evacuation time estimates include:

- **1923 Berkeley Fire Repeat:** In a scenario replicating Berkeley's most destructive historical fire, evacuation orders would stretch from Berkeley's eastern edge and extend as far west as Sacramento Street, involving residents from Marin Avenue stretching as far south as the UC Berkeley campus. Evacuation times for this area range from 1 hour and 35 minutes to 4 hours and 35 minutes. Notably, phasing the evacuation (having those closest to the fire leave first) did not

improve overall evacuation times—and in some cases, worsened them for both the broader area and those nearest the fire’s origin.

- Panoramic Hill Fire: In this area, which is shared with the City of Oakland and has only one road in and out, estimated evacuation times range from 45 minutes to 1 hour and 45 minutes.
- Tsunami Warning (East of I-80): In a tsunami warning scenario affecting areas east of I-80, evacuation times range from 55 minutes to 1 hour and 50 minutes to 2 hours and 15 minutes.
- Tsunami Warning (West of I-80): In a tsunami warning scenario that does not cross I-80, evacuation times range from 55 minutes to 1 hour and 45 minutes.

Evacuation is generally faster when the city’s population is lower—such as during the overnight hours, weekends, or summer, when K–12 schools are out of session and college/university populations are reduced.

For individual evacuees, leaving earlier can result in a faster evacuation trip. The Study also found that evacuating earlier leads to faster travel times. For example, households that begin evacuating 30 minutes after an evacuation order experience significantly less congestion than those who leave 60 minutes after the order is issued.

Understanding Community Risk: Comparing Evacuation Times to Hazards

The Study helps us understand how long it could take to evacuate different areas of the city. But evacuation times only tell part of the story. To fully understand the risk to our community, we must compare evacuation times with how quickly different hazards—like wildfires or tsunamis—could impact the community.

Tsunami

Tsunamis are usually caused by underwater earthquakes and can impact Berkeley. Berkeley’s tsunami zone starts at the Bay and extends eastward as far as 7th Street. Depending on a tsunami origin, Berkeley could have many hours of notice (for example, 12 hours for a tsunami originating in Japan), or only minutes for a tsunami originating in a fault in the Bay Area, which is considered less likely.

What the Modeling Shows

Depending on tsunami size and origin, the area of Berkeley that would need to evacuate could be different. The Study modeled evacuation times for two different Warning-level tsunamis:

- Tsunami Warning – Phase 3: For a tsunami reaching (but not crossing) I-80, evacuation times ranged from 0:55 to 1:20.
- Tsunami Warning - Max Phase: For a tsunami reaching as far east as 7th Street, evacuation times ranged from 1:50 to 2:15.

From this analysis, it is likely that most people will be able to evacuate out of the path of a tsunami. Although near-source tsunamis on local faults with only minutes of notice are possible, scientists consider this unlikely.

Berkeley Hills Fire

Wildfires are a serious threat to the Berkeley Hills. Fires can start in the wildlands to Berkeley's east and quickly spread into neighborhoods. Strong Diablo winds, dry fuels, and steep terrain spread fires more quickly and make them harder to stop.

In a fire, hills residents will need to evacuate using narrow, winding streets. The Study shows that these roadways can become overwhelmed with traffic during a large-scale evacuation, such as would be necessary during a major fire. To better understand the risk to the community, City staff studied a repeat of Berkeley's worst fire: the 1923 Berkeley Fire. Using historical data, staff modeled how quickly that fire might spread today and compared it with evacuation time estimates from the Study.

What the Modeling Shows

- Estimated evacuation time: 4 hours and 10 minutes (fall, midweek, midday)
- Estimated fire spread time: 5 hours from Berkeley's eastern border to Shattuck Avenue
- Key takeaway: Most people will be able to evacuate—but some could be overtaken by fire on the road as they try to escape.

This model assumes that responders will be able to issue evacuation orders one hour before a growing fire reaches the Berkeley border. Even with this early warning, evacuation time estimates indicate that fast-moving fire could overtake people who are still stuck in traffic.

A detailed version of this analysis is provided on the Evacuation StoryMap entitled "Evacuation and Fire Spread," available at <https://bit.ly/EvacuationStory>.

Applying the Findings

Across California and beyond, we have seen growing numbers of evacuees trapped in traffic as fast-moving fires overtake roadways—in Los Angeles, Lahaina, Paradise, and locally during the 1991 Tunnel Fire in the Oakland-Berkeley Hills. The Evacuation Time Study reinforces what Berkeley's emergency responders and many community members already understand: In a wind-driven wildfire, people in the fire's path may not have enough time to safely evacuate.

This analysis confirms the urgent need for a new, community-wide approach to evacuation planning and response in fire-prone urban areas like Berkeley—one that starts with individual households and extends to regional and State-level policy. Recognizing this risk, the Berkeley Fire Department has issued public advisories since

2018 on Extreme Fire Weather days—conditions under which a fire could spread faster than the community can evacuate. On those days, the Fire Department strongly recommends that residents leave the hills early, even before a fire starts.

In light of the Study’s findings, the Department will continue this practice. To further support residents’ leave early and evacuation planning, the Fire Department provides the Household Fire Weather Planning Tool and offers community workshops to help households create personal plans for Extreme Fire Weather days. In addition to these fire-focused offerings, the Berkeley Ready program will be providing family-oriented evacuation and go-bag workshops for all hazards, including tsunami, this summer and fall.

See *Community Outreach* below for details on upcoming trainings.

Additional Evacuation Time Study Findings

In addition to estimating how long it takes to evacuate different areas, the Evacuation Time Study includes important findings that can inform emergency response strategies, housing policy, public alert systems, transportation planning, and roadway design.

Community Evacuation Behaviors (Appendix D)

To better understand how residents and workers in Berkeley may respond during an evacuation, an online demographic survey was conducted. Berkeley community members completed a total of 1,453 surveys, corresponding to a sampling error of $\pm 2.5\%$ at the 95% confidence level based on the 2020 Census household data.

Key findings include:

- **Mobilization Time:** The survey asked evacuation behavior questions to calculate how long it would take people to start evacuating after receiving an order. Some community members may take up to 3.5 hours to get on the road. These longer “mobilization” times significantly increase an area’s overall evacuation time.

The survey didn’t ask separate questions for different types of emergencies—for example, a fire next to the home versus a tsunami hours away. In real life, people may move faster when the danger feels more immediate. To reflect this, the study established two evacuation times for each fire scenario:

- One based on actual survey responses
 - One using a faster “urgent mobilization” time to better represent how people might respond in a fast-moving fire.
- **School Pickups During Emergencies:** About 22% of households have children who attend school in Berkeley. During an emergency, 88.2% of these households plan to pick up their children or send someone they trust to do so.

This behavior is likely to create congestion around schools and in evacuating areas more broadly.

- **Transportation Access:** An estimated 12,870 residents do not have direct access to a vehicle and will need transportation assistance to evacuate in a vehicle. However, 87% of these individuals plan to ride with a friend or neighbor, leaving approximately 1,686 people (1.4% of the city) who will rely on government-provided transportation or other alternatives like walking and biking.
- **Special Assistance Needs:** About 6% of households reported that someone in their home would need help from outside the household (such as a caregiver or personal attendant) to prepare to evacuate or to get to a vehicle. Some will also require specialized transportation assistance: Citywide, approximately 1.6% of people will require a wheelchair accessible van, 0.2% require an ambulance and 0.4% require other modes of transportation. The remaining 3.8% do not require a specialized vehicle to evacuate.
- **Walking and Biking:** About 2.2% of residents, employees, and college students plan to evacuate on foot, while 1.4% plan to evacuate by bicycle.
- **Sheltering Plans:** The vast majority (89%) of respondents plan to evacuate to the home of a friend or family member, a hotel, motel, campground, short-term rental (e.g., Airbnb), or a second/seasonal home. 6% plan to use a public evacuation shelter. About 2% answered that they planned to evacuate to another location (work/office, vehicle, UC Berkeley campus, Berkeley marina, etc.). Another 2% responded that their evacuation location would depend on the emergency.
- **Evacuation Order Compliance:** During an emergency evacuation, 1% of people would disregard evacuation orders and stay in place.

Community Transportation Support Needs (Section 8)

The Study assessed the transportation resources required to evacuate community members who do not have access to a vehicle, including residents of special facilities (schools, preschools/day care centers, and colleges/universities), medical facilities providing inpatient care services (including skilled nursing facilities), and transit-dependent visitors and employees.

These groups would collectively require 571 buses, 161 wheelchair vans, and 253 ambulances. However, a simultaneous evacuation of all of Berkeley is not a realistic scenario. Modeling specific large-scale hazard scenarios provides more useful estimates for emergency planning. For example:

- **1923 Fire Repeat:** 262 buses, 48 wheelchair-accessible vans, and 66 ambulances will be needed to evacuate all populations at risk.

- Tsunami Warning – Max Phase: 41 buses, 4 wheelchair-accessible vans, and 8 ambulances will be needed for full evacuation of affected areas.

The City of Berkeley does not have its own mass transportation resources to be used in an evacuation, with the exception of two Aging Services shuttles. In any major evacuation, the City will be almost entirely dependent on support from local, regional and State partners to provide mass transportation assistance—both standard (e.g., buses) and specialized (e.g., ambulances and wheelchair vans). While coordination with these partners is essential, there is significant uncertainty about how many resources could realistically be made available to the City of Berkeley on short notice—particularly in high-demand scenarios like a repeat of the 1923 Fire, or in scenarios with simultaneous regional impact, such as a tsunami.

Staff expects considerable challenges in utilizing any available mass transit resources for evacuation, especially in a wildfire scenario. Roads may be blocked by debris or too crowded with evacuees. Additionally, conditions may be too dangerous to enter evacuating areas: buses are not equipped, and drivers are not trained, to navigate roadways that may be on fire.

To address these challenges, Berkeley staff will continue working with local and regional partners to identify creative and collaborative solutions to expand transportation capacity.

At the same time, staff will continue to explore strategies for use at the household and neighborhood level to help residents develop realistic, self-reliant evacuation plans, recognizing that government assistance may be limited or unavailable during large-scale emergencies. Community members should use these and other key study findings when creating or updating their household evacuation plans. The most important ideas to consider are:

- Connect with neighbors and plan to help each other evacuate;
- Carpool when evacuating to reduce traffic and assist neighbors without vehicles;
- Berkeley Hills residents, especially those needing extra time or support, should plan to leave early during extreme fire weather; and
- People in Berkeley's tsunami zone (generally west of 7th Street) should include walking or biking in their tsunami evacuation plans when possible.

Evacuation Routes and Signage (Section 9)

In suburban and rural areas, evacuation planning often depends on designating specific "Evacuation Routes" and guiding people to them with signage. In an urban environment like Berkeley, this strategy can actually increase evacuation times. Unlike rural areas—where a single road may be the only way out—Berkeley's dense, interconnected roadway network offers multiple paths to safety. Directing all evacuees to a few

designated routes can overwhelm those corridors, leading to traffic bottlenecks and slower overall evacuation times.

Even Berkeley's highest-capacity roadways—often referred to as the city's traditional "evacuation routes"—are not designed to handle the full volume of traffic in a large-scale evacuation. The Study shows that evacuation times are shorter when vehicles are spread across all available roadways, rather than funneled onto a limited number of higher-capacity streets.

While the Study identifies roadways in Berkeley with greater traffic-handling capacity, these should not be considered exclusive or official "Evacuation Routes." Instead, all roadways should be treated as potential evacuation routes. This approach maximizes the flexibility and efficiency of the city's evacuation system.

Parking Restrictions to Improve Evacuation and Responder Ingress (Section 9)

The Study finds that temporary or permanent parking restrictions (such as red curbing) are unlikely to significantly improve evacuation flow in the Berkeley Hills. The main constraint on vehicle movement in an evacuation is not the reduced roadway width from parked cars, but rather congestion at intersections, which are limited in their capacity to manage merging traffic from multiple directions. In fact, removing parked cars may cause vehicles to reach these chokepoints more quickly, potentially worsening overall congestion.

However, the Study does identify a potential benefit for emergency responders. Parking restrictions could improve emergency vehicle ingress, both during evacuations and day-to-day operations. Targeted restrictions on key roadways used by emergency response vehicles can enhance maneuverability and reduce delays for critical services—without requiring broad parking bans that provide limited benefit to evacuation flow. This targeted approach allows the City to improve emergency access where it matters most, while minimizing unnecessary impacts to residents.

Traffic Congestion Patterns (Appendix F)

Traffic congestion is a major factor that slows evacuation and is expected to occur across all scenarios studied. Congestion is most severe during daytime, midweek, and fall conditions, when Berkeley experiences its highest levels of vehicle activity.

In a 1923 Fire Repeat scenario, extreme congestion is widespread. This significantly increases the time evacuees spend on the road and raises the risk that some may be directly impacted by the fire while still attempting to escape.

For a Tsunami Warning – Max Phase, congestion is also expected—particularly on key roads in West Berkeley and along the waterfront. In the rare event of a tsunami caused by a local earthquake, some evacuees may still be on the road when the waves arrive.

These findings emphasize the importance of early evacuation, effective public alerting, and distributing traffic across all available roadways to reduce delays and improve safety.

Evacuation Traffic Congestion Analysis (Appendix F, Appendix G, and Section 10)

The Study identifies patterns of traffic congestion during a range of evacuation scenarios (Appendix F). Modeling shows that, in certain cases, particularly during wildfires, congestion becomes widespread across the roadway network, increasing the risk that evacuees could be overtaken by fire before reaching safety.

While traffic congestion occurs citywide, four areas consistently exhibit patterns likely worsened by pre-timed traffic signals and roadway designs that slow vehicles or restrict their movement:

- South and West of the UC Berkeley Campus
- South and West of Clark Kerr Campus
- North of Ohlone Park
- Lawrence Berkeley National Laboratory

For each of these areas, the Study details how traffic calming devices (TCDs), pre-timed signals, and other attributes of Berkeley's roadway network or built and natural environment affect evacuation traffic flow (Appendix G).

Traffic calming devices, such as diverters, traffic circles, and speed humps, are intentionally designed to reduce vehicle speeds for pedestrian safety, impose capacity constraints, and/or disrupt network connectivity for vehicles. Analysis confirms that these devices are functioning as intended, effectively lowering vehicle speeds. However, this design approach can conflict with the primary objective during an evacuation: enabling the swift and efficient movement of people out of the affected area.

Berkeley's pre-timed traffic signals operate on fixed schedules, without adjusting to real-time traffic conditions. During an evacuation, this inflexibility can worsen congestion and delay evacuees. In contrast, actuated signals respond to actual demand at each approach, allowing for more efficient traffic flow. The Study found that converting Berkeley's pre-timed signals to actuated signals could reduce evacuation times by up to 13% (see Section 10).

Analyzing Increased Hills Density (Section 10.5)

The City also used the Study to better understand impacts to evacuation times from potential development in the Berkeley Hills from Accessory Dwelling Units (ADUs), Junior Accessory Dwelling Units (JADUs), and Middle Housing.

As noted above in *Understanding Community Risk: Comparing Evacuation Times to Hazards*, under present-day development levels, a catastrophic wind-driven fire could overtake evacuees as they try to escape the Berkeley Hills. There are no feasible options to significantly increase the capacity of the area's roadway network. This means that as density increases in the Berkeley Hills, so does the number of residents who may be unable to escape in time during a fast-moving wildfire.

The Study used two different approaches to measure impacts from ADUs/JADUs and from Middle Housing.

Middle Housing

In June 2025, the Council changed zoning laws to permit Middle Housing in all areas of Berkeley except for the Hillside Overlay, pending results of the Evacuation Time Study. For Middle Housing, the Study's goal was to directly inform the Berkeley City Council on impacts to evacuation times from Middle Housing in the Hillside Overlay. The Study assumed land use changes similar to allowable development levels from the recently-approved Middle Housing zoning ordinance.

ADUs/JADUs

In 2022, the California Department of Housing and Community Development (HCD) found Berkeley's local ordinance regulating ADU development in the Hillside Overlay to be out of compliance with State law. HCD stated the City did not adequately demonstrate that new ADUs in the Hillside Overlay would actually impact public safety and evacuation. HCD claimed that the UC Berkeley analysis that the City cited was not specific enough. HCD staff confirmed that if the City wanted to maintain certain provisions of the local ordinance, the City should provide more detailed and specific evidence to support the findings.

The City designed analysis under the Evacuation Time Study to be responsive to these HCD concerns. The Study considered impacts to evacuation times from theoretical maximum levels of ADU/JADU development permissible under State law, which would equate to adding 3 ADUs on every eligible parcel. While this projection vastly overestimates the likely extent of ADU development, precise estimates of long-term development levels are difficult to pinpoint. Out of an abundance of caution, and to be responsive to HCD's comments on the City's ADU ordinance, the Study assumed a maximum permissible level of ADU development in its model.

Analysis Structure and Results

The analysis examined these development types separately and together. Studies also explored how evacuation times would be affected if ADU/JADU residents living near public transit did not own vehicles and instead relied on public transit in an evacuation. Broadly speaking, the Study found that adding people to the Berkeley Hills increases evacuation times for the area.

Before analyzing the impact of ADUs/JADUs and Middle Housing in the Berkeley Hills, the Study created a Future Case to serve as a baseline. This Future Case reestablishes evacuation time estimates using Berkeley's projected population growth through 2031. When evaluating the specific effects of ADUs/JADUs and Middle Housing in the Berkeley Hills, the Future Case provides a more accurate comparison point than present-day evacuation time estimates. The Study then measured evacuation times with ADUs/JADUs and Middle Housing in the Berkeley Hills, comparing them against this Future Case to isolate their impact.

The Study considered four evacuation regions, with the 1923 Fire Repeat and the Panoramic Hills Fire best representing potential hazard scenarios. Key findings include:

- Theoretical maximum ADU/JADU development increased evacuation times for a 1923 Fire Repeat by 102% on average, and for a Panoramic Hill Fire by 52% on average.
- Likely Middle Housing development through 2031 also increased evacuation times by up to 6% for a 1923 Fire Repeat. It did not have an impact on Panoramic Hill Fire evacuation times, because City Council direction and the Housing Element did not include Panoramic Hill (designated ES-R) for proposed Middle Housing. The percentage increases for Middle Housing are lower than ADU/JADU development because there are considerably fewer parcels likely to develop Middle Housing by 2031 as compared to maximum permissible ADU/JADU development.
- Combining ADU/JADU and Middle Housing increases evacuation times above the Future Case by 105% on average for a 1923 Fire, and about 54% on average for Panoramic Hill Fire.
- Evacuation times still increase when ADU/JADU dwellers living near transit do not own cars. Analysis assumed that residents of ADUs and JADUs living within a ½ mile of a transit stop would not own cars, and would rely on public transit to evacuate. Evacuating all of the ADU/JADU dwellers in the Hillside Overlay living near transit, would require an additional 1,051 buses. If ADU/JADU dwellers living near transit do not own cars, the 1923 Fire Repeat evacuation times increase by 65% on average, and by 70% on average for Panoramic Hill Fire.
- Finally, if Middle Housing is added to the analysis above, evacuation times further increase. Middle Housing zoning changes are not expected to influence occupants' vehicle ownership, so Middle Housing dwellers are assumed to evacuate in personal vehicles. When compared to the Future Case, evacuation times increase by 68% on average for the 1923 Fire Repeat and 69% on average for the Panoramic Hill Fire.

Comparing Study Findings with Current ADU Development Levels

Currently, Berkeley sees about 100 new ADUs per year citywide, with approximately 15% located in the Hillside Overlay. While the Evacuation Time Study analyzed evacuation impacts from the theoretical maximum level of ADU development allowed under State law, it did not model impacts from current ADU development rates.

However, the Study's analysis of Middle Housing provides a basis for general comparisons. Present-day ADU development in the Hillside Overlay adds far fewer residents than likely Middle Housing development, suggesting that the resulting increases in evacuation times from ADUs are likely lower than those from Middle Housing.

Still, even at today's lower development levels, ADU-related impacts on evacuation exist—and will compound an already high-risk baseline, where current conditions could result in some evacuees being overtaken by fire.

Because any increase in density in the Hillside Overlay contributes to longer evacuation times, the City could consider adopting more restrictive local development standards for ADUs in the area. This could include limiting ADUs to the minimum size and height permitted under State law. Smaller ADUs may reduce the number of additional residents needing to evacuate, helping to slightly slow the increase in evacuation times associated with ADU development.

Analysis: Second Egress Route from Panoramic Hill (Section 10.4)

Panoramic Hill, a neighborhood shared by Berkeley and Oakland, has only one road in and out: Panoramic Way. The Study modeled whether adding a second way out of Panoramic Hill could improve evacuation times. A conceptual second exit route was considered, connecting Dwight Place in Oakland to Dwight Way in Berkeley. This conceptual route is on land at the intersection of four jurisdictions: the City of Berkeley, East Bay Regional Park District, the City of Oakland, and the University of California.

When evacuation times were modeled using the mobilization times (the time it takes people to get ready to leave) reported by the community in the demographic survey, the second exit did not reduce overall evacuation times for Panoramic Hill. This is because the overall evacuation time was extended not by traffic delays but instead by how long people reported it would take them to prepare to leave.

However, in a fast-moving wildfire, people may leave more quickly than they reported in the survey. To account for this, the Study also modeled an evacuation where everyone in Panoramic Hill leaves 30 minutes after receiving an evacuation order. In this case, the maximum time benefit from a second exit was 25 minutes (from a baseline of 1:25 to evacuate all of Panoramic Hill midday, during the week, during the fall, to 1:00 with the notional secondary route). This is a reduction of 29%.

This reduction would largely benefit the evacuation times for Oakland residents on the eastern half of Panoramic Hill (Based on Berkeley's weather patterns, a wind-driven fire would move from northeast to southwest. The general pattern of evacuation movement will be westward, meaning that residents of the western/lower/Berkeley portion of the hill would not be likely to navigate east/uphill to use the secondary route.). By providing a more direct way out for the eastern portion of Panoramic, the secondary route shortens those residents' evacuation distance and associated travel times. This consequently lowers the overall times to fully clear Panoramic Hill when Berkeley and Oakland are considered together. The City of Oakland and its residents may consider further exploration of this topic with appropriate stakeholders.

Evacuation Time Study Recommendations (Section 11)

The findings of the Evacuation Time Study offer valuable insights to guide Berkeley's disaster response planning, transportation and roadway design, land use policies, and household-level evacuation preparedness. City officials support the Study's recommendations and are actively working to integrate them into future workplans, emergency planning efforts, and policy development.

Study recommendations are:

1. Emergency Response Strategies

- 1.1. Overlay evacuation time estimates with hazard-specific data (such as fire spread rates for fire regions, and tsunami arrival times on tsunami warning regions.)
- 1.2. Develop regional/State planning partnerships to quantify resource shortfalls for transit-dependent evacuees.
- 1.3. Use study results to prioritize specific locations for Traffic Control Points (staff intersections and help improve traffic flow) during evacuations.
- 1.4. During evacuations, reduce or eliminate external/pass-through traffic. This can include use of electronic roadside signage, closure of off-ramps into Berkeley, and/or diversion of through traffic to other routes.
- 1.5. Encourage schools to develop and communicate site evacuation plans that enable parents and guardians to pick up their children at sites outside the evacuation zone.

2. Extreme Fire Weather Leave Early Policy

- 2.1. Maintain Berkeley Fire Department Leave Early Policy for extreme fire weather. Focus on households at relatively greater risk due to extended mobilization times and/or on neighborhoods with extended driving times due to severe congestion.

3. Housing Development Policies

- 3.1. Institute separate, more restrictive ADU/JADU development provisions in the Hillside Overlay.
- 3.2. Examine ETE increases from Middle Housing zoning changes in the Hillside Overlay in the context of fire spread scenarios.
- 3.3. Consider impacts to evacuation when implementing zoning changes that could result in an increase in demand on roadways used by wildfire or tsunami evacuees.

4. Community Alerting

- 4.1. Conduct community education about Berkeley's evacuation zones, the emergency alerting systems that will provide evacuation orders/warnings, and how community members can register for/opt-in to those systems.
- 4.2. Conduct community education to encourage potential evacuees to monitor evolving conditions and stay in contact with social networks.
- 4.3. Clearly define areas at risk as well as areas not at risk in public alerts. Include explicit instructions for people outside the hazard area to shelter in place.

5. Improving Household Mobilization and Evacuation Travel Times

- 5.1. Encourage carpooling.
- 5.2. Encourage familiarity with primary, secondary, and tertiary evacuation routes.
- 5.3. Parents should make provisions with schools to pick up children outside the evacuation zone.
- 5.4. Commuters should plan to remain outside of the evacuation zone and reunite with other household members outside the hazard area, instead of returning to the evacuation zone.

6. Evacuating on Bicycle and Foot

- 6.1. Encourage community members to explore walking or cycling for household/business tsunami evacuation plans.

7. Traffic Calming Devices

- 7.1. Existing Infrastructure: Develop a citywide connectivity and evacuation capacity improvement strategy, integrating approaches such as actuated or adaptive

signal timing and replacing TCDs with removable/retractable options, and other evolving technologies.

7.2. Future infrastructure: Develop and implement a methodology to evaluate and consider evacuation efficiency and roadway capacity during the planning and implementation phases of future roadway infrastructure development, including TCD installations.

7.3. First Responder response times: Develop and implement a methodology to assess impacts from TCDs to first responder response times in daily traffic environments.

8. Traffic Signal Improvements

8.1. Optimize Signal Timing Plans: Evaluate and implement improved signal timing strategies, including actuated and adaptive systems.

8.2. Install Battery Backup Systems: Upgrade all traffic signal cabinets to include battery backup systems that can operate for a minimum of 6-8 hours.

8.3. Enhance Emergency Vehicle Pre-emption: Evaluate potential improvements to traffic signal system to have the latest pre-emption equipment and capabilities.

8.4. Strengthen Communications Infrastructure: Install a robust fiber-optic network to improve the reliability and speed of traffic signal communications.

8.5. Deploy Smart Traffic Cameras: Install smart traffic cameras at key intersections and corridors to provide real-time detection, monitoring, and traffic data collection.

8.6. Implement Transit Signal Priority (TSP) for public transit vehicles: Upgrade traffic signal system along Berkeley's highest capacity routes.

8.7. Coordinate Regionally: Work closely with surrounding jurisdictions to ensure interoperability and synchronization of traffic signal systems during emergency evacuations.

8.8. Traffic Signal Software for Centralized Control: Assess the need for traffic signal software upgrades to enable full communication with external systems and centralized command through the City's envisioned Traffic Management Center (TMC).

9. Parking Restrictions

9.1. Explore parking restrictions along arterial roadways in the Berkeley Hills utilized by emergency response vehicles for ingress during emergency response.

- 9.2. Explore temporary parking restrictions implemented on certain roadway segments only during hazardous conditions (e.g., fire weather) to improve emergency responder ingress times during evacuations.

Community Evacuation Education

While the Evacuation Time Study is a technical document designed to guide emergency planning and response, City staff have taken steps to make its findings accessible and actionable for the broader Berkeley community.

Berkeley's Evacuation StoryMaps

To help translate complex Study findings into useful public information, staff developed a series of interactive ArcGIS StoryMaps, available online at <https://bit.ly/EvacuationStory>. These StoryMaps use clear visuals, maps, and narrative storytelling to explain key insights from the Study and provide practical guidance for residents.

The StoryMaps cover the following topics:

1. The Evacuation Time Study Project: Explains why the Study was conducted and highlights key evacuation time estimates for different hazard scenarios.
2. Household Evacuation Planning: Offers useful takeaways from the Study to help residents create their own evacuation plans.
3. Evacuation and Fire Spread: Compares wildfire spread rates in the Berkeley Hills with evacuation timelines to assess risk to the community.
4. Improving Evacuation Times: Evaluates proposed ideas such as parking restrictions and road design changes to see whether they would meaningfully improve evacuation safety or speed.

In addition to content focused on the Evacuation Time Study, the Evacuation StoryMap collection also includes content addressing State evacuation planning requirements:

1. Access Impaired Neighborhoods Analysis: Addresses the requirements of Senate Bill 99, which mandates identification of residential developments in hazard areas that lack at least two emergency evacuation routes.
2. Evacuation Route Safety, Capacity and Viability Analysis: Addresses the requirements of Assembly Bill 747, which requires local governments to assess the capacity, safety, and viability of evacuation routes under various emergency conditions.

Community Outreach

Staff have begun incorporating key findings from the Evacuation Time Study into existing community preparedness education efforts. This includes integration into

workshops such as the Household Fire Weather Planning Workshop, which guides people in creating a plan to stay safe during fire season, and the Family Emergency Preparedness Workshop, which provides essential tips and tools to stay safe during emergencies, including evacuation and go-bag planning. These workshops are held periodically online and at public venues like libraries. Upcoming trainings (with advance registration required) are listed below:

Household Fire Weather Planning Workshop

- Tuesday, August 19 from 7pm to 8pm on Zoom, [link to register](#)
- Thursday, September 4 from 5pm to 6pm at North Branch Library, [link to register](#)
- Monday, September 15 from 12pm to 1pm at Claremont Branch Library, [link to register](#)

Family Emergency Preparedness Workshops (for families with children)

- Saturday, August 23 from 11am to 12pm at North Branch Library, [link to join waitlist](#) (sold out)
- Saturday, September 27 from 3pm to 4pm at Central Library, [link to join waitlist](#) (sold out)
- Saturday, October 4 from 11am to 12pm at Claremont Branch Library, [link to register](#)

Attachments:

1. Evacuation Time Study
2. Evacuation StoryMaps Text-Only Version (Screen Reader Accessible)
3. Resolution No. 70,712-N.S. Contract: KLD Engineering, P.C. for Evacuation and Response Time Modeling (adopted March 14, 2023)
4. Resolution No. 71,368-N.S. Contract No. 32300165 Amendment: KLD Engineering, P.C. for Evacuation and Response Analysis (adopted June 4, 2024)
5. Household Fire Weather Planning Tool

cc:

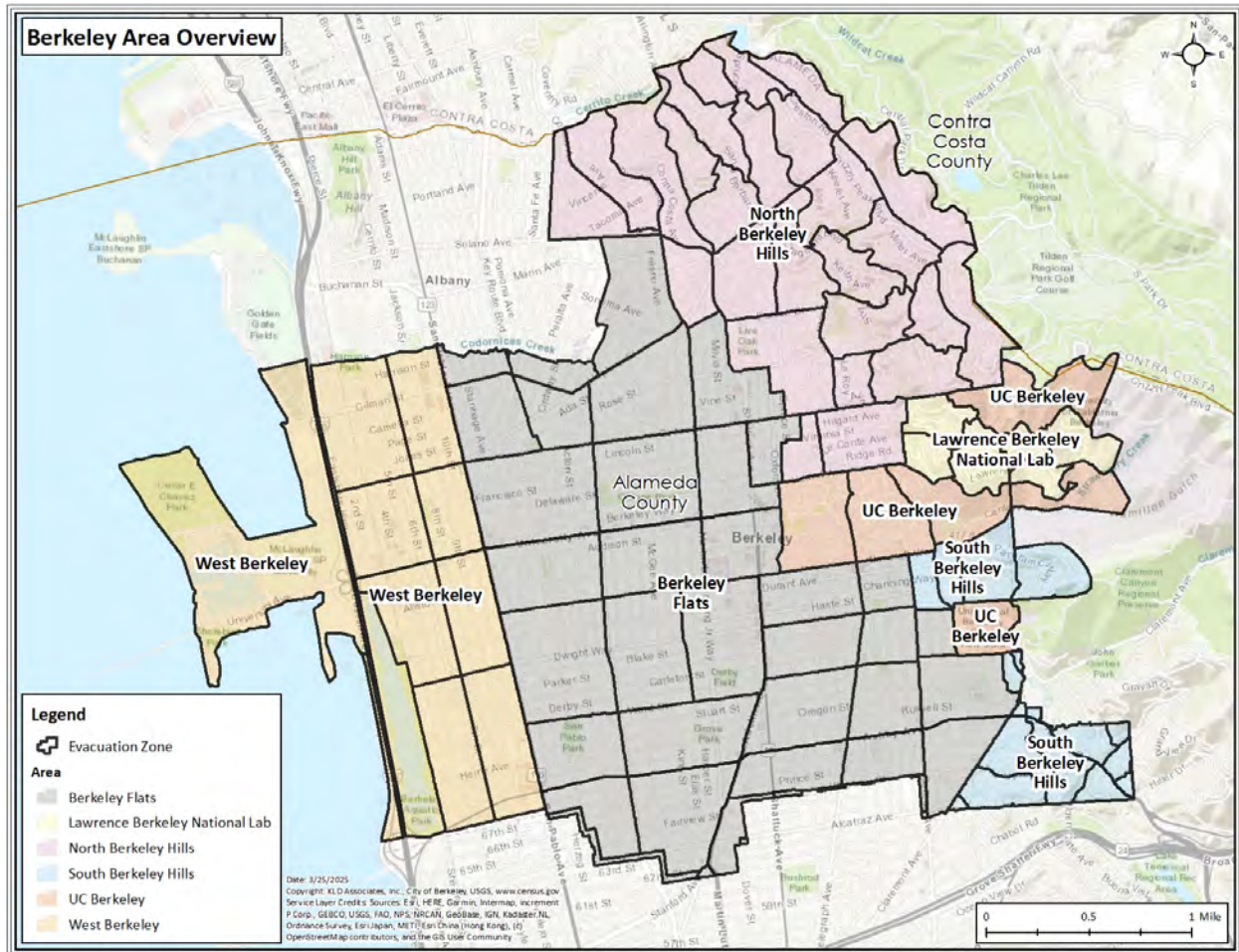
David White, Deputy City Manager
David Sprague, Fire Chief
Terrance Davis, Director of Public Works
Jordan Klein, Director of Planning & Development
Jen Louis, Police Chief

Jenny Wong, City Auditor
Farimah Brown, City Attorney
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City of Berkeley

Evacuation Time Estimate Study



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EXECUTIVE SUMMARY

A key element of protecting the Berkeley community during wildfires, tsunamis, and other emergencies is safely evacuating people from danger zones. On a typical day, Berkeley's road network balances traffic flow with speed reduction to minimize injuries and/or fatalities. In an emergency, however, it may need to handle the rapid evacuation of tens of thousands of people away from a hazard, including:

- Residents, visitors, employees, and college students evacuating in personal vehicles and via public transit;
- Medical facilities, K-12 schools, preschools and daycares needing transit support;
- Residents without access to a vehicle requiring transit support, including specialized vehicles like wheelchair-accessible vans and ambulances; and
- A small percentage of Berkeley residents, employees, and college students who plan to evacuate on foot or bicycle.

Managing the complex needs of diverse users during emergencies requires a clear understanding of Berkeley's emergency alerting systems, evacuee behavior, transportation needs, and road capacity. To support this, the City has contracted KLD Associates, Inc. to study evacuation dynamics during wildfires, tsunamis, and other emergencies. By analyzing these factors individually and in combination, the study will help guide disaster response, transportation planning, development policy, and household evacuation plans.

This study provides **Evacuation Time Estimates (ETE)** for different conditions—such as time of day, day of week, and season—based on congestion patterns during potential evacuations in Berkeley. **ETE measures the time needed to exit the zones under evacuation order, not to reach a final destination.** The analysis includes evacuation sensitivity studies, which analyze the impact of traffic calming measures, increased housing density, and evacuation tactics to inform emergency planning and decision-making.

City of Berkeley

The City of Berkeley is located on the eastern shore of the San Francisco Bay within Alameda County, California. The eastern edge of Berkeley, bordering Contra Costa County, is defined by the Berkeley Hills, a significant wildland-urban interface, creating a unique interface between urban development and fire-dependent natural ecosystems.

The city is densely populated and occupies an area of about 10.5 square miles.

The city houses approximately 117,000 residents. The city is divided into 106 Evacuation Zones¹. Figure 6-1 shows a map of the Evacuation Zones which were considered for this study.

¹ <https://protect.genasys.com/>

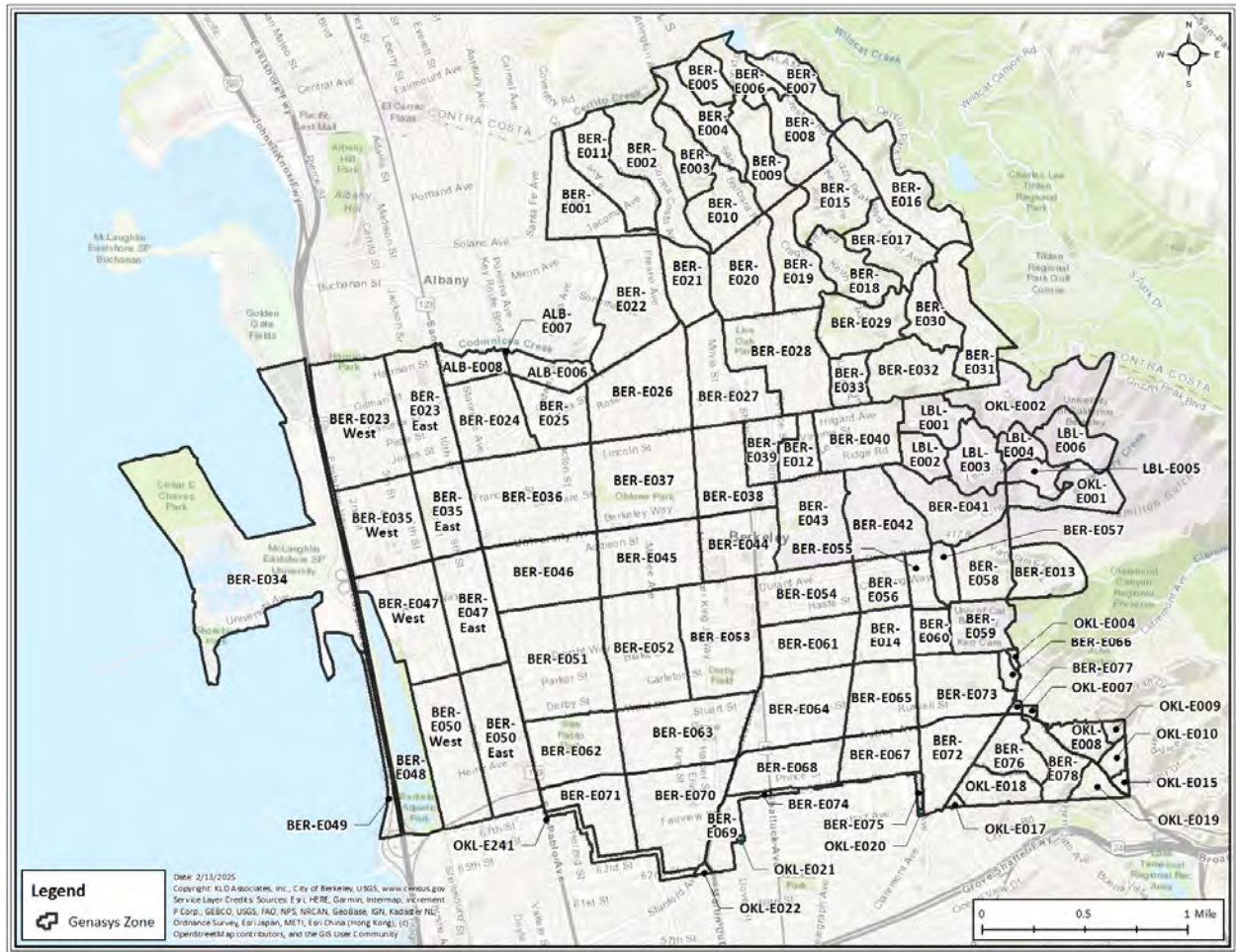


Figure 6-1. Evacuation Zones Boundaries

Berkeley's road network is characterized by predominantly north-south routes and limited east-west connectivity. In addition to the approximately 90,000 vehicles that may need to evacuate the city, Berkeley's position in the heart of the Bay Area means that another 47,000 additional vehicles passing through Berkeley as external traffic could also be traversing Berkeley roadways while evacuation was underway. All of these factors could contribute to difficulties in evacuating during an emergency.

Evacuation Regions

This study groups Berkeley's Evacuation Zones (displayed in Figure 6-1) into 14 different Evacuation Regions. Each Region is included in this study to inform a specific planning question from the City of Berkeley.

Evacuation Regions and Study Questions

See Appendix E for maps visualizing these Regions.

Region		Planning Question
R01	Citywide Evacuation	Transportation planning: What patterns of traffic congestion could occur when Berkeley's roadway network is overtaxed?
R02	Fire - 1923 - All	Hazard analysis: How long will it take to evacuate people during a current-day repeat of the 1923 Berkeley Fire?
R03	Fire - 1923 - Phase a (0 minutes)	Hazard analysis: Will phasing evacuation improve evacuation times for a repeat of the 1923 Berkeley Fire?
R03	Fire - 1923 - Phase b (0 + 90 minutes)	
R03	Fire - 1923 - Phase c (0 + 180 minutes)	
R04	Panoramic Hill Fire	Hazard analysis: How long will it take to evacuate people during a fire affecting Panoramic Hill?
R05	Fire Zones - Fire Zones 2 & 3 Combined	Included to analyze administrative changes that could affect development in the Berkeley Hills.
R06	Tsunami - Phase 3	Hazard analysis: How long will it take to evacuate people from a tsunami affecting areas west of I-80?
R07	Tsunami - Max Phase	Hazard Analysis: How long will it take to evacuate people from a tsunami that crosses I-80?
R08	Berkeley Flats	How long will it take to evacuate specific geographic areas of Berkeley?
R09	North Berkeley Hills	
R10	South Berkeley Hills	
R11	West Berkeley	
R12	UC Berkeley	
R13	Lawrence Berkeley National Lab	
R14	UC Berkeley + Lawrence Berkeley National Lab	

Evacuation Time Estimates

The study modeled evacuations associated with wildfire and tsunami, as well as areas that may evacuate together. Evacuation time estimates are influenced by scenario (time of day, day of week, and season) as well as how quickly evacuees prepare to leave and enter the roadway (mobilization time). Key evacuation time estimates include:

- In a current-day repeat of the 1923 Berkeley Fire, known as Berkeley’s worst, the time to evacuate people out of the hazard area ranges from 1:35 (hh:mm) to 4:35². Phasing the evacuation – evacuating areas at risk in stages, with the closest to the fire leaving first – results in similar or worse evacuation times, both for the area overall and for the populations closest to the origin of the fire.
- In a fire affecting Panoramic Hill, an area shared with the City of Oakland with one way in and out, the time to evacuate people out of the hazard area ranges from 0:45 to 1:45.
- In a Tsunami Warning affecting areas east of I-80, evacuation times range from 0:55 to 1:45. It should be noted that in the December 5, 2024 Tsunami Warning, as part of a Max Phase evacuation, this area was evacuated approximately 1 hour after the National Tsunami Warning Center issued alerts, and 45 minutes after evacuations of the area began.

Table 7-4 summarizes the ETE values recommended for use in response plans based on the analysis of this report (Section 7). Rows marked “Urgent Mobilization” present ETE expected when evacuees mobilize more quickly than would be predicted from responses to a community survey conducted from August 10 – October 8, 2023 (see “Community Evacuation Behaviors” below and Appendix D for further survey details). Urgent Mobilization times are associated with no-notice evacuations, such as wildfires that ignite in close proximity to the city.

² These times include base case 90th and 100th percentile ETE and urgent mobilization ETE.

Table 7-4. Time to Clear the Indicated Area for Response Plans

	Summer	Summer	Summer	Fall	Fall	Fall
	Midweek	Weekend	Midweek Weekend ³	Midweek	Weekend	Midweek Weekend ⁴
Scenario:	1	2	3	4	5	6
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
R01 - Citywide Evacuation	5:10*	4:25*	2:30	5:35*	4:00*	2:30
R02 - Fire 1923	2:25	1:50	1:45	4:10*	1:50	1:45
R02 - Fire 1923 Urgent Mobilization	2:25	1:50	1:35	4:10*	1:45	1:35
R03 - Fire 1923 Phase a	4:25*	4:30*	1:40	4:30*	4:15*	2:10
R03 - Fire 1923 Phase a Urgent Mobilization	2:30*	2:10*	1:25	3:30*	2:10*	1:35
R03 - Fire 1923 Phase b	6:10*	5:55*	2:15	6:15*	6:00*	2:30
R03 - Fire 1923 Phase b Urgent Mobilization	4:00*	4:00*	1:40	4:00*	2:10*	1:40
R03 - Fire 1923 Phase c	4:10	4:20	4:30	4:00	4:25	4:35
R03 - Fire 1923 Phase c Urgent Mobilization	3:35	3:45	1:40	3:50	1:30	1:40
R04 - Panoramic Hill Fire	1:40	1:35	1:40	1:45	1:35	1:40
R04 - Panoramic Hill Fire Urgent Mobilization	1:05	0:50	0:45	1:45	0:50	0:50
R05 - Fire Zones 2 & 3 Combined	2:05	1:55	1:45	2:20	1:55	1:45
R06 - Tsunami - Phase 3	1:20	1:20	1:05	1:45	0:55	1:10
R07 - Tsunami - Max Phase	2:15	2:10	1:50	2:15	2:05	1:50
R08 - Berkeley Flats	4:10*	2:35	2:10	4:20*	2:25	2:05
R09 - North Berkeley Hills	2:10	2:00	1:50	2:05	1:50	1:45
R10 - South Berkeley Hills	1:35	1:30	1:35	2:15	1:35	1:35
R11 - West Berkeley	1:40	1:35	1:35	1:45	1:35	1:35
R12 - UC Berkeley	1:05	1:15	1:25	1:20	1:30	1:35
R13 - Lawrence Berkeley National Lab	1:25*	0:45	0:45	2:15*	0:45	0:45
R14 - UC Berkeley + Lawrence Berkeley National Lab	1:30	1:15	1:20	2:15	1:30	1:35

³ Nighttime scenarios (Scenarios 3 and 6) have approximately the same demand between midweek and weekends.

⁴ Nighttime scenarios (Scenarios 3 and 6) have approximately the same demand between midweek and weekends.

* Entries with an asterisk are 100th percentile ETE. All other ETE presented in Table 7-4 are the 90th percentile ETE. See Section 7 for details.

Overall evacuation times are faster when Berkeley's population is lower: at night, on weekends, and during summertime, when K-12 schools are not in session and college/university populations are significantly reduced.

For individual evacuees, leaving earlier can result in a faster evacuation trip. Analysis shows that all households who start evacuation trips 30 minutes after receiving an evacuation order will encounter less traffic congestion than they would leaving 60 minutes after the order is issued. For example:

- In a repeat of the 1923 Fire (R02), a 30-minute delay in beginning the evacuation trip also adds another 35 minutes to a vehicle's travel time. This 30-minute delay in leaving, coupled with the additional time on the road, almost doubles an evacuee's overall time from receiving an evacuation order to exiting the evacuated area – from 70 minutes overall to 135 minutes.
- In a Tsunami Warning affecting areas east of Interstate 80, leaving 30 minutes later would add another 45 minutes to a vehicle's travel time. See "Evacuee Experience" writeups in Section 7 for details.

Community Evacuation Behaviors

An online demographic survey was conducted of the people living and working in Berkeley; 1,453 households responded to the survey, which corresponds to a sampling error of $\pm 2.5\%$ at the 95% confidence level based on the 2020 Census household data.

The survey gathered demographic information (average household size, vehicle ownership, etc.), behavioral responses (would evacuees follow evacuation instructions issued by local officials), and time to complete mobilization activities.

Key takeaways include:

- Community members could take as long as 3.5 hours to start their evacuation trip ("mobilize"). Longer mobilization times lead to longer evacuation times overall (Section 7). Populations with the shortest mobilization times are employees and visitors. The population with the longest mobilization times is households with commuters who plan to pick up children from school in an emergency. See Section 5 (Table 5-9) and Appendix D.
- Approximately 22% of households have children who attend school in Berkeley. In an emergency, 88.2% of those households plan to pick up their children or send a trusted guardian to pick up their children at school. This behavior is expected to increase traffic congestion immediately around schools and in evacuating areas more broadly.
- Automobile ownership: The average number of automobiles available per household is 1.55. 73.6% of households would use 1 vehicle for evacuation; 14.6% plan to use 2. Approximately 97% of households of 2 or more people have access to at least one vehicle. 7.5% of all households do not have access to a vehicle. See Appendix D.

- Citywide, 12,870 residents do not have direct access to a vehicle and will require transportation assistance. However, approximately eighty-seven percent (87%) of Berkeley's transit-dependent population will rideshare with a neighbor or friend. This leaves 1,686 (1.4%) of residents citywide who will rely on transportation assistance from the government. (See Table 3-10 and Appendix D.)
- Six percent of households indicated that someone in the household would need help from someone outside the household (caretaker, personal attendant) to prepare to evacuate or to get to a vehicle. Some will also require specialized transportation assistance: Citywide, approximately 1.6% of people will require a wheelchair accessible van, 0.2% require an ambulance and 0.4% require other modes of transportation. The remaining 3.8% do not require a specialized vehicle to evacuate.
- Citywide 2.2% of Berkeley residents, employees, and college students plan to evacuate on foot and 1.4% plan to evacuate on bicycle. (Appendix D)
- During an emergency evacuation, 1% of people would disregard evacuation orders and stay in place. (See Appendix D)
- Emergency officials may notify people outside a hazard area that they are not in danger, and that they are requested to shelter in place (not evacuate). Ninety percent (90%) of households would comply with this request and the remaining 10% would choose to evacuate the area. (See Appendix D)
- Eighty-nine percent (89%) of emergency evacuees plan to evacuate to a friend or relative's home, a hotel, motel, campground, short-term rental (ex. AirBnB/VRBO), or second/seasonal home. Approximately 6% plan to evacuate to an evacuation shelter. See Figure D-12 for complete results.
- Approximately 50% of households have pets. Approximately 38.4% of households have small pets/animals and 11.3% have large pets/animals. Figure D-15 displays these results.

Community Transportation Support Needs

Analysis quantified the transportation resources needed to support evacuation of all Berkeley residents who lack access to a vehicle, residents of special facilities (schools, preschools/day care centers, and colleges/universities), medical facilities providing inpatient care services (including skilled nursing facilities), and transit-dependent visitors and employees. Citywide, these groups collectively require 571 buses, 161 wheelchair vans, and 253 ambulances to evacuate. See Table 8-1 for additional details. However, as discussed in Section 7, a simultaneous evacuation of all of Berkeley is not a realistic scenario. The resource needs associated with a specific large-scale hazard event better inform emergency planning, for example:

- For a repeat of the 1923 Fire (Regions R02 or R03), it is estimated that 262 buses, 48 wheelchair-accessible vans, and 66 ambulances will be needed to evacuate all populations at risk.

- For a Tsunami Warning – Max Phase, it is estimated that 41 buses, 4 wheelchair-accessible vans, and 8 ambulances will be required to evacuate all populations at risk.

These resource needs indicate that for the mass evacuation emergencies studied, the City of Berkeley will be reliant on partners in Berkeley and throughout the region to provide mass transportation assistance to people in Berkeley without access to vehicles. These needs for assistance include both generalized transportation (buses) and specialized vehicles such as wheelchair vans and ambulances.

Evacuation Routes and Signage

In suburban and rural areas, it is critical to designate specific roadways as “Evacuation Routes” and to direct the community to them with signage. In urban environments like Berkeley, this approach can actually reduce evacuation efficiency. City roadway networks generally offer multiple roadways that can serve as evacuation routes and lead evacuees to safety, as compared to suburban and rural systems where there may be only one roadway leading out of a hazard area.

Even Berkeley’s highest-capacity roadways, traditionally designated Berkeley’s “evacuation routes,” are not designed to singlehandedly carry a large volume of vehicles associated with a large-scale evacuation. Rather, evacuation times improve when evacuating vehicles are distributed across all available roadways instead of being directed to roadways with higher (but still inadequate) capacity.

Figure 9-1 highlights Berkeley roadways possessing the greatest capacity for vehicular traffic. These roadways are likely to carry the greatest number of vehicles in an evacuation. However, **these routes are not designated “Evacuation Routes” at the exclusion of other roadways. All available roadways should be considered evacuation routes.** See Section 9.

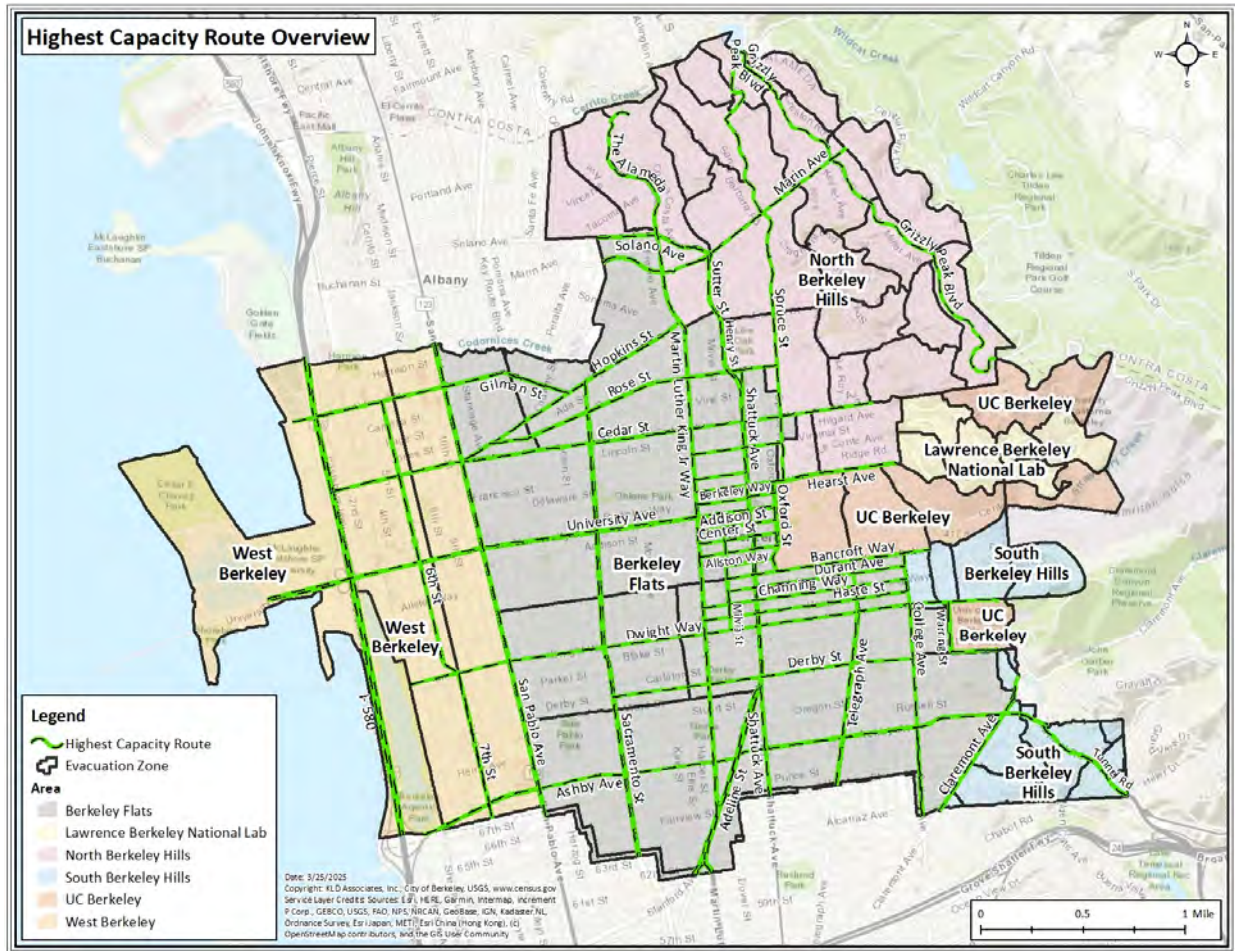


Figure 9-1. Highest Capacity Routes - Overview

Traffic Congestion Patterns

Traffic congestion slows evacuations, and severe congestion is expected to occur in all evacuation cases studied. Congestion is greatest in evacuation scenarios during the day, midweek, during the fall, when Berkeley has the highest vehicular demand.

Some evacuation cases have severe congestion across long stretches of roadway; areas of severe congestion are more limited for other cases.

Figure F-8 shows the patterns of traffic congestion for a 1923 Fire Repeat at 1 hour and 2 hours after the Evacuation Order. Severe congestion is extensive, prolonging the time that evacuees will spend on the roadways and increasing the likelihood that they will be directly impacted by the fire as they try to evacuate.

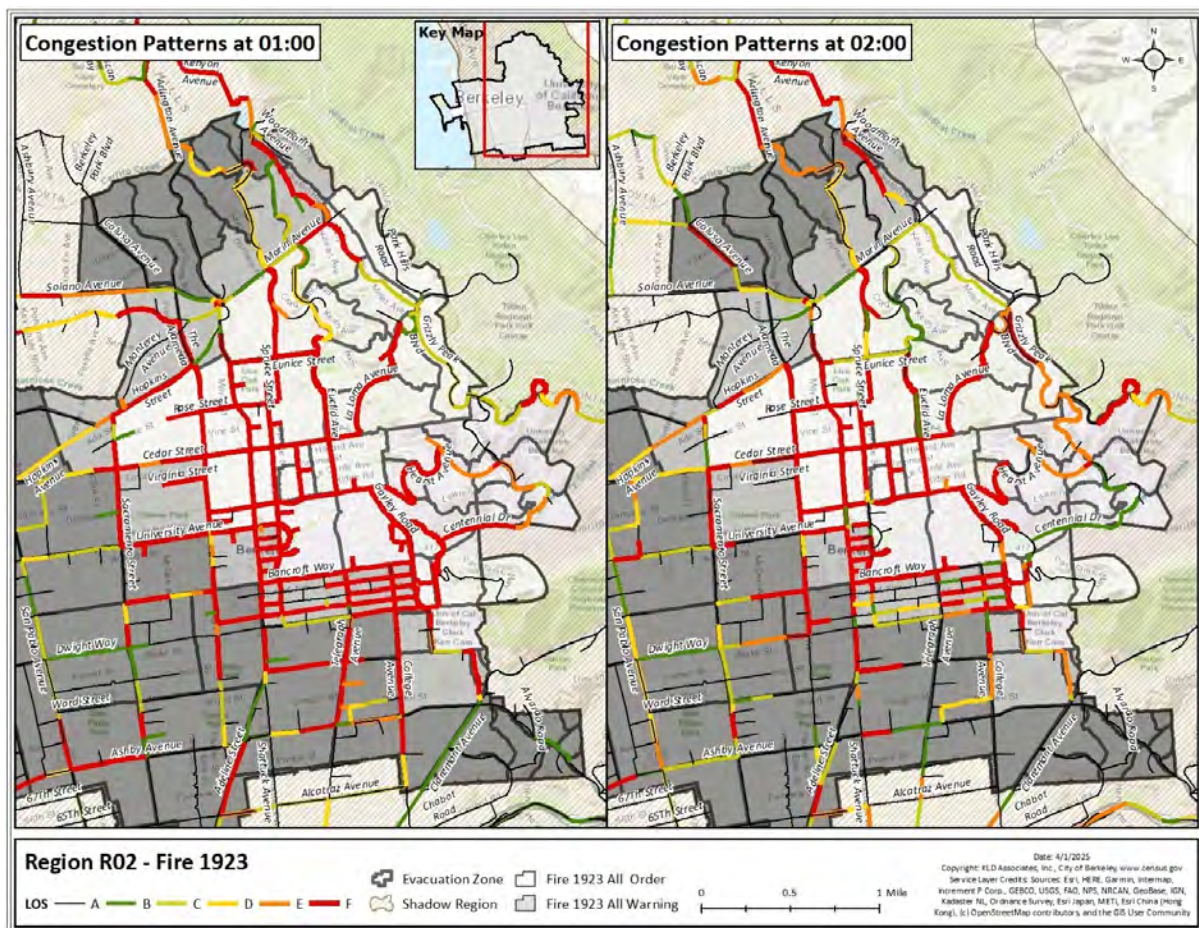


Figure F-8. Region R02 Congestion Patterns 1 Hour and 2 Hours after the Evacuation Order

Figure F-18 displays the patterns of traffic congestion for Tsunami Warning Max Phase at 30 minutes and 1 hour after the Evacuation Order. Evacuees in Region R07 can use I-580, University Ave, Gilman St, Ashby Ave and Seventh/Sixth St to leave the evacuated area. All of these roads experience some level of congestion during the evacuation.

These results indicate that traffic congestion will prolong the time that evacuees will spend on the roadways escaping the tsunami inundation area. Depending on the amount of tsunami warning provided, evacuees could still be evacuating on the roadways at the time of impact.

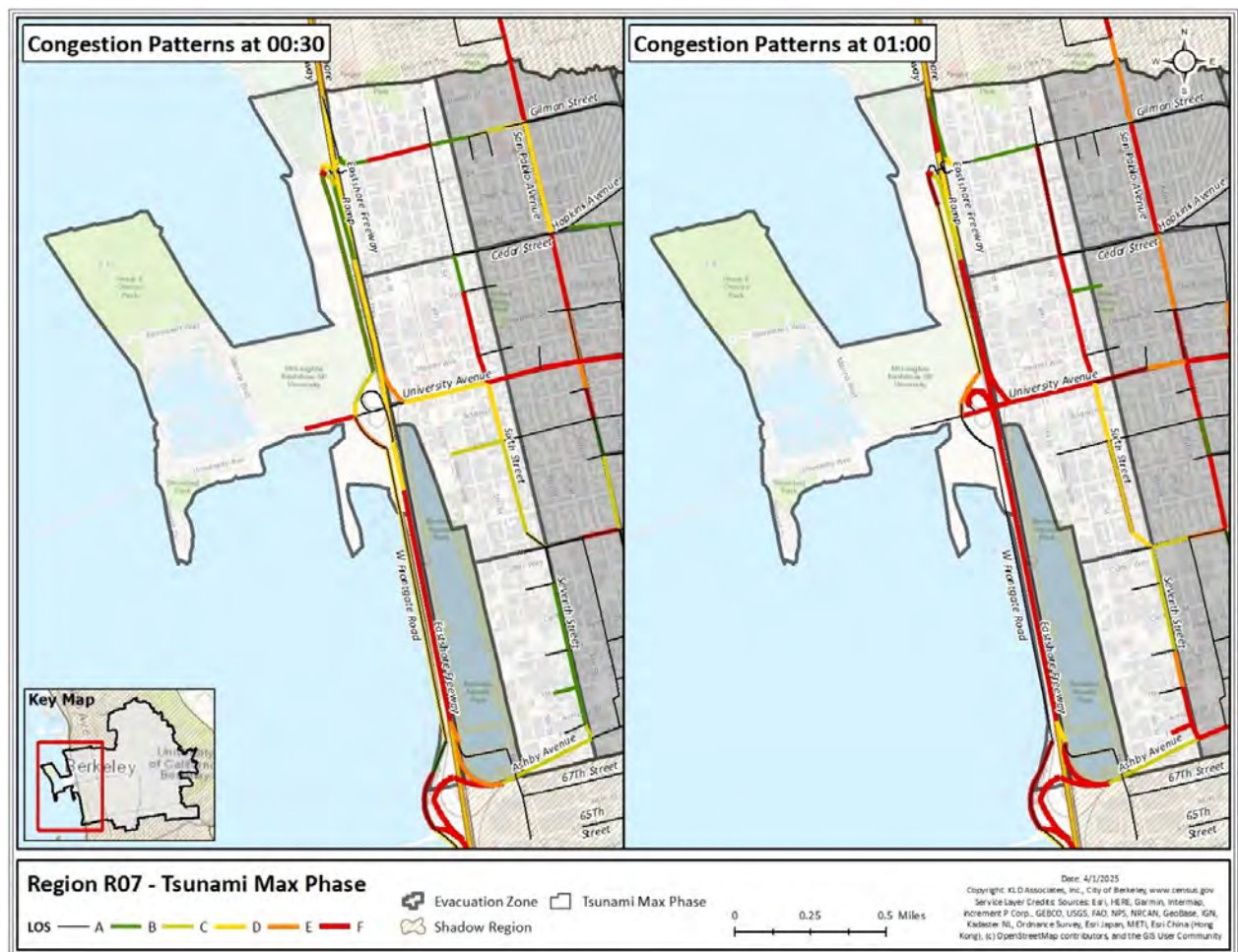


Figure F-18. Region R07 Congestion Patterns 30 Minutes and 1 Hour after the Evacuation Order

Street Network Characteristics

The existing characteristics of the road network are noted in Appendix G to provide a comprehensive analysis of the challenges to evacuation traffic flow. Some are assumed to be fixed, such as preexisting facilities and parks; others are noted as traffic design elements that could be improved for evacuation traffic flow.

Traffic Signals

Section 10 identifies improvements to evacuation traffic flow from a widescale transition to actuated/adaptive traffic signals. Appendix G highlights pre-timed signals with notable impacts across various evacuation cases studied, so that they may be considered for prioritization in a shift to actuated/adaptive signals.

Traffic Calming Devices

The impact of Traffic Calming Devices (TCDs) on evacuation illustrates the complexity of the public safety demands on Berkeley's roadway system. In a day-to-day context, traffic calming devices (including diverters, traffic circles, and speed tables) support public safety by reducing vehicle speeds for pedestrian safety, reducing capacity on residential streets, and/or disrupting network connectivity for vehicles. The analysis indicates that the TCDs throughout the city are performing as designed, effectively reducing vehicular speeds and thus reducing the risk of severe injury and/or fatal traffic crashes.

In evacuations, the public safety goal for roadways shifts to expediting traffic flow, both to help evacuees quickly escape, and also to help responders access the hazard area. In a large-scale evacuation, the roadway demands from evacuating vehicles will greatly exceed the capacities of Berkeley's highest capacity roadways (indicated on Figure 9-1). Evacuating drivers will need to decide between waiting in traffic to enter high-capacity roadways or using residential streets (with lower capacities and potentially also TCDs) as they attempt to escape the hazard area.

Because evacuating drivers will use all roadways, they will be slowed by TCDs in two ways – directly, when they encounter them while trying to escape, and indirectly, as drivers trying to avoid TCDs increase congestion on Berkeley's highest capacity routes.

The day-to-day public safety function of TCDs poses significant challenges to evacuation traffic flow. This situation illustrates the dynamic and complex public safety demands on Berkeley's roadway system.

Analyzing Increased Hills Density

The City also used this study to better understand how potential development in the Berkeley Hills could impact evacuation times. Section 10.5 includes detailed analysis addressing multiple development scenarios in the Hillside Overlay, which encompasses the City's Very High Fire Hazard Severity Zone.

These studies considered three different types of development: Accessory dwelling units (ADUs), junior accessory dwelling units (JADUs), and Middle Housing. The analysis examined these development types separately and together. Studies also explored how evacuation times would

be affected if ADU/JADU residents living near public transit did not own vehicles and instead relied on public transit in evacuation.

This analysis began with the establishment of a Future Case, assuming projected 2031 population increases in Berkeley.⁵ The future case did not include the ADUs/JADUs and/or Middle Housing. Impacts to ETE from ADUs/JADUs and Middle Housing were measured against this Future Case in order to pinpoint evacuation time impacts from these particular development types in the Hillside Overlay.

The study considered four evacuation regions: Region R01 – Citywide Evacuation, Region R02 – 1923 Fire, Region R04 – Panoramic Hill Fire, and Region R05 – Fire Zones 2 & 3 Combined.

The 1923 Fire Repeat (Region R02) and the Panoramic Hills Fire (Region R04) best represent potential hazard scenarios. The 90th percentile ETEs are recommended to be used for evacuation planning purposes (see Section 7). Key findings for 90th percentile ETEs in Regions R02 and R04 include:

Potential Development

- **Maximum ADU/JADU development** increased evacuation times for a 1923 Fire (Region R02) by 102% on average, and for a Panoramic Hill Fire (Region R04) by 52% on average.
- **Likely Middle Housing** development results in increases of up to 8% across the analyzed regions. This increase is smaller than increases from ADU/JADU development because there are considerably fewer parcels likely to develop Middle Housing by 2031 as compared to maximum ADU/JADU development.
- **Combining Maximum ADU/JADU development with Likely Middle Housing** increases evacuation times above the Future Case by 105% on average for a 1923 Fire (Region R02), and about 54% on average for Panoramic Hill Fire (Region R04).

Potential Development with Fewer New Vehicles

- **Maximum ADU/JADU development, but with fewer new vehicles:** Evacuation times still increase when ADU/JADU dwellers living near transit do not own cars. Analysis assumed that residents of ADUs and JADUs living within ½ mile of a transit stop would not own cars and would rely on public transit to evacuate. The 1923 Fire (Region R02) would require an estimated additional 1,051 buses to evacuate these residents. For this case, evacuation times increase by 65% on average, and by 70% on average for Panoramic Hill Fire (Region R04).
- **Adding Middle Housing:** Finally, under this scenario where ADU/JADU dwellers living near transit do not own cars, if likely Middle Housing is added, evacuation times further increase. Middle Housing zoning changes are not expected to influence occupants' vehicle ownership, so Middle Housing dwellers are assumed to evacuate in personal vehicles.

⁵2031 was selected to align analysis with the 2023-2031 Housing Element Update, which included a projection of likely development that could result from implementation of the "Middle Housing" zoning changes.

When middle housing is added to the scenario where ADU/JADU dwellers living near transit do not own cars, evacuation times increase 68% on average for the 1923 Fire (Region R02) and 69% on average for the Panoramic Hill Fire (Region R04).

Based on the results of the study, it is recommended that the City institute separate, more restrictive ADU/JADU development provisions in the Hillside Overlay. For Middle Housing, it is recommended that the City examine these increases in the context of fire spread scenarios. By overlaying fire spread data with evacuation time estimates, the City can better contextualize potential impacts to public health and safety from Middle Housing zoning changes.

Studies in Section 10.5 illustrate how increasing population density in an area, even when the added people do not own vehicles, can increase emergency evacuation times and create public safety impacts. More broadly, the City should consider impacts to evacuation when implementing zoning changes that could result in an increase in demand on roadways used by wildfire or tsunami evacuees.

Recommendations

The results of this report can inform Berkeley's disaster response planning, transportation and roadway planning, development policies, and the individual evacuation plans of Berkeley households. Section 11 details the following recommendations for consideration by City officials:

1. Emergency Response Strategies
 - 1.1. Overlay evacuation time estimates with hazard-specific data (such as fire spread rates for fire regions, and tsunami arrival times on tsunami warning regions.)
 - 1.2. Develop regional/State planning partnerships to quantify resource shortfalls for transit-dependent evacuees.
 - 1.3. Prioritize specific locations for Traffic Control Points (staffed intersections that help improve traffic flow) during evacuations.
 - 1.4. During evacuations, reduce or eliminate external/pass-through traffic. This can include use of electronic roadside signage, closure of I-80 and CA-24 off-ramps into Berkeley, and/or diversion of through traffic to other routes.
 - 1.5. Encourage schools to develop and communicate site evacuation plans that enable parents and guardians to pick up their children at sites outside the evacuation zone.
2. Extreme Fire Weather Leave Early Policy
 - 2.1. Maintain Berkeley Fire Department Leave Early Policy for extreme fire weather. Focus on households at relatively greater risk due to extended mobilization times and/or on neighborhoods with extended driving times due to severe congestion.
3. Housing Development Policies
 - 3.1. Institute separate, more restrictive ADU/JADU development provisions in the Hillside Overlay.

- 3.2. Examine ETE increases from Middle Housing zoning changes in the Hillside Overlay in the context of fire spread scenarios.
 - 3.3. Consider impacts to evacuation when implementing zoning changes that could result in an increase in demand on roadways used by wildfire or tsunami evacuees.
4. Community Alerting
 - 4.1. Conduct community education about Berkeley's evacuation zones, the emergency alerting systems that will provide evacuation orders/warnings, and how community members can register for/opt-in to those systems.
 - 4.2. Conduct community education to encourage potential evacuees to monitor evolving conditions and stay in contact with social networks.
 - 4.3. Clearly define areas at risk as well as areas not at risk in public alerts. Include explicit instructions for people outside the hazard area to shelter in place.
5. Improving Household Mobilization and Evacuation Travel Times
 - 5.1. Encourage carpooling.
 - 5.2. Encourage familiarity with primary, secondary, and tertiary evacuation routes.
 - 5.3. Parents should make provisions with schools to pick up children outside the evacuation zone.
 - 5.4. Commuters should plan to remain outside of the evacuation zone and reunite with other household members outside the hazard area, instead of returning to the evacuation zone.
6. Evacuating on Bicycle and Foot
 - 6.1. Encourage community members to explore walking or cycling for household/business tsunami evacuation plans.
7. Traffic Calming Devices
 - 7.1. Existing Infrastructure: Develop a citywide connectivity and evacuation capacity improvement strategy, integrating approaches such as actuated or adaptive signal timing and replacing TCDs with removable/retractable options, and other evolving technologies.
 - 7.2. Future infrastructure: Develop and implement a methodology to evaluate and consider evacuation efficiency and roadway capacity during the planning and implementation phases of future roadway infrastructure development, including TCD installations.
 - 7.3. First Responder response times: Develop and implement a methodology to assess impacts from TCDs to first responder response times in daily traffic environments.
8. Traffic Signal Improvements
 - 8.1. Optimize Signal Timing Plans: Evaluate and implement improved signal timing strategies, including actuated and adaptive systems.

- 8.2. Install Battery Backup Systems: Upgrade all traffic signal cabinets to include battery backup systems that can operate for a minimum of 6-8 hours.
 - 8.3. Enhance Emergency Vehicle Pre-emption: Evaluate potential improvements to traffic signal system to have the latest pre-emption equipment and capabilities.
 - 8.4. Strengthen Communications Infrastructure: Install a robust fiber-optic network to improve the reliability and speed of traffic signal communications.
 - 8.5. Deploy Smart Traffic Cameras: Install smart traffic cameras at key intersections and corridors to provide real-time detection, monitoring, and traffic data collection.
 - 8.6. Implement Transit Signal Priority (TSP) for public transit vehicles: Upgrade traffic signal system along Berkeley's highest capacity routes.
 - 8.7. Coordinate Regionally: Work closely with surrounding jurisdictions to ensure interoperability and synchronization of traffic signal systems during emergency evacuations.
 - 8.8. Traffic Signal Software for Centralized Control: Assess the need for traffic signal software upgrades to enable full communication with external systems and centralized command through the City's envisioned Traffic Management Center (TMC).
9. Parking Restrictions
- 9.1. Explore parking restrictions along arterial roadways in the Berkeley Hills utilized by emergency response vehicles for ingress during emergency response.
 - 9.2. Explore temporary parking restrictions implemented on certain roadway segments only during hazardous conditions (e.g., fire weather).

1 INTRODUCTION

This section introduces the study and an overview of the process used to compute Evacuation Time Estimates (ETE) for the City of Berkeley, including preliminary activities of the project.

This study analyzed traffic conditions and evacuation times for a variety of evacuation scenarios in the City of Berkeley. Alternative emergency management strategies that could be used in response to an evacuation of the City of Berkeley were also examined. This study, and the results contained within this report, will further inform the City of Berkeley's emergency planning and protective action decision making.

The Study included the following key analysis components:

1. Methods and Assumptions – Section 2, Study Estimates and Assumptions through Section 6, Evacuation Cases describe the methods used for the evacuation simulation model (DYNEV-II) and the assumptions made for the modeling.
2. Evacuation Time Estimates (ETE) – The estimated total time it takes for the population of an area to evacuate based on the evacuation simulation model. See Section 7, Evacuation Time Estimates for additional information and Section 8, Transit-Dependent Population and special facility ETE calculations.
3. Sensitivity Studies (What-if Scenarios) – Analyzes the sensitivity of the ETE results to changes in several input parameters. See Section 10, Evacuation Sensitivity Studies (What-if Scenarios) for additional information.
4. Recommendations – Recommendations based on the results and analysis of the Study as well as professional knowledge. See Section 11, Recommendations for additional information.

At the time of this Study, there were no available state or federal regulations on evacuation modeling for wildfires. However, the nuclear industry is highly regulated and offers several resources for developing evacuation studies. While the hazard is different, many of the concepts of evacuation (e.g., warning time, imminent threat of danger, outbound movements (away from the hazard), etc.) are applicable. As such, most of the references used in this Study have been published by the US Nuclear Regulatory Commission (NRC) for evacuation planning for nuclear power plants, including:

- Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, Rev. 1, February 2021.
- Development of Evacuation Time Estimate Studies for Nuclear Power Plants, NUREG/CR-6863, January 2005.
- Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG-0654/FEMA-REP-1, Rev. 1, November 1980.

There are some contrasts between nuclear evacuations and wildfire evacuations in particular. While there may be no visible warnings of an impending nuclear emergency or incoming tsunami, a large wildfire will be visible throughout the region. As a result, it is reasonable to assume many more residents will evacuate before warnings and orders are issued. This study presents more conservative results because it assumes that people will wait to evacuate until an order or warning is issued. The results quantifying the impact of leaving early are contained in Section 10.

The work effort reported herein was supported and guided by local stakeholders who contributed suggestions, critiques, and the local knowledge base required. Table 1-1 presents a summary of stakeholders and interactions.

1.1 Overview of the ETE Process

The following outline presents a brief description of the Study's effort in chronological sequence:

1. Information Gathering:

- a. Defined the scope of work in discussions with representatives from the City of Berkeley.
- b. Attended meetings with local stakeholders to define methodology and data needs.
- c. Conducted a detailed field survey of the roadway system and area traffic conditions within the City of Berkeley and the Shadow Region.¹ Aerial imagery was used to gather roadway information in areas that could not be driven, like Lawrence Berkeley National Laboratory (LBNL).
- d. Obtained demographic data from the 2020 Census. Projected the 2020 Census data to the study year: 2024 (see Section 3.1).
- e. Estimated the number of employees commuting into the City of Berkeley from areas outside the City of Berkeley using data provided by the city and the data obtained from the US Census Longitudinal Employer-Household Dynamics from the OnTheMap Census² analysis tool (see Section 3.4).
- f. Conducted a random sample demographic survey of the residents within the City of Berkeley (see Section 5) to gather demographic and mobilization information.
- g. Obtained data (to the extent available) to develop a database of schools, colleges, special facilities, visitors, and transportation resources available.

¹ An evacuation in the Shadow Region occurs when residents voluntarily evacuate from areas beyond the area officially given the Evacuation Order. This phenomenon can intensify traffic congestion and prolong evacuation times for people in the areas of actual risk.

² *OnTheMap*, onthemap.ces.census.gov/.

The majority of this data was provided by the city, supplemented with online research.

2. Estimated the Trip Generation Time Distribution representing the time required by various population groups (permanent residents, employees, and visitors) to prepare for the evacuation trip (i.e., to mobilize). These estimates were based on the demographic survey results and notification time estimate/assumptions (see Section 5 and Appendix D).
3. Defined Evacuation Scenarios. These scenarios reflect the variation in demand associated with different seasons, day of week and time of day (see Section 6).
4. Obtained Evacuation Regions from City of Berkeley. “Regions” are groupings of Evacuation Zones³ for which ETEs are calculated, depending on the location of the hazard and the extent of the area to be evacuated (see Section 6 and Appendix E).
5. Estimated the demand for transit services for persons at special facilities and for transit-dependent persons, see Section 3.
6. Prepared the input streams for the DYNEV-II system which computes ETE for the Focus Areas (see Appendices B and C).
 - a. Estimated the evacuation traffic demand, based on the available information derived from the United States (U.S.) Census Bureau data, provided by stakeholders, and from the demographic survey.
 - b. Created the link-node representation of the evacuation network (see Section 1.3), which was used as the basis for the computer analysis that calculates the ETE.
 - c. Applied the procedures specified in the 2022 Highway Capacity Manual (HCM) to the data acquired during the field survey, to estimate the capacity of all highway segments comprising the evacuation routes.
 - d. Calculated the evacuating traffic demand for each Evacuation Region and each Evacuation Scenario.
 - e. Specified selected candidate destinations for each “origin” (location of each “source” where evacuation trips are generated over the mobilization time) to support evacuation travel consistent with outbound movement relative to the location of the hazard.
7. Executed the DYNEV-II model to determine optimal evacuation routing and compute ETE for all residents, visitors, and employees with access to personal vehicles. Generated a complete set of ETEs for all Evacuation Regions and Evacuation Scenarios.

³ <https://protect.genasys.com/>

8. Documented ETE results (see Section 7).
9. Estimated the resource needs for transit dependents including those for special facilities (schools, medical facilities and nursing homes) to evacuate (see Section 8).
10. Tested what-if scenarios to evaluate alternative evacuation management strategies that could be used in response to different hazard situations to potentially reduce evacuation time and/or to see the impacts to evacuation time due to specific changes to the input parameters (see Section 10).

1.2 Location of the Study Area

The City of Berkeley is located on the eastern shore of the San Francisco Bay within Alameda County, California. It shares municipal boundaries with Oakland and Emeryville to the south, and Albany and Kensington to the north. The eastern edge of Berkeley, bordering Contra Costa County, is defined by the Berkeley Hills, a significant wildland-urban interface. This location places Berkeley within close proximity to major Bay Area population centers, including San Francisco, located across the bay, and Oakland, its immediate neighbor. The city's position also means it is adjacent to substantial wildland areas in the Berkeley Hills, creating a unique interface between urban development and natural ecosystems. Figure 1-1 displays the boundary of the City of Berkeley and the neighboring communities and cities. This map identifies the major roadways and the Shadow Region as well.

1.3 Preliminary Activities

Field Surveys of the Roadway Network

KLD personnel drove the entire roadway system within the city and the Shadow Region. The Shadow Region considered for this study is bounded by I-580, Piedmont Ave and Moraga Ave to the south, State Route 13 and State Route 24 to the southeast, the eastern boundary of Tilden Park to the east, by Moeser Lane, San Pablo Avenue, Potrero Avenue, S 55th Street, and Bayview Avenue to the North, and I-580 and the San Francisco Bay to the West, as shown in Figure 1-1. The characteristics of each section of roadway in the study area were recorded. The characteristics considered are listed in Table 1-2.

Video and audio recording equipment were used to capture a permanent record of the roadway infrastructure. No attempt was made to meticulously measure such attributes as lane width and shoulder width; estimates of these measures based on visual observation and recorded images were considered appropriate for the purpose of estimating the capacity of roadway sections. For example, Exhibit 15-7 in the HCM indicates that a reduction in lane width from 12 feet (the “base” value) to 10 feet can reduce free flow speed (FFS) by 1.1 mile per hour (mph) – not a material difference – for two-lane highways. Exhibit 15-46 in the HCM shows little sensitivity for the estimates of Service Volumes at Level of Service (LOS) E (near capacity), with respect to FFS, for two-lane highways.

The data from the audio and video recordings were used to create detailed geographic information systems (GIS) shapefiles and databases of the roadway characteristics and of the

traffic control devices observed during the road survey; this information was referenced while preparing the input stream for the DYNEV II System.

As documented on page 15-6 of the HCM 2022, the capacity of a two-lane highway is 1,700 passenger cars per hour in one direction. A capacity of 2,250 vehicles per hour (vph) per lane is assigned for freeway sections, as per Exhibit 12-37 of the HCM 2022. The road survey identified several segments which are characterized by adverse geometrics (i.e., steep hills and tight curves with no shoulders) on two-lane highways which are reflected in reduced values for both capacity and speed. These estimates are consistent with the service volumes for LOS E presented in HCM Exhibit 15-46. Further discussion of roadway capacity is provided in Section 4.

Traffic signals are either pre-timed (signal timings are fixed over time and do not change with the traffic volume on competing approaches) or are actuated (signal timings vary over time based on the changing traffic volumes on competing approaches). Actuated signals require detectors to provide traffic data used by the signal controller to adjust the signal timings. These detectors are typically magnetic loops in the roadway or video cameras mounted on the signal masts and pointed toward the intersection approaches. If detectors were observed on the approaches to a signalized intersection during the road survey, detailed signal timings were not collected as the timings vary with traffic volume.

If no detectors were observed, the signal control at the intersection was considered pre-timed, and detailed signal timings were provided by the City of Berkeley. These signal timings were input to the DYNEV II system used to compute ETE.

Figure 1-2 presents the link-node analysis network that was constructed to model the evacuation roadway network in the city and the Shadow Region. The directional arrows on the links and the node numbers have been removed from Figure 1-2 to clarify the figure. The observations made during the field survey along with aerial imagery were used to calibrate the analysis network.

Demographic Survey

A demographic survey was performed to gather information needed for the evacuation study. Appendix D presents the survey instrument, the procedures used, and tabulations of data compiled from the survey returns.

This data was utilized to develop estimates of vehicle occupancy to estimate the number of evacuating vehicles during an evacuation and to estimate elements of the mobilization process. This database was also referenced to estimate the number of transit-dependent people, as well as capture attitudinal responses to evacuation.

Computing the Evacuation Time Estimates

The overall study procedure is outlined in Appendix B. Demographic data was obtained from several sources, as detailed later in this report. These data were analyzed and converted into vehicle demand data. The vehicle demand was loaded onto appropriate “source” links of the

analysis network using GIS mapping software. The DYNEV II system was then used to compute ETE for all Regions and Scenarios.

Analytical Tools

The DYNEV II System⁴ that was employed for this study is comprised of several integrated computer models. One of these is the DYNEV (DYnamic Network EVacuation) macroscopic simulation model⁵, a new version of the IDYNEV model that was developed by KLD under contract with the Federal Emergency Management Agency (FEMA).

DYNEV II consists of four sub-models:

- A macroscopic traffic simulation model.
- A Trip Distribution (TD) model that assigns a set of candidate destination (D) nodes for each “origin” (O) located within the analysis network, where evacuation trips are “generated” over time. This establishes a set of O-D tables.
- A Dynamic Traffic Assignment (DTA) model which assigns trips to paths of travel (routes) which satisfy the O-D tables, over time. The TD and DTA models are integrated to form the DTRAD (Dynamic Traffic Assignment and Distribution) model⁵.
- A Myopic Traffic Diversion model which diverts traffic to avoid intense, local congestion, if possible.

Another software product developed by KLD, named UNITES (UNified Transportation Engineering System) was used to expedite data entry and to automate the production of output tables.

The dynamics of traffic flow over the network are graphically animated using the software product, EVAN (EVacuation ANimator), developed by KLD. EVAN is GIS based and displays statistics such as LOS, vehicles discharged, average speed, and percent of vehicles evacuated, output by the DYNEV II System. The use of a GIS framework enables the user to zoom in on areas of congestion and query road name, town name and other geographic information.

The procedure for applying the DYNEV II System within the framework of developing ETE is outlined in Appendix B. Appendix A is a glossary of terms.

For the reader interested in an evaluation of the original model, I-DYNEV, the following references are suggested:

- NUREG/CR-4873 – Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code.

⁴ The models of the IDYNEV System were recognized as state of the art by the Atomic Safety & Licensing Board (ASLB) in past hearings. (Sources: Atomic Safety & Licensing Board Hearings on Seabrook and Shoreham; Urbanik). The models have continuously been refined and extended since those hearings and were independently validated by a consultant retained by the NRC. The DYNEV II model incorporates the latest technology in traffic simulation and in dynamic traffic assignment. (Urbanik, T., et. al. Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code, NUREG/CR-4873, Nuclear Regulatory Commission, June, 1988.)

⁵ <https://kldassociates.com/wp-content/uploads/2024/10/DTRAD-DYNEV.pdf>

- NUREG/CR-4874 – The Sensitivity of Evacuation Time Estimates to Changes in Input Parameters for the I-DYNEV Computer Code.

The evacuation analysis procedures are based upon the need to:

- Route traffic along paths of travel that will expedite vehicles' travel from their respective points of origin to points outside the evacuated area.
- Restrict movement toward the wildfire to the extent practicable and disperse traffic demand so as to avoid focusing demand on a limited number of roadways.
- Move traffic in directions that are generally outbound relative to the location of the hazard.

DYNEV II provides a detailed description of traffic operations on the evacuation network. This description enables the analyst to identify bottlenecks and to develop countermeasures that are designed to represent the behavioral responses of evacuees. The effects of these countermeasures may then be tested with the model.

Model Limitations

The focus of this study is to estimate times for evacuating vehicular traffic. It does not analyze ingress times, and as a result the interaction between inbound vehicles (such as responders and/or buses) with outbound evacuees is not considered. Additionally, the model is not multimodal and does not analyze evacuation times for cyclists or pedestrians or consider the interaction between drivers, cyclists and/or pedestrians. See Section 11 for Berkeley public safety recommendations related to evacuating on bike or on foot.

Table 1-1. Stakeholder Interaction

City of Berkeley Stakeholders	Nature of Stakeholder Interaction
Fire Department Department of Public Works Planning and Development Department Police Department	<ul style="list-style-type: none">• Attended project meetings.• Reviewed demographic survey questions.• Assisted in publicizing the demographic survey.• Assisted in data collection.• Reviewed and discussed all study assumptions.• Identified evacuation regions for study.• Attended bi-weekly meetings, as needed.

Table 1-2. Roadway Characteristics

- Number of lanes
- Lane width
- Shoulder type & width
- Interchange geometries
- Lane channelization & queuing capacity (including turn bays/lanes)
- Geometrics: curves, grades (>4%)
- Unusual characteristics: Narrow bridges, sharp curves, poor pavement, inadequate delineations, toll booths, etc.
- Posted speed
- Actual free speed
- Abutting land use
- Traffic control and calming devices
- Intersection configuration (including roundabouts where applicable)
- Traffic signal type

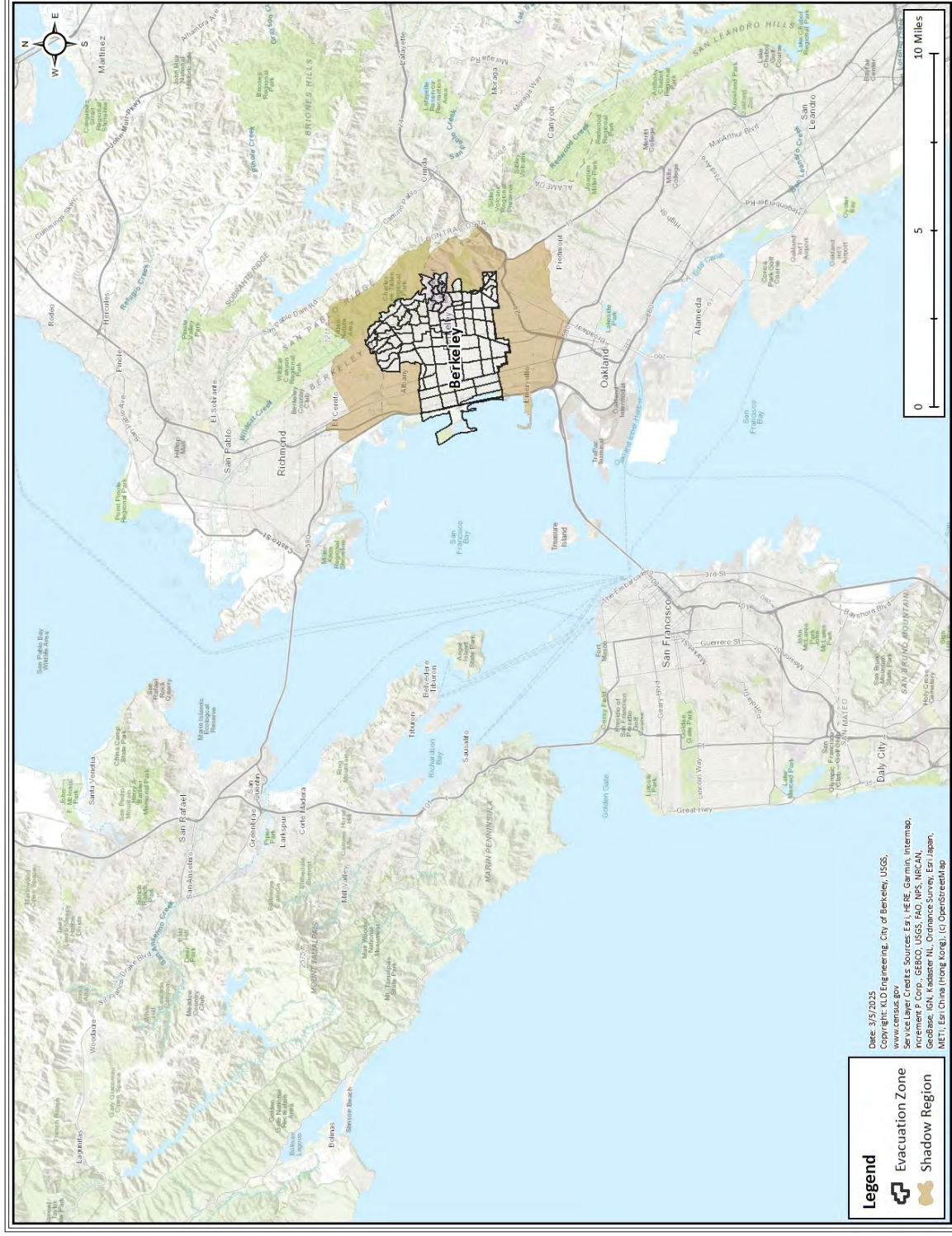


Figure 1-1. Study Area Location

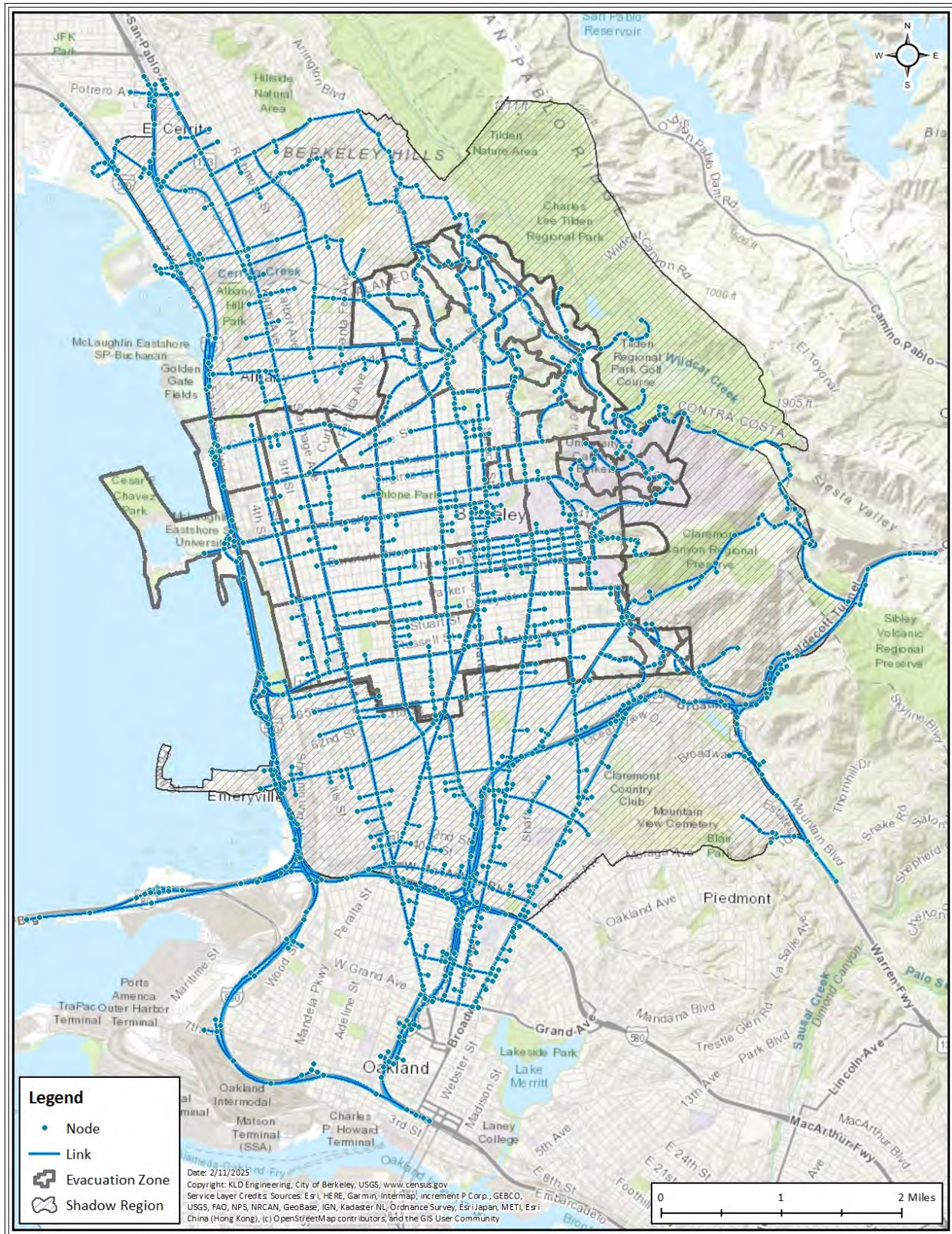


Figure 1-2. Study Area Link-Node Analysis Network

2 STUDY ESTIMATES AND ASSUMPTIONS

This section discusses the data estimates and project assumptions utilized in this study. These assumptions were discussed with representatives from the City of Berkeley. An assumptions memorandum documenting all the project assumptions was reviewed and approved by stakeholders prior to their use in this study.

2.1 Data Estimates

1. The permanent resident population estimates are based on the 2020 U.S. Census population data from the Census Bureau website¹ extrapolated to December 2024 using annual growth rates that are computed from the 2023 Census population estimates. A methodology, referred to as the “area ratio method,” will be employed to estimate the population within portions of census blocks that are divided by the evacuation zone boundaries. It is assumed that the population is evenly distributed across a census block in order to employ the area ratio method.
2. Estimates of the number of employees commuting into the study area was provided by the City of Berkeley, supplemented by data from the U.S. Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool².
3. Based on the demographic survey, the majority (64%) of households that have a commuter commute to work/college at least four days a week. Thus, no reduction in commuters was considered for remote work and learning.
4. Population estimates at special facilities (schools and medical facilities) was based on the data received from the City of Berkeley, supplemented by internet searches where data was missing.
5. Population estimates at tourist attractions (hotels, marinas, camps, parks, etc.) were based on parking lot capacities within the City of Berkeley, and the annual number of tourists that visit City of Berkeley. It is assumed that 30% of tourists visit the city via public transit and average vehicle occupancy rate is equal to the average household size (2.37).
6. The variation of tourists in different seasons and day of the week was based on the data provided by the City of Berkeley. The number of tourists within the city during nighttime scenarios (Scenario 3 and 6) was reduced by 60% compared to the daytime.
7. The relationship between permanent resident population and evacuating vehicles was based on the Census³ and the results of the demographic survey. Values of 2.37 persons

¹ www.census.gov

² <http://onthemap.ces.census.gov/>

³ <https://www.census.gov/quickfacts/fact/table/berkeleycitycalifornia/IPE120223>

per household and 1.14 evacuating vehicles per household were used for the permanent resident population.

8. Employee vehicle occupancies were based on the results of the demographic survey. In this study, 1.08 employees per vehicle were used. In addition, it is assumed there are two people per carpool, on average.
9. Roadway capacity estimates were based on field surveys performed in May 2023 and the application of the Highway Capacity Manual 2022.

2.2 Methodological Assumptions

1. The Planning Basis Assumption for the calculation of ETE is a rapidly escalating hazard that requires immediate evacuation, and includes the following:
 - a. The order to evacuate is announced coincident with local emergency alerts (AC Alert/IPAWS, Genasys Protect, Outdoor Warning System Sirens, Nixle, social media, local news and similar communication systems).
 - b. Mobilization of the general population will commence within 15 minutes after the order to evacuate.
 - c. The ETE are measured relative to the order to evacuate being issued by officials.
 - d. In a fire context, the “rapidly escalating hazard” scenario being modeled is one where a fire has ignited and is growing in a manner and location that warrants issuance of an evacuation order for all or parts of Berkeley. This study is not analyzing behaviors among evacuees for whom the hazard is actively present (i.e., there is active fire in the neighborhood). This means that mobilization times are not reflective of this type of situation. Additionally, driver behavior in the model does not reflect more unpredictable community behaviors expected when fire is present (violating traffic laws, driving erratically, etc.).
2. The DYNEV II⁴ (Dynamic Network Evacuation) macroscopic simulation model was used to compute ETE in this study.
3. Evacuation movements (paths of travel) will be generally outbound relative to the hazard to the extent permitted by the highway network. All major evacuation routes were used in the analysis.
4. Evacuees will drive safely, travel away from the hazard to the extent practicable given the highway network and will obey all traffic control devices and traffic guides. It is noted that drivers under extreme duress may not drive safely, obey traffic control devices, or drive lawfully.
5. One hundred percent (100%) of the people told to evacuate will do so. Although the

⁴ The models of the I-DYNEV System were recognized as state of the art by the Atomic Safety & Licensing Board (ASLB) in past hearings. (Sources: Atomic Safety & Licensing Board Hearings on Seabrook and Shoreham; Urbanik). The models have continuously been refined and extended since those hearings and were independently validated by a consultant retained by the NRC. The DYNEV II model incorporates the latest technology in traffic simulation and in dynamic traffic assignment.

demographic survey indicated that 0.8% of people will not leave an area under evacuation order, the ETE is designed to identify the time required to fully evacuate the area.

6. The Evacuation Zones were used to create the study area. Regions are defined by groupings of the Evacuation Zones. Regions to be considered are defined in Table 6-1.
7. Berkeley's evacuation zones establish the underlying geographies for evacuation measurements. For Region R05, evacuation zones do not match boundaries for Fire Zones 2 & 3 exactly. If a significant portion of the evacuation zone was part of Fire Zone 2 or 3, then the entire evacuation zone was included in Fire Zone 2 & 3.
8. The Shadow Region is defined as the area beyond the City of Berkeley and is bounded by I-80 and Grove Shafter Freeway to the south, to the boundary of Tilden Park to the east, Kensington Community to Terrace Drive to Stockton Avenue to Panama Avenue to the North, and the San Francisco Bay to the West.
9. Shadow population characteristics (household size, evacuating vehicles per household, and mobilization time) are assumed to be the same as that of the permanent resident population.
10. This study assumes that 20% of households within the Shadow Region and within the Evacuation Zones not ordered to evacuate, will choose to evacuate, based on the recommendation from Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, Rev. 1, February 2021. It is noted that due to the limited geographic (North-South) extent of wildfire entry points, it is unlikely that shadow region evacuation will be homogenous. As an example, a wildfire entering Berkeley at Spruce/Wildcat Canyon/Cannon would likely result in 100% evacuation of Kensington and 0% evacuation of Oakland, Emeryville, and Piedmont. Due to the limitations of this study, a uniform 20% was assumed, acknowledging that the geographic areas of shadow evacuation will vary depending on the ignition point of the wildfire.
11. Phased evacuation is a systematic approach to evacuating people. Instead of everyone rushing out at once, the evacuation happens in stages, prioritizing those in immediate danger. This helps prevent overcrowding, making the evacuation process safer and more efficient. A phased evacuation is assumed for Region R03 (see Table 6-1), where residents in specified zones are ordered to evacuate, while residents in other zones receive an evacuation warning and/or are issued no protective order. After some time, zones that were issued a warning, or were given no action, may be issued an order to evacuate, or an evacuation warning, respectively, etc. and so on.
 - a. During a phased evacuation, residents are assumed to still follow their regular mobilization curve starting at the time of the first evacuation order (0 minutes/Phase a), 30 minutes after the first evacuation order (Phase b), or 60 minutes after the evacuation order (Phase c).
 - i. A voluntary evacuation of 20% is assumed for those within areas that are given no action.

- b. Only residents are expected to phase their evacuation. Non-resident population groups (employees, tourists, etc.) are assumed to evacuate immediately if they are in zones that will later be given an evacuation order.
- 12. It is assumed that 50% of residents will voluntarily evacuate within zones that are given an evacuation warning. For phased evacuation cases, if a zone ultimately reaches an evacuation order, following a phase of no action (20% voluntary evacuation) and an evacuation warning (50% voluntary evacuation), only about 30% of residents remain.
- 13. Scenarios are outlined in Table 2-1. Fall means that K-12 public schools and colleges are in session. Summer means that K-12 public schools and colleges are in session at summer school enrollment levels (lower than normal enrollment).
- 14. Employment was assumed to be at its peak during fall scenarios. Employment is reduced slightly (96%) for summer scenarios. This is based on the estimation that 50% of the employees commuting into the evacuation zones will be on vacation for a week during the approximate 12 weeks of summer. It was further estimated that those taking vacations were uniformly dispersed throughout the summer with approximately 4% of employees vacationing each week. It was further estimated that only 10% of the employees work in the nighttime and during the weekends.
- 15. This study does not assume that roadways are empty at the start of an evacuation. The amount of initialization/fill traffic that is on the roadways in the study area at the start of the evacuation depends on the scenario and the region being evacuated.
- 16. To account for boundary conditions beyond the study area, this study assumes a 25% reduction in capacity on two-lane roads and multilane highways for roadways that have traffic signals downstream. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the study area and the fact that the evacuating traffic (“main street”) volume will be more significant than the competing traffic (“side street”) volume at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time. There is no reduction in capacity for freeways due to boundary conditions.
- 17. Schools often prefer that parents and guardians not pick their children up from an evacuating school. This preference is to help facilitate an orderly evacuation, and the intention is that parents instead pick up their children from a secondary site outside of the evacuating area. Many parents will nevertheless choose to pick their children up from school while the school is evacuating. This influx of vehicles to school sites could impact evacuation flow. The results of the demographic survey indicate some parents will pick up their children from school prior to beginning their evacuation trip (see Assumption 2.a.i in Section 2.4). Based on survey responses, this study uses survey responses and assumes that 18% of households will pick up schoolchildren prior to beginning their evacuation trip.

2.3 Assumption on Mobilization Times

1. Evacuee mobilization times (also called trip generation time) were based on a statistical analysis of data acquired from a random sample demographic survey of the study area residents (documented in Section 5 and Appendix D).
2. The notification time distribution (the time required for evacuees to receive notification of an evacuation) used in the study was estimated using the results of the demographic survey, the data provided by the City of Berkeley and similar studies of this nature.
3. Based on the results of the demographic survey, 41.6% of the households in the evacuation zones have at least 1 commuter; 30.1% of households will await the return of household members before beginning their evacuation trip, based on the demographic survey results. Therefore, about 13% ($41.6\% \times 30.1\% = 12.5\%$) of households will await the return of household members, prior to beginning their evacuation trip. It is noted that these behaviors may not occur for active wildfire situations with ample indication (smoke and embers) of the emergent nature of the threat. In these situations, it is possible that fewer households will wait for all members to return prior to beginning their evacuation trip. Section 10 explores how evacuation time estimates change when evacuees leave more quickly.

2.4 Transit Dependent Assumptions

1. Approximately eighty-seven percent (87%) of the transit-dependent population will rideshare with a neighbor or friend, based on the demographic survey results.
2. Public transportation vehicle needs will be computed for special facilities:
 - a. Schools and preschools/day care centers:
 - i. Based on the demographic survey, approximately 22% of households have school children and 83% of them would pick them up from the school prior to starting their evacuation trip. The results of the demographic survey were used to estimate the trip generation distribution for this population group, which makes up about 18% ($22\% \times 83\% = 18.3\%$) of households within the evacuation zones.
 - ii. If schools are in session, transport (buses) needs were computed based on school enrollments. In addition, the demand at schools will be reduced by 83% to account for parents that will pick up their children prior to evacuating.
 - iii. Schoolchildren, if school is in session, are given priority in assigning transit vehicles, if available.
 - iv. For those schools wherein buses are used to evacuate students, multiple waves of ETE were computed in the event there is shortfall of bus resources.
 - v. It is assumed that infants from infant care centers are picked up by parents.

- b. Colleges/Universities
 - i. The colleges specifically considered were Berkeley City College and UC Berkeley. At both of these schools, some students have personal vehicles they will use to evacuate and some will rideshare. Although students may walk or cycle, the model conservatively assumes that remaining students without their own car or access to a vehicle will use a bus provided as part of emergency response to evacuate. See Section 3 for additional information.
 - ii. Students at small local colleges are likely local residents living within the city or remote learning students living outside of the city.
 - c. Medical Facilities
 - i. Buses, wheelchair transport vehicles and ambulance needs were computed for the evacuation of patients at medical facilities.
 - ii. The percent breakdown of ambulatory/wheelchair-using/bedridden patients at medical facilities was assumed to be 45%/30%/25%⁵, respectively, for facilities where no data was provided.
 - d. Numbers of people requiring specialized transportation were based on emPOWER data provided by the City of Berkeley. 348 people within the city are assumed to require specialized transportation assistance to evacuate. 99 people using motorized wheelchairs/scooters will evacuate in 50 wheelchair accessible vans. 249 bedbound people will evacuate in 125 ambulances.
 - e. The number of people experiencing homelessness was based on the data provided by the City of Berkeley. This population group is transit dependent and is picked up from shelters during an evacuation.
 - f. Households with 3 or more vehicles were assumed to have no need for transit vehicles.
3. Transit vehicle capacities and maximum speed limits:
- a. Students and children at preschools/day care centers were assumed to be 70 students per bus for elementary schools/preschools/day care centers and 50 students per bus for middle/high schools.
 - b. Students at colleges/universities were assumed to be 30 students per bus.
 - c. Ambulatory transit-dependent residents were assumed to be 30⁶ people per bus.
 - d. Employees and visitors, who will not have luggage, etc., are assumed to be 60 passengers per bus⁷.
 - e. Ambulatory patients at medical facilities were assumed to be 30⁶ people per bus.
 - f. Wheelchair accessible van was assumed to be 2 passengers per van.

⁵ These percentages are based on the breakdown at the facilities at which data was obtained.

⁶ The data provided by the City of Berkeley indicates that buses for ambulatory evacuees can accommodate at most 30 passengers with 45 standees. During an evacuation, however, it is likely that resident evacuees will carry personal items such as luggage and pets that will take up some of the available capacity within the bus. Hence, it is conservatively assumed that each bus can carry approximately 30 people.

⁷ According to the AC Transit website, buses can accommodate between 40 and 78 passengers. An average of 60 passengers per bus was assumed.

- g. Basic Life Support (BLS) (ambulances) was assumed to be 2 persons per vehicle.
 - h. The maximum bus speed was assumed to be 55 miles per hour in uncongested environments.
4. Transit vehicle⁸ mobilization times:
- a. It is understood that the mobilization times for school and transit buses will vary. For the purpose of this study, it is assumed that school and transit buses will arrive at schools, preschools/day care centers and colleges/universities to be evacuated within 90 minutes of the order to evacuate.
 - b. Buses for transit-dependent evacuees will not be immediately available to pick them up. It is conservatively assumed that these buses will arrive at their designated pick-up routes within 180 minutes of the order to evacuate, which includes considering the notification, arrival and briefing times for the bus drivers.
 - c. Vehicles will arrive at medical facilities to be evacuated within 90 minutes of the order to evacuate.
5. Transit vehicle loading times:
- a. School, preschool/day care center and college/university buses will be loaded in 15 minutes.
 - b. Buses for transit dependent evacuees will require 1 minute of loading time per passenger⁹.
 - c. Buses for medical facilities will require 1 minute of loading time per ambulatory passenger.
 - d. Wheelchair transport vehicles will require 5 minutes of loading time per passenger.
 - e. Ambulances will require 30 minutes per bedridden passenger¹⁰.
6. Tourists that arrive via public transit and rideshare applications, like Uber, will evacuate via the same means that they arrived in the city.

2.5 Access Control Assumptions

1. Vehicles will be traveling through the study area (external-external trips) at the start of a hazard. After the order to evacuate is announced, these pass-through travelers will also evacuate. External traffic vehicles will primarily utilize CA-24, Interstate (I)-580, I-80, and I-880 to pass through the area. It is likely that dynamic and variable message signs will be strategically positioned outside of the hazard area at logical diversion points to attempt to divert traffic away from the hazardous area within the City of Berkeley. As such, it is assumed this pass-through (external) traffic ceases at 2 hours after the order

⁸ The City of Berkeley does not own or manage school and/or transit buses

⁹ This includes the time for the vehicle to slow down, come to a stop, open the door, the passenger to enter the vehicle, and then for the vehicle to speed up to free flow speed on the roadway.

¹⁰ This includes the time for the bedridden passengers to be brought to the ambulance door, load onto the ambulance, and hook up to the necessary equipment onboard the ambulance.

to evacuate to allow police to mobilize personnel and equipment to block the roadways and to allow time for commuters to return home and unite with family. Average Annual Daily Traffic (AADT) along CA-24 I-580, I-80, and I-880 will be based on the data obtained from California Department of Transportation (Caltrans)¹¹.

2. External traffic is estimated to be reduced by 60% during nighttime scenarios (Scenario 3 and 6). Nighttime scenarios are considered the time after everyone returns home (commuters and children) and before everyone leaves in the morning for work/school.

Table 2-1. Evacuation Scenario Definitions

Scenarios	Season ¹²	Day of Week	Time of Day
1	Summer	Midweek	Midday
2	Summer	Weekend	Midday
3	Summer	Midweek, Weekend	Nighttime
4	Fall	Midweek	Midday
5	Fall	Weekend	Midday
6	Fall	Midweek, Weekend	Nighttime

¹¹ <https://dot.ca.gov/programs/traffic-operations/census>

¹² Fall means that school is in session at normal enrollment levels. Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

3 DEMAND ESTIMATION

This section discusses the estimates of demand, expressed in terms of people and vehicles, which constitute a critical element in developing an evacuation plan. This section also documents the sources of data, as well as the methodology used to extract relevant data from these sources. These estimates consist of three components:

1. An estimate of population within the City of Berkeley, stratified into groups (e.g., residents, employees, visitors, special facilities, etc.).
2. An estimate, for each population group, of average occupancy per evacuating vehicle. This estimate is used to determine the number of evacuating vehicles from the population estimates.
3. An estimate of potential double-counting of vehicles.

Appendix C presents much of the source material for the population estimates. Our primary source of population data, the 2020 Census, is not adequate for directly estimating some visitors.

Throughout the year, vacationers and visitors enter the City of Berkeley. These non-residents may dwell within the city for a short period (e.g., a few days or one or two weeks), or may enter and leave within one day. Estimates of the size of these population components must be obtained, so that the associated number of evacuating vehicles can be ascertained.

The potential for double-counting people and vehicles must be addressed. For example:

- A resident who works and shops within the city could be counted as a resident, again as an employee and once again as a shopper.
- A visitor who spends time at a park and then goes shopping could be counted two times.

Furthermore, the number of vehicles at a location depends on the time of day. For example, parking lots at area parks, which are full at noon, may be almost empty at dawn. Estimating counts of vehicles by simply adding up the capacities of different types of parking facilities will tend to overestimate the number of visitors and can lead to ETE that are too conservative.

Analysis of the population characteristics of the study area indicates the need to identify four distinct groups:

- Permanent residents - people who are year-round residents, including college students who live in Berkeley.
- Visitors - people who reside outside of the city who enter the area for a specific purpose (i.e., recreation) and then leave the area.
- Employees - people who reside outside of the city and commute to work within the city on a daily basis.
- College students who live outside Berkeley – people who reside outside of the city and commute to Berkeley colleges on a daily basis during the school year.

Estimates of the population and number of evacuating vehicles within the city are presented by different subdivisions of the city (Berkeley Flats, North Berkeley Hills, South Berkeley Hills, West

Berkeley, UC Berkeley and Lawrence Berkeley National Lab). These subdivisions are referred to as Areas throughout this report. The grouping of Evacuation Zones¹ that make up each Area are shown in Figure 3-1 and in more detail in Figure 3-2 through Figure 3-6. The evacuation zones were overlaid with the boundary of the City of Berkeley. When the zone extended beyond the City of Berkeley boundary, portions of the City of Oakland were included to reflect the area that would evacuate together. In addition, the eastern portion of Panoramic Hill, which lies completely in the City of Oakland, is included in the study as its own zone because people in this area will need to enter the City of Berkeley to evacuate.

3.1 Permanent Residents

The primary source for estimating permanent population is the latest U.S. Census data. The U.S. Census Bureau conducts a physical census of the permanent resident population in the U.S. every ten years. The latest census began on April 1, 2020, with data from the census being published on September 16, 2021. In the years between the decennial censuses, the Census Bureau works with state and local agencies to provide annual population estimates at the state and local levels. These estimates are done using data on deaths, births and migration. This annual data gathering process and analysis is extensive. As such, population estimates are a year behind – 2024 data are released in 2025². However, the ETE simulations for this study were completed prior to the release of the 2024 data. Thus, this study is based on 2020 Census population data from the Census Bureau website³ extrapolated to 2024 using annual growth rates computed from the 2023 Census population estimates as outlined in the methodology below.

The Census Bureau QuickFacts website⁴ provides annual population estimates for each state, county⁵, and municipality⁶ in the United States. As discussed above, Census population estimates are a year behind. By the time this study started, the most recent population estimates available for the counties and municipalities are for the time period from April 1, 2020 to July 1, 2023. The population change and annual growth rate for each county and municipality in the study area (the City of Berkeley plus the Shadow Region) are provided in Table 3-1 and Table 3-2, respectively. Figure 3-7 shows the county and municipality boundaries identified by the Census Bureau.

The permanent resident population, as per the 2020 Census, for the city and the Shadow Region was projected to 2024 using the compound growth formula (Equation 1). In the compound growth formula, g is the annual growth rate, and X is the number of years projected forward from Year 2020. The compound growth formula can be solved for g as shown in Equation 2.

Equation 1

$$(Compound\ Growth\ for\ X\ years): Population\ 202X = Population\ 2020 (1 + g)^x$$

¹ <https://protect.genasys.com/>

² The schedule for release of Census data is provided on the Census website: <https://www.census.gov/programs-surveys/popest/about/schedule.html>

³ www.census.gov

⁴ <https://www.census.gov/quickfacts/fact/table/US/PST045222>

⁵ <https://www.census.gov/data/datasets/time-series/demo/popest/2020s-counties-total.html>

⁶ <https://www.census.gov/data/datasets/time-series/demo/popest/2020s-total-cities-and-towns.html>

Equation 2

(Solving for the annual growth rate): $g = (\text{Population 202X} \div \text{Population 2020})^{1/x} - 1$

The 2020 and 2023 population data provided in Table 3-1 and Table 3-2 were used in Equation 2 to compute the annual growth rate for each county and municipality in the study area using $X = 3.25$ (3 years and 3 months from April 1, 2020 to July 1, 2023). The computed annual growth rate for each county and municipality is summarized in the final column of Table 3-1 and Table 3-2, respectively.

The most detailed data should always be used when forecasting population. In terms of detailed data, municipal data is the finest level of detail, then county data, and state data. The municipality growth rate was used first and if that was not available or applicable within the study area, then the county growth rate was used. County growth rates are available for the entire study area and were used (in the absence of municipal data) as they are the finest level of detail available for the entire study area. Thus, state data was not used.

The Census Bureau does not provide population data specific to the boundaries of the study area. As such, the county or municipality population was used to compute the annual growth rate. Then, the appropriate municipality or county growth rate was applied only to those census blocks located within the study area. All other blocks outside of the study area were not considered as part of the City of Berkeley or Shadow Region population, even if they are located within one of the municipalities or counties that intersect the study area.

The appropriate annual growth rate was applied to each census block in the study area depending on which county or municipality the block is located within. The population was extrapolated to December 1, 2024 using Equation 1 with $X = 4.67$ (4 years and 8 months from the April 1, 2020 Census date to December 1, 2024), as the base year for this study.

The permanent resident population is estimated by cutting the census block polygons by the boundaries of Evacuation Zones and Shadow Region using GIS software. A ratio of the original area of each census block and the updated area (after cutting) is multiplied by the total block population to estimate what the population is within the city. This methodology (referred to as the “area ratio method”) assumes that the population is evenly distributed across a census block. Table 3-3 provides the permanent resident population within the city, by Area, for 2020 and for 2024 (based on the methodology above). As indicated, the permanent resident population within the city has decreased by -6.08% since the 2020 Census.

To estimate the number of vehicles, the 2024 extrapolated permanent resident population is divided by the average household size and then multiplied by the average number of evacuating vehicles per household. The average household size (2.37 persons/household) is based on the 2018-2022 American Community Survey 5-year estimates⁷ and the number of evacuating vehicles per household (1.14 vehicles/household – See Appendix D, Sub-section D.3.2) was adapted from the demographic survey results. Permanent resident population and vehicle

⁷ <https://www.census.gov/programs-surveys/acs>

estimates are presented in Table 3-4. Note, the 2020 Census includes residents living in group quarters, such as skilled nursing facilities, group homes, college/university student housing, juvenile homes, etc. These people are transit dependent (will not evacuate in personal vehicles) and are included in the special facility evacuation demand estimates. To avoid double counting vehicles, the vehicle estimates for these people have been removed. The resident vehicles in Table 3-4 have been adjusted accordingly.

3.2 Shadow Population

A portion of the population living outside the evacuation area may elect to evacuate without having been instructed to do so. This area is called the Shadow Region, which is bounded by I-580, Piedmont Ave and Moraga Ave to the south, State Route 13 and State Route 24 to the southeast, the eastern boundary of Tilden Park to the east, by Moeser Lane, San Pablo Avenue, Potrero Avenue, S 55th Street, and Bayview Avenue to the North, and I-580 and the San Francisco Bay to the West, as shown in Figure 3-8. Based upon NUREG/CR-7002, Rev. 1 guidance, it is assumed that 20% of the permanent resident population, based on U.S. Census Bureau data, in this Shadow Region will elect to evacuate.

Shadow population characteristics (household size, evacuating vehicles per household, mobilization time) are assumed to be the same as that of Berkeley's permanent resident population. As shown in Table 3-4, there are 114,671 permanent residents and 111,443 vehicles in the Shadow Region. Similar to the vehicle estimates for Berkeley residents, resident vehicles at group quarters have been removed from the shadow population vehicle demand in Table 3-4.

3.3 Visitor Population

Visitors are defined as those who are not permanent residents nor commuting employees but enter the City of Berkeley for a specific purpose (i.e., recreation or shopping). The visitor population was estimated based on the information provided by Visit Berkeley. Based on the data provided, the City of Berkeley had approximately 30,200,000 visits during a period of 364 days (from January 2023 to December 2023), and each visitor spends an average of 12 hours and 47 minutes (767 minutes) dwell time within the city. Based on the conversations with the city staff, it was assumed that 30% of these visits arrive via public transportation and the remaining 70% arrive via private vehicles. This computes to 44,192 visitors on a daily basis, on average, $[(30,200,000 \text{ visits}/364 \text{ days}) \times (767 \text{ minutes}/1,440 \text{ minutes per day}) = 44,192 \text{ visitors}]$. Of these 44,192 visitors, 13,258 $(44,192 \times 30\%)$ of them arrive by public transportation, and 30,934 $(44,192 - 13,258)$ visitors arrive in private vehicles.

Of the visitors that use public transportation (13,258 visitors), it was assumed that 50% of them would arrive by rail and 50% of them would arrive in the city using a bus. This results in 6,629 visitors arriving in the city via rail and 6,629 visitors arriving on 111 buses. (Unlike permanent residents, where the bus capacity is conservatively limited to 30 people per bus, visitors will have fewer belongings and will, therefore, need less space. Hence, it was assumed that buses for

visitors can accommodate 60 visitors per bus⁸.) These visitors were loaded along the AC Transit routes within the city, see Section 9.

Since the locations of these visits/visitors could be anywhere within the city, the visitor vehicles were assumed to be located along streets where street parking is allowed as well as in the parking garages available within the City of Berkeley. Assuming the visitors travel to recreational areas and facilities as a family/household, the average household size (2.37 persons per household – see Section 3.1) was used to estimate the visitor vehicles. As a result, there are approximately 13,052 ($30,934 \div 2.37$) evacuating tourist vehicles.

In addition, visitors within the Shadow Region at Tilden Regional Park and the Tilden Park Golf Course were included in the study since they need to enter the city limits to evacuate. Based on aerial imagery, Tilden Regional Park has approximately 419 parking spaces and Tilden Park Golf Course has approximately 130 parking spaces. Assuming the parking lots are fully occupied at peak times, this study estimates a total of 549 evacuating vehicles from Tilden Regional Park and the Tilden Park Golf Course. The average household size (2.37 persons per household – see Section 3.1) was used to estimate visitor population at Tilden Regional Park and 2 persons per vehicle were used to estimate visitor population at the Tilden Park Golf Course, resulting in a population of 993 visitors (419×2.37) at Tilden Regional Park and 260 visitors (130×2.00) at the Tilden Park Golf Course.

In summary, 6,629 visitors would evacuate using rail, 6,629 visitors would evacuate in 111 buses and the remaining 32,187 visitors would evacuate in 13,601 private vehicles.

3.4 Employees

The estimate of employees commuting into the City of Berkeley is based on the employment data provided by the city and the data obtained from the U.S. Census Bureau's OnTheMap Census analysis tool⁹.

The employment data provided by the City of Berkeley, as of October 2022, includes the coordinates of employers and the average number of their employees. The employer locations were plotted using GIS software. Employees who work at small companies are likely local residents. Based on federal guidance on major employers and discussions with the city, to avoid double-counting residents who live within the city, only employers with 100 or more employees are considered as *major employers*. Employers with less than 100 employees were removed from the analysis.

Staff at major employers within Berkeley fall into two categories:

- Those who live and work in the City of Berkeley
- Those who live outside of the City of Berkeley and commute to jobs within the city

⁸ According to the AC Transit website, buses can accommodate between 40 and 78 passengers. An average of 60 passengers per bus was assumed.

⁹ <http://onthemap.ces.census.gov/>

Those of the first category are already counted as part of the permanent resident population. To avoid double counting, we focus only on those employees commuting from outside the city who will evacuate along with the permanent resident population. The LEHD (Longitudinal Employer-Household Dynamics) Origin-Destination Employment Statistics (LODES) data¹⁰ from OnTheMap website was then used to estimate the percent of employees that work within the city but live outside. The data indicates approximately 84.4% of these employees live outside of the City of Berkeley. This value was applied to the average number of employee values to compute the number of employees commuting into the city. There are an estimated 25,341 employees who work within the city but live outside.

To estimate the employee vehicles, a vehicle occupancy of 1.08 employees per vehicle obtained from the demographic survey (see Appendix D, Sub-section D.3.1) was used for the major employers. Given the limited parking spaces within the City of Berkeley, based on the demographic survey 35.7%¹¹ of the employees would take public transit to the city and the remaining employees who drive to work would park their vehicles within a 10-minute walking distance (approximately 0.5 miles) from their workplaces. As such, employee vehicles were distributed evenly within a 10-minute walking radius from their place of employment.

Table 3-5 and Table C-4 in Appendix C summarize the estimates of employees and employee vehicles commuting into the City of Berkeley, by Area. As shown in the tables, there are approximately 25,341 employees, including 9,046 employees who take public transit (5,247 employees would use a bus and the remaining 3,799 employees would use rail)¹², and 16,296 employees who would use personal vehicles or rideshare. This results in 15,080 employee vehicles and 88⁸ buses (full of employees) commuting into the city on a daily basis.

3.5 Special Facility Population Demand

3.5.1 Medical Facilities

There are 11 medical facilities within the City of Berkeley that provide inpatient care services, indicated in Table 3-6¹³. In addition to these 11 facilities, 2020 Census data was used to identify skilled nursing facilities throughout the city at the census block level. These are labeled in Table 3-6 as “Other Medical Facilities Throughout the City”.

The breakdown of ambulatory, wheelchair-using and bedridden patients for some of the medical facilities was obtained by making phone calls to individual facilities. For those facilities wherein data could not be obtained, existing data was used to estimate the number of each type of patient (see Section 2.4, Assumption 2.c.ii) at each facility. Table C-3 in Appendix C summarizes

¹⁰ The LODES data is part of the LEHD data products from the U.S. Census Bureau. This dataset provides detailed spatial distributions of workers' employment and residential locations and the relation between the two at the census block level. The latest LODES data available is as of 2019 when this study started. For detailed information, please refer to this site: <https://lehd.ces.census.gov/data/>

¹¹ As illustrated in Appendix D, Figure D-8, among employees commuting via bus, BART, a combination of public transit modes, driving alone, or carpooling, approximately 35.7% utilize public transportation. Employees who indicated that they would walk or bike as their primary mode of transportation were assumed to be local residents and thus excluded from the non-resident employee population.

¹² Based on the demographic survey, of the employees that take public transportation to work, approximately 58% use a bus and the remaining 42% use rail. See Appendix D Figure D-8.

¹³ There are residential care facilities for the elderly (RCFE) or adult residential facilities (ARF) (maximum of 6 patients) that are not included as part of medical facilities. It is assumed that RCFE and ARF would be evacuated in personal vehicles of staff within the home and are already included in the vehicle estimates for the general population.

the data gathered. Table 3-6 presents the current census and transportation requirement of medical facilities in the City of Berkeley. As shown in this table, 861 people have been identified as living in, or being treated in, these facilities. The number of ambulances is determined by assuming that 2 bedridden patients can be accommodated per ambulance trip; the number of wheelchair vans assumes 2 wheelchairs per trip, and the number of buses estimated assumes 30 ambulatory patients per trip (see Section 2.4, Assumptions 3.c-e). As shown in Table 3-6, 20 buses, 111 wheelchair vans and 128 ambulances are needed to evacuate all medical facilities.

3.5.2 Juvenile Homes

As the 2020 Census data indicates, there are juvenile homes within the City of Berkeley. Their locations and population are listed in Appendix C, Table C-6. In total, there are 9 people in three different locations. It was assumed that these people would be evacuated with vehicles with 2 people per vehicle which would result in 5 vehicles to evacuate these facilities.

3.6 College/University, School, Preschool/Day Care Center Population Demand

3.6.1 School, Preschool/Day Care Center Population

Table 3-7 presents the population and transportation requirements for all schools and preschools/day care centers within the City of Berkeley. This information was provided by the City and supplemented by internet searches for schools where data was not provided. The column in Table 3-7 entitled “Buses Required” specifies the number of buses needed for each facility under the following set of assumptions and estimates:

- The demographic survey results indicate 83% of the households with school children would pick up their children prior to starting their evacuation trip. As such, the total enrollments were reduced by 83% to estimate the need for buses.
- Bus capacity, expressed in students per bus, was assumed to be 30 for colleges/universities, 50 for high school and middle school buses, and 70 for elementary school and preschool/day care center buses.
- Those staff members who do not accompany the students will evacuate in their private vehicles.
- No allowance is made for student absenteeism, which is typically 3 percent daily.

The need for buses could be further reduced by any high school students who have evacuated using private vehicles (if permitted by school authorities). Since the number of students who drive to school is unknown, these reductions were not considered. In total, an estimated 112 buses are required for all schools/preschools/day care centers within the city, as shown in Table 3-7. Those buses that are originally allocated to evacuate schoolchildren that are not needed due to children being picked up by their parents, can be gainfully assigned to service other facilities or those persons who do not have access to private vehicles or to ride-sharing. School buses are represented as two vehicles in the ETE simulation due to their larger size and more sluggish operating characteristics.

3.6.2 College/University Student Population

The City of Berkeley has 12 small colleges and 2 large colleges/universities: Berkeley City College

(BCC) and University of California – Berkeley (UC Berkeley). The data for all colleges/universities were provided by the City of Berkeley. It was assumed that students from most small local colleges are likely local residents living within the city or remote learning students living outside of the city. As such, these facilities were ignored to avoid double counting. Students at California Jazz Conservatory, Acupuncture and Integrative Medicine College, and Institute of Buddhist Studies would evacuate in personal vehicles. Although students may evacuate using rail, on foot, or on bike, this study conservatively assumes that students at BCC and UC Berkeley would either evacuate in personal vehicles or emergency evacuation buses.

Based on the data provided for UC Berkeley¹⁴, there are 45,882 students and 3.94% of them telecommute or are remote. This equates to 44,075 students that are physically present on campus. Based on the data provided, 27% of students are On-Campus students (11,900 students), of which 18% own a personal vehicle (2,142 students). This equates to 1,983 On-Campus Student vehicles (using an average vehicle occupancy rate of 1.08 based on the demographic survey) for UC Berkeley. Of the remaining 82% of On-Campus students that do not own a personal vehicle, 87% of them would rideshare (based on the results of the demographic survey). The remaining students who do not own a vehicle, and will not rideshare, will require a bus to evacuate. This results in 1,269 On-Campus students evacuating on 43 buses (assuming 30 students per bus, see Section 2). Based on the data provided, 70% of students live within the city limits which includes both On-Campus students (11,900) and Off-Campus students that live within the city. As such, 18,953 $((44,075 \times .070) - 11,900)$ Off-Campus students live within the city. The remaining 13,222 $(44,075 - 11,900 - 18,953 = 13,222)$ are Off-Campus students that commute into UC Berkeley from outside of the city limits. Based on the data provided approximately 41% Off-Campus students drive to campus and the remaining approximately 59% utilize Bear Transit, AC Transit, BART, and other modes of public transit. Using the same vehicle occupancy rates, rideshare percentages (for those who would normally use public transit), and bus capacities as On-Campus students, this equates to 12,110 Off-Campus student vehicles and 75 Off-Campus student buses. The data indicates 25% of the non-city Off-Campus students that utilize public transit will utilize BART. As such, there are approximately 255 Off-Campus students that use BART to commute to UC Berkeley from outside of the city limits. There are a total of 14,093 student vehicles and 118 buses, and 255 students that use BART, at UC Berkeley.

Based on the data provided, there are 6,519 students that attend BCC. Of these students, 474 students live within Berkeley and commute to BCC, and 1,482 students live outside of Berkeley and commute to BCC. The remaining students do not commute to campus. Other detailed data was not available for BCC. As such, the vehicle ownership percentage (18%), vehicle occupancy rates (1.08), rideshare percentages (87%), and bus capacities (30) obtained for UC Berkeley were utilized for BCC. As such, there are an estimated 79 personal vehicles and 2 buses for students that live within Berkeley who attend BCC. Of the students that live outside of Berkeley (1,482 students), 36% of students would drive to campus and 41% would take public transportation¹⁵. Using the same vehicle occupancy rates, rideshare percentages, and bus capacities mentioned above, there are an estimated 494 personal vehicles and 5 buses for students that live outside of

¹⁴ Annual Commuter Report, Berkeley University of California Parking & Transportation, 2023

¹⁵ <https://statics.teams.cdn.office.net/evergreen-assets/safelinks/1/atp-safelinks.html>

Berkeley who commute to BCC. In total, there are 573 student vehicles and 7 buses evacuating from BCC.

In total, as shown in Table 3-8, students would evacuate in 14,938 personal vehicles and would require 125 buses to evacuate. Table 3-9 shows the breakdown of on/off campus students for UC Berkeley and Berkeley City College. As previously mentioned, buses are represented as two vehicles in the ETE simulation due to their larger size and more sluggish operating characteristics.

3.7 Transit Dependent Resident Population

The demographic survey (see Appendix D) results were used to estimate the portion of the population requiring transit service:

- Those people in households that do not have a vehicle available.
- Those people in households that do have vehicle(s) that would not be available at the time the evacuation is advised.

In the latter group, the vehicle(s) may be used by a commuter(s) who does not return (or is not expected to return) home to evacuate the household.

Table 3-10 presents estimates of transit-dependent people. Note:

- Estimates of people requiring transit vehicles include schoolchildren. For those evacuation scenarios where children are at school when an evacuation is ordered, separate transportation is provided for the schoolchildren. The actual need for transit vehicles by residents is thereby less than the given estimates. However, estimates of transit vehicles are conservatively not reduced when schools are in session.
- It is reasonable and appropriate to consider that many transit-dependent people will evacuate by ridesharing with neighbors, friends or family. The results from the demographic survey indicate that approximately 87% of those who do not own their own cars would share a ride with neighbors or friends. As such, 87% of transit dependent individuals were assumed to rideshare.

The estimated number of bus trips needed to service transit-dependent people is based on an estimate of average bus occupancy of 30 people at the conclusion of the bus run. Table 3-10 indicates that transportation must be provided for 1,686 people within the City of Berkeley. Therefore, a total of 57 buses are required from a capacity standpoint. In order to service all of the transit dependent population and have at least one bus drive through each of the Areas that contain transit dependent people, **112 buses** are used in the ETE calculations. These buses are represented as two vehicles in the ETE simulations due to their larger size and more sluggish operating characteristics.¹⁶

To illustrate this estimation procedure, we calculate the number of persons, P, requiring public transit or ride-share, and the number of buses B:

¹⁶ Due to the inherent congestion during an evacuation, the incremental impedance caused by buses stopping for passenger boarding on roadways without dedicated shoulders or lanes is considered negligible. The pre-existing stop-and-go conditions mitigate any significant disruption.

$$P = \text{No. of HH} \times \sum_{i=0}^n \{(\% \text{ HH with } i \text{ vehicles}) \times [(Average \text{ HH Size}) - i]\} \times A^i C^i$$

Where:

A = Percent of households with commuters

C = Percent of households who will not await the return of a commuter

$$P = 49,267 \times [0.0747 \times 1.51 + 0.428 \times (1.99 - 1) \times 0.416 \times 0.699 + 0.403 \times (2.74 - 2) \times (0.416 \times 0.699)^2] = 12,870$$

$$B = [(1 - 0.869) \times P] \div 30 = 57$$

These calculations are explained as follows:

- The number of households (HH) is computed by dividing the population by the average household size (116,762 ÷ 2.37) and is 49,267.
- All members (1.51 avg.) of households (HH) with no vehicles (7.47%) will evacuate by public transit or rideshare. The term 49,267 (number of households) x 0.0747 x 1.33, accounts for these people.
- The members of HH with 1 vehicle away (42.80%), who are at home, equal (1.99-1). The number of HH where the commuter will not return home is equal to (49,267 x 0.428 x 0.99 x 0.416 x 0.699), as 41.6% of households have a commuter, 69.9% of which would not return home in the event of an emergency. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms.
- The members of HH with 2 vehicles that are away (40.30%), who are at home, equal (2.74 - 2). The number of HH where neither commuter will return home is equal to 49,267x 0.403 x 0.74 x (0.416 x 0.699)². The number of persons who will evacuate by public transit or rideshare is equal to the product of these two terms (the last term is squared to represent the probability that neither commuter will return).
- Households with 3 or more vehicles are assumed to have no need for transit vehicles.
- The total number of persons requiring public transit is the sum of such people in HH with no vehicles, or with 1 or 2 vehicles that are away from home.
- The number of buses needed is computed as the product of the number of people requiring public transit and the percentage of people who will not rideshare (100% minus 87%) divided by the bus occupancy.
- Because the Census counts people experiencing homelessness, it is assumed that the homeless population are included inside these calculations of transit-dependent people.

KLD used AC Transit and other transit services within Berkeley to service the transit-dependent population within the city. These routes are shown in Figure 9-7 through Figure 9-9. It is assumed that transit dependent population would gather along the nearest transit route or transit stop to board a bus to evacuate the area.

3.7.1 Bay Area Rapid Transit and Caltrain (Rail) Demand

Data suggests that some employees, visitors and college students use Bay Area Rapid Transit (BART) and Caltrain for their daily commute. Since this study only considers vehicular demand on the City of Berkeley roadway system, it does not include evacuation using rail systems. As shown in Table 3-11, there are 6,629 visitors, 3,799 employees and 255 UC-Berkeley Off-Campus students that would evacuate using rail resources.

3.8 People Requiring Specialized Transportation Assistance

Based on data provided by the City of Berkeley, HHS emPOWER Program¹⁷ (December 2023 update) identifies a total of 348 people within the city who are assumed to require transportation assistance to evacuate. The data from emPOWER does not provide details on the number of ambulatory, wheelchair-using and bedridden people. This study conservatively assumes that people who use motorized wheelchairs or scooters a wheelchair-accessible van and people using electric beds will require ambulances to evacuate. This equates to 99 motorized wheelchair/scooter users in 50 wheelchair accessible vans, and 249 bedbound people in 125 ambulances.

3.9 External Traffic

Vehicles will be traveling through the study area (external-external trips) at the time of an incident. After the evacuation order is announced, these through-travelers will also need to evacuate. These through vehicles are assumed to travel on the freeways traversing the study area – CA-24, Interstate 880 (I-880), I-580 and I-80. It is likely dynamic and variable message signs, and/or manual diversion, will be strategically positioned outside of the study area at logical diversion points to attempt to divert traffic away from the area at risk. As such, it is assumed this external traffic will cease at 2 hours after the evacuation order to allow emergency responders to facilitate evacuation.

Average Annual Daily Traffic (AADT) data was obtained from Caltrans¹⁸ to estimate the number of vehicles per hour on the aforementioned routes. The AADT was multiplied by the K-Factor, which is the proportion of the AADT on a roadway segment or link during the design hour, resulting in the Design Hour Volume (DHV). The design hour is usually the 30th highest hourly traffic volume of the year, measured in vehicles per hour (vph). The DHV is then multiplied by the D-Factor, which is the proportion of the DHV occurring in the peak direction of travel (also known as the directional split).

The resulting values are the directional design hourly volumes (DDHV) and are presented in Table 3-12. The DDHV is then multiplied by 2 hours (dynamic messaging signs are assumed to be activated within the 120 minutes of the evacuation order) to estimate the total number of external vehicles loaded on the analysis network. As indicated, there are 47,962 external traffic vehicles within the study area prior to the activation of the roadblocks and the diversion of this

¹⁷ <https://empowerprogram.hhs.gov/>

¹⁸ <https://dot.ca.gov/programs/traffic-operations/census/>

traffic. This number is reduced by 60% for nighttime scenarios (Scenarios 3 and 6) as discussed in Section 6.

3.10 Background Traffic

Section 5 discusses the time needed for the people in the study area to mobilize and begin their evacuation trips. There are 14 time periods during which traffic is loaded on to roadways in the study area to model the mobilization time of people in the study area, see Table 5-9. All traffic is loaded within these 14 time periods. Note, there is no traffic generated during the 15th time period, as this time period is intended to allow traffic that has already begun evacuating to clear the study area boundaries.

In traffic simulations, the network is initially empty. Thus, for this study, the network needs to be filled (to represent routine travel conditions just prior to an evacuation order) so that system performance can be assessed under a more realistic set of conditions. As such, there is an initialization time period (often referred to as “fill time” in traffic simulation) wherein a portion of the traffic volumes from the start of the evacuation (Time Period 1) are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of Time Period 1 depends on the scenario and the region being evacuated (see Section 6). For example, there are 5,545 vehicles on the roadways in the study area for Region R01 under Scenario 4 (winter, midweek, midday, normal conditions).

3.11 Summary of Demand

A summary of population and vehicle demand is provided in Table 3-13 and Table 3-14, respectively. This summary includes all population groups described in this section. A total of 274,376 people and 150,994 vehicles are considered in this study.

Table 3-1. County Population Change from April 1, 2020 to July 1, 2023

County	2020 Population	2023 Population	Percent Change	Annual Growth Rate
<i>City of Berkeley</i>				
Alameda	1,682,349	1,622,188	-3.58%	-1.11%
<i>Shadow Region</i>				
Contra Costa	1,165,930	1,155,025	-0.94%	-0.29%

Table 3-2. Municipality Population Change from April 1, 2020 to July 1, 2023

Municipality	2020 Population	2023 Population	Percent Change	Annual Growth Rate
Alameda County, CA				
<i>City of Berkeley</i>				
Berkeley	124,326	118,962	-4.31%	-1.35%
<i>Shadow Region</i>				
Albany	20,271	19,097	-5.79%	-1.82%
Emeryville	12,902	12,732	-1.32%	-0.41%
Oakland	440,669	436,504	-0.95%	-0.29%
Piedmont	11,277	10,635	-5.69%	-1.79%
Contra Costa County, CA				
<i>Shadow Region</i>				
El Cerrito	25,955	25,552	-1.55%	-0.48%
Orinda	19,505	19,364	-0.72%	-0.22%
Richmond	116,324	114,106	-1.91%	-0.59%

Table 3-3. Permanent Resident Population within the City of Berkeley and Shadow Region

Refer to Figure 3-1 for geographic representation of these areas.

Area	2020 Population	2024 Extrapolated Population
Berkeley Flats	81,753	76,770
North Berkeley Hills	23,223	21,819
South Berkeley Hills	7,238	6,799
West Berkeley	9,785	9,188
UC Berkeley	2,327	2,186
Lawrence Berkeley National Lab	0	0
TOTAL	124,326	116,762
Population Growth (2020-2024):		-6.08%
Shadow Region	114,671	111,443
STUDY AREA TOTAL	238,997	228,205

Table 3-4. Permanent Resident Population and Vehicles

Area	2024 Extrapolated Population	2024 Resident Vehicles
Berkeley Flats	76,770	32,193
North Berkeley Hills	21,819	9,426
South Berkeley Hills	6,799	2,078
West Berkeley	9,188	3,680
UC Berkeley ¹⁹	2,186	237
Lawrence Berkeley National Lab	0	0
TOTAL	116,762	47,614
Shadow Region	111,443	52,094
STUDY AREA TOTAL	228,205	99,708

¹⁹ The population estimates shown within the UC Berkeley Area only include the data produced by the Census, not the estimated student population. The estimated student population, and evacuating student vehicles (including transit dependent students), is contained within Section 3.6.2 and Table 3-8.

Table 3-5. Summary of Employees and Employee Vehicles Commuting into the City of Berkeley

Area	Employees	Employee Vehicles^{20,21}
Berkeley Flats	5,553	6,059
North Berkeley Hills	0	853
South Berkeley Hills	172	103
West Berkeley	5,035	2,831
UC Berkeley	11,553	3,563
Lawrence Berkeley National Lab	3,028	1,847
TOTAL	25,341	15,256

²⁰ As described in Section 3.4, the employees driving to the city would park their vehicles within a 10-minute walking distance from their workplaces due to the limited parking spaces. As a result, the vehicle numbers in Berkeley Flats and North Berkeley Hills are greater than the population numbers, while the vehicle number in UC Berkeley is significantly less than the vehicle estimate.

²¹ Includes 88 buses (176 vehicles) for employees who commute using buses.

Table 3-6. Medical Facilities Transit Demand Estimates

Area	Facility Name	Municipality	Current Census	Ambulatory	Wheelchair Users	Bedridden	Buses	Wheelchair Vans	Ambulances
Berkeley Flats	Silverado Memory Care Center	Berkeley	87	37	22	28	2	11	14
Berkeley Flats	Chaparral House	Berkeley	42	6	18	18	1	9	9
Berkeley Flats	Elegance Berkeley	Berkeley	47	20	12	15	1	6	8
Berkeley Flats	Alta Bates Summit Medical Center - Herrick Campus	Berkeley	58	58	0	0	2	0	0
Berkeley Flats	Kyakameena Care Center	Berkeley	60	26	15	19	1	8	10
Berkeley Flats	Berkeley Pines Care Center	Berkeley	32	4	18	10	1	9	5
Berkeley Flats	Elmwood Care Center	Berkeley	77	33	19	25	2	10	13
Berkeley Flats	Alta Bates Summit Medical Center - Alta Bates Campus	Berkeley	183	73	37	73	3	19	37
Berkeley Flats	Ashby Care Center	Berkeley	29	5	14	10	1	7	5
North Berkeley Hills	New Bridge Foundation	Berkeley	45	20	14	11	1	7	6
UC Berkeley	Redwood Gardens Apartments	Berkeley	168	76	50	42	3	25	21
Berkeley Flats	Other Medical Facilities Throughout the City	Berkeley	33	33	0	0	2	0	0
TOTAL:			861	391	219	251	20	111	128

Table 3-7. School and Preschool/Day Care Center Population Demand Estimates

Area	School Name	Enrollment	Buses Required
Berkeley Flats	Berkeley Rose Waldorf School	97	1
Berkeley Flats	Ruth Acty Elementary School	433	2
Berkeley Flats	The Crowden School	75	1
Berkeley Flats	Martin Luther King Middle School	1,007	4
Berkeley Flats	School of the Madeleine	337	1
Berkeley Flats	Bayhill High School	73	1
Berkeley Flats	Berkeley Arts Magnet at Whittier School	407	1
Berkeley Flats	Berkeley High School	3,427	12
Berkeley Flats	Pacific Boychoir Academy	30	1
Berkeley Flats	Berkwood Hedge School	128	1
Berkeley Flats	Oxford Elementary at West Campus	256	1
Berkeley Flats	The Berkeley School	236	1
Berkeley Flats	Longfellow Arts and Technology Middle School	504	2
Berkeley Flats	Berkeley Technology Academy	36	1
Berkeley Flats	Walden Center & School	84	1
Berkeley Flats	Washington Elementary School	416	2
Berkeley Flats	East Bay School for Boys	105	1
Berkeley Flats	Sylvia Mendez Elementary School	409	1
Berkeley Flats	The Elmwood Academy	100	1
Berkeley Flats	Willard Middle School	669	3
Berkeley Flats	Malcolm X Elementary School	552	2
Berkeley Flats	Escuela Bilingue Internacional	324	1
Berkeley Flats	Emerson Elementary	323	1
Berkeley Flats	Maybeck High School	121	1
North Berkeley Hills	Thousand Oaks Elementary	382	1
North Berkeley Hills	Cragmont Elementary School	331	1
South Berkeley Hills	John Muir Elementary School	306	1

Area	School Name	Enrollment	Buses Required
West Berkeley	Black Pine Circle School	347	1
West Berkeley	Rosa Parks Environmental Science School	442	2
West Berkeley	VIA Center	20	1
	SCHOOL TOTAL:	11,977	51
Area	Preschool/Daycare Name	Enrollment	Buses Required
Berkeley Flats	Berkeley Rose Waldorf School	24	1
Berkeley Flats	Hearts Leap Beginnings	40	1
Berkeley Flats	Hearts Leap ICRI Preschool	70	1
Berkeley Flats	Berkeley Little School	42	1
Berkeley Flats	Ala Costa Center for the Developmentally Disabled	58	1
Berkeley Flats	BUSD - Hopkins Street	140	1
Berkeley Flats	Mustard Seed Preschool	66	1
Berkeley Flats	Jewish Community Ctr of The East Bay-Berkeley	75	1
Berkeley Flats	Cedar Creek Montessori School	40	1
Berkeley Flats	Woolly Mammoth Childcare & Preschool	69	1
Berkeley Flats	Berkeley Montessori School	119	1
Berkeley Flats	The New School of Berkeley	48	1
Berkeley Flats	The New School of Berkeley-Schoolage	45	1
Berkeley Flats	Hearts Leap North	45	1
Berkeley Flats	Berkeley Special Education Preschool	90	1
Berkeley Flats	Berkeley YMCA EHS - Vera Casey	26	1
Berkeley Flats	Congregation Beth Israel-Gan Shalom	32	1
Berkeley Flats	Little Elephant Montessori, Inc.	24	1
Berkeley Flats	Shu Ren International School	179	1
Berkeley Flats	Berkeley International Montessori School	21	1
Berkeley Flats	Child Education Center	107	1
Berkeley Flats	Congregation Netivot Shalom	30	1

Area	School Name	Enrollment	Buses Required
Berkeley Flats	Little Beans Preschool	40	1
Berkeley Flats	Rosemarie's Motivational Preschool	22	1
Berkeley Flats	BUSD - King Child Development Center	108	1
Berkeley Flats	Cornerstone Children's Center	112	1
Berkeley Flats	UCB - Dwight Way Center	42	1
Berkeley Flats	UCB - Harold E. Jones Child Study Ctr/Childcare	56	1
Berkeley Flats	UCB - Haste Street Child Development Center	92	1
Berkeley Flats	Berkeley YMCA Head Start - South YMCA	94	1
Berkeley Flats	Model School Comprehensive Humanistic Learning Ctr	63	1
Berkeley Flats	Through the Looking Glass Early Head Start	24	1
Berkeley Flats	American International Montessori School	117	1
Berkeley Flats	Ephesian Children's Center	36	1
Berkeley Flats	Mi Mundo Preschool	29	1
Berkeley Flats	VIA Nova Children's School	45	1
Berkeley Flats	The Monteverde School	30	1
Berkeley Flats	St. John's Child Care Center	45	1
North Berkeley Hills	Step One School	108	1
North Berkeley Hills	Berkeley Hills Nursery School	40	1
North Berkeley Hills	Childrens Community Center	52	1
North Berkeley Hills	Dandelion Nursery School, Inc	24	1
North Berkeley Hills	Beth El Nursery School	74	1
UC Berkeley	UCB - Clark Kerr Campus Children's Center	29	1
UC Berkeley	UCB - Clark Kerr Preschool	29	1
South Berkeley Hills	Kids In Motion	70	1
South Berkeley Hills	Arbor Preschool East	22	1
West Berkeley	BUSD - Franklin Preschool	192	1
West Berkeley	Centro Vida Bilingual Childcare Center	64	1
West Berkeley	Duck's Nest - Berkeley	91	1

Area	School Name	Enrollment	Buses Required
West Berkeley	Golden Gate Learning Center	57	1
West Berkeley	Bahia School Age Program	65	1
West Berkeley	Dolma Child Care Center	14	1
West Berkeley	Berkeley YMCA Head Start - West	86	1
West Berkeley	Nia House Learning Center	94	1
West Berkeley	Ecole Bilingue De Berkeley	426	2
West Berkeley	Global Montessori International School	90	1
West Berkeley	Pixar Child Development Center	108	1
West Berkeley	Sunshine Preschool (CEID)	45	1
West Berkeley	Aquatic Park School	77	1
PRESCHOOL/DAYCARE TOTAL:		4,202	61
GRAND TOTAL		16,179	112

Table 3-8. College/University Student Estimates

Area	College/University Name	Enrollment	Student Vehicles	Buses Required
Berkeley Flats	Berkeley School of Theology	65	0	0
Berkeley Flats	Berkeley City College	6,519	573	7
Berkeley Flats	California Jazz Conservatory	88	81	0
Berkeley Flats	Acupuncture and Integrative Medicine College-Berkeley	153	142	0
Berkeley Flats	Institute of Buddhist Studies	53	49	0
North Berkeley Hills	Pacific Lutheran Theological Seminary	50	0	0
North Berkeley Hills	Dominican School of Philosophy & Theology	100	0	0
North Berkeley Hills	Church Divinity School of the Pacific	122	0	0
North Berkeley Hills	Graduate Theological Union	275	0	0
North Berkeley Hills	Jesuit School of Theology	112	0	0
North Berkeley Hills	Pacific School of Religion	139	0	0
North Berkeley Hills	Zaytuna College	43	0	0
South Berkeley Hills	The Wright Institute	638	0	0
UC Berkeley	University of California - Berkeley	44,075	14,093	118
COLLEGE/UNIVERSITY TOTAL:		52,432	14,938	125

Table 3-9. UC Berkeley and City College On/Off Student Estimates

Area	College/University Name ²²	Enrollment	On-Campus Students	Off-Campus Commuter Students	Total Student Vehicles	On-Campus Student Vehicles	Off-Campus Student Vehicles	Buses Required	On-Campus Student Buses	Off-Campus Student Buses
Berkeley Flats	Berkeley City College	6,519	474 ²³	1,482	573	79	494	7	2	5
UC Berkeley	University of California - Berkeley	44,075	11,900	13,222	14,093	1,983	12,110	118	43	75
TOTAL:		50,594	12,374	14,704	14,666	2,062	12,604	125	45	80

²² The difference between on/off campus students are students who reside within Berkeley and are included as permanent residents

²³ Berkeley City College does not offer On-Campus housing, these 474 students live within Berkeley and are assumed to be near houses/apartments within the vicinity of the college. Census Blocks within the vicinity of the college were adjusted to avoid double counting these students as residents.

Table 3-10. Transit-Dependent Population Estimates

2024 Extrapolated Population	Survey: Average HH Size with Indicated No. of Vehicles			Estimated No. of Households	Survey: Percent HH with Indicated No. of Vehicles			Survey: Percent HH with Non- Returning Commuters	Total People Requiring Transport	Survey: Estimated Ridesharing Percentage	People Requiring Public Transit	Percent Population Requiring Public Transit
	0	1	2		0	1	2					
116,762	1.51	1.99	2.74	49,267	7.47%	42.80%	40.30%	69.90%	12,870	86.9%	1,686	1.4%

Table 3-11. Rapid Transit (Rail) Demand Estimates

Population group	People
Visitors	6,629
Employees	3,799
College Students	255
TOTAL:	10,683

Table 3-12. External Traffic Estimates

Road Name	Direction	CA DOT AADT ²⁴	K-Factor ²⁵	D-Factor ²⁵	Hourly Volume	External Traffic
CA-24	Southbound	169,000	0.082	0.25	3,465	6,930
I-880	Northbound	128,000	0.082	0.33	3,464	6,928
I-580	Northbound	169,000	0.082	0.33	4,573	9,146
I-580	Southbound	257,000	0.067	0.25	4,305	8,610
I-80	Northbound	231,000	0.067	0.25	3,869	7,738
I-80	Southbound	257,000	0.067	0.25	4,305	8,610
TOTAL						47,962

²⁴ California Department of Transportation (Caltrans), <https://dot.ca.gov/programs/traffic-operations/census/>
²⁵ Highway Capacity Manual (HCM) 2022

Table 3-13. Summary of Population Demand

Area	Residents ²⁶	Transit-Dependent Residents ²⁷	Visitors	Employees	Special Facilities ²⁸	College Students ²⁹	Schools and Preschools	Shadow Population ³⁰	External Traffic	Total
Berkeley Flats	76,770	1,111	37,563 ³¹	5,553	650 ³²	6,878	12,494	0	0	110,968
North Berkeley Hills	21,819	315		0	45	841	1,011	0	0	31,544
South Berkeley Hills	6,799	96		172	0	638	398	0	0	15,616
West Berkeley	9,188	134		5,035	7 ³³	0	2,218	0	0	24,095
UC Berkeley	1,955	31		11,553	168	44,075	58	0	0	65,583
Lawrence Berkeley National Lab	0	0	0	3,028	0	0	0	0	0	3,028
Shadow Region	0	0	1,253	0	0	0	0	22,289	0	23,542
Total	116,762	1,686	32,187	25,341	870	52,432	16,179	22,289	0	274,376

²⁶ Computed from the Census.

²⁷ Computed from the Census and the demographic survey.

²⁸ Special Facilities represent the population at medical facilities and juvenile homes.

²⁹ College students includes on-campus student populations.

³⁰ Shadow Population has been reduced to 20%. Refer to Section 2.

³¹ For simplicity, these visitors were distributed equally within each Area inside the Total column of this table for a representative value of the total number of visitors within each Area.

³² Includes 2 people at a juvenile home.

³³ Includes 7 people at two juvenile homes within this Area.

Table 3-14. Summary of Vehicle Demand³⁴

Area	Residents	Transit-Dependent Residents	Visitors	Employees	Special Facilities ³⁵	College Students	Schools and Preschools	Shadow Population ³⁰	External Traffic	Total
Berkeley Flats	32,193	112	13,274 ³¹	6,059	213 ³⁶	859	164	0	0	42,254
North Berkeley Hills	9,426	56		853	15	0	14	0	0	13,019
South Berkeley Hills	2,078	27		103	0	0	6	0	0	4,869
West Berkeley	3,680	24		2,831	4 ³⁷	0	36	0	0	9,230
UC Berkeley	193	5		3,563	52	14,329	4	0	0	20,845
Lawrence Berkeley National Lab	0	0	0	1,847	0	0	0	0	0	1,847
Shadow Region	0	0	549	0	0	0	0	10,419	47,962	58,930
Total	47,614	224	13,823	15,256	285	15,188	224	10,419	47,962	150,994

³⁴ Buses (including Transit-Dependent Buses) are represented as two passenger vehicles. Excludes rapid transit demand since rail has its own dedicated roadway.

³⁵ Special Facilities represent the vehicles at medical facilities and juvenile homes.

³⁶ Includes 1 vehicle at a juvenile home.

³⁷ Includes 4 vehicles at two juvenile homes within this Area.

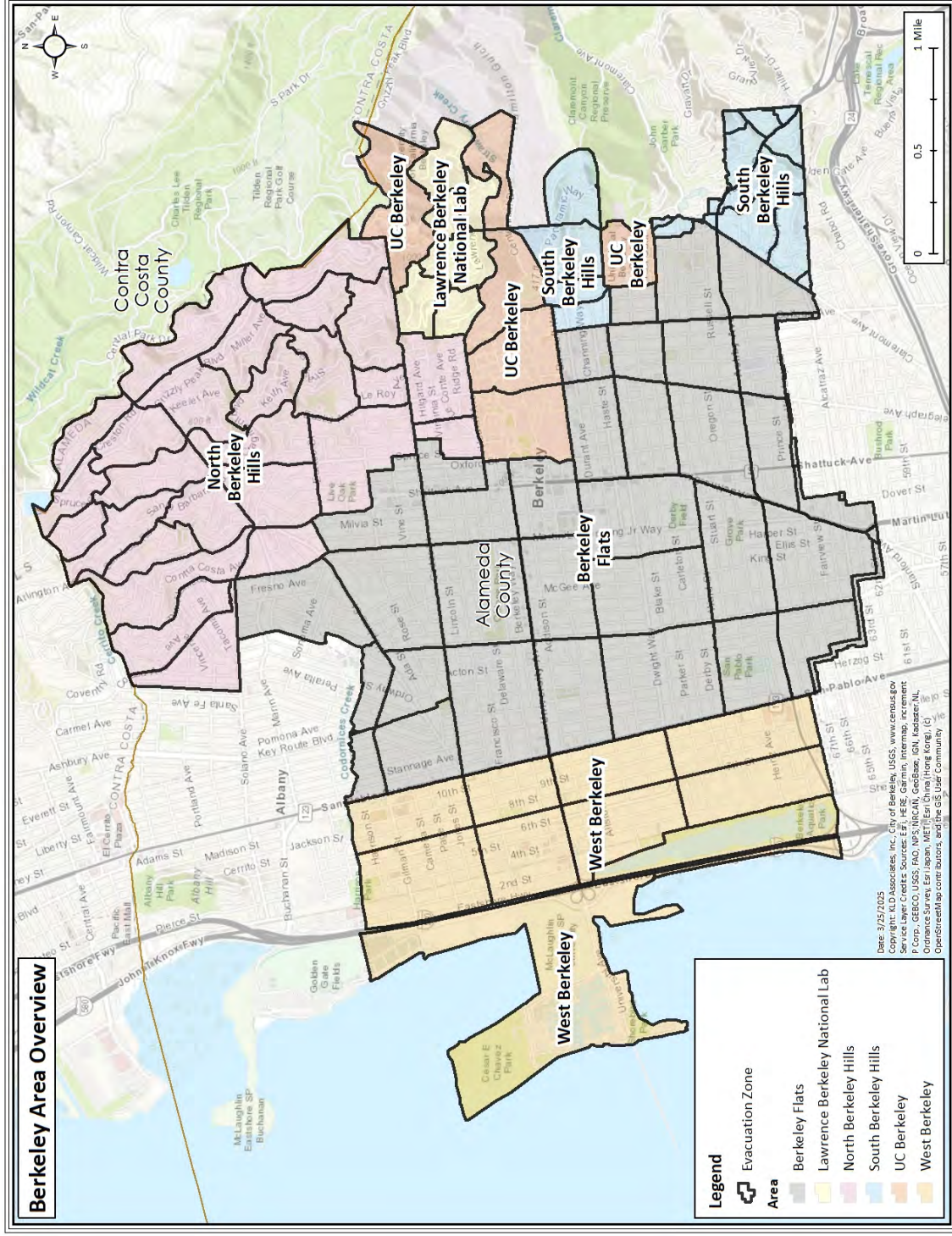
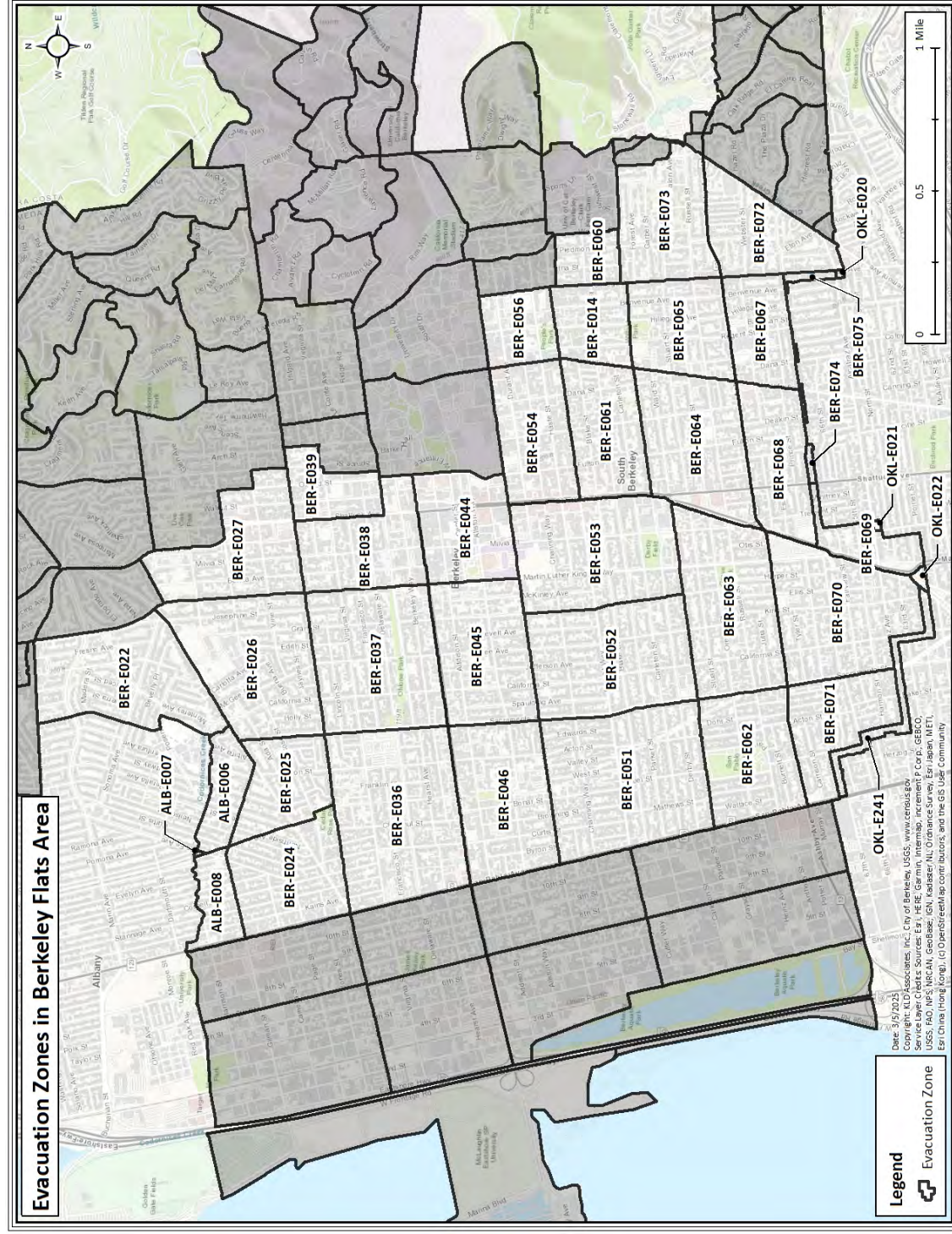


Figure 3-1. Overview of Evacuation Zone and Area Boundaries



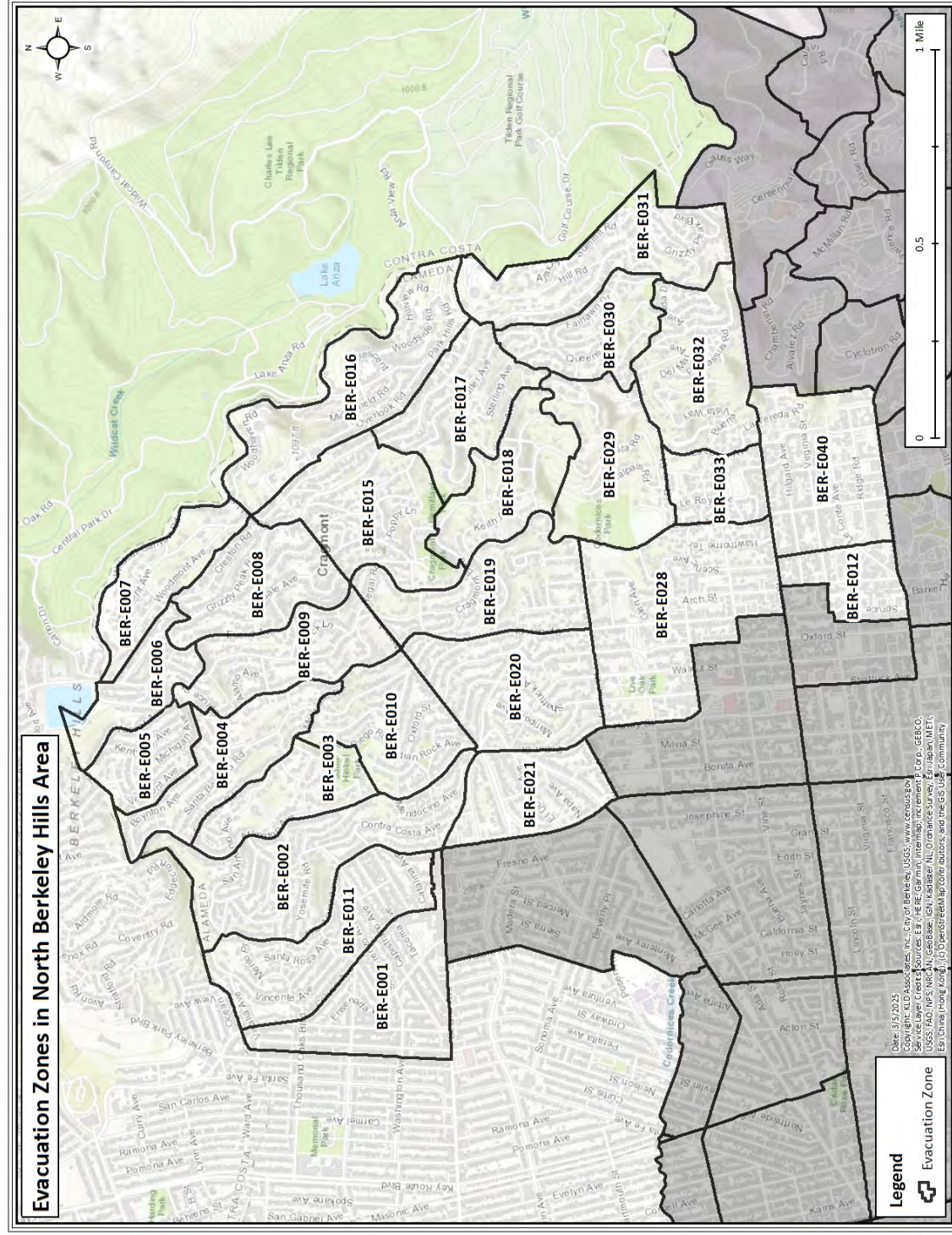


Figure 3-3. Evacuation Zones in the North Berkeley Hills Area

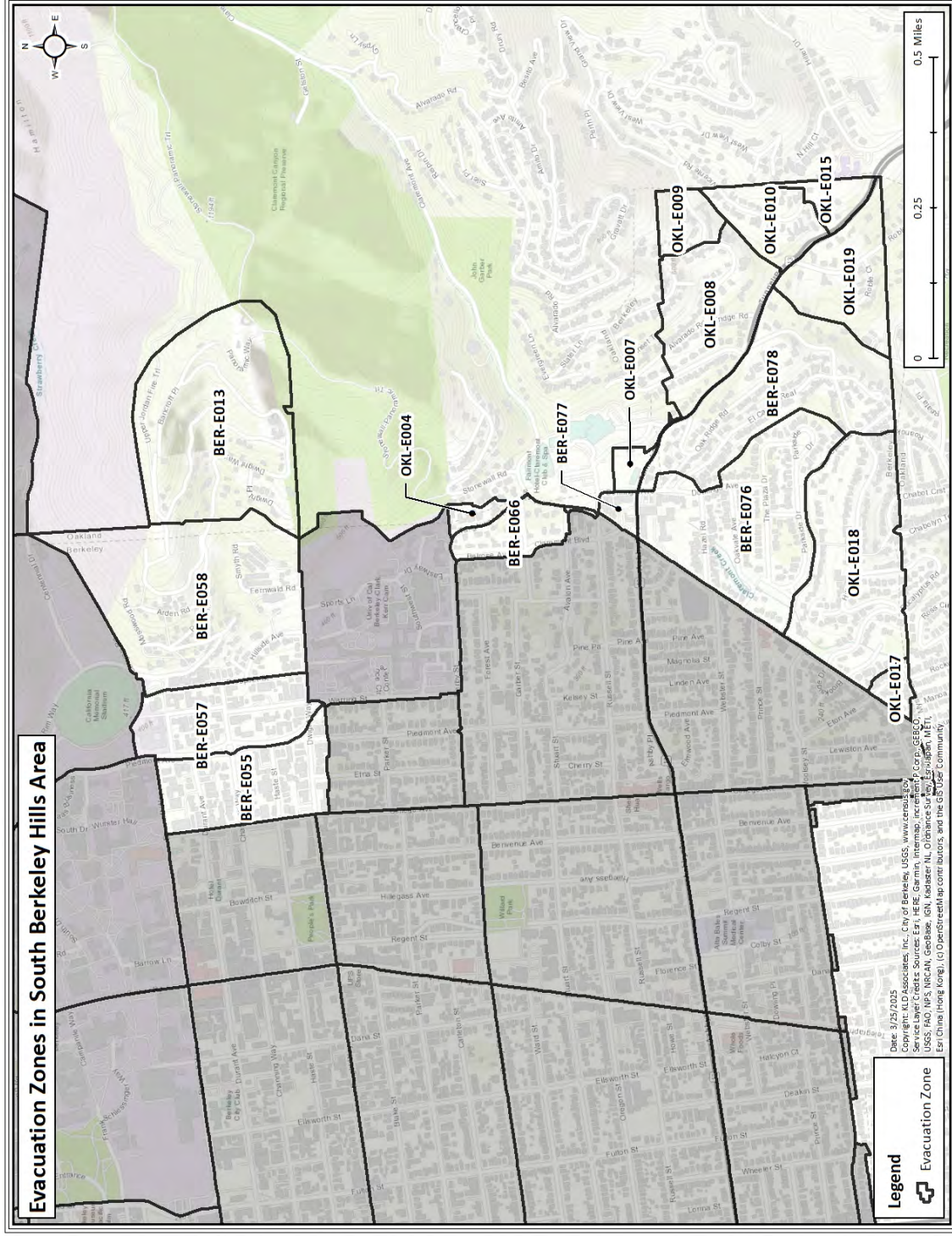


Figure 3-4. Evacuation Zones in the South Berkeley Hills Area



Figure 3-5. Evacuation Zones in the West Berkeley Area

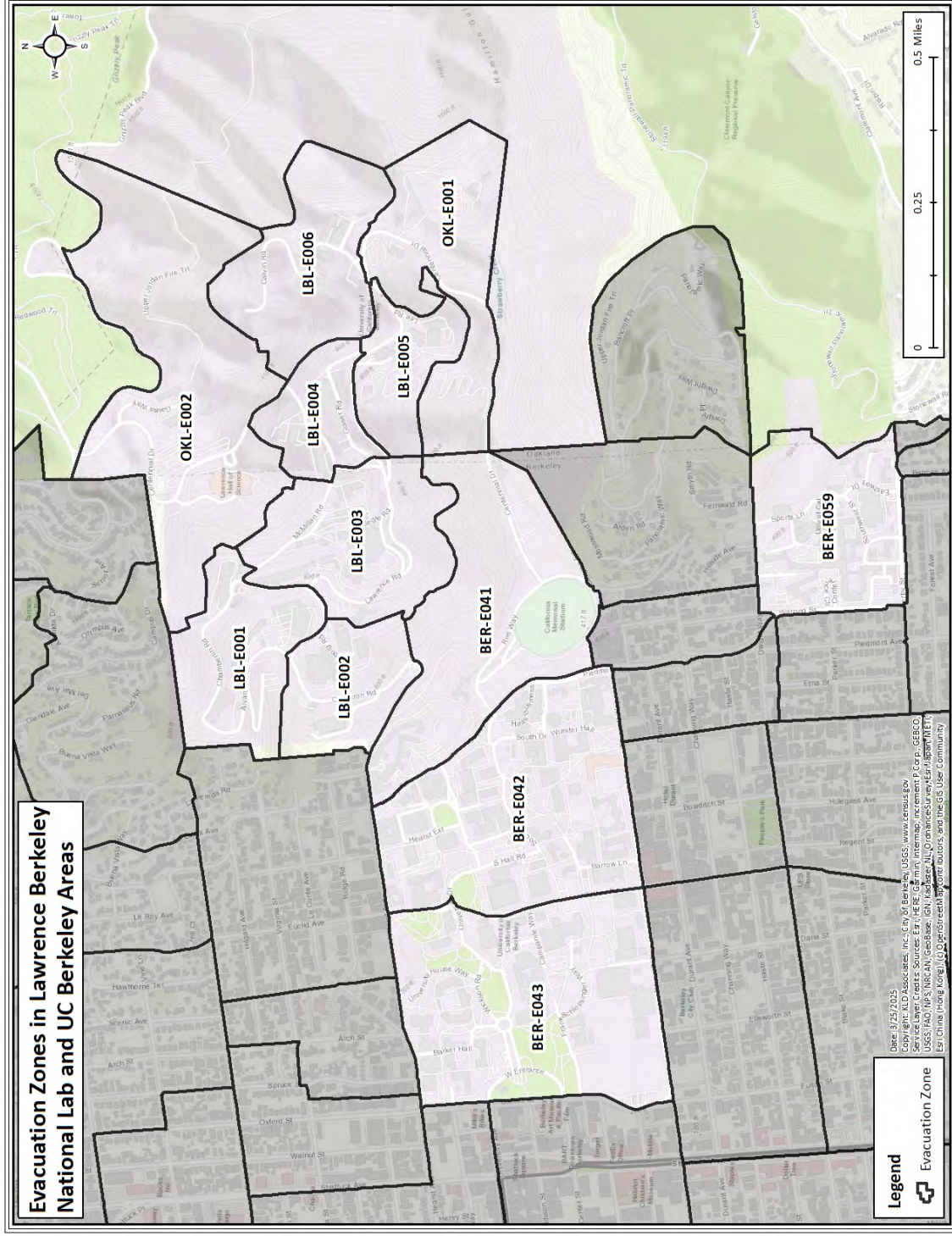


Figure 3-6. Evacuation Zones in the Lawrence Berkeley National Lab and UC Berkeley Areas

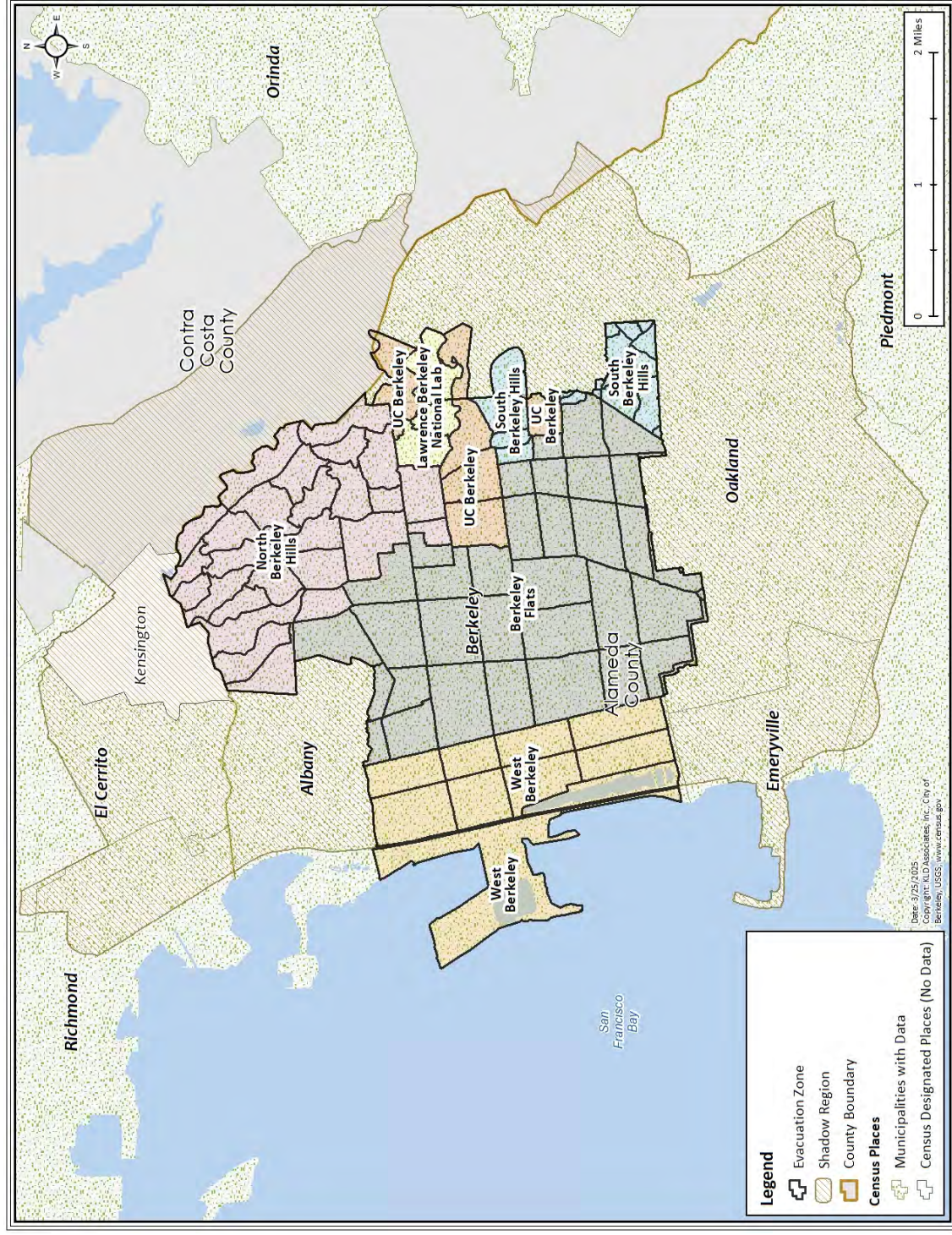


Figure 3-7. Census Boundaries within the Study Area

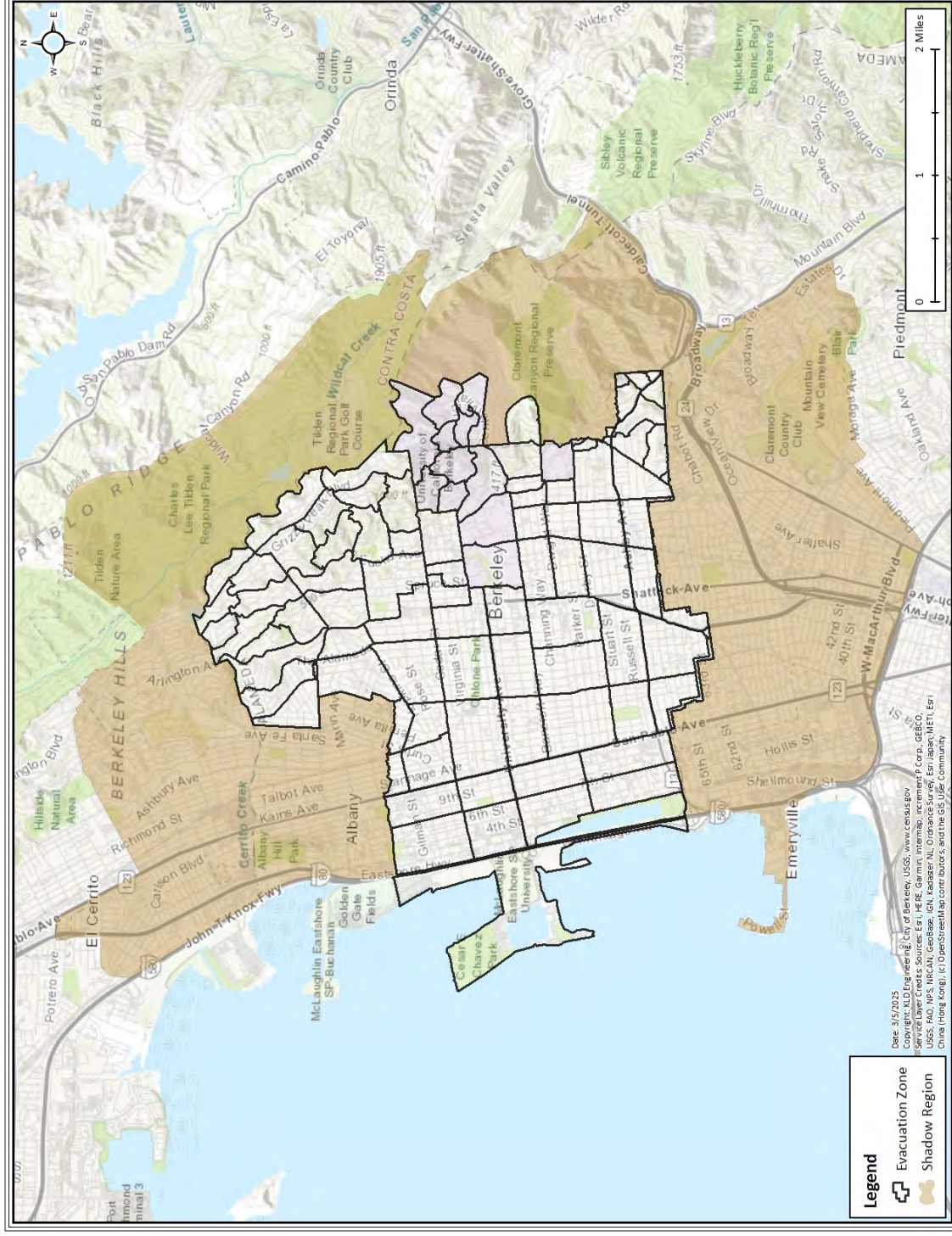


Figure 3-8. Shadow Region

4 ESTIMATION OF ROADWAY CAPACITY

The ability of the road network to service vehicle demand is a major factor in determining how rapidly an evacuation can be completed. The capacity of a road is defined as the maximum sustainable hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane of roadway during a given time period under prevailing roadway, environmental, traffic and control conditions, as stated in the 2022 Highway Capacity Manual 7th Edition (HCM 2022). This section discusses how the capacity of the roadway network was estimated.

In discussing capacity, different operating conditions have been assigned alphabetical designations, A through F, to reflect the range of traffic operational characteristics. These designations have been termed "Levels of Service" (LOS). For example, LOS A represents free-flow and high-speed operating conditions; LOS F represents a forced flow condition. LOS E describes traffic operating at or near capacity.

Another concept, closely associated with capacity, is "Service Volume". Service volume (SV) is defined as "The maximum hourly rate at which vehicles, bicycles or persons reasonably can be expected to traverse a point or uniform section of a roadway during an hour under specific assumed conditions while maintaining a designated level of service." This definition is similar to that for capacity. The major distinction is that values of SV vary from one LOS to another, while capacity is the SV at the upper bound of LOS E, only.

Thus, in simple terms, SV is the maximum traffic that can travel on a road and still maintain a certain perceived level of quality to a driver based on the A, B, C, rating system (LOS). Any additional vehicles above the SV would drop the rating to a lower letter grade.

This distinction is illustrated in Exhibit 12-37 of the HCM 2022. As indicated there, the SV varies with Free Flow Speed (FFS), and LOS. The SV is calculated by the DYNEV II simulation model, based on the specified link attributes, FFS, capacity, control device and traffic demand.

Other factors also influence capacity. These include, but are not limited to:

- Lane width
- Shoulder width
- Pavement condition
- Horizontal and vertical alignment (curvature and grade)
- Percent truck traffic
- Control device (and timing, if it is a signal)
- Weather conditions (rain, fog, wind speed, smoke)

These factors are considered during the road survey and in the capacity estimation process; some factors have greater influence on capacity than others. For example, lane and shoulder width have only a limited influence on FFS and capacity based on the HCM 2022. Consequently, lane and shoulder widths at the narrowest points were observed during the road survey (or aerial imagery for roadways that could not be driven) and these observations were recorded,

but no detailed measurements of lane or shoulder width were taken. Horizontal and vertical alignment can influence both FFS and capacity. The estimated FFS were measured using the survey vehicle's speedometer and observing local traffic, under free flow conditions. The FFS ranged from 10 mph to 70 mph within the City of Berkeley area. Capacity is estimated from the procedures of the HCM 2022. For example, HCM 2022 Exhibit 7-1(b) shows the sensitivity of SV at the upper bound of LOS D to grade (capacity is the SV at the upper bound of LOS E).

The amount of traffic that can flow on a roadway is effectively governed by vehicle speed and spacing. The faster that vehicles can travel when closely spaced, the higher the amount of flow.

Since congestion arising from evacuation may be significant, estimates of roadway capacity must be determined with great care. Because of its importance, a brief discussion of the major factors that influence roadway capacity is presented in this section.

4.1 Capacity Estimations on Approaches to Intersections

At-grade intersections are apt to become the first bottleneck locations under local heavy traffic volume conditions. This characteristic reflects the need to allocate access time to the respective competing traffic streams by exerting some form of control. During evacuation, control at critical intersections will often be provided by traffic control personnel assigned for that purpose, whose directions may supersede traffic control devices. See Section 9 for more information.

The per-lane capacity of an approach to a signalized intersection can be expressed (simplistically) in the following form:

$$Q_{cap,m} = \left(\frac{3600}{h_m} \right) \times \left(\frac{G - L}{C} \right)_m = \left(\frac{3600}{h_m} \right) \times P_m$$

where:

$Q_{cap,m}$	=	Capacity of a single lane of traffic on an approach, which executes movement, m , upon entering the intersection; vehicles per hour (vph)
h_m	=	Mean queue discharge headway of vehicles on this lane that are executing movement, m ; seconds per vehicle
G	=	Mean duration of GREEN time servicing vehicles that are executing movement, m , for each signal cycle; seconds
L	=	Mean "lost time" for each signal phase servicing movement, m ; seconds
C	=	Duration of each signal cycle; seconds
P_m	=	Proportion of GREEN time allocated for vehicles executing movement, m , from this lane. This value is specified as part of the control treatment.
m	=	The movement executed by vehicles after they enter the intersection: through, left-turn, right-turn, and diagonal.

The turn-movement-specific mean discharge headway h_m , depends in a complex way upon many factors: roadway geometrics, turn percentages, the extent of conflicting traffic streams, the control treatment, and others. A primary factor is the value of "saturation queue discharge headway", h_{sat} , which applies to through vehicles that are not impeded by other conflicting traffic streams. This value, itself, depends upon many factors including motorist behavior. Formally, we can write,

$$h_m = f_m(h_{sat}, F_1, F_2, \dots)$$

where:

h_{sat}	=	Saturation discharge headway for through vehicles; seconds per vehicle
F_1, F_2	=	The various known factors influencing h_m
$f_m()$	=	Complex function relating h_m to the known (or estimated) values of h_{sat} , $F_1, F_2, \dots$

The estimation of h_m for specified values of h_{sat} , F_1 , F_2 , ... is undertaken within the DYNEV II simulation model by a mathematical model¹. The resulting values for h_m always satisfy the condition:

$$h_m \geq h_{sat}$$

That is, the turn-movement-specific discharge headways are always greater than, or equal to the saturation discharge headway for through vehicles. These headways (or its inverse equivalent, "saturation flow rate"), may be determined by observation or using the procedures of the HCM 2022.

The above discussion is necessarily brief given the scope of this Evacuation Time Estimate (ETE) study and the complexity of the subject of intersection capacity. In fact, Chapters 19, 20 and 21 in the HCM 2022 address this topic. The factors, $F_1, F_2, \dots$, influencing saturation flow rate are identified in equation (19-8) of the HCM 2022.

The traffic signals within the Evacuation Zones and Shadow Region are modeled using representative phasing plans and phase durations obtained as part of the field data collection. Traffic responsive signal installations allow the proportion of green time allocated (P_m) for each approach to each intersection to be determined by the expected traffic volumes on each approach during evacuation circumstances. The amount of green time (G) allocated is subject to maximum and minimum phase duration constraints; 4 seconds of yellow time are indicated for each signal phase and 1 second of all-red time is assigned between signal phases, typically. If

¹Lieberman, E., "Determining Lateral Deployment of Traffic on an Approach to an Intersection", McShane, W. & Lieberman, E., "Service Rates of Mixed Traffic on the far Left Lane of an Approach". Both papers appear in Transportation Research Record 772, 1980. Lieberman, E., Xin, W., "Macroscopic Traffic Modeling For Large-Scale Evacuation Planning", presented at the TRB 2012 Annual Meeting, January 22-26, 2012.

a signal is pre-timed, the yellow and all-red times observed during the road survey are used. A lost time (L) of 5.0 seconds is used for each signal phase in the analysis.

4.2 Capacity Estimation along Sections of Roadway

The capacity of roadway sections² - as distinct from approaches to intersections- is a function of roadway geometrics, traffic composition (-e.g. percent heavy trucks and buses in the traffic stream) and, of course, motorist behavior. There is a fundamental relationship which relates SV (i.e. the number of vehicles serviced within a uniform roadway section in a given time period) to traffic density. The top curve in Figure 4-1 illustrates this relationship.

As indicated, there are two flow regimes: (1) Free Flow (left side of curve); and (2) Forced Flow (right side). In the Free Flow regime, the traffic demand is fully serviced; the SV increases as demand volume and density increase, until the service volume attains its maximum value, which is the capacity of the roadway section. As traffic demand and the resulting roadway density increase beyond this "critical" value, the rate at which traffic can be serviced (i.e. the SV) can actually decline below capacity ("capacity drop"). Therefore, in order to realistically represent traffic performance during congested conditions (i.e. when demand exceeds capacity), it is necessary to estimate the service volume, V_F , under congested conditions.

The value of V_F can be expressed as:

$$V_F = R \times Capacity$$

where:

R = Reduction factor which is less than unity

We have employed a value of $R=0.90$. The advisability of such a capacity reduction factor is based upon empirical studies that identified a fall-off in the service flow rate when congestion occurs at "bottlenecks" or "choke points" on a freeway system. Zhang and Levinson³ describe a research program that collected data from a computer-based surveillance system (loop detectors) installed on the Interstate Highway System, at 27 active bottlenecks in the twin cities metro area in Minnesota over a 7-week period. When flow breakdown occurs, queues are formed which discharge at lower flow rates than the maximum capacity prior to observed breakdown. These queue discharge flow (QDF) rates vary from one location to the next and also vary by day of week and time of day based upon local circumstances. The cited reference presents a mean QDF of 2,016 passenger cars per hour per lane (pcphpl). This figure compares with the nominal capacity estimate of 2,250 pcphpl estimated for the ETE. The ratio of these two numbers is 0.896 which translates into a capacity reduction factor of 0.90.

Since the principal objective of the ETE analyses is to develop a "realistic" estimate of evacuation times, use of the representative value for this capacity reduction factor ($R=0.90$) is justified. This factor is applied only when flow breaks down, as determined by the simulation

² This analysis is based on computed capacity alone and does not consider the time-varying demand impact on actual capacity.

³Lei Zhang and David Levinson, "Some Properties of Flows at Freeway Bottlenecks," Transportation Research Record 1883, 2004.

model.

The estimated value of capacity is based primarily upon the type of facility and on roadway geometrics. Sections of roadway with adverse geometrics are characterized by lower free-flow speeds and lane capacity. The impact of narrow lanes and shoulders on free-flow speed and on capacity is not material, particularly when flow is predominantly in one direction as is the case during an evacuation.

The procedure used here was to estimate "section" capacity, V_E , based on observations made traveling over each section of the evacuation network, based on the posted speed limits and travel behavior of other motorists and by reference to the HCM 2022. The DYNEV II simulation model determines for each roadway section, represented as a network link, whether its capacity would be limited by the "section specific" service volume, V_E , or by the intersection specific capacity. For each link, the model selects the lower value of capacity.

4.3 Application to the City of Berkeley Study Area

As part of the development of the link-node analysis network for the study area, an estimate of roadway capacity is required. The source material for the capacity estimates presented herein is contained in:

2022 Highway Capacity Manual 7th Edition (HCM 2022)
Transportation Research Board
National Research Council
Washington, D.C.

The roadway system in the study area consists primarily of three categories of roads and, of course, intersections:

- Two-Lane roads: Local, State
- Multilane Highways (at-grade)
- Freeways

Each of these classifications will be discussed below.

4.3.1 Two Lane Roads

Note: Data collected on the road survey conducted in May 20-26, 2023, and aerial imagery for roadways that could not be driven (like LBNL), was used to accurately model the speeds on roads within Berkeley. See Section 1.3 for details.

Ref: HCM 2022 Chapter 15

Two lane roads comprise the majority of roadways within the study area. The per-lane capacity of a two-lane roadway is estimated at 1,700 passenger cars per hour (pc/h). This estimate is essentially independent of the directional distribution of traffic volume except that, for extended distances, the two-way capacity will not exceed 3,200 pc/h. The HCM 2022 procedures then estimate LOS and Average Travel Speed. The DYNEV II simulation model

accepts the specified value of capacity as input and computes average speed based on the time-varying demand: capacity relations.

Based on the field survey and on expected traffic operations associated with evacuation scenarios:

- Most sections of two-lane roads within the study area are classified as “Class I”, with “level terrain”; some are “rolling terrain”.
- “Class II” highways [roadways] are mostly those within urban and suburban centers.

4.3.2 Multilane Roadway

Ref: HCM 2022 Chapter 12

Exhibit 12-8 of the HCM 2022 presents a set of curves that indicate a per-lane capacity ranging from approximately 1,900 to 2,300 pc/h, for free-speeds of 45 to 70 mph, respectively. Based on observation, the multilane roadways outside of urban areas within the study area service traffic with free-speeds in this range. The actual time-varying speeds computed by the simulation model reflect the demand and capacity relationship and the impact of control at intersections.

4.3.3 Freeways

Ref: HCM 2022 Chapters 10, 12, 13, 14

Chapter 10 of the HCM 2022 describes a procedure for integrating the results obtained in Chapters 12, 13 and 14, which compute capacity and LOS for freeway components. Chapter 10 also presents a discussion of simulation models. The DYNEV II simulation model automatically performs this integration process.

Chapter 12 of the HCM 2022 presents procedures for estimating capacity and LOS for “Basic Freeway Segments”. Exhibit 12-37 of the HCM 2022 presents capacity vs. free speed estimates, which are provided below.

Free Speed (mph):	55	60	65	70+
Per-Lane Capacity (pc/h):	2,250	2,300	2,350	2,400

The inputs to the simulation model are roadway geometrics, free-speeds and capacity based on field observations. The simulation logic calculates actual time-varying speeds based on demand: capacity relationships. A conservative estimate of per-lane capacity of 2,250 pc/h is adopted for this study for freeways.

Chapter 13 of the HCM 2022 presents procedures for estimating capacity, speed, density and LOS for freeway weaving sections. The simulation model contains logic that relates speed to demand volume: capacity ratio. The value of capacity obtained from the computational

procedures detailed in Chapter 13 depends on the "Type" and geometrics of the weaving segment and on the "Volume Ratio" (ratio of weaving volume to total volume).

Chapter 14 of the HCM 2022 presents procedures for estimating capacities of ramps and of "merge" areas. There are three significant factors to the determination of capacity of a ramp-freeway junction: The capacity of the freeway immediately downstream of an on-ramp or immediately upstream of an off-ramp; the capacity of the ramp roadway; and the maximum flow rate entering the ramp influence area. In most cases, the freeway capacity is the controlling factor. Values of this merge area capacity are presented in Exhibit 14-10 of the HCM 2022 and depend on the number of freeway lanes and on the freeway free speeds. Ramp capacity is presented in Exhibit 14-12 and is a function of the ramp's FFS. The DYNEV II simulation model logic simulates the merging operations of the ramp and freeway traffic in accord with the procedures in Chapter 14 of the HCM 2022. If congestion results from an excess of demand relative to capacity, then the model allocates service appropriately to the two entering traffic streams and produces LOS F conditions (The HCM 2022 does not address LOS F explicitly).

4.3.4 Intersections

Ref: HCM 2022 Chapters 19, 20, 21, 22

Procedures for estimating capacity and LOS for approaches to intersections are presented in Chapter 19 (signalized intersections), Chapters 20, 21 (un-signalized intersections) and Chapter 22 (roundabouts). The complexity of these computations is indicated by the aggregate length of these chapters. The DYNEV II simulation logic is likewise complex.

The simulation model explicitly models intersections: Stop/yield-controlled intersections (both 2-way and all-way) and traffic signal-controlled intersections. Where intersections are controlled by fixed time controllers, traffic signal timings are set to reflect average (non-evacuation) traffic conditions. Actuated traffic signal settings respond to the time-varying demands of evacuation traffic to adjust the relative capacities of the competing intersection approaches.

The model is also capable of modeling the presence of manned traffic control. At specific locations where it is advisable or where existing plans call for overriding existing traffic control to implement manned control, the model will use actuated signal timings that reflect the presence of traffic guides. At locations where a special traffic control strategy (continuous left-turns, contra-flow lanes) is used, the strategy is modeled explicitly.

4.4 Simulation and Capacity Estimation

Chapter 6 of the HCM 2022 is entitled, "HCM and Alternative Analysis Tools." The chapter discusses the use of alternative tools such as simulation modeling to evaluate the operational performance of roadway networks. Among the reasons cited in Chapter 6 to consider using simulation as an alternative analysis tool is:

“The system under study involves a group of different facilities or travel modes with mutual interactions involving several HCM chapters. Alternative tools are able to analyze these facilities as a single system.”

This statement succinctly describes the analyses required to determine traffic operations across an area encompassing a study area operating under evacuation conditions. The model utilized for this study is DYNEV II⁴. It is essential to recognize that simulation models do not replicate the methodology and procedures of the HCM – they *replace* these procedures by describing the complex interactions of traffic flow and computing Measures of Effectiveness (MOE) detailing the operational performance of traffic over time and by location. The DYNEV II simulation model includes some HCM 2022 procedures only for the purpose of estimating capacity.

All simulation models must be calibrated properly with field observations that quantify the performance parameters applicable to the analysis network. Two of the most important of these are: (1) FFS; and (2) saturation headway, h_{sat} . The first of these is estimated by direct observation during the road survey or aerial imagery; the second is estimated using the concepts of the HCM 2022, as described earlier.

It is important to note that simulation represents a mathematical representation of an assumed set of conditions using the best available knowledge and understanding of traffic flow and available inputs. Simulation should not be assumed to be a prediction of what will happen under any event because a real evacuation can be impacted by an infinite number of things – many of which will differ from these test cases – and many others cannot be taken into account with the tools available.

4.5 Boundary Conditions

As illustrated in Figure 1-2, the link-node analysis network used for this study is finite. The analysis network extends well beyond the Evacuation Zones in order to model intersections with other major population areas and evacuation routes beyond the study area. However, the network does have an end at the destination (exit) nodes⁴. Beyond these destination nodes, there may be signalized intersections or merge points that impact the capacity of the evacuation routes leaving the study area. Rather than neglect these “boundary conditions,” this study assumes a 25% reduction in capacity on two-lane roads (Section 4.3.1 above) and multilane roadways (Section 4.3.2 above). There is no reduction in capacity for freeways due to boundary conditions. The 25% reduction in capacity is based on the prevalence of actuated traffic signals outside the study area and the fact that the evacuating traffic volume (“main street”) will be more significant than the competing traffic volume (“side street”) at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time.

⁴ <https://kldassociates.com/wp-content/uploads/2024/10/DTRAD-DYNEV.pdf>

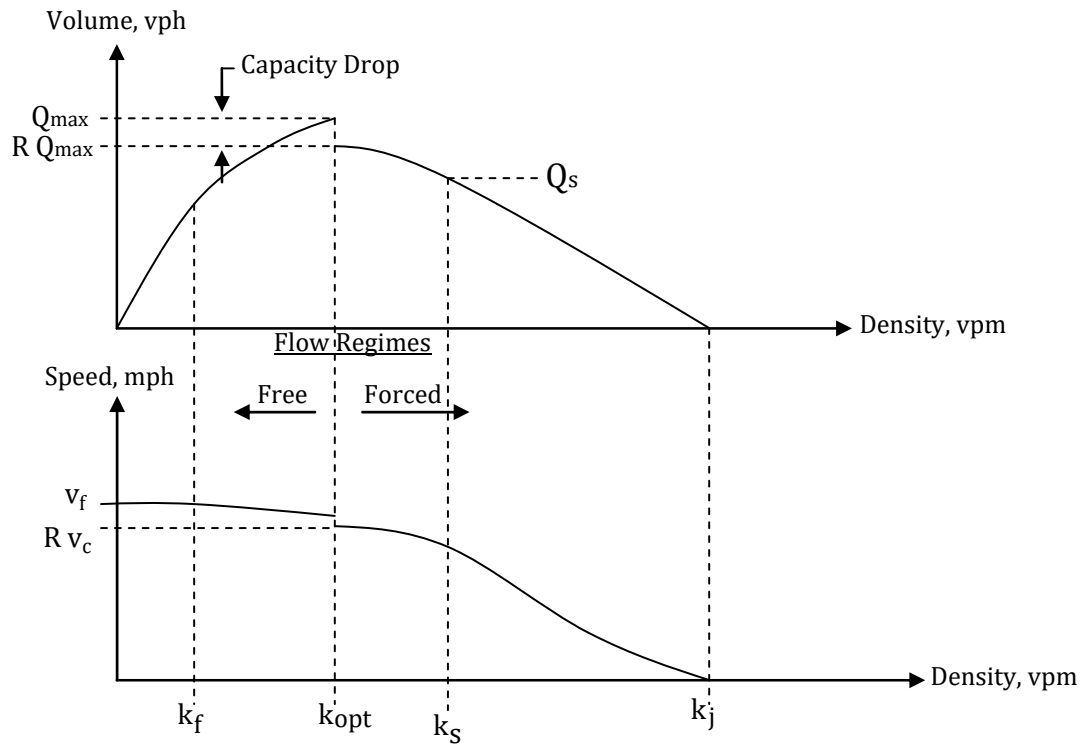


Figure 4-1. Fundamental Diagrams

5 ESTIMATION OF TRIP GENERATION TIME

It is general practice for planners to estimate the distributions of elapsed times associated with mobilization activities undertaken by the public to prepare for the evacuation trip. The elapsed time associated with each activity is represented as a statistical distribution reflecting differences between members of the public. The quantification of these activity-based distributions relies largely on the results of the demographic survey. We define the sum of these distributions of elapsed times as the Trip Generation Time Distribution. This section documents how the trip generation time distributions were estimated.

5.1 Background

In general, during an emergency, priorities are given to life safety, preservation of property and resource conservation. To ensure life safety, depending on the severity of the emergency, emergency officials may issue warnings or orders that include evacuation.

As a Planning Basis, we will adopt a conservative posture, a rapidly escalating wildfire or tsunami situation, wherein evacuation is required, ordered promptly and no early protective actions have been implemented when calculating the Trip Generation Time. In these analyses, we have assumed:

1. The evacuation order will be announced coincident with local emergency alerts (e.g., AC Alert/IPAWS, Genasys Protect, Outdoor Warning System Sirens, Nixle, social media, local news and similar communication systems).
2. Mobilization of the general population will commence within 15 minutes after the order to evacuate.
3. The ETE are measured relative to the order to evacuate being issued by officials.

We emphasize that the adoption of this planning basis is not a representation that these events will occur within the indicated time frame. Rather, these assumptions are necessary in order to:

1. Establish a temporal framework for estimating the Trip Generation distribution
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

The notification process consists of two events:

1. Transmitting information using the alert and notification systems mentioned above.
2. Receiving and correctly interpreting the information that is transmitted.

The population within Berkeley is engaged in a wide variety of activities. It must be anticipated that some time will elapse between the transmission and receipt of the information advising the public of an event.

The amount of elapsed time will vary from one individual to the next depending on where that person is, what that person is doing, and related factors. Furthermore, some persons who will be directly involved with the evacuation process may be outside the city at the time the evacuation is ordered. These people may be commuters, and other travelers who reside within the city and who will return to join the other household members upon receiving notification of an emergency.

As indicated in Section 2.13 of NUREG/CR-6863, the estimated elapsed times for the receipt of notification can be expressed as a distribution reflecting the different notification times for different people within, and outside, the city. By using time distributions, it is also possible to distinguish between different population groups and different day-of-week and time-of-day scenarios, so that accurate ETE may be computed.

For example, people at home or at work within Berkeley might be notified by wireless emergency alerts, other alerts to their mobile or home phones, emails, outdoor warning sirens, television and/or radio (if available). Those well outside the city might be notified by word-of-mouth, with potentially longer time lags. Furthermore, the spatial distribution of the population will differ with time of day: families- will be united in the evenings but dispersed during the day. In this respect, weekends will differ from weekdays.

The information required to compute trip generation times is typically obtained from a demographic survey of residents. Such a survey was conducted for this study. Appendix D discusses the survey sampling plan, the number of completed surveys obtained, documents the survey instrument utilized, and provides the survey results. The remaining discussion will focus on the application of the trip generation data obtained from the online demographic survey to the development of the ETE documented in this report.

5.2 Fundamental Considerations

The environment leading up to the time that people begin their evacuation trips consists of a sequence of events and activities. Each event (other than the first) occurs at an instant in time and is the outcome of an activity.

Activities are undertaken over a period of time. Activities may be in "series" (i.e. to undertake an activity implies the completion of all preceding events) or may be in parallel (two or more activities may take place over the same period of time). Activities conducted in series are functionally dependent on the completion of prior activities; activities conducted in parallel are functionally independent of one another. The relevant events associated with the public's preparation for evacuation are:

<u>Event Number</u>	<u>Event Description</u>
1	Notification
2	Awareness of Situation
3	Depart Work
4	Arrive Home
5	Depart on Evacuation Trip

Associated with each sequence of events are one or more activities, as outlined in Table 5-1.

These relationships are shown graphically in Figure 5-1.

- An Event is a 'state' that exists at a point in time (e.g., depart work, arrive home)
- An Activity is a 'process' that takes place over some elapsed time (e.g., prepare to leave work, travel home)

As such, a completed Activity changes the 'state' of an individual (i.e., the activity, 'travel home' changes the state from 'depart work' to 'arrive home'). Therefore, an Activity can be described as an 'Event Sequence'; the elapsed times to perform an event sequence vary from one person to the next and are described as statistical distributions on the following pages.

An employee who lives outside of Berkeley will follow sequence (c) of Figure 5-1. A household within Berkeley that has one or more commuters at work and will await their return before beginning the evacuation trip will follow the first sequence of Figure 5-1(a). A household within the city that has no commuters at work, or that will not await the return of any commuters, will follow the second sequence of Figure 5-1(a), regardless of day of week or time of day.

Households with no commuters on weekends or in the evening/night-time will follow the applicable sequence in Figure 5-1(b). Visitors will always follow one of the sequences of Figure 5-1(b). Some visitors away from their residence could elect to evacuate immediately without returning to the residence, as indicated in the second sequence.

It is seen from Figure 5-1, that the Trip Generation time (i.e., the total elapsed time from Event 1 to Event 5) depends on the scenario and will vary from one household to the next. Furthermore, Event 5 depends, in a complicated way, on the time distributions of all activities preceding that event. That is, to estimate the time distribution of Event 5, we must obtain estimates of the time distributions of all preceding events. For this study, we adopt the conservative posture that all activities will occur in sequence.

In some cases, assuming certain events occur in series rather than in parallel (for instance, commuter returning home before beginning preparation to leave, or picking up school children only after the preparation to leave) can result in rather conservative (that is, longer) estimates of mobilization times. It is reasonable to expect that at least some parts of these events will overlap for many households, but that assumption is not made in this study.

5.3 Estimated Time Distributions of Activities Preceding Event 5

The time distribution of an event is obtained by "summing" the time distributions of all prior contributing activities. (This "summing" process is quite different than an algebraic sum since it is performed on distributions – not scalar numbers).

Time Distribution No. 1, Notification Process: Activity 1 → 2

A demographic survey of Berkeley residents was conducted to study the evacuation behavior of the population. The survey results were used to create the notification time distribution. The survey asked specific questions about notifying neighbors and friends during an emergency using various methods like phone calls, text messages, social media, and in person conversation. The City of Berkeley also uses Outdoor Warning System sirens, Genasys Protect, and AC Alert/IPAWS/Nixle to notify their residents. Because of the indiscriminate reach of these systems, it is possible that people who receive the alerts and are outside of the intended evacuation area will choose to leave, adding to demand on the roadways.

Given the presence of the existing emergency alert systems and the responses to the demographic survey regarding notification of friends and neighbors, assumptions were made about the notification of people in Berkeley (including residents outside of the Berkeley City limits at the time of the emergency). It was assumed that about 37% of residents are notified within 5 minutes of an emergency, 93% of the residents are notified within 25 minutes, and 100% of the residents are notified within 35 minutes. The distribution of Activity 1 → 2 shown in Table 5-2 and plotted in Figure 5-2 reflects data obtained by the demographic survey and the above assumptions.

Distribution No. 2, Prepare to Leave Work: Activity 2 → 3

It is reasonable to expect that the vast majority of business enterprises within Berkeley will elect to shut down following an evacuation order and most employees would leave work quickly. Commuters who work outside the city could, in all probability, also leave quickly since facilities outside Berkeley would remain open and other personnel would remain to maintain business operations. The distribution of Activity 2 → 3 shown in Table 5-3 reflects data obtained by the demographic survey. This distribution is also applicable for residents to leave stores, restaurants, parks and other locations within the city. This distribution is plotted in Figure 5-2.

Distribution No. 3, Travel Home: Activity 3 → 4

These data are provided directly by households that responded to the demographic survey. This distribution is plotted in Figure 5-2 and listed in Table 5-4.

Distribution No. 4, Prepare to Leave Home: Activity 4 → 5

These data are provided directly by households that responded to the demographic survey. This distribution is plotted in Figure 5-2 and listed in Table 5-5.

Distribution No. 5, Pickup School Children:

Approximately 22% of households have children within the city (see Appendix D). Of these households, approximately 83% of them will pick up their children at the school during an emergency. Picking up children from school take time; this time must be incorporated into the trip generation time distributions. This distribution is Figure 5-2 and listed in Table 5-6.

5.4 Calculation of Trip Generation Time Distribution

The time distributions for each of the mobilization activities presented herein must be combined to form the appropriate Trip Generation Distributions. As discussed above, this study assumes that the stated events take place in sequence such that all preceding events must be completed before the current event can occur. For example, if a household awaits the return of a commuter, the work-to-home trip (Activity 3 → 4) must precede Activity 4 → 5.

To calculate the time distribution of an event that is dependent on two sequential activities, it is necessary to “sum” the distributions associated with these prior activities. The distribution summing algorithm is applied repeatedly to form the required distribution. As an outcome of this procedure, new time distributions are formed; we assign “letter” designations to these intermediate distributions to describe the procedure. Table 5-7 presents the summing procedure to arrive at each designated distribution.

Table 5-8 presents a description of each of the final trip generation distributions achieved after the summing process is completed.

5.4.1 Statistical Outliers

As already mentioned, some portion of the survey respondents answer “don’t know/prefer not to say” to some questions or choose to not respond to a question. The mobilization activity distributions are based upon actual responses. But it is the nature of surveys that a few numeric responses are inconsistent with the overall pattern of results. An example would be a case in which for 500 responses, almost all of them estimate less than two hours for a given answer, but 3 say “four hours” and 4 say “six or more hours”.

These “outliers” must be considered: are they valid responses, or so atypical that they should be dropped from the sample?

In assessing outliers, there are three alternatives to consider:

1. Some responses with very long times may be valid, but reflect the reality that the respondent really needs to be classified in a different population subgroup, based upon special transportation needs;
2. Other responses may be unrealistic (6 hours to return home from commuting distance, or 2 days to prepare the home for departure);
3. Some high values are representative and plausible, and one must not cut them as part of the consideration of outliers.

The issue is how to make the decision that a given response or set of responses are to be considered “outliers” for the component mobilization activities, using a method that objectively quantifies the process.

There is considerable statistical literature on the identification and treatment of outliers singly or in groups, much of which assumes the data is normally distributed and some of which uses non-parametric methods to avoid that assumption. The literature cites that limited work has been done directly on outliers in sample survey responses.

In establishing the overall mobilization time/trip generation distributions, the following principles are used:

1. It is recognized that the overall trip generation distributions are conservative estimates, because they assume a household will do the mobilization activities sequentially, with no overlap of activities;
2. The individual mobilization activities (receive notification, prepare to leave work, travel home, prepare home, pickup school children) are reviewed for outliers, and then the overall trip generation distributions are created (see Figure 5-1, Table 5-7, Table 5-8);
3. Outliers can be eliminated either because the response reflects a special population (e.g., special transportation needs, transit dependent) or lack of realism, because the purpose is to estimate trip generation patterns for personal vehicles;
4. To eliminate outliers,
 - a) the mean and standard deviation of the specific activity are estimated from the responses,
 - b) the median of the same data is estimated, with its position relative to the mean noted,
 - c) the histogram of the data is inspected, and
 - d) all values greater than 3.0 standard deviations are flagged for attention, taking special note of whether there are gaps (categories with zero entries) in the histogram display.

In general, only flagged values more than 3.5 standard deviations from the mean are allowed to be considered outliers, with gaps in the histogram expected.

When flagged values are classified as outliers and dropped, steps “a” to “d” are repeated.

5. As a practical matter, even with outliers eliminated by the above, the resultant histogram, viewed as a cumulative distribution, is not a normal distribution. A typical situation that results is shown in Figure 5-3.
6. In particular, the cumulative distribution differs from the normal distribution in two key aspects, both very important in loading a network to estimate evacuation times:
 - Most of the real data is to the left of the “normal” curve above, indicating that the network loads faster for the first 80-85% of the vehicles, potentially causing more (and earlier) congestion than otherwise modeled;

- The last 10-15% of the real data “tails off” slower than the comparable “normal” curve, indicating that there is significant traffic still loading at later times.

Because these two features are important to preserve, it is the histogram of the data that is used to describe the mobilization activities, not a “normal” curve fit to the data. One could consider other distributions, but using the shape of the *actual* data curve is unambiguous and preserves these important features;

7. With the mobilization activities each modeled according to Steps 1-6, including preserving the features cited in Step 6, the overall (or total) mobilization times are constructed.

This is done by using the data sets and distributions under different scenarios (e.g., commuter returning, no commuter returning, and children pickup or no children pickup). In general, these are additive, using weighting based upon the probability distributions of each element; Figure 5-4 presents the combined trip generation distributions designated for each population group considered. These distributions are presented on the same time scale. (As discussed earlier, the use of strictly additive activities is a conservative approach, because it makes all activities sequential – preparation for departure follows the return of the commuter; children pickup follows the preparation for departure, and so forth. In practice, it is reasonable that some of these activities are done in parallel, at least to some extent – for instance, preparation to depart begins by a household member at home while the commuter is still on the road.)

The mobilization distribution results are used in their tabular/graphical form as direct inputs to later computations that lead to the ETE.

The DYNEV II simulation model is designed to accept varying rates of vehicle trip generation for each origin centroid, expressed in the form of histograms. These histograms, which represent Distributions A, C, D, E, and F properly displaced with respect to one another, are tabulated in Table 5-9 (Distribution B, Arrive Home, omitted for clarity).

The final time period (15) is 600 minutes long. This time period is added to allow the analysis network to clear, in the event congestion persists beyond the trip generation period. Note that there are no trips generated during this final time period.

5.4.2 Phased Evacuation Trip Generation

As detailed in Section 6: Evacuation Cases, Region R03 studies a phased evacuation for a repeat of the 1923 Berkeley Fire.

In a phased evacuation, permanent residents in imminent danger will be given an evacuation order while other areas will receive an evacuation warning or no protective action. The evacuation orders are issued subsequently at specified times after the initial evacuation order.

Region R03 considers the spread pattern from the 1923 fire. Per Berkeley Fire Department direction, zone status may change up to three times over the course of the tri-phased analysis as the simulated fire spreads. This means that individual zones may shift from no action necessary, to Evacuation Warning and/or Evacuation Order status based on patterns of fire spread.

Assumptions

1. It is assumed that 100% of residents in Evacuation Zones ordered to evacuate will evacuate, 50% of residents in Evacuation Zones that receive an evacuation warning will evacuate, and 20% of residents in Evacuation Zones with no protective action instructions will evacuate.
2. The population in the Shadow Region beyond Berkeley boundaries will react as they do for all non-phased evacuation scenarios. That is 20% of these households will elect to evacuate without delay.
3. Only permanent residents are expected to phase their evacuation. Non-resident population groups (employees, tourists, etc.) start following their mobilization times immediately.
4. Residents still follow their regular mobilization curve starting at the time of the first evacuation order (0 minutes/Phase a), 90 minutes after the first evacuation order (Phase b), or 180 minutes after the evacuation order (Phase c).

Procedure

1. Permanent residents in Evacuation Zones in Region R03 will be phased as follows:
 - a. Phase a (0 minutes):
 - i. The following Evacuation Zones will be under Evacuation Order - BER-E031, LBL-E006, OKL-E002, BER-E016
 - ii. The following Evacuation Zones will be under Evacuation Warning - BER-E015, BER-E032, LBL-E004, LBL-E005, LBL-E001, BER-E008, BER-E017, BER-E007, BER-E030, OKL-E001, LBL-E003
 - b. Phase b (90 minutes):
 - i. The following Evacuation Zones will be under Evacuation Order - BER-E031, BER-E015, BER-E032, LBL-E006, LBL-E004, LBL-E005, LBL-E001, BER-E017, BER-E030, OKL-E001, LBL-E003, OKL-E002, BER-E016
 - ii. The following Evacuation Zones will be under Evacuation Warning - BER-E018, BER-E040, BER-E013, BER-E041, LBL-E002, BER-E019, BER-E029, BER-E008, BER-E007, BER-E058, BER-E033
 - c. Phase c (180 minutes):
 - i. The following Evacuation Zones will be under Evacuation Order - BER-E018, BER-E057, BER-E012, BER-E040, BER-E013, BER-E031, BER-E041, BER-E015, BER-E032, LBL-E006, LBL-E004, LBL-E005, LBL-E001, LBL-E002, BER-E026, BER-E019, BER-E029, BER-E017, BER-E030, OKL-E001, LBL-E003, BER-E058, BER-E059, BER-E027, BER-E020, BER-E033, BER-E028, BER-E038, BER-E039, BER-E043, BER-E042, OKL-E002, BER-E016

- ii. The following Evacuation Zones will be under Evacuation Warning - BER-E056, BER-E021, BER-E044, BER-E009, BER-E037, BER-E022, BER-E010, BER-E055, BER-E066, BER-E025, BER-E008, BER-E007, OKL-E004, BER-E073, BER-E060, BER-E054, ALB-E006

Table 5-1. Event Sequence for Evacuation Activities

Event Sequence	Activity	Distribution
1 → 2	Receive Notification	1
2 → 3	Prepare to Leave Work	2
2,3 → 4	Travel Home	3
2,4 → 5	Prepare to Leave to Evacuate	4
N/A	Children Pickup	5

Table 5-2. Time Distribution for Notifying the Public

Elapsed Time (Minutes)	Cumulative Percent of Population Notified
0	0.0%
5	37.0%
10	41.0%
15	46.0%
20	71.0%
25	93.0%
30	99.0%
35	100.0%

Table 5-3. Time Distribution for Employees to Prepare to Leave Work/College¹

Elapsed Time (Minutes)	Cumulative Percent Employees Leaving Work
0	0.0%
5	25.7%
10	56.0%
15	75.6%
20	86.9%
25	90.3%
30	98.7%
35	100.0%

¹ The survey data was normalized to distribute the "prefer not to say" response. That is, the sample was reduced in size to include only those households who responded to this question. The underlying assumption is that the distribution of this activity for the "prefer not to say" responders, if the event takes place, would be the same as those responders who provided estimates.

Table 5-4. Time Distribution for Commuters to Travel Home

Elapsed Time (Minutes)	Cumulative Percent Returning Home
0	0.0%
5	9.8%
10	16.3%
15	25.2%
20	36.1%
25	48.2%
30	60.5%
35	71.9%
40	81.4%
45	88.6%
50	93.5%
55	96.6%
60	98.4%
75	99.7%
90	100.0%

NOTE: The survey data was normalized to distribute the "prefer not to say" response.

Table 5-5. Time Distribution for Population to Prepare to Evacuate

Elapsed Time (Minutes)	Cumulative Percent Ready to Evacuate
0	0.0%
15	15.3%
30	33.9%
45	57.7%
60	78.9%
75	92.1%
90	97.8%
105	99.6%
120	99.9%
135	100.0%

NOTE: The survey data was normalized to distribute the "prefer not to say" response.

Table 5-6. Time Distribution for Population to Pick-up School Children from School

Elapsed Time (Minutes)	Cumulative Percent Ready to Evacuate
0	0.0%
5	4.5%
10	23.0%
15	48.1%
20	63.8%
25	71.1%
30	85.4%
35	89.2%
40	94.8%
45	100.0%

NOTE: The survey data was normalized to distribute the "prefer not to say" response.

Table 5-7. Mapping Distributions to Events

Apply "Summing" Algorithm To:	Distribution Obtained	Event Defined
Distributions 1 and 2	Distribution A	Event 3
Distributions A and 3	Distribution B	Event 4
Distributions B and 4	Distribution C	Event 5
Distributions 1 and 4	Distribution D	Event 5
Distributions C and 5	Distribution E	Event 5
Distributions D and 5	Distribution F	Event 5

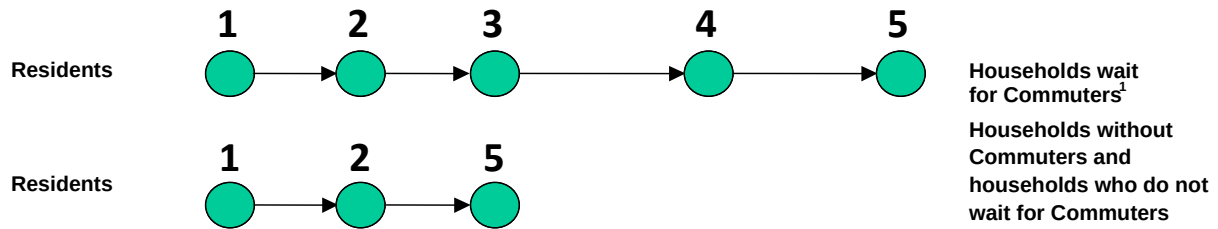
Table 5-8. Description of the Distributions

Distribution	Description
A	Time distribution of commuters departing place of work (Event 3). Also applies to employees who work within the city who live outside, and to visitors within the city.
B	Time distribution of commuters arriving home (Event 4).
C	Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip (Event 5).
D	Time distribution of residents without commuters returning home, leaving home to begin the evacuation trip (Event 5).
E	Time distribution of residents with commuters who pick-up school children from school, return home, leaving home to begin the evacuation trip (Event 5).
F	Time distribution of residents with no commuters who pickup school children from school, leaving home to begin the evacuation trip (Event 5).

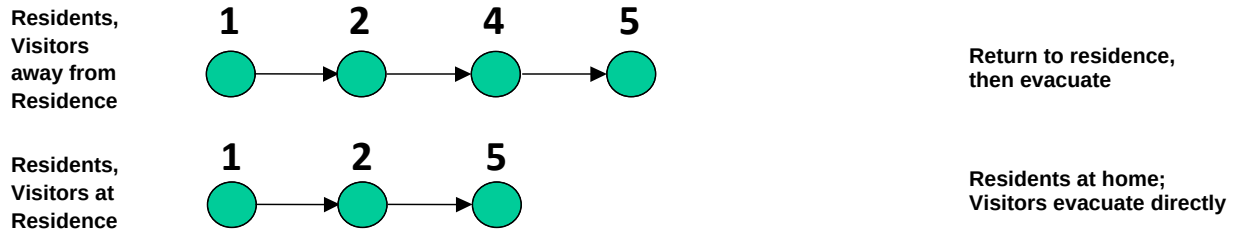
Table 5-9. Trip Generation Histograms for the City of Berkeley Population²

Time Period	Duration (Min)	Percent of Total Trips Generated Within Indicated Time Period					
		Employees (Distribution A)	Visitors (Distribution A)	Residents with Commuters (Distribution C)	Residents without Commuters (Distribution D)	Residents with Commuters Child Pick Up (Distribution E)	Residents without Commuters Child Pick Up (Distribution F)
1	15	22%	22%	0%	4%	0%	0%
2	15	38%	38%	0%	12%	0%	3%
3	15	33%	33%	3%	18%	0%	9%
4	15	7%	7%	7%	22%	2%	16%
5	15	0%	0%	13%	20%	6%	20%
6	15	0%	0%	17%	14%	10%	20%
7	15	0%	0%	19%	7%	16%	15%
8	15	0%	0%	17%	2%	17%	10%
9	15	0%	0%	12%	1%	17%	5%
10	15	0%	0%	7%	0%	14%	1%
11	15	0%	0%	3%	0%	9%	1%
12	15	0%	0%	1%	0%	5%	0%
13	15	0%	0%	1%	0%	3%	0%
14	15	0%	0%	0%	0%	1%	0%
15	600	0%	0%	0%	0%	0%	0%

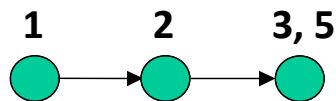
² Shadow vehicles are loaded onto the analysis network (Figure 1-2) using Distribution C.



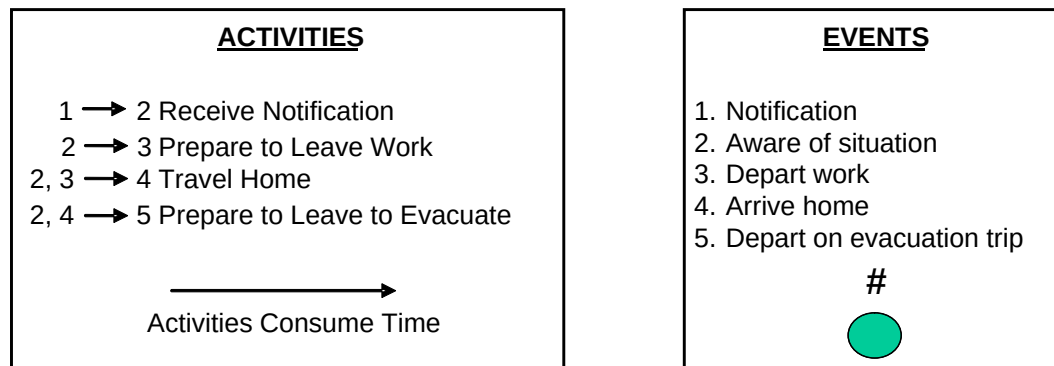
(a) A hazard occurs during midweek, at midday; year round



(b) A hazard occurs during weekend or during the evening²



(c) Employees who live outside of the City of Berkeley



¹ Applies for evening and weekends also if commuters are at work.

² Applies throughout the year for visitors.

Figure 5-1. Events and Activities Preceding the Evacuation Trip

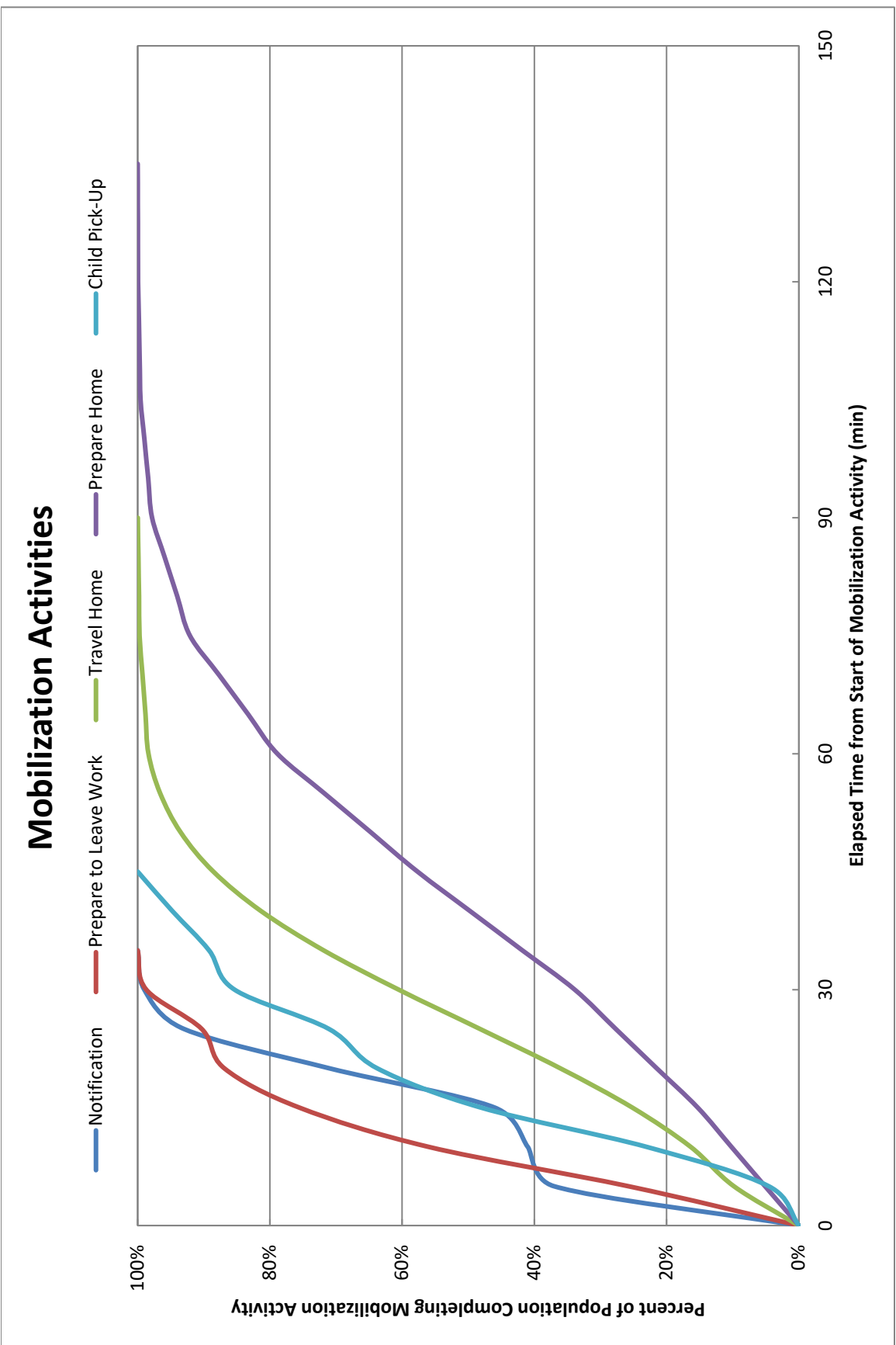


Figure 5-2. Time Distributions for Evacuation Mobilization Activities

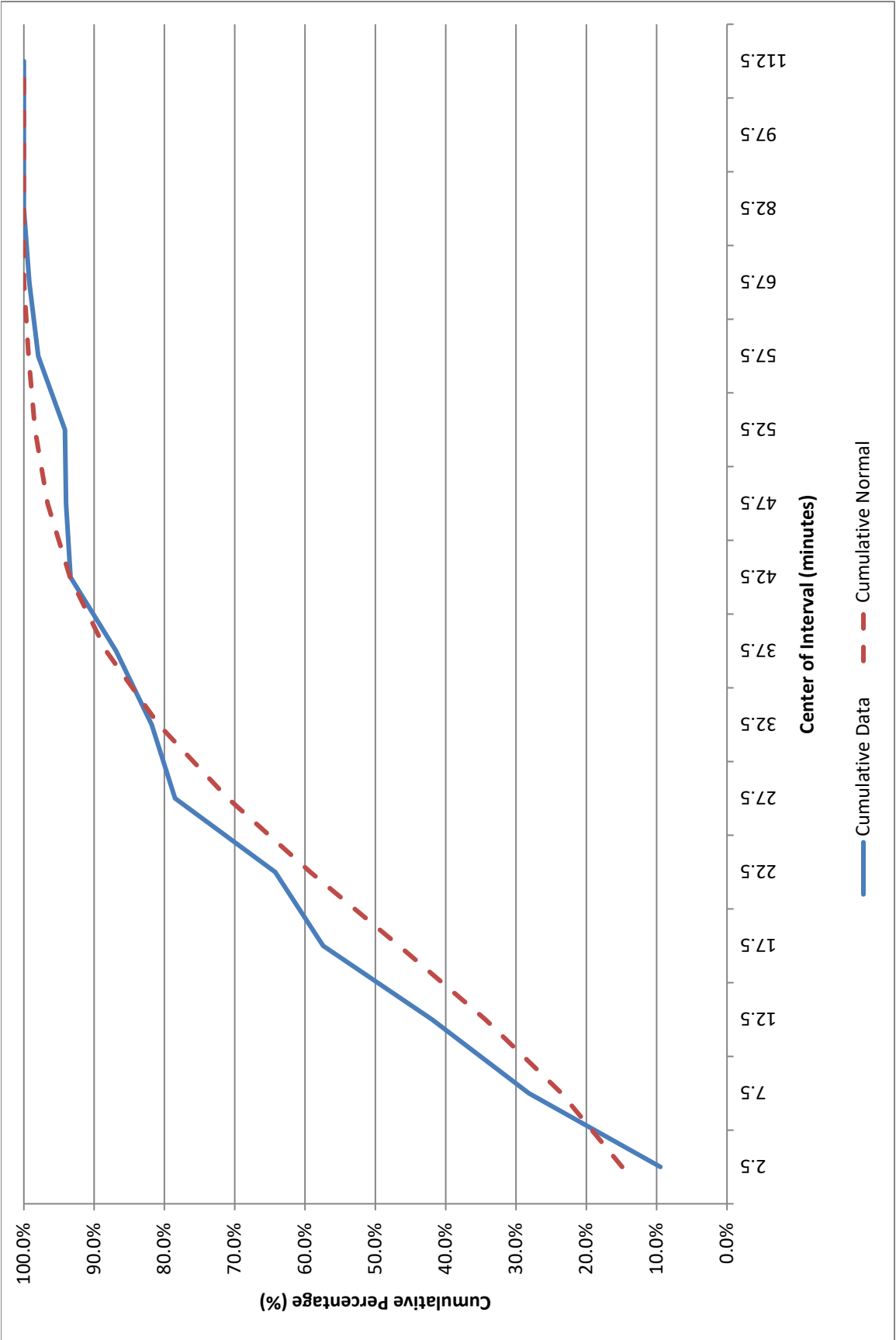


Figure 5-3. Comparison of Data Distribution and Normal Distribution

Trip Generation Distributions

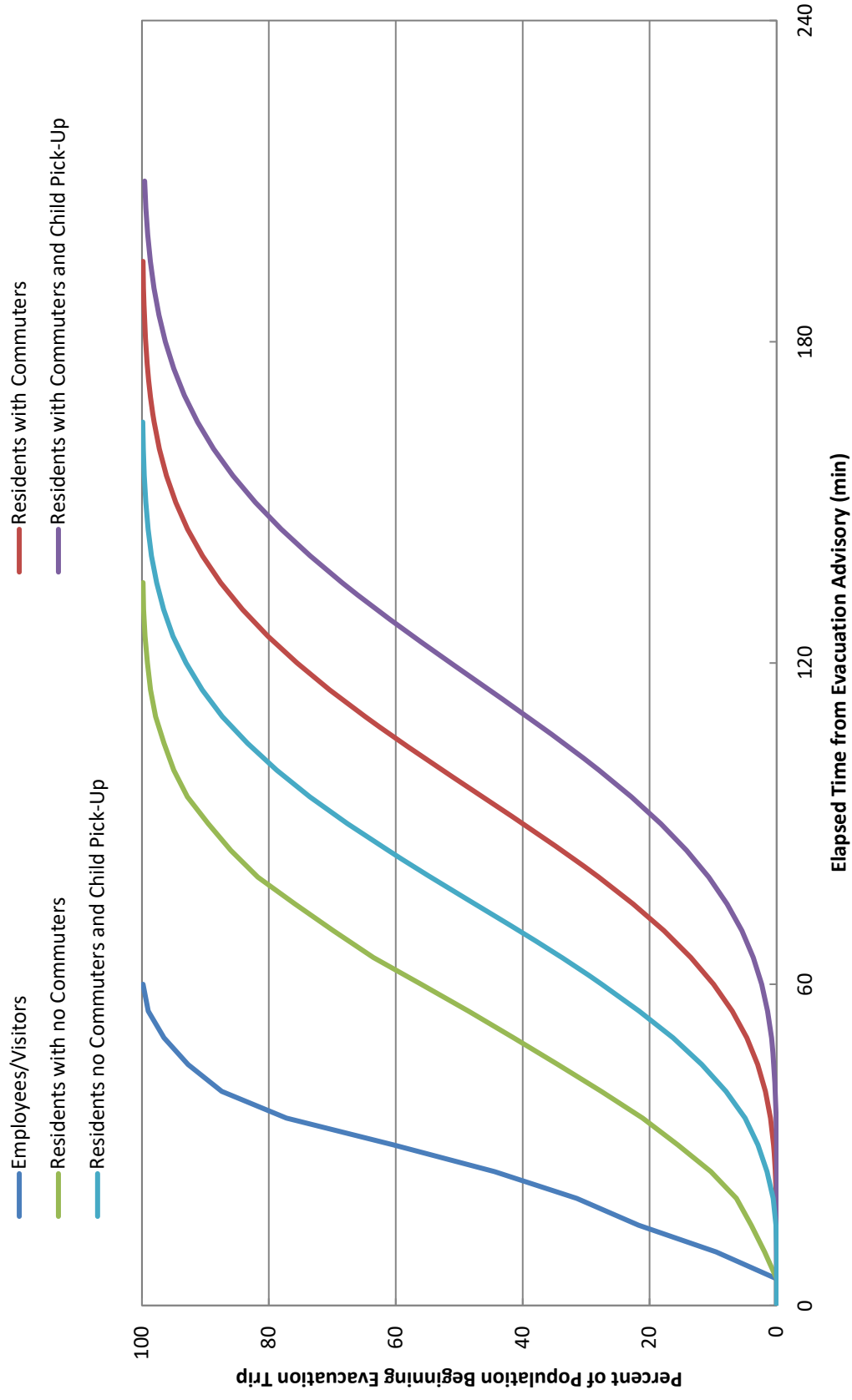


Figure 5-4. Comparison of Trip Generation Distributions

6 EVACUATION CASES

This section discusses the spatial and temporal variations in evacuation situations. The regions outlined in the study were created based on various geometric areas that would be evacuated in response to a wildfire, tsunami, or other potential emergency. The Evacuation Zones¹ were used as Zone boundaries for this study. The scenarios outlined in the study were created based on the various temporal changes that affect the number of vehicles evacuating. This section provides an overview of all the possible evacuation cases that were studied. An evacuation “case” defines a combination of Evacuation Region and Evacuation Scenario. For this specific study, the definitions of “Region” and “Scenario” are as follows:

Region	A grouping of evacuating Evacuation Zones that must be evacuated in response to a wildfire, tsunami, or other emergency.
Scenario	A combination of circumstances, including time of day, day of week, and season. Scenarios define the number of people in each of the affected population groups and their respective mobilization time distributions.

A total of 14 Regions were defined which encompass all the groupings of Evacuation Zones considered. These Regions are defined in Table 6-1. Table 6-2 shows which Evacuation Zones evacuate for each Region, as well as which Evacuation Zones receive an Evacuation Order and/or an Evacuation Warning (specifically for Region R03, the only phased evacuation case). Table 6-3 shows the phases, or stages, of the phased evacuation case (Region R03). A phased evacuation means that the Evacuation Zones receive Evacuation Orders and/or Evacuation Warnings in phases, rather than all at once. The Evacuation Zone boundaries are identified in Figure 6-1. Appendix E shows individual maps of all the regions shown in Table 6-1.

Region R01 is the evacuation of all Evacuation Zones within the city at once.

Region R02 and Region R04 are fire evacuations in which some Evacuation Zones receive an Evacuation Order while other Evacuation Zones simultaneously receive an Evacuation Warning. As discussed in Section 2, 50% of people are assumed to voluntarily evacuate from Evacuation Zones that receive an Evacuation Warning. One hundred percent (100%) of people are assumed to evacuate Evacuation Zones that receive an Evacuation Order.

Region R03 is a fire evacuation in which groups of Evacuation Zones receive an Evacuation Warning and/or an Evacuation Order in phases. It should be noted that Region R02 is the same geographic evacuation as Region R03 Phase C, but Region R03 is phased and Region R02 is all at once.

Regions R05 through R14 are evacuations of combinations of Evacuation Zones likely to be evacuated concurrently. These regions were defined based on discussions with Planning and

¹ <https://protect.genasys.com/search>

Fire Department personnel at the City of Berkeley.

- Region R05 is an evacuation of Berkeley Fire Zones 2 and 3.
- Regions R06 and R07 simulate a warning-level tsunami.
- Regions R08-R11 are geographic groupings of Berkeley that could be evacuated concurrently based on their geographic proximity but do not have a distinct hazard identified to trigger evacuation.
- Regions R12-R14 are geographic groupings of UC Berkeley and LBNL properties, which have distinct evacuation authorities from the City of Berkeley and could be evacuated in tandem with, or separate from, City property.

A total of 6 Scenarios were evaluated for all Regions. Thus, there are a total of 84 ($14 \times 6 = 84$) unique evacuation cases. Table 6-4 provides a description of all Scenarios that were considered.

Each combination of Region and Scenario implies a specific population to be evacuated. The population group and the vehicle estimates presented in Section 3 and in Appendix C are peak values. These peak values are adjusted depending on the scenario and region being considered, using Scenario and Region-specific percentages, such that the average population is considered for each evacuation case. The Scenario percentages are presented in Table 6-5. Table 6-6 presents the vehicle counts for each scenario for an evacuation of Region R01 – all Evacuation Zones within the City.

The percentages presented in Table 6-5 were determined as follows:

The number of residents with commuters during the week (when workforce is at its peak) is equal to the product of 41.6% (the number of households with at least one commuter) and 30.1% (the number of households with a commuter that would await the return of the commuter prior to evacuating) – approximately 13%. See assumption 3 in Section 2.3. It is estimated for weekend and nighttime scenarios that 10% of households with returning commuters will have a commuter at work during those times.

It can be argued that the estimate of permanent residents overstates, somewhat, the number of evacuating vehicles, especially during the summer. It is certainly reasonable to assert that some portion of the population would be on vacation during the summer and would travel elsewhere. A rough estimate of this reduction can be obtained as follows:

- Assume 50 percent of all household's vacation for a two-week period over the summer.
- Assume these vacations, in aggregate, are uniformly dispersed over 10 weeks, i.e. 10 percent of the population is on vacation during each two-week interval.
- Assume half of these vacationers leave the area.

On this basis, the permanent resident population would be reduced by 5 percent in the summer and by a lesser amount in the off-season. Given the uncertainty in this estimate, we elected to apply no reductions in permanent resident population for the summer scenarios to account for residents who may be out of the area.

When schools are in session (Scenarios 4 and 6), approximately 18 percent of households citywide who a) have school children, and b) would elect to pick their school children from school during an emergency (see Section 2.4).

Employment is assumed to be at its peak during the fall, midweek, midday scenarios. Employment is reduced slightly (96%) for summer, midweek, midday scenarios. This is based on the estimation that 50% of the employees commuting into the City of Berkeley will be on vacation for a week during the approximately 12 weeks of summer. It is further estimated that those taking vacation will be uniformly dispersed throughout the summer with approximately 4% of employees vacationing each week. It is further estimated that only 10% of the employees are at work during the evening/overnight and on weekends.

Based on the data provided by Visit Berkeley², there are approximately 30,200,000 visits on average throughout the year. This equates to approximately 2,516,667 visits per month on average. During the fall and summer months, there are 2,166,667 and 3,225,000 visits on average, respectively. Since the average yearly number of visits was used to calculate the number of average daily visitors in Berkeley (see Section 3), factors of 0.86 ($2,166,667 \div 2,516,667 = 0.86$) and 1.28 ($3,225,000 \div 2,516,667 = 1.28$) were used to estimate the number of daily visitors for fall and summer, respectively.

Furthermore, there are 4,314,286 weekly average visits in Berkeley. For weekdays, the number of visits is 4,300,000 visits and for the weekend it is 4,666,667 visits. As previously mentioned, the average weekly number was used to estimate the number of total visitors. Hence, factors of ($4,300,000 \div 4,314,286 \approx 1$) 1.00 and ($4,666,667 \div 4,314,286 = 1.08$) 1.08 were used to estimate the number of visits for weekdays and weekends, respectively. As shown in Table 6-5, these factors were used to estimate the number of tourists for fall weekends ($0.86 \times 1.08 = 0.93$), fall weekdays ($0.86 \times 1.00 = 0.86$), summer weekends ($1.28 \times 1.08 = 1.39$) and summer weekdays ($1.28 \times 1.00 = 1.28$). Since nighttime data was not available, it was assumed that there are 60% fewer visits during the nighttime. As such, scenario percentages for summer and fall during the night were estimated to be ($0.40 \times 1.39 = 0.56$) 0.56 and ($0.40 \times 0.93 = 0.37$) 0.37 in the summer and fall, respectively.

As noted in the shadow footnote to Table 6-5, the shadow percentages are computed using a base of 20% (see assumption 10 in Section 2.2).

Transit buses for the transit-dependent population and medical patients and vehicles for juvenile homes are set to 100% for all scenarios as it is assumed that these population groups are present in the City of Berkeley for all evacuation scenarios.

As discussed in Section 8, schools are in session during the fall season, midweek, midday and 100% of buses and student vehicles will be needed and present under those circumstances. It is estimated that summer school/college enrollment is approximately 10% of enrollment during

² <https://www.visitberkeley.com/>

the regular school year for summer scenarios. K-12 schools are not in session during weekends and at nighttime, thus buses for school children are not needed and off campus college students are not present under those circumstances; It is estimated that 10% of on campus students will be present during the summer, and 100% of on campus students will be present during fall.

External traffic is estimated to be reduced by 60% during nighttime scenarios and is 100% for all other scenarios.

Table 6-1. Evacuation Regions

See Appendix E for maps visualizing these Regions.

Region	
R01	Citywide Evacuation
R02	Fire - 1923 - All
R03	Fire - 1923 - Phase a (0 minutes)
	Fire - 1923 - Phase b (0 + 90 minutes)
	Fire - 1923 - Phase c (0 + 180 minutes)
R04	Panoramic Hill Fire
R05	Fire Zones - Fire Zones 2 & 3 Combined
R06	Tsunami - Phase 3
R07	Tsunami - Max Phase
R08	Berkeley Flats
R09	North Berkeley Hills
R10	South Berkeley Hills
R11	West Berkeley
R12	UC Berkeley
R13	Lawrence Berkeley National Lab
R14	UC Berkeley + Lawrence Berkeley National Lab

Table 6-2. Regions by Evacuation Zones

Region	Description	Evacuation Zones
R01	Citywide Evacuation	<p>BER-E018, BER-E005, BER-E057, BER-E012, BER-E040, BER-E046, BER-E056, OKL-E010, OKL-E021, BER-E021, BER-E074, BER-E077, BER-E044, BER-E023 West, BER-E013, BER-E031, BER-E009, BER-E078, BER-E037, BER-E004, BER-E041, BER-E015, BER-E052, BER-E062, BER-E064, BER-E002, BER-E032, BER-E011, BER-E022, BER-E061, BER-E075, BER-E036, BER-E063, LBL-E006, LBL-E004, LBL-E005, LBL-E001, LBL-E002, BER-E026, BER-E003, BER-E010, BER-E019, BER-E029, BER-E055, BER-E066, BER-E025, BER-E051, BER-E008, BER-E017, BER-E048, BER-E068, BER-E007, BER-E030, OKL-E004, BER-E071, OKL-E008, OKL-E009, OKL-E007, OKL-E241, BER-E065, OKL-E001, OKL-E019, ALB-E008, BER-E047 West, LBL-E003, BER-E073, BER-E058, BER-E049, BER-E059, BER-E006, BER-E035 West, OKL-E018, BER-E027, BER-E020, BER-E024, OKL-E022, BER-E060, OKL-E020, BER-E053, BER-E014, BER-E033, BER-E054, OKL-E015, BER-E067, BER-E028, BER-E034, BER-E045, BER-E038, BER-E070, BER-E039, BER-E043, BER-E001, BER-E069, BER-E042, BER-E072, OKL-E002, BER-E016, BER-E050 East, OKL-E017, ALB-E006, BER-E076, ALB-E007, BER-E023 East, BER-E047 East, BER-E035 East, BER-E050 West</p>
R02	Fire 1923	<p>Order</p> <p>BER-E018, BER-E057, BER-E012, BER-E040, BER-E013, BER-E031, BER-E041, BER-E015, BER-E032, LBL-E006, LBL-E004, LBL-E005, LBL-E001, LBL-E002, BER-E026, BER-E019, BER-E029, BER-E017, BER-E030, OKL-E001, LBL-E003, BER-E058, BER-E059, BER-E027, BER-E020, BER-E033, BER-E028, BER-E038, BER-E039, BER-E043, BER-E042, OKL-E002, BER-E016,</p> <p>Warning</p> <p>BER-E056, BER-E021, BER-E044, BER-E009, BER-E037, BER-E022, BER-E010, BER-E055, BER-E066, BER-E025, BER-E008, BER-E007, OKL-E004, BER-E073, BER-E060, BER-E054, ALB-E006</p>
R03 a	Fire 1923 Phased	<p>Order</p> <p>BER-E031, LBL-E006, OKL-E002, BER-E016</p> <p>Warning</p> <p>BER-E015, BER-E032, LBL-E004, LBL-E005, LBL-E001, BER-E008, BER-E017, BER-E007, BER-E030, OKL-E001, LBL-E003</p>

Region	Description	Evacuation Zones
R03 b	Fire 1923 Phased	<p>Order</p> <p>BER-E031, BER-E015, BER-E032, LBL-E006, LBL-E004, LBL-E005, LBL-E001, BER-E017, BER-E030, OKL-E001, LBL-E003, OKL-E002, BER-E016</p> <p>Warning</p> <p>BER-E018, BER-E040, BER-E013, BER-E041, LBL-E002, BER-E019, BER-E029, BER-E008, BER-E007, BER-E058, BER-E033</p>
R03 c	Fire 1923 Phased	<p>Order</p> <p>BER-E018, BER-E057, BER-E012, BER-E040, BER-E013, BER-E031, BER-E041, BER-E015, BER-E032, LBL-E006, LBL-E004, LBL-E005, LBL-E001, LBL-E002, BER-E026, BER-E019, BER-E029, BER-E017, BER-E030, OKL-E001, LBL-E003, BER-E058, BER-E059, BER-E027, BER-E020, BER-E033, BER-E028, BER-E038, BER-E039, BER-E043, BER-E042, OKL-E002, BER-E016</p> <p>Warning</p> <p>BER-E056, BER-E021, BER-E044, BER-E009, BER-E037, BER-E022, BER-E010, BER-E055, BER-E066, BER-E025, BER-E008, BER-E007, OKL-E004, BER-E073, BER-E060, BER-E054, ALB-E006</p>
R04	Panoramic Hill Fire	<p>Order</p> <p>OAK-E003, OAK-E004, OAK-E005, BER-E013, BER-E058, BER-E059, BER-E066</p> <p>Warning</p> <p>OAK-E006, OAK-E007, OAK-E009, BER-E041, BER-E055, BER-E057, BER-E060, BER-E073, BER-E077</p>
R05	Fire Zones 2 & 3 Combined	<p>BER-E018, BER-E005, BER-E057, BER-E012, BER-E040, OKL-E010, BER-E021, BER-E031, BER-E009, BER-E078, BER-E004, BER-E041, BER-E015, BER-E002, BER-E032, BER-E011, BER-E003, BER-E010, BER-E019, BER-E029, BER-E055, BER-E066, BER-E008, BER-E017, BER-E007, BER-E030, OKL-E004, OKL-E008, OKL-E009, OKL-E007, OKL-E019, BER-E058, BER-E059, BER-E006, OKL-E018, BER-E020, BER-E033, OKL-E015, BER-E028, BER-E016, OKL-E017, BER-E076</p>
R06	Tsunami – Phase 3	<p>BER-E049, BER-E034</p>

Region	Description	Evacuation Zones
R07	Tsunami – Max Phase	BER-E023 West, BER-E048, BER-E047 West, BER-E049, BER-E035 West, BER-E034, BER-E050 West
R08	Berkeley Flats	BER-E046, BER-E056, OKL-E021, BER-E074, BER-E044, BER-E037, BER-E052, BER-E062, BER-E064, BER-E022, BER-E061, BER-E075, BER-E036, BER-E063, BER-E026, BER-E025, BER-E051, BER-E068, BER-E071, OKL-E241, BER-E065, ALB-E008, BER-E073, BER-E027, BER-E024, OKL-E022, BER-E060, OKL-E020, BER-E053, BER-E014, BER-E054, BER-E067, BER-E045, BER-E038, BER-E070, BER-E039, BER-E069, BER-E072, ALB-E006, ALB-E007
R09	North Berkeley Hills	BER-E018, BER-E005, BER-E012, BER-E040, BER-E021, BER-E031, BER-E009, BER-E004, BER-E015, BER-E002, BER-E032, BER-E011, BER-E003, BER-E010, BER-E019, BER-E029, BER-E008, BER-E017, BER-E007, BER-E030, BER-E006, BER-E020, BER-E033, BER-E028, BER-E001, BER-E016
R10	South Berkeley Hills	BER-E057, OKL-E010, BER-E077, BER-E013, BER-E078, BER-E055, BER-E066, OKL-E004, OKL-E008, OKL-E009, OKL-E007, OKL-E019, BER-E058, BER-E059, OKL-E018, OKL-E015, OKL-E017, BER-E076
R11	West Berkeley	BER-E023 West, BER-E048, BER-E047 West, BER-E035 West, BER-E050 East, BER-E023 East, BER-E047 East, BER-E035 East, BER-E050 West, BER-E049, BER-E034
R12	UC Berkeley	BER-E041, OKL-E001, BER-E059, BER-E043, BER-E042, OKL-E002
R13	Lawrence Berkeley National Lab	LBL-E006, LBL-E004, LBL-E005, LBL-E001, LBL-E002, LBL-E003
R14	UC Berkeley and Lawrence Berkeley National Lab	BER-E041, LBL-E006, LBL-E004, LBL-E005, LBL-E001, LBL-E002, OKL-E001, LBL-E003, BER-E059, BER-E043, BER-E042, OKL-E002

Table 6-3. Region R03 Phased Evacuation Zones

Region R03			
Zone	Phase a - Immediate Action	Phase b - 30 Minutes After Initial Action	Phase c - 60 Minutes After the Initial Action
ALB-E006	N/A	N/A	Warning
BER-E007	Warning	Warning	Warning
BER-E008	Warning	Warning	Warning
BER-E009	N/A	N/A	Warning
BER-E010	N/A	N/A	Warning
BER-E012	N/A	N/A	Order
BER-E013	N/A	Warning	Order
BER-E015	Warning	Order	Order
BER-E016	Order	Order	Order
BER-E017	Warning	Order	Order
BER-E018	N/A	Warning	Order
BER-E019	N/A	Warning	Order
BER-E020	N/A	N/A	Order
BER-E021	N/A	N/A	Warning
BER-E022	N/A	N/A	Warning
BER-E025	N/A	N/A	Warning
BER-E026	N/A	N/A	Order
BER-E027	N/A	N/A	Order
BER-E028	N/A	N/A	Order
BER-E029	N/A	Warning	Order
BER-E030	Warning	Order	Order
BER-E031	Order	Order	Order
BER-E032	Warning	Order	Order
BER-E033	N/A	Warning	Order
BER-E037	N/A	N/A	Warning
BER-E038	N/A	N/A	Order
BER-E039	N/A	N/A	Order
BER-E040	N/A	Warning	Order
BER-E041	N/A	Warning	Order
BER-E042	N/A	N/A	Order
BER-E043	N/A	N/A	Order
BER-E044	N/A	N/A	Warning
BER-E054	N/A	N/A	Warning
BER-E055	N/A	N/A	Warning
BER-E056	N/A	N/A	Warning
BER-E057	N/A	N/A	Order
BER-E058	N/A	Warning	Order

Region R03			
Zone	Phase a - Immediate Action	Phase b - 30 Minutes After Initial Action	Phase c - 60 Minutes After the Initial Action
BER-E059	N/A	N/A	Order
BER-E060	N/A	N/A	Warning
BER-E066	N/A	N/A	Warning
BER-E073	N/A	N/A	Warning
LBL-E001	Warning	Order	Order
LBL-E002	N/A	Warning	Order
LBL-E003	Warning	Order	Order
LBL-E004	Warning	Order	Order
LBL-E005	Warning	Order	Order
LBL-E006	Order	Order	Order
OKL-E001	Warning	Order	Order
OKL-E002	Order	Order	Order
OKL-E004	N/A	N/A	Warning
All Other Zones	N/A	N/A	N/A
No Protective Action (N/A) (20% Evacuate)		Evacuation Warning (50% Evacuate)	Evacuation Order (100% Evacuate)

Table 6-4. Evacuation Scenario Definitions

Scenario	Season	Day of Week	Time of Day
1	Summer	Midweek	Midday
2	Summer	Weekend	Midday
3	Summer	Midweek, Weekend	Nighttime
4	Fall	Midweek	Midday
5	Fall	Weekend	Midday
6	Fall	Midweek, Weekend	Nighttime

Table 6-5. Percent of Population Groups Evacuating for Various Scenarios

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Tourists	Shadow Region	Special Facilities ³	Transit Buses	Off Campus College Vehicles	On Campus College Vehicles	School Buses	External Through Traffic
1	13%	87%	96%	128%	20%	100%	100%	10%	10%	10%	100%
2	1%	99%	10%	139%	20%	100%	100%	0%	10%	0%	100%
3	1%	99%	10%	56%	20%	100%	100%	0%	10%	0%	40%
4	13%	87%	100%	86%	20%	100%	100%	100%	100%	100%	100%
5	1%	99%	10%	93%	20%	100%	100%	0%	100%	0%	100%
6	1%	99%	10%	37%	20%	100%	100%	0%	100%	0%	40%

Notes:

Households with Returning Commuters are Households of the City of Berkeley residents who await the return of commuters prior to beginning the evacuation trip.

Households Without Returning Commuters are Households of the City of Berkeley residents who do not have commuters or will not await the return of commuters prior to beginning the evacuation trip.

Employees are those who live outside the City of Berkeley but work within.

Tourists are people who are in the City of Berkeley at the time of an event for recreational or other (non-employment) purposes.

Shadow Region represents residents in the shadow region (outside of the City of Berkeley) who will spontaneously decide to relocate during the evacuation. The basis for the values shown is a 20% relocation of shadow residents.

Off Campus College Vehicles are students who live off campus, both inside and outside of Berkeley, and will evacuate using a private vehicle or public transit (bus or rail).

On Campus College Vehicles are students who live on campus at the time of an event and will evacuate using a private vehicle or public transit (bus or rail).

Special Facility, School and Transit Buses represent vehicle-equivalents present on the road during evacuation servicing medical facilities, schools and transit-dependent people (1 bus is equivalent to 2 passenger vehicles).

External Through Traffic is traffic on interstates and major arterial roads at the start of the evacuation. This traffic is assumed to stop within approximately 2 hours of the evacuation begins.

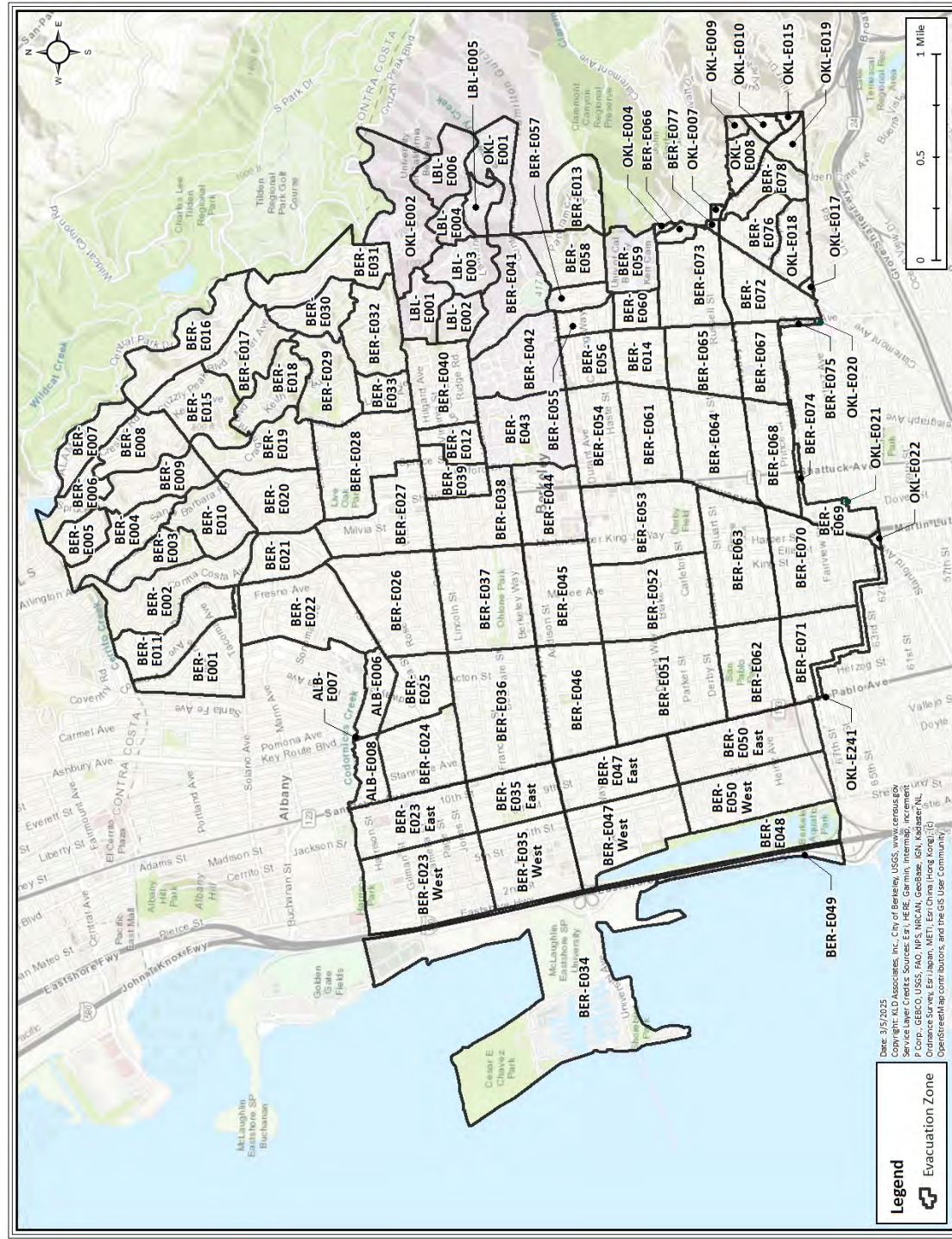
³ Special Facilities represent the vehicles at medical facilities and juvenile homes.

Table 6-6. Vehicle Estimates by Scenario⁴

Scenarios	Households with Returning Commuters	Households without Returning Commuters	Employees	Tourists	Shadow ⁵	Special Facilities	Transit Buses	Off Campus College Vehicles	On Campus College Vehicles	School Buses	External Traffic	Total Scenario Vehicles
1	5,952	41,662	14,646	17,693	10,419	285	224	1,312	207	22	47,962	140,384
2	598	47,016	1,526	19,214	10,419	285	224	0	207	0	47,962	127,451
3	598	47,016	1,543	7,741	10,419	285	224	0	207	0	19,185	87,218
4	5,952	41,662	15,256	11,888	10,419	285	224	13,119	2,069	224	47,962	149,060
5	598	47,016	1,526	12,855	10,419	285	224	0	2,069	0	47,962	122,954
6	598	47,016	1,526	5,115	10,419	285	224	0	2,069	0	19,185	86,437

⁴ Vehicle estimates are for an evacuation of the entire city (Region R01).

⁵ Shadow vehicles have been reduced to 20%. Refer to Section 2.



7 GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE)

This section presents the ETE results of the computer analyses using the DYNEV II System¹. These results cover 14 Evacuation Regions and the 6 Evacuation Scenarios discussed in Section 6.

The ETE for all Evacuation Cases are presented in Table 7-1 and Table 7-2. These tables present the estimated **times to clear** the indicated population percentages from the Evacuation Regions for all Evacuation Scenarios. **The ETE does not represent the time experienced by an individual evacuee nor does it account for the time to reach a destination.** Table 6-1 defines the Evacuation Regions considered. The tabulated values of ETE are obtained from the DYNEV II System outputs which are generated at 5-minute intervals.

7.1 Voluntary Evacuation and Shadow Evacuation

“Voluntary evacuees” are people within the city for which an Evacuation Order or Warning has not been issued, yet who elect to evacuate. “Shadow evacuation” is the outward movement of some people from outside of the city limits (also for whom no Evacuation Order or Warning has been issued). Both voluntary and shadow evacuations are assumed to take place over the same time frame as the evacuation from within the impacted Evacuation Region.

Within the city:

- 100% of permanent residents who are issued an Evacuation Order are assumed to evacuate. (See Section 6).
- 50% of permanent residents who are issued an Evacuation Warning are assumed to evacuate.
- 20% of permanent residents located outside of the evacuation region who are not given an Evacuation Order or Warning, are assumed to evacuate. Outside of the city, it is assumed that 20% of people in the Shadow Region will also choose to leave the area.

Figure 7-1 presents the area identified as the Shadow Region. The Shadow Region extends beyond the City of Berkeley. The Shadow Region is bounded by I-580, Piedmont Ave and Moraga Ave to the south, State Route 13 and State Route 24 to the southeast, the eastern boundary of Tilden Park to the east, by Moeser Lane, San Pablo Avenue, Potrero Avenue, S 55th Street, and Bayview Avenue to the North, and I-580 and the San Francisco Bay to the west. The population and number of evacuating vehicles in the Shadow Region were estimated using the same methodology that was used for permanent residents within the City of Berkeley (see Section 3.1). As discussed in Section 3.2, it is estimated that a total of 111,443 permanent residents reside in the Shadow Region; 20% of them would evacuate. See Table 6-6 for the number of evacuating vehicles from the Shadow Region.

¹ <https://kldassociates.com/wp-content/uploads/2024/10/DTRAD-DYNEV.pdf>

Traffic generated within this Shadow Region including external-external traffic, traveling away from the hazard, has the potential for impeding evacuating vehicles from within the city or Evacuation Region. All ETE calculations include this shadow traffic movement.

7.2 Evacuation Rates

Evacuation is a continuous process, as implied by Figure 7-2 through Figure 7-7. These figures indicate the rate at which traffic flows out of the city (Region R01) under the indicated conditions. One figure is presented for each scenario considered.

The distance between the trip generation and ETE curves is the travel time. Plots of trip generation versus ETE are indicative of the level of traffic congestion during evacuation. The evacuation population mobilizes over 3 hours and 15 minutes, or 3 hours and 30 minutes on school days, as discussed in Section 5. Despite evacuees mobilizing over a lengthy period of time, pronounced congestion can be seen throughout the city when the entire city evacuates at once (as shown in Appendix F). Thus, as seen in Figure 7-2 through Figure 7-7, the two curves are spatially separated. In Scenario 4 (fall, midweek, midday) for example, evacuees that leave within 30 minutes of the evacuation order experience travel times of up to 40 minutes. Those that leave later experience travel times of up to 2 hours and 35 minutes.

It should be noted that slower mobilization can actually reduce congestion, as it distributes vehicles over a longer period, allowing the road network to handle evacuation traffic more effectively. This could lead to shorter evacuation times and reduced travel times, assuming there is sufficient time for longer mobilization before the hazard reaches the city limits.

7.3 Evacuation Time Estimate (ETE) Results

Table 7-1 and Table 7-2 present the ETE values for all 14 Evacuation Regions and all 6 Evacuation Scenarios.

This analysis presents ETE for both the 90th and 100th percentile, as described below:

Table	Contents
7-1	<p>90th Percentile ETE: ETE represents the time required for 90 percent of the population within a Region to evacuate out of the Zone(s) of the Region under Evacuation Order. An evacuation is considered 90% complete when 90% of all evacuating vehicles/people in Evacuation Order zones have arrived in Zones that are either a) under Evacuation Warning or b) not under threat. This includes vehicles used by the transit-dependent population.</p> <p>All Scenarios (time of day, day of week, season) are considered.</p>
7-2	<p>100th Percentile ETE: ETE represents the time required for 100 percent of the population within a Region to evacuate out of the Zone(s) of the Region under Evacuation Order. An evacuation is considered 100% complete when 100% of all evacuating vehicles/people in Evacuation Order zones have arrived in Zones that are either a) under Evacuation Warning or b) not under threat. This includes vehicles used by the transit-dependent population.</p> <p>All Scenarios (time of day, day of week, season) are considered.</p>
7-4	<p>ETE for Response Planning: Presents the ETE (90th or 100th) most appropriate for response planning.</p>

The 90th and 100th percentile ETEs present different information. The US NRC recommends emergency planners and responders use the 90th percentile ETE when making protective action decisions, instead of the 100th percentile. This is because frequently, the last 10% of vehicles take an unusually long time to prepare to leave (“Trip Generation”). This extended trip generation time results in a long evacuation “tail” that is unrelated to traffic congestion. This tail can reflect highly variable individual evacuee behaviors (such as individual households with an extremely long mobilization time as compared to their neighbors). Therefore, using the 100th percentile ETEs for community-wide evacuation planning is not recommended, although it is provided in this report for completeness.

Although counterintuitive, the 90th percentile ETE for a case with a large number of evacuating vehicles can be less than a case with fewer evacuating vehicles. This is because the 90th percentile ETE depends on the composition of the evacuating vehicular traffic (e.g., residents, employees, visitors). Areas with a higher proportion of quickly mobilizing evacuees (such as employees or visitors) can reach the 90th percentile ETE more quickly compared to areas predominantly populated by permanent residents, who typically require a longer time to mobilize even if they have a higher total demand. Often, this anomaly is seen in cases without traffic congestion, or where traffic congestion clears prior to the end of trip generation.

This analysis determined the Trip Generation Time using the results of the community survey (Appendix D). Survey respondents reported how long it would take them to prepare to leave (trip generation time.) Some respondents indicated that it would take multiple hours to leave, which creates this long evacuation “tail.” However, survey results may not accurately reflect the Trip Generation times for no-notice events such as a fire immediately adjacent to the home. Therefore, a truncation of the mobilization time was tested in Section 10 for Region R02 and R04.

It can be seen that when mobilization times are shorter, the 100th percentile ETE are also shorter, validating the NRC concepts.

Snapshots of congestion at certain times into the evacuation for some cases are presented in Appendix F. These diagrams reflect the ETE statistics for the evacuation scenarios and regions for which they represent. The majority of the congestion is located on higher capacity routes that serve a majority of the evacuating population – discussed further in Section 9.

7.3.1 Prepare to Evacuate Time Can Dictate Time to Escape Hazard Area

As described above, an analysis comparing the 90th and 100th percentile ETE shows that for most of the 14 Evacuation Regions and their 6 Evacuation Scenarios, the 100th percentile ETE is dictated by trip generation². This means that generally, the extended time it takes the final evacuees to get on the road is the reason for the extended evacuation time.

However, there are exceptions to this statement listed below. This means that under the circumstances below, traffic congestion causes extended evacuation times, and even if evacuees got on the road more quickly, the area would not be cleared more quickly.

- Region R01: A citywide evacuation, during the day
- Region R02: An unphased evacuation of the 1923 Fire during the fall, midweek, midday
- Region R03 Phase a and Phase b: A phased evacuation of the Fire 1923 (due to the “spike”), during the day, and
- Region R08: An evacuation of Berkeley Flats on weekdays during the day.
- Region R13: An evacuation of LBNL on weekdays during the day.

For the cases above, it is recommended that the City considers the 100th percentile ETE when making protective action decisions. For all other cases, trip generation time dictates 100th percentile ETE, and for those other cases it is recommended that the city considers the 90th percentile ETE when making protective action decisions.

Section 10 presents analysis of how evacuation times change when mobilization times are truncated, representing what would happen if evacuees got onto roadways more quickly when they receive an evacuation order. The impacts of reduced trip generation times varied across different Evacuation Regions and cases. ETEs were reduced by up to 65% in some cases. In others the reductions were smaller. In others, the ETE actually increased because the concentrated demand on the roadway network overwhelmed the system. See Section 10 for details.

Roadway Impacts from Picking up Schoolchildren

It should be noted that some parents will pick up their children from school prior to beginning their evacuation trip (see Assumption 2.a.i in Section 2.4). While the estimated trip mobilization time includes the time for parents to pick up their children prior to evacuating (see Section 5), the potential for localized congestion at schools during this process was not factored into the study. It's important to note that while the total number of evacuating vehicles remains the same,

² Since LBNL only has employees within the region, the mobilization of this region is 1:05, rather than 3:40 or 3:25, which is only for residents as discussed in Section 5.

the shift in trip origin from homes to schools for these evacuees could create altered congestion patterns than those represented in this study. Consequently, the Estimated Evacuation Time (ETE) could experience slight variations depending on the efficiency of parent pick-up procedures and the resulting traffic flow around school zones.

7.3.2 Region R01: Citywide Evacuation

It should be first noted that **Region R01 does not reflect a realistic emergency or disaster**. An event requiring simultaneous evacuation of all of Berkeley would have regional impacts to roadway and transportation systems that are far beyond the scope of this analysis.

Rather, Citywide evacuation was included in this document in order to stress Berkeley's roadway network to identify areas of potential traffic congestion that may not have been apparent from other evacuation cases.

Analysis Results

For a citywide evacuation, the 90th percentile ETE for midweek midday scenarios is 3 hours and 50 minutes, 3 hours for weekend middays and 2 hours and 30 minutes for nighttime scenarios, on average. The 90th percentile ETE is the highest for midweek midday scenarios because of the increased traffic demand due to employees within the city. The 90th percentile ETE is at its peak (4 hours) for fall midweek midday scenarios as schools are in session, especially UC Berkeley, compared to the summer scenarios where the school population is lower. Nighttime scenarios have the lowest 90th ETE due to the decreased numbers of employees, visitors and commuting students within the city. As mentioned before, the 100th percentile ETE is dictated by congestion for midday scenarios and trip mobilization time for nighttime scenarios. During the day, increased vehicular demand overwhelms the roadway network within the city, causing delays and increasing ETE. At night, the demand is reduced, hence, the 100th percentile ETE is dictated by when the last vehicle departs for an evacuation.

7.3.3 Region R02: 1923 Berkeley Fire Repeat

The city pursued an ETE analysis for a repeat of the 1923 Berkeley Fire. Region R02 uses the final perimeter of the fire and assigns zones to evacuation order or warning status based on the final impact of the fire. This means that the Region R02 analysis identifies the ETE if the full area of impact received evacuation warnings/orders at the same time.

Analysis Results

For Region R02, the 90th percentile ETE ranges between 1 hour and 45 minutes and 2 hours and 55 minutes. The 100th percentile ETE ranges between 3 hours and 25 minutes to 4 hours and 10 minutes. Similar to a citywide evacuation (Region R01), the variance in ETE between different scenarios is to the fluctuations in demand in different seasons, time of day, and day of the week within Berkeley. Additionally, for Region R02, there are Evacuation Warning zones around the periphery of the fire extent. The increase in shadow evacuation (50% compared to 20% in other areas) in these areas slows down vehicles leaving the zones that receive an Evacuation Order, further delaying their evacuation time.

Evacuee Experience

Figure 7-8 shows the ETE and trip generation time (mobilization time) for Region R02 Scenario 4. As discussed in Section 7.2, the distance between these curves is the average travel time experienced for an evacuee that mobilizes at a specific time after the Evacuation Order. For example, if an evacuee mobilizes 45 minutes after the Evacuation Order, it will take them approximately 65 minutes to leave the area at risk. (Find 0:45 on the x-axis, follow a straight vertical line up until it hits the red line, follow a straight horizontal line to the right until it hits the blue line, follow a straight vertical line down until it hits the x-axis; read the time and subtract 0:45 to compute the average travel time for a vehicle that departs at 0:45 after the evacuation order.)

The travel time experienced for different time periods are summarized below (the sum of these two times can be used to calculate the ETE):

- Mobilized 30 minutes after the Evacuation Order – Travel Time 40 minutes
- Mobilized 60 minutes after the Evacuation Order – Travel Time 75 minutes
- Mobilized 90 minutes after the Evacuation Order – Travel Time 80 minutes
- Mobilized 150 minutes after the Evacuation Order – Travel Time 80 minutes

7.3.4 Regions R02 and R03: Analyzing the Impacts of a Phased Fire Evacuation

The city pursued two separate ETE analyses for a repeat of the 1923 Berkeley Fire.

- As discussed above, the Region R02 analysis identifies the ETE if the full area of impact received evacuation warnings/orders at the same time.
- Region R03 uses the same fire perimeter, exploring the impact to evacuation times from issuing evacuation warnings/orders sequentially based on real-time fire spread. The zones in the fire area are assigned to phases based on historical fire spread data. The phases are a (eastern zones), b (middle zones), and c (western zones).

This analysis is designed to answer 2 questions:

- Does phasing evacuation speed or slow the overall evacuation times for the entire region affected by a repeat of the 1923 Fire?
- How does phasing the evacuation affect the evacuation times for individual evacuation zones? The fire is presumed to move from the east to the west. Even if the overall evacuation time slows with a phased evacuation, does the phased evacuation enable people nearest to the fire to more quickly get out of the way of the hazard?

Overall Analysis Results

Analysis shows that overall, phasing the evacuation of the same area increases the overall evacuation time for the area. Comparing the simultaneous (R02) and phased (R03 – phase c) evacuations, Table 7-1 reveals that the phased evacuation has an average increase of 2 hours and 15 minutes at the 90th percentile ETE across all scenarios. The extended ETE in the R03 Phased evacuation is caused by a combination of:

- The delayed evacuation order timing for Phase c: The final and westernmost area in the Region receives the evacuation order 180 minutes after Phase a; and
- A “spike” (sharp increase) in the mobilization (trip-generation rate) of evacuating vehicles. Once evacuation orders were issued for Phase a, many people in surrounding areas (phase b and c) were preparing to evacuate. Once Phase b and then c received their official evacuation warning or order, many of these evacuees were more ready to go than they would have been if they received their evacuation order/warning at the beginning of the event. This decreases the mobilization times for Phases b and c, and the associated spike in vehicles entering the roadway oversaturates evacuation routes, which increases traffic congestion and prolongs ETE.

Impacts on Areas Closest to Fire Ignition

To determine how phasing affects evacuation times for areas closest to a fire ignition (phases a and b), additional data was extracted from the simulation results for the simultaneous (R02) and phased (R03) evacuations. The results are shown in Table 7-3. They indicate that a phased evacuation approach can actually increase the ETE for those areas closest to the hazard, (phase a and phase b).

This counterintuitive phenomenon is attributable to vehicles evacuating eastward toward the fire area and into phase a and b, in an attempt to escape severe congestion further west. The model generally routes evacuating vehicles away from the hazard, but if roadways are not specifically blocked from entry, drivers may still temporarily route toward the hazard if they find a less congested roadway option. As such, evacuation times are not improved for areas closer to the fire when a phased evacuation is implemented. Details include the following:

- For Phase a, the easternmost zones closest to the fire, the 90th percentile ETE increases by 10 minutes, on average, when remaining zones are phased. This increase is due to traffic from outside of Phase a entering Phase a. This traffic starts entering Phase a when the initial evacuation order is issued, as voluntary evacuees (outside of Phase a) move through the area. It continues and increases after the 90-minute mark when Phase b is instructed to evacuate.
- For central zones (Phase b), the 90th percentile ETE increases by an average of 25 minutes in a phased evacuation (Region R03) compared to the corresponding phase under Region R02 (simultaneous evacuation). Combined with a longer mobilization time, the results indicate a spike in evacuating traffic that increases congestion and prolongs ETE.
- As stated above, for the western zones of impact (Phase c), the 90th percentile ETE increases by 65 to 170 minutes in a phased evacuation (Region R03) compared to the simultaneous evacuation (Region R02).

These results support implementing a simultaneous evacuation, rather than a phased evacuation, in a case similar to the 1923 Fire.

Evacuee Experience

Simultaneous Evacuation: Discussed above in Section 7.3.3.

Phased Evacuation: shows the ETE and trip generation time (mobilization time) for Region R03 Scenario 4. The travel time experienced for different time periods are summarized below (the sum of these two times can be used to calculate the ETE):

- Mobilized 30 minutes after the Evacuation Order – Travel Time 65 minutes
- Mobilized 60 minutes after the Evacuation Order – Travel Time 110 minutes
- Mobilized 90 minutes after the Evacuation Order – Travel Time 100 minutes
- Mobilized 150 minutes after the Evacuation Order – Travel Time 60 minutes

7.3.5 Region R04: Panoramic Hills Fire

This region was selected due to the extremely limited roadway options in the Panoramic Hills area, which has one way in and out. This area is also Berkeley Fire Zone 3, reflecting the high risk to residents from its wildland-urban interface, along with its evacuation challenges.

Analysis Results

For Region R04, the 90th percentile ETE ranges between 1 hour and 35 minutes and 1 hour and 45 minutes. The 100th percentile ETE ranges between 3 hours and 25 minutes to 3 hours and 40 minutes. Due to its comparatively smaller area, Region R04 involves fewer evacuation zones than other regions. Consequently, the reduced vehicular demand on the roadway system results in congestion that clears quickly, as shown in Figure F-12 and Figure F-13. The 100th percentile ETE is primarily governed by the time required for complete mobilization.

Evacuee Experience

Figure 7-10 shows the ETE and trip generation time (mobilization time) for Region R04 Scenario 4. The figure further reinforces the fact that there is little congestion, ETE mimics trip generation, and travel times to exit the region are low. The travel time experienced for different time periods are summarized below (the sum of these two times can be used to calculate the ETE):

- Mobilized 15 minutes after the Evacuation Order – Travel Time 5 minutes
- Mobilized 30 minutes after the Evacuation Order – Travel Time 5 minutes
- Mobilized 45 minutes after the Evacuation Order – Travel Time 10 minutes
- Mobilized 90 minutes after the Evacuation Order – Travel Time 5 minutes

7.3.6 Region R05: Fire Zones 2 & 3

It is unlikely that there would be a simultaneous evacuation of Fire Zones 2 and 3 (the Berkeley hills) in association with a particular emergency or disaster. This region is included to help analyze impacts of the Berkeley Hills from administrative changes that could affect development in the area.

Analysis Results

For Region R05, the 90th percentile ETE ranges between 1 hour and 45 minutes and 2 hours and 20 minutes. The 100th percentile ETE ranges between 3 hours and 25 minutes to 3 hours and 40 minutes. Depending on the scenario, 90% of the population could mobilize within 1 hour and 30

minutes to 1 hour and 45 minutes for Region R05. This indicates the 90th percentile ETE is dictated by congestion for midday scenarios and mobilization time nighttime scenarios. The 100th percentile ETE is primarily governed by the time required for complete mobilization.

Evacuee Experience

Figure 7-11 shows the ETE and trip generation time (mobilization time) for Region R05 Scenario 4. The travel time experienced for different time periods are summarized below (the sum of these two times can be used to calculate the ETE):

- Mobilized 30 minutes after the Evacuation Order – Travel Time 20 minutes
- Mobilized 60 minutes after the Evacuation Order – Travel Time 40 minutes
- Mobilized 90 minutes after the Evacuation Order – Travel Time 45 minutes
- Mobilized 150 minutes after the Evacuation Order – Travel Time 35 minutes

7.3.7 Regions R06 and R07: Tsunami Warning

These regions are included to analyze areas of potential impact from a warning-level tsunami, which is the highest level of tsunami alert. Two separate regions are included in alignment with the State of California's Tsunami Evacuation Playbooks. Region R07 is the "Max Phase," including all areas of Berkeley that could be impacted by tsunami inundation. Region R06 is a slightly scaled back area limited to the zones to the east of I-80. Under select Warning-level tsunamis, State responders may be able to confirm that the tsunami's impact will be less than the worst-case scenario and may in turn be able to advise local responders to limit areas of evacuation to this narrower area represented by Region R06. Both regions are included for analysis.

Analysis Results

For Region R06 and R07, the 90th percentile ETE ranges between 55 minutes and 2 hours and 15 minutes. The 100th percentile ETE ranges between 3 hours and 25 minutes to 3 hours and 40 minutes. For Region R06, 90% of the evacuating traffic can mobilize within approximately 45 minutes and approximately 1 hour 30 minutes for Region R07. All 90th percentile ETE are higher than the mobilization time indicating that there is congestion within the network that dictates the 90th percentile ETE. Region R06 has two ways to exit the region: University Avenue and Frontage Road. Congestion on these two roadways delays the 90th percentile ETE by 30 minutes on average. For Region R07, there are more ways out of the area being evacuated, but there is more demand as the area under the Evacuation Order is expanded to Seventh St. As shown in Figure F-17 and Figure F-19, most of the congestion clears by 2 hours and 30 minutes for Region R06 and R07, respectively. The 100th percentile ETE is dictated by mobilization for both regions.

Evacuee Experience

Tsunami Warning (East of I-80): Figure 7-12 shows the ETE and trip generation time (mobilization time) for Region R06 Scenario 4. The travel time experienced for different time periods are summarized below (the sum of these two times can be used to calculate the ETE):

- Mobilized 15 minutes after the Evacuation Order – Travel Time 10 minutes
- Mobilized 30 minutes after the Evacuation Order – Travel Time 20 minutes

- Mobilized 45 minutes after the Evacuation Order – Travel Time 60 minutes
- Mobilized 60 minutes after the Evacuation Order – Travel Time 65 minutes

Tsunami Warning (Max Phase): Figure 7-13 shows the ETE and trip generation time (mobilization time) for Region R07 Scenario 4. The travel time experienced for different time periods are summarized below (the sum of these two times can be used to calculate the ETE):

- Mobilized 15 minutes after the Evacuation Order – Travel Time 5 minutes
- Mobilized 30 minutes after the Evacuation Order – Travel Time 30 minutes
- Mobilized 45 minutes after the Evacuation Order – Travel Time 65 minutes
- Mobilized 90 minutes after the Evacuation Order – Travel Time 50 minutes

7.3.8 Regions R08 through R11: Geographic Areas of Berkeley

Regions R08 through R11 are not associated with particular hazards, and instead break down Berkeley's geography into associated areas "Berkeley Flats, North Berkeley Hills," etc. These regions are included in the analysis to provide responders with details for use should a hazard without a geographic limit (such as a hazardous materials release) impact one of these areas.

Analysis Results

The 90th and 100th percentile ETE for these regions are as follows:

- Region R08 (Berkeley Flats)
 - o 90th percentile – Between 2 hours and 5 minutes to 3 hours and 10 minutes.
 - o 100th percentile – Between 3 hours and 25 to 4 hours and 20 minutes.
- Region R09 (North Berkeley Hills)
 - o 90th percentile – Between 1 hour and 45 minutes to 2 hours and 10 minutes.
 - o 100th percentile – Between 3 hours and 25 to 3 hours and 40 minutes.
- Region R10 (South Berkeley Hills)
 - o 90th percentile – Between 1 hour and 30 minutes to 2 hours and 15 minutes.
 - o 100th percentile – Between 3 hours and 25 to 3 hours and 40 minutes.
- Region R11 (West Berkeley)
 - o 90th percentile – Between 1 hour and 35 minutes to 1 hour and 45 minutes.
 - o 100th percentile – Between 3 hours and 25 to 3 hours and 40 minutes.

The 90th percentile ETE for these regions depends on the number of evacuating vehicles. As expected, the 90th percentile ETE for Berkeley Flats is the highest as it has the highest demand among these regions. The 100th percentile ETE is dictated by mobilization time with the exception of the Berkeley Flats (Region R08) during weekdays during the day (when employment is highest).

7.3.9 Regions R12 through R14: UC Berkeley and Lawrence Berkeley National Laboratory (LBNL)

UC Berkeley and Lawrence Berkeley National Laboratory (LBNL) zones have been included in the study as Regions R12 (UC Berkeley, including Clark Kerr Campus), R13 (LBNL) and R14 (UC Berkeley and LBNL). These Regions were established in this analysis in acknowledgement of these entities' evacuation authorities separate from the City of Berkeley. In addition, these regions

were separately analyzed to understand the impacts of an evacuation limited to UC Berkeley property (Region R12), LBNL (Region R13), and UC Berkeley and LBNL together (Region R14).

Analysis Results

For UC Berkeley, the 90th percentile ETE is between 1 hour and 5 minutes to 1 hour 35 minutes. Evacuating traffic within UC Berkeley is mostly comprised of employees and college students, with a maximum mobilization time of 60 minutes (more than 90% are mobilized in 45 minutes). The 20-to-50-minute difference between the mobilization time of employees and college students, when compared against the higher 90th percentile ETE values, indicates how congestion impacts the 90th percentile ETE. The 100th percentile ETE is dictated by trip mobilization time.

LBNL experiences the lowest 90th percentile ETE (45 minutes) during weekend and nighttime scenarios. During the day, the increased numbers of shadow evacuees outside of LBNL coupled with the higher LBNL evacuee demand lead to congestion at the intersection of Gayley Rd/La Loma Ave/Hearst Ave, delaying the 90th percentile ETE for an evacuation of LBNL and resulting in ETEs as high as 2 hours during the day. This increase in ETE when compared to weekend and nighttime scenarios is attributed to the Lab's reduced operational activity and consequently lower vehicular demand during weekend and nighttime scenarios, compared to midweek and midday scenarios. The 100th percentile ETE for midday scenarios is dictated by traffic congestion at the Gayley Rd/La Loma Ave/Hearst Ave intersection. The 100th percentile ETE during the weekend and nighttime is dictated by trip mobilization time.

When LBNL and UC Berkeley evacuate together, the 90th percentile ETE ranges from 1 hour and 15 minutes to 2 hours and 15 minutes. The 100th percentile ETE for LBNL and UC Berkeley combined mimics the ETE for UC Berkeley as the mobilization (and ultimately the evacuation) of UC Berkeley dictates the ETE of the UC Berkeley plus LBNL region.

An anomaly can be seen when inspecting Region R12 and R14 in Table 7-1. One might expect the 90th percentile ETE for UC Berkeley evacuating by itself (R12) to be shorter than the 90th percentile ETE for UC Berkeley and LBNL evacuating (R14). As shown in Table 7-1, there is one case where this is not true (Scenario 3). This is a result of the composition of vehicular demand within each of these evacuating regions. LBNL is purely made up of employees. UC Berkeley has employees, commuting students, and residents within its zones. When more quickly mobilizing vehicles (LBNL employees) are added in, the 90th percentile ETE can be reached more quickly, in the absence of traffic congestion from external traffic (during Scenario 3).

This anomaly, however, cannot be seen (and is not possible) at the 100th percentile. Figure 7-14 shows the ETE and trip generation time (mobilization time) for an LBNL evacuation, during fall, midweek, midday (Region R13 Scenario 4). The travel times experienced for different time periods are summarized below (the sum of these two times can be used to calculate the ETE):

- Mobilized 15 minutes after the Evacuation Order – Travel Time 15 minutes
- Mobilized 30 minutes after the Evacuation Order – Travel Time 50 minutes
- Mobilized 45 minutes after the Evacuation Order – Travel Time 80 minutes
- Mobilized 60 minutes after the Evacuation Order – Travel Time 75 minutes

7.4 ETE for Response Planning

Table 7-4 summarizes the ETE values recommended for use in response plans based on the analysis of this report.

Per US NRC recommendation, the table presents 90th percentile ETE, except when marked with an asterisk (*). Entries with an asterisk are 100th percentile ETE. In these cases, traffic congestion dictates ETE, meaning that the 100th percentile is more appropriate for planning purposes (see Section 7.3).

Rows marked “Urgent Mobilization” present ETEs expected when evacuees mobilize more quickly (30 minutes) than would be predicted from responses to the Demographic Survey (Appendix D). These times were identified through the Sensitivity Study for Evacuation Readiness, described in detail in Section 10.1. These times are associated with no-notice evacuations, such as active wildfires in close proximity to the city.

7.5 Guidance on Using ETE Tables

The user first determines the percentile of population for which the ETE is sought (federal guidance for nuclear emergencies calls for the 90th percentile). The applicable value of ETE within the chosen table may then be identified using the following procedure:

1. Identify the applicable **Scenario** (Table 6-4):

- Season
 - Summer
 - Fall
- Day of Week
 - Midweek
 - Weekend
- Time of Day
 - Midday
 - Nighttime

While these Scenarios are designed, in aggregate, to represent conditions throughout the year, some further clarification is warranted:

- The seasons are defined as follows:
 - Summer assumes that public schools are not in session.
 - Fall considers that public schools are in session.
 - Time of Day: Midday implies the time over which most commuters are at work or are travelling to/from work.
2. With the desired percentile ETE and Scenario identified, now identify the **Evacuation Region**:
- Determine which Region is evacuating using Table 6-1:
3. Determine the **ETE Table** based on the **percentile** selected (Table 7-1 or Table 7-2). Then, for the **Scenario** identified in Step 1 and the **Region** identified in Step 2, proceed as follows:
- The columns of Table 7-1 and Table 7-2 are labeled with the Scenario numbers. Identify

the proper column in the selected Table using the Scenario number defined in Step 1.

- Identify the row in this table that provides ETE values for the Region identified in Step 2.
- The unique data cell defined by the column and row so determined contains the desired value of ETE expressed in Hours:Minutes.

Example

To identify the ETE for the following conditions:

- Wednesday, October 14th at 12:00 PM.
- The hazard threatens the North Berkeley Hills.
- The desired ETE is that of an evacuation of 90 percent of the population from within the impacted Region.

Table 7-1 is applicable because the 90th percentile ETE is desired. Proceed as follows:

1. Identify the Scenario as fall, midweek, midday conditions. Entering Table 6-4 (or Table 7-1), it is seen that this combination of circumstances describes Scenario 4.
2. In Table 6-1, locate the Region that has North Berkeley Hills: Region R09.
3. In Table 7-1 (90th percentile ETE table), locate the data cell containing the value of ETE for Scenario 4 and Region R09. This data cell is in column (4) and in the row for Region R09; it contains the ETE value of 2 hours and 5 minutes.

Table 7-1. Time to Clear the Indicated Area of 90 Percent of the Affected Population

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
R01 - Citywide Evacuation	3:40	3:10	2:30	4:00	2:55	2:30
R02 - Fire 1923	2:25	1:50	1:45	2:55	1:50	1:45
R03 - Fire 1923 Phase a	2:05	1:40	1:40	2:45	1:35	2:10
R03 - Fire 1923 Phase b	2:15	2:00	2:15	2:45	2:10	2:30
R03 - Fire 1923 Phase c	4:10	4:20	4:30	4:00	4:25	4:35
R04 - Panoramic Hill Fire	1:40	1:35	1:40	1:45	1:35	1:40
R05 - Fire Zones 2 & 3 Combined	2:05	1:55	1:45	2:20	1:55	1:45
R06 - Tsunami - Phase 3	1:20	1:20	1:05	1:45	0:55	1:10
R07 - Tsunami - Max Phase	2:15	2:10	1:50	2:15	2:05	1:50
R08 - Berkeley Flats	2:55	2:35	2:10	3:10	2:25	2:05
R09 - North Berkeley Hills	2:10	2:00	1:50	2:05	1:50	1:45
R10 - South Berkeley Hills	1:35	1:30	1:35	2:15	1:35	1:35
R11 - West Berkeley	1:40	1:35	1:35	1:45	1:35	1:35
R12 - UC Berkeley	1:05	1:15	1:25	1:20	1:30	1:35
R13 - Lawrence Berkeley National Lab	1:15	0:45	0:45	2:00	0:45	0:45
R14 - UC Berkeley + Lawrence Berkeley National Lab	1:30	1:15	1:20	2:15	1:30	1:35

Table 7-2. Time to Clear the Indicated Area of 100 Percent of the Affected Population

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
R01 - Citywide Evacuation	5:10	4:25	3:25	5:35	4:00	3:25
R02 - Fire 1923	3:40	3:25	3:25	4:10	3:25	3:25
R03 - Fire 1923 Phase a	4:25	4:30	4:40	4:30	4:15	4:35
R03 - Fire 1923 Phase b	6:10	5:55	6:00	6:15	6:00	6:10
R03 - Fire 1923 Phase c	6:20	6:20	6:20	6:20	6:20	6:20
R04 - Panoramic Hill Fire	3:40	3:25	3:25	3:40	3:25	3:25
R05 - Fire Zones 2 & 3 Combined	3:40	3:25	3:25	3:40	3:25	3:25
R06 - Tsunami - Phase 3	3:40	3:25	3:25	3:40	3:25	3:25
R07 - Tsunami - Max Phase	3:40	3:25	3:25	3:40	3:25	3:25
R08 - Berkeley Flats	4:10	3:25	3:25	4:20	3:25	3:25
R09 - North Berkeley Hills	3:40	3:25	3:25	3:40	3:25	3:25
R10 - South Berkeley Hills	3:40	3:25	3:25	3:40	3:25	3:25
R11 - West Berkeley	3:40	3:25	3:25	3:40	3:25	3:25
R12 - UC Berkeley	3:40	3:25	3:25	3:40	3:25	3:25
R13 - Lawrence Berkeley National Lab	1:25	1:05	1:05	2:15	1:05	1:05
R14 - UC Berkeley + Lawrence Berkeley National Lab	3:40	3:25	3:25	3:40	3:25	3:25

Table 7-3. Time to Clear the Indicated Area of 90 Percent of the Affected Population for 1923 Fire Repeat

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
R02 Phase a	2:00	1:35	1:25	2:45	1:35	1:40
R03 Phase a	2:05	1:40	1:40	2:45	1:35	2:10
R02 Phase b	2:15	1:45	1:35	2:40	1:40	1:30
R03 Phase b	2:15	2:00	2:15	2:45	2:10	2:30
R02 Phase c	2:25	1:50	1:45	2:55	1:50	1:45
R03 Phase c	4:10	4:20	4:30	4:00	4:25	4:35

Table 7-4. Time to Clear the Indicated Area for Response Planning

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	1	2	3	4	5	6
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
R01 - Citywide Evacuation	5:10*	4:25*	2:30	5:35*	4:00*	2:30
R02 - Fire 1923	2:25	1:50	1:45	4:10*	1:50	1:45
R02 - Fire 1923 Urgent Mobilization	2:25	1:50	1:35	4:10*	1:45	1:35
R03 - Fire 1923 Phase a	4:25*	4:30*	1:40	4:30*	4:15*	2:10
R03 - Fire 1923 Phase a Urgent Mobilization	2:30*	2:10*	1:25	3:30*	2:10*	1:35
R03 - Fire 1923 Phase b	6:10*	5:55*	2:15	6:15*	6:00*	2:30
R03 - Fire 1923 Phase b Urgent Mobilization	4:00*	4:00*	1:40	4:00*	2:10*	1:40
R03 - Fire 1923 Phase c	4:10	4:20	4:30	4:00	4:25	4:35
R03 - Fire 1923 Phase c Urgent Mobilization	3:35	3:45	1:40	3:50	1:30	1:40
R04 - Panoramic Hill Fire	1:40	1:35	1:40	1:45	1:35	1:40
R04 - Panoramic Hill Fire Urgent Mobilization	1:05	0:50	0:45	1:45	0:50	0:50
R05 - Fire Zones 2 & 3 Combined	2:05	1:55	1:45	2:20	1:55	1:45
R06 - Tsunami - Phase 3	1:20	1:20	1:05	1:45	0:55	1:10
R07 - Tsunami - Max Phase	2:15	2:10	1:50	2:15	2:05	1:50
R08 - Berkeley Flats	4:10*	2:35	2:10	4:20*	2:25	2:05
R09 - North Berkeley Hills	2:10	2:00	1:50	2:05	1:50	1:45
R10 - South Berkeley Hills	1:35	1:30	1:35	2:15	1:35	1:35
R11 - West Berkeley	1:40	1:35	1:35	1:45	1:35	1:35
R12 - UC Berkeley	1:05	1:15	1:25	1:20	1:30	1:35
R13 - Lawrence Berkeley National Lab	1:25*	0:45	0:45	2:15*	0:45	0:45
R14 - UC Berkeley + Lawrence Berkeley National Lab	1:30	1:15	1:20	2:15	1:30	1:35

* Entries with an asterisk are 100th percentile ETE. All other ETE presented in Table 7-4 are the 90th percentile ETE.

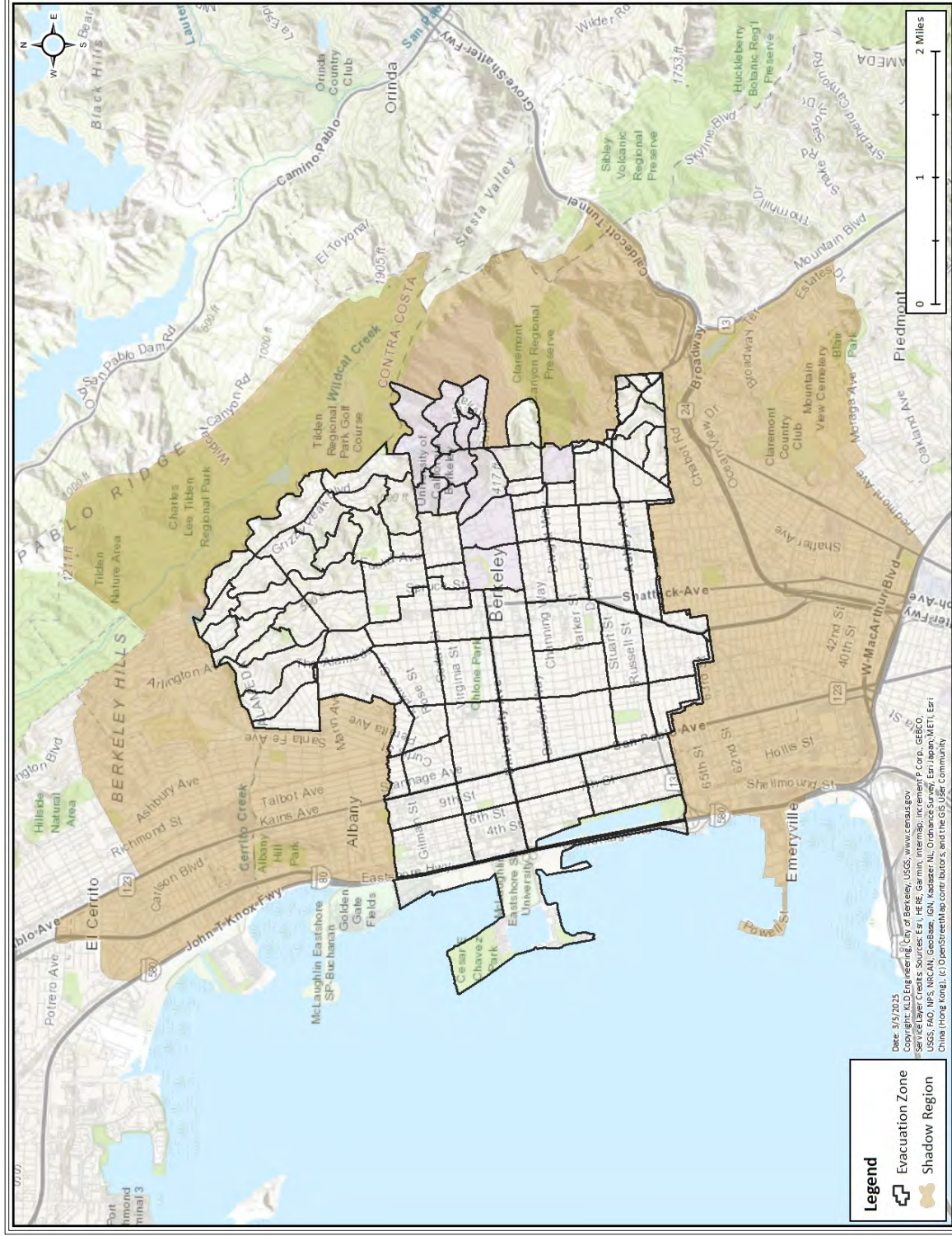


Figure 7-1. Study Area Shadow Region

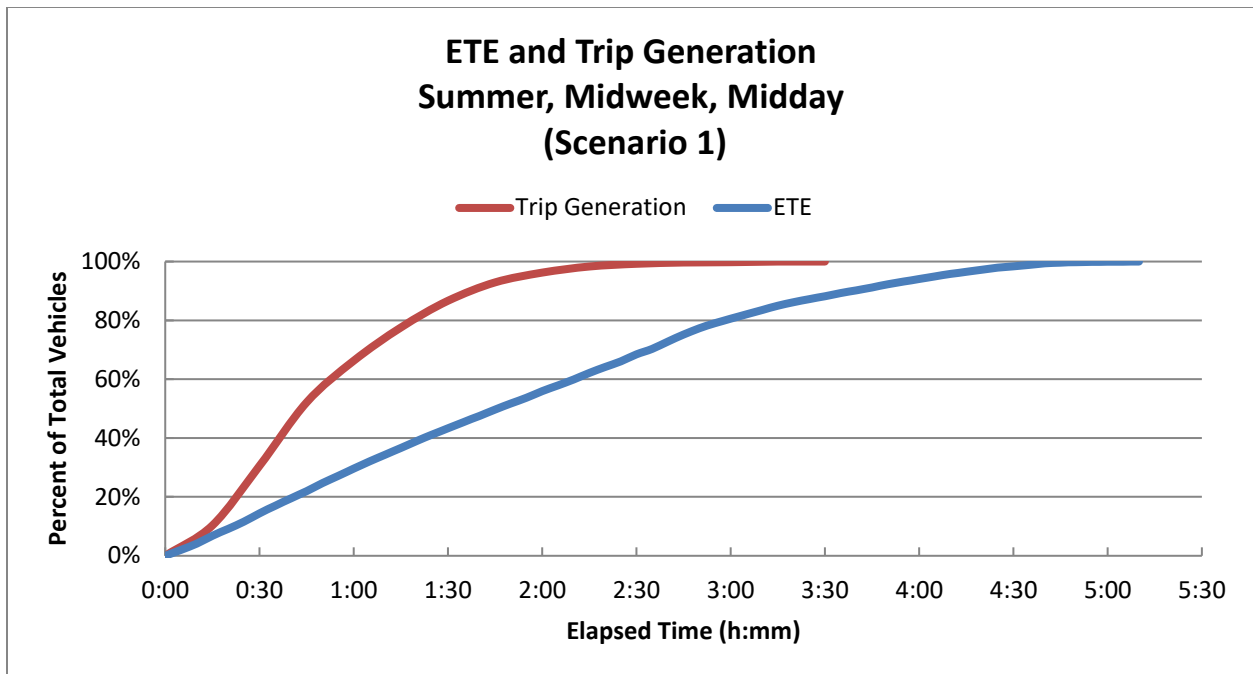


Figure 7-2. Evacuation Time Estimates - Scenario 1 for Region R01

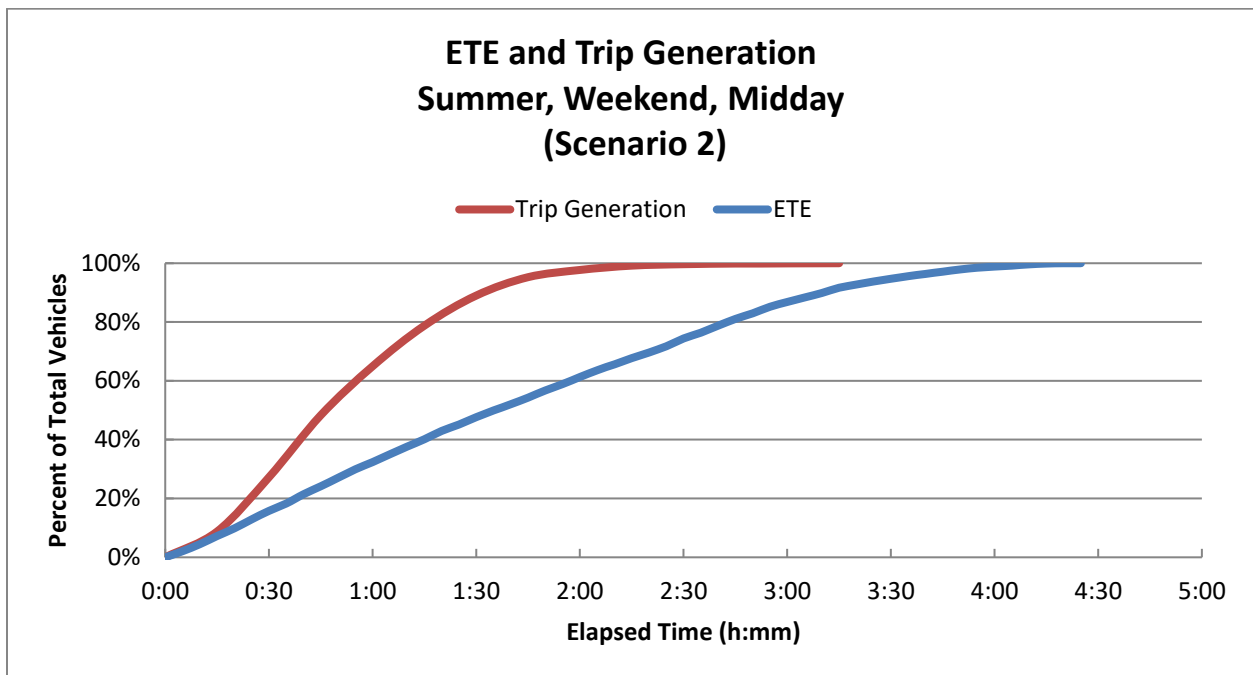


Figure 7-3. Evacuation Time Estimates - Scenario 2 for Region R01

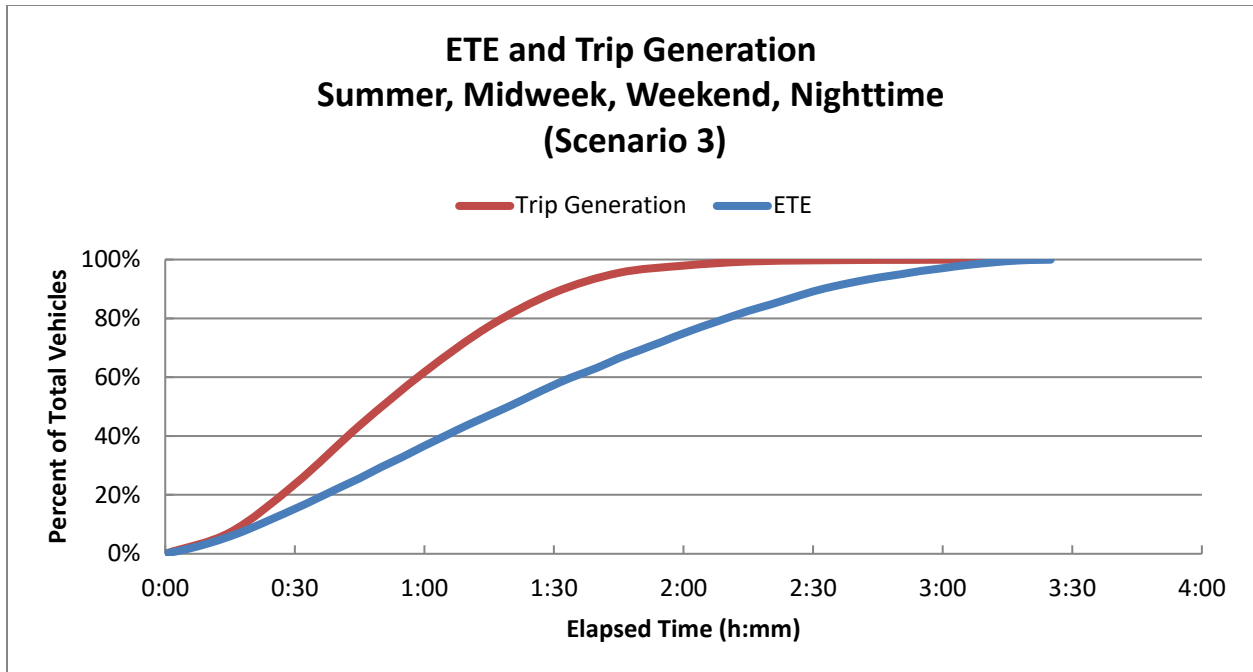


Figure 7-4. Evacuation Time Estimates - Scenario 3 for Region R01

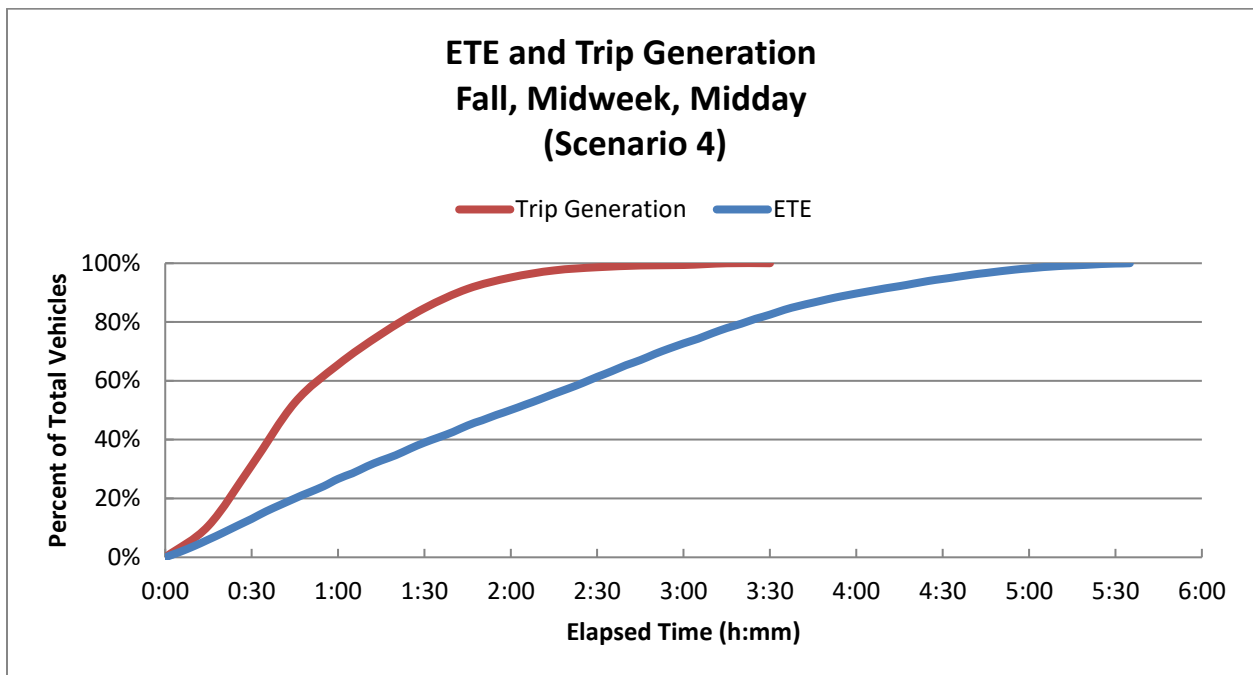


Figure 7-5. Evacuation Time Estimates - Scenario 4 for Region R01

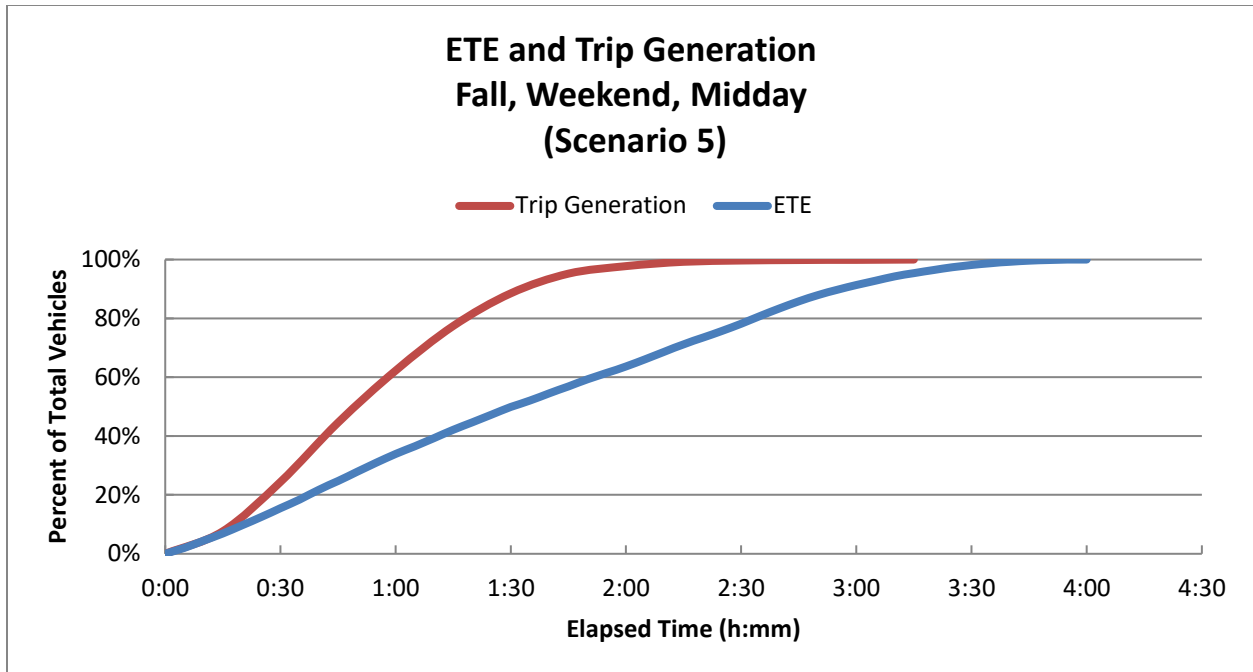


Figure 7-6. Evacuation Time Estimates - Scenario 5 for Region R01

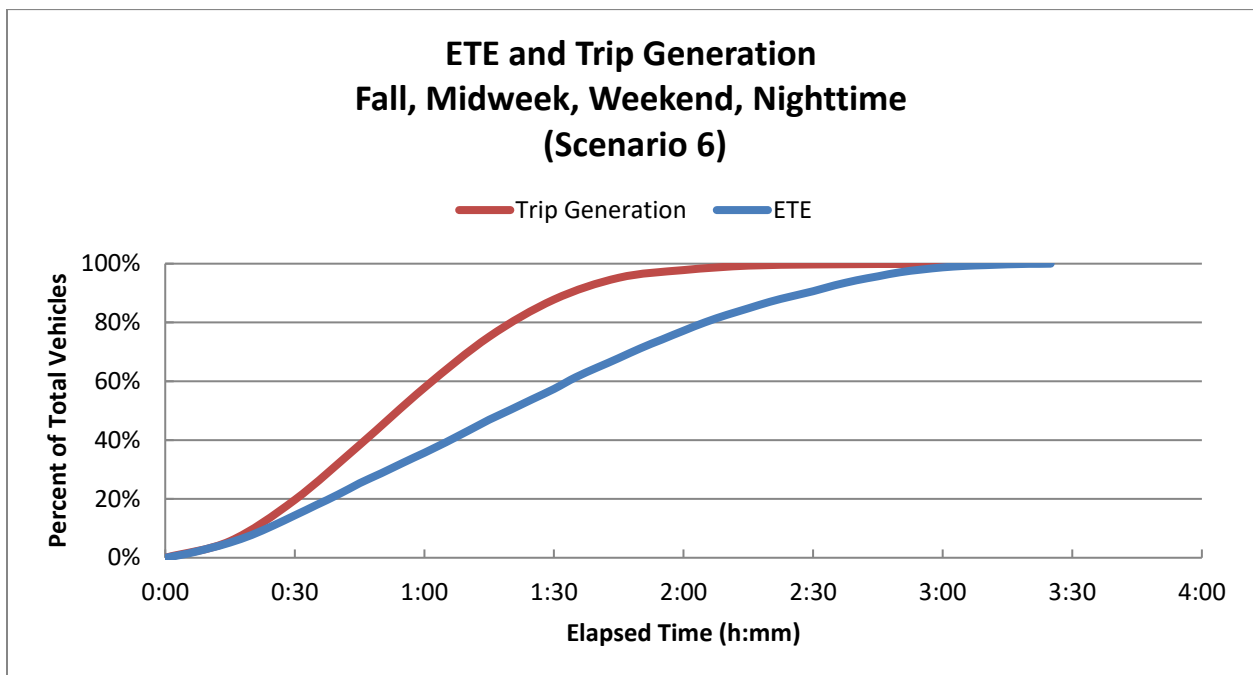


Figure 7-7. Evacuation Time Estimates - Scenario 6 for Region R01

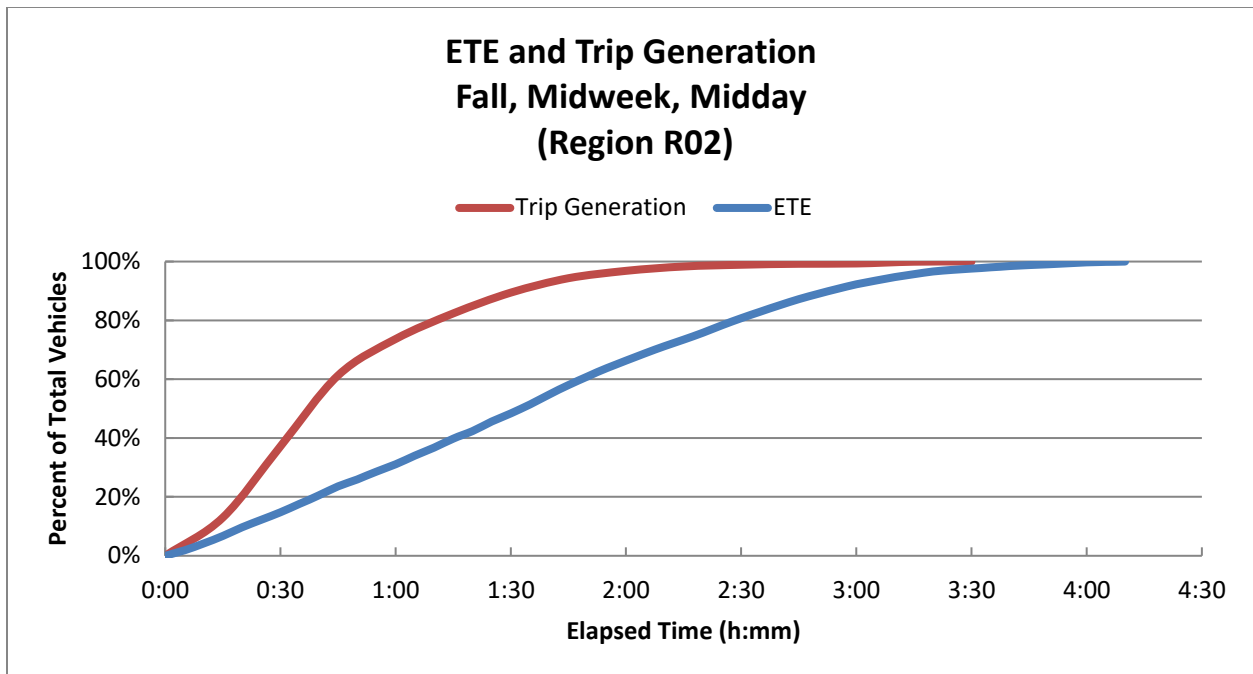


Figure 7-8. Evacuation Time Estimates - Scenario 4 for Region R02

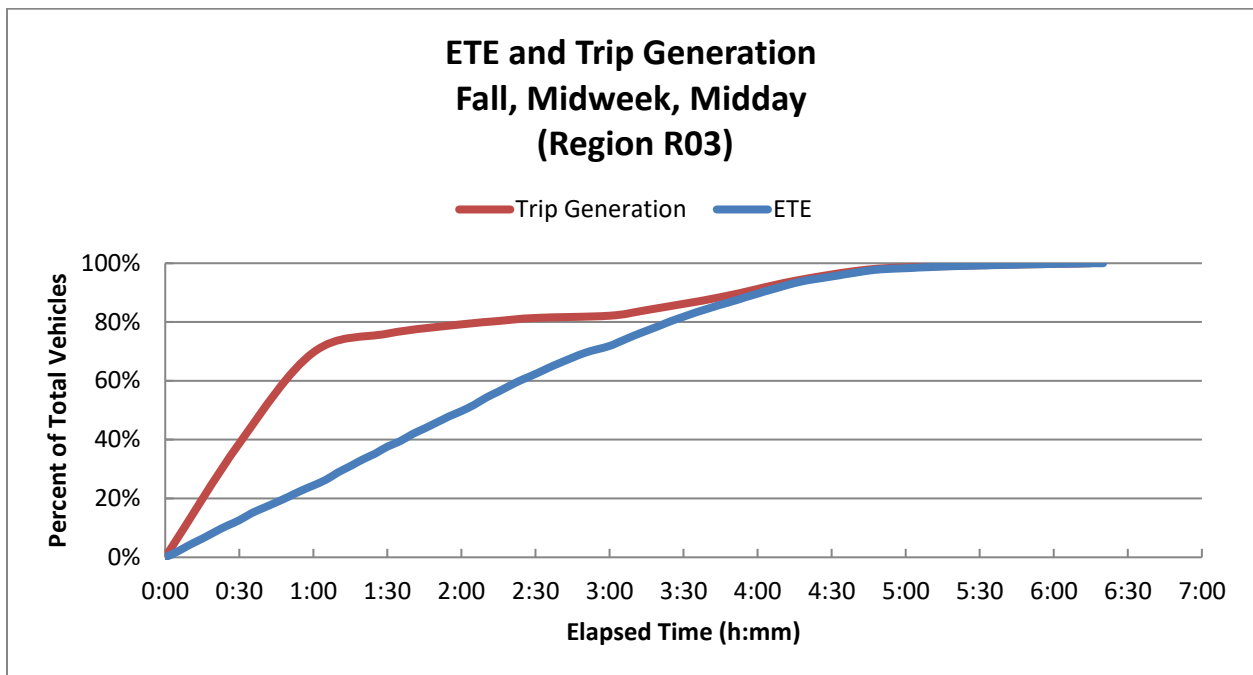


Figure 7-9. Evacuation Time Estimates - Scenario 4 for Region R03

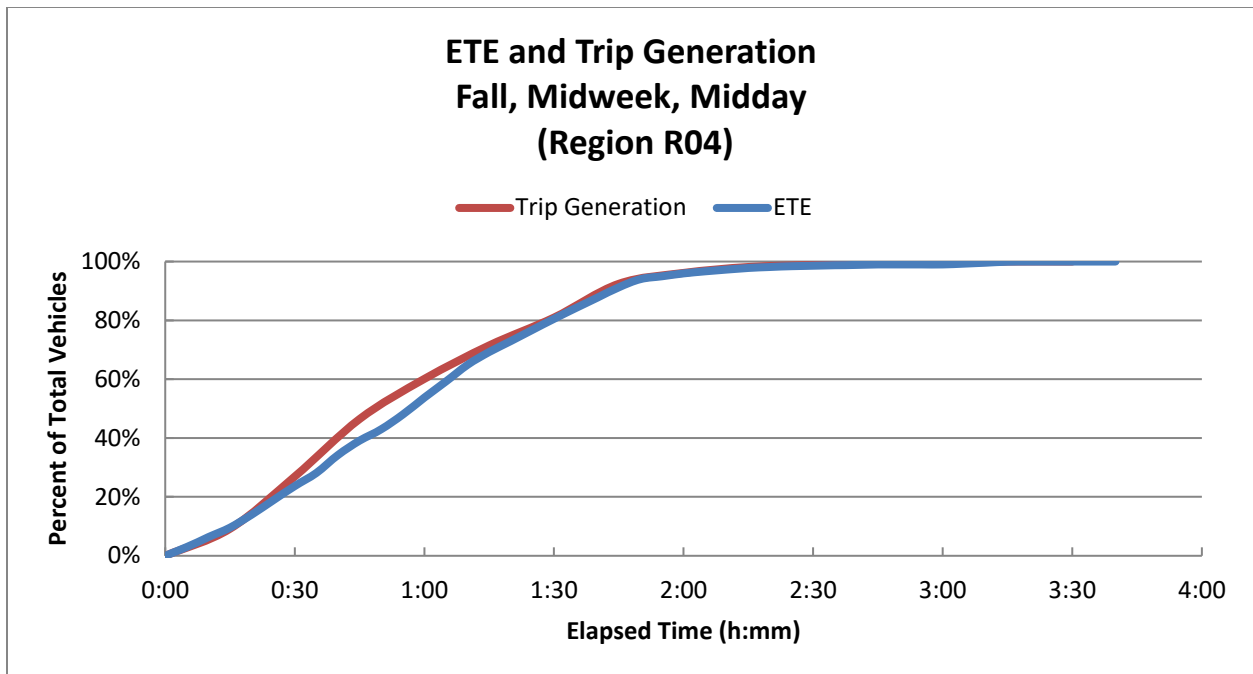


Figure 7-10. Evacuation Time Estimates - Scenario 4 for Region R04

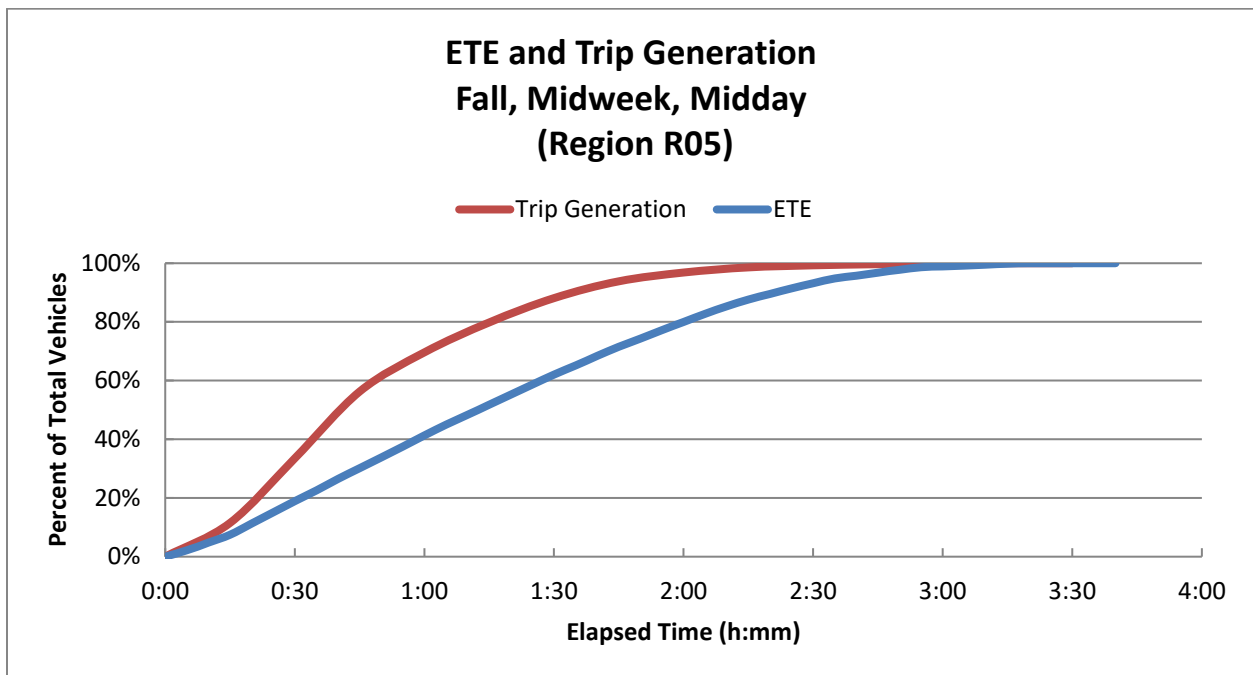


Figure 7-11. Evacuation Time Estimates - Scenario 4 for Region R05

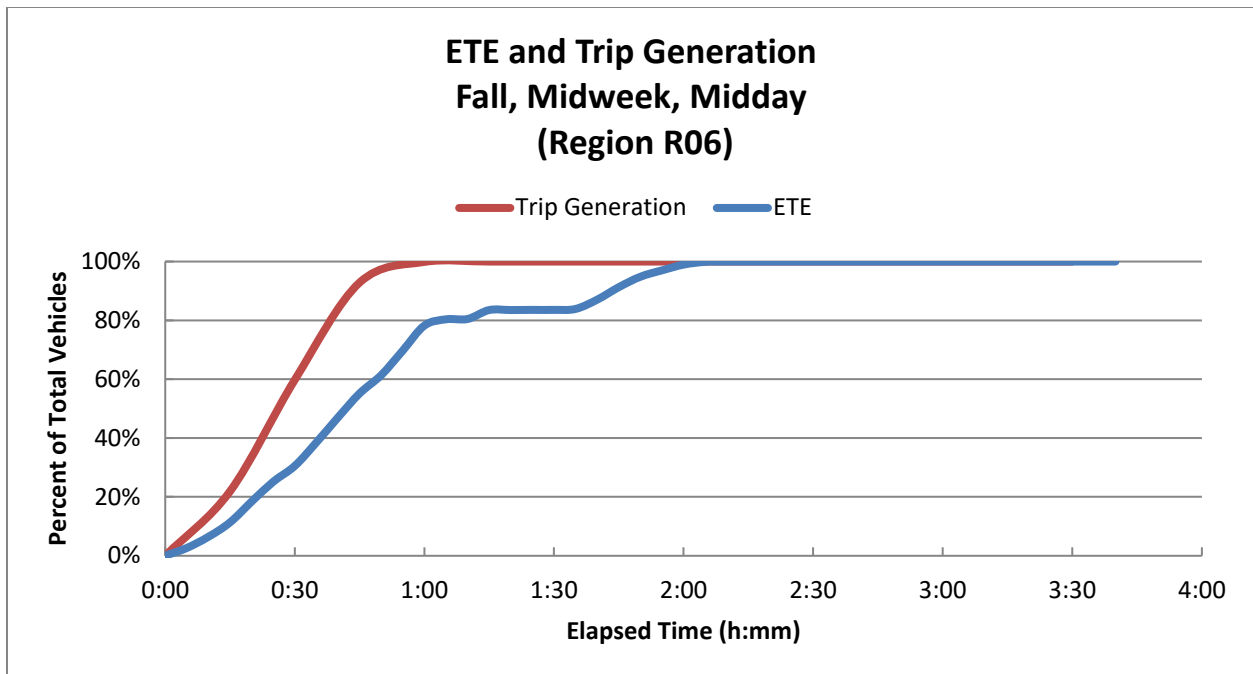


Figure 7-12. Evacuation Time Estimates - Scenario 4 for Region R06

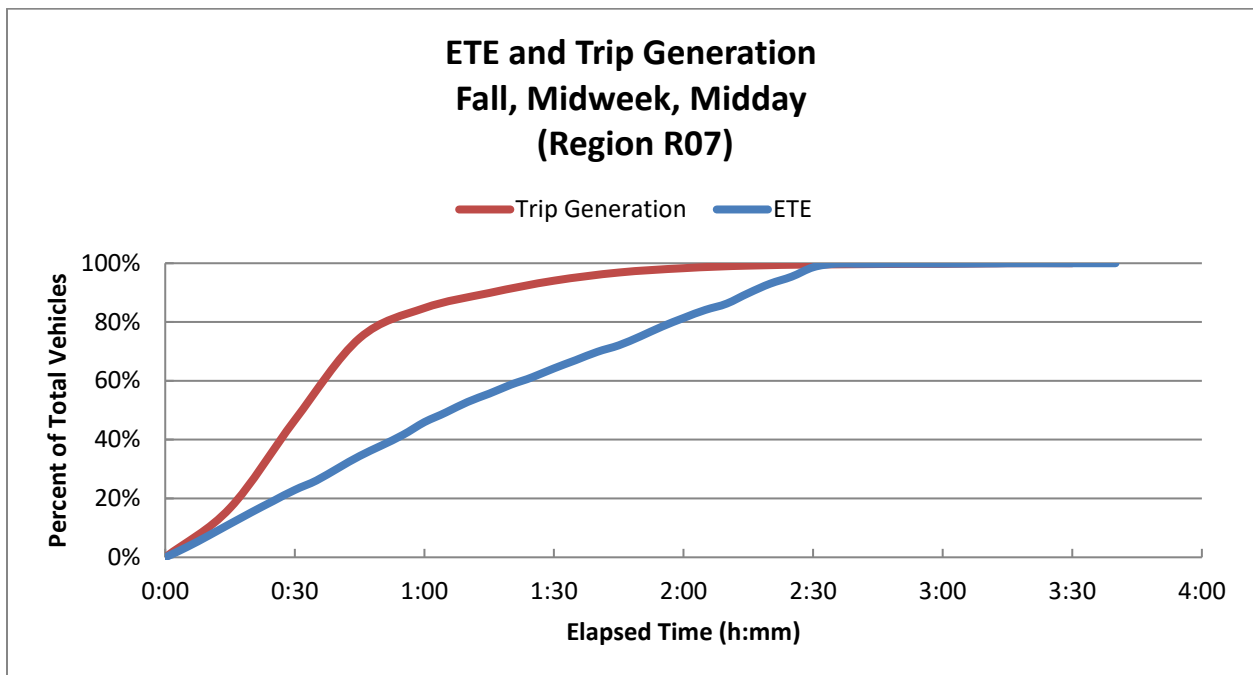


Figure 7-13. Evacuation Time Estimates - Scenario 4 for Region R07

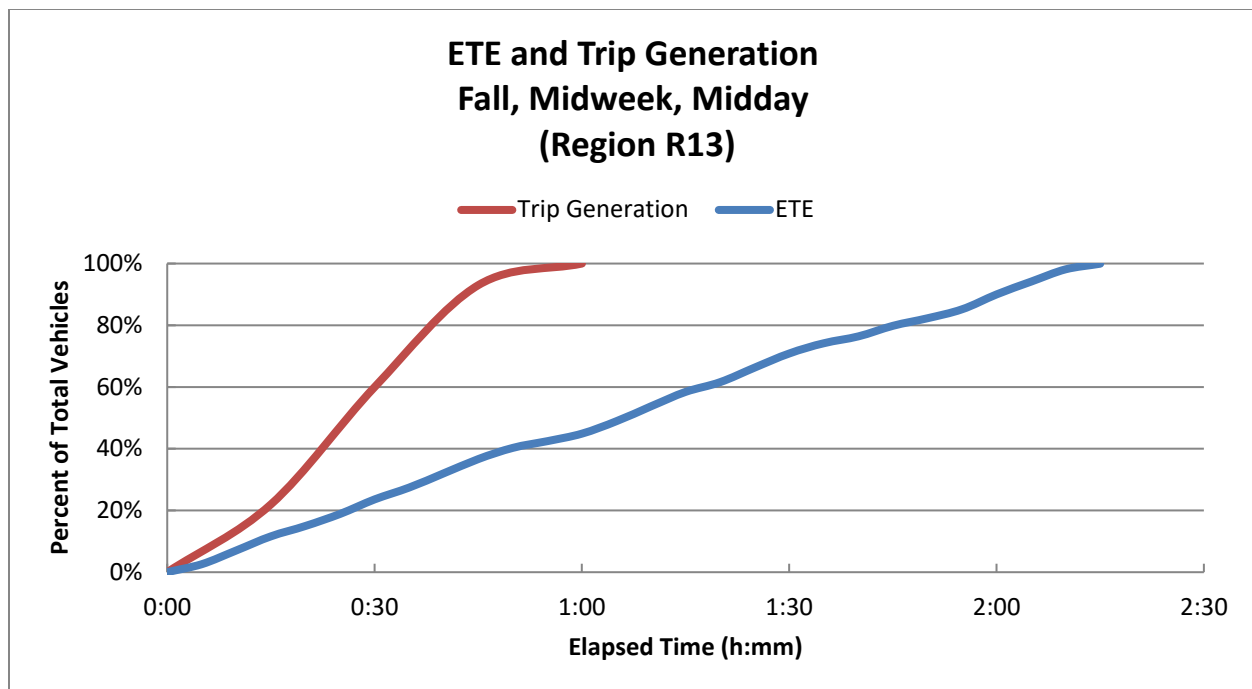


Figure 7-14. Evacuation Time Estimates - Scenario 4 for Region R13

8 TRANSIT-DEPENDENT AND SPECIAL FACILITY EVACUATION ACTIVITIES

This section details the analyses applied and the results obtained in the form of evacuation time estimates for transit vehicles. The demand for transit services reflects the needs of three population groups:

- residents with no vehicles available;
- residents of special facilities (i.e., schools, preschools/day care centers, colleges/universities, and medical facilities); and
- transit-dependent visitors and employees.

These transit vehicles mix with the general evacuation traffic that is comprised mostly of “passenger cars” (pc’s). The presence of each transit vehicle in the evacuating traffic stream is represented within the modeling paradigm as equivalent to two pc’s. This equivalence factor represents the longer size and more sluggish operating characteristics of a transit vehicle, relative to those of a pc.

Transit vehicles must be mobilized in preparation for their respective evacuation missions. Specifically:

- Drivers must be alerted
- They must travel to the depot
- They must be briefed there and assigned to a route or facility.

These activities consume time. In the absence of standards or studies, for the purposes of this analysis, it is assumed that bus mobilization time will average approximately 90 minutes extending from the evacuation order to the time when buses first arrive at schools/preschools/day care centers, colleges/universities, or medical facilities, and 180 minutes for the transit dependent population (see Section 2.4). It is noted that the bus mobilization time can expand or contract based on available resources and the situation regionally (for example, if regional resources are being requested by multiple jurisdictions).

During this mobilization period, other mobilization activities are taking place. One of these is the action taken by parents, neighbors, relatives and friends to pick up children from school prior to the arrival of buses, so that they may join their families. Virtually all studies of evacuations have concluded that this “bonding” process of uniting families is universally prevalent during emergencies and should be anticipated in the planning process. As discussed in Section 2, this study assumes that some children will likely be picked up by parents or guardians prior to an evacuation and that the time to perform this activity is included in the trip generation times discussed in Section 5. This report provides estimates of buses under the assumption 83% of children at schools and preschools/day care centers will be picked up by their parents based on the results of the demographic survey.

The procedure for computing transit dependent ETE is to:

- Estimate demand for transit service
- Estimate time to perform all transit functions
- Estimate route travel times out of the area at risk.

These procedures were done for Citywide Evacuation (Region R01), Fire 1923 (Regions R02 and R03), Panoramic Hill Fire (Region R04), Fire Zone 2 & 3 (Region R05), Tsunami Phase 3 (Region R06), and Tsunami Max Phase (Region R07). A fall midway midweek scenario was selected for this analysis as it represents the highest vehicular demand.

8.1 Analysis of Resource Needs for Each Evacuation Region

Table 8-1 summarizes the number of vehicles needed to evacuate schools, preschools/day care centers, colleges/universities, medical facilities, and the transit-dependent population¹ for different Regions. For an evacuation of the entire City, 10,683 people would utilize rail services, people would rely on 586 buses, 259 wheelchair accessible vehicles and 148 ambulances. For the other regions considered, approximately 40% or less of these resources are needed, the second highest demand being the 1923 Fire region (Region R02) and lowest being Tsunami Phase 3 region (Region R06).

The City can work to quantify likely resource shortfalls associated with the evacuation scenarios in this report through planning partnerships with transit providers serving Berkeley and the region, as well as emergency management and mutual aid partners at the Operational Area (County) and State. Section 8 identifies resource needs for transit-dependent evacuees. Planning partners can clarify regional and State capacity to provide support, as well as time estimates to mobilize those resources in localized and regional disaster scenarios.

8.2 Evacuation Activities for Transit Dependent Population Groups

Figure 8-1 presents the chronology of events relevant to transit operations. The elapsed time for each activity will now be discussed with reference to Figure 8-1.

Activity: Mobilize Drivers (A→B→C)

Mobilization is the elapsed time from the Evacuation Order until the time buses arrive at the facility to be evacuated or first bus stop along a pickup route. It is assumed that for a rapidly escalating emergency with no observable indication before the fact, drivers would likely require 90 minutes to be contacted, to travel to the depot, be briefed, and to travel to the route for the special facilities². It is assumed this process takes 180 minutes for transit dependent individuals,

¹ It was conservatively assumed that all transit dependent residents would utilize buses to evacuate, rather than rapid transit. This assumption provides an upper bound of the number of vehicles that would be needed to evacuate this population. It also provides a more conservative evacuation time estimate for those with and without their own vehicles since it results in more evacuating vehicles on the roadway (rather than utilizing rapid transit vehicles that have their own dedicated railway). It was assumed that visitors who would need transit assistance would be split 50/50 between buses and rail to evacuate. It was assumed that employees who would need transit assistance would be split 58/42 between buses and rail to evacuate, based on results of the demographic survey (see Figure D-8).

² The special facilities considered within the study area are schools, preschools/day care centers, colleges/universities and medical facilities.

including residents, employees, and visitors to utilize public transit buses, see Assumption 4b in Section 2.4.

Activity: Board Passengers (C→D)

A loading time of 15 minutes is assumed for buses servicing schools, preschools/day care centers and colleges/university. Loading times of 1 minute, 5 minutes, and 30 minutes per patient are assumed for ambulatory patients, wheelchair using patients, and bedridden patients, respectively. A loading time of 1 minute per person is used for the general transit dependent population. Concurrent loading on multiple vehicles is assumed.

For multiple stops along a pick-up route (transit-dependent bus routes) estimation of travel time must allow for the delay associated with stopping and starting at each pick-up point. The time, t , required for a bus to decelerate at a rate, “ a ”, expressed in ft/sec/sec, from a speed, “ v ”, expressed in ft/sec, to a stop, is $t = v/a$. Assuming the same acceleration rate and final speed following the stop yields a total time, T , to service boarding passengers:

$$T = t + B + t = B + 2t = B + \frac{2v}{a},$$

Where B = Dwell time to service passengers. The total distance, “ s ” in feet, travelled during the deceleration and acceleration activities is: $s = v^2/a$. If the bus had not stopped to service passengers, but had continued to travel at speed, v , then its travel time over the distance, s , would be: $s/v = v/a$. Then the total delay (i.e. pick-up time, P) to service passengers is:

$$P = T - \frac{v}{a} = B + \frac{v}{a}$$

Assigning reasonable estimates:

- B = 50 seconds: a generous value for a single passenger, carrying personal items, to board per stop
- v = 25 mph = 37 ft/sec
- a = 4 ft/sec/sec, a moderate average rate

Then, $P \approx 1$ minute per stop. Allowing 30 minutes of pick-up time per bus run implies 30 stops per run.

Activity: Travel Time to Safety (D→E)

Mobilizing buses, wheelchair accessible vans and ambulances and loading them with transit dependent individuals take time. Unlike other population groups, transit dependent individuals need to wait for these two events to take place before they can start their evacuation trip. The total time to complete these events is as follows:

- Schools/Preschools/Colleges – 105 minutes (90 minutes to mobilize resources and 15 minutes of loading time)
- Transit-Dependent Population – 210 minutes (180 minutes to mobilize resources and 30 minutes of loading time)
- Medical Facilities:
 - Ambulatory Patients – 120 minutes (90 minutes to mobilize resources and 30

- minutes max loading time per vehicle)
- Wheelchair Bound Patients – 100 minutes (90 minutes to mobilize resources and 10 minutes max loading time per vehicle)
- Bedridden Patients – 150 minutes (90 minutes to mobilize resources and 60 minutes max loading time per vehicle)
- Access and/or Functional Needs Population: The mobilization of buses for Access and/or Functional needs population is the same as transit-dependent population (180 minutes) but the loading time depends on the number of stops the resources need to make which vary for each Region.

As discussed in Section 7.3, the difference between the trip generation and ETE curves provides the average travel time for a specific departure time. Plots of trip generation versus ETE are indicative of the level of traffic congestion during evacuation. The travel time to safety activity can only start after the resources for the transit-dependent individuals leave the facility being evacuated and/or when buses complete all their stops for the transit-dependent population.

The trip generation versus ETE plots in Section 7 can be used to estimate the travel time for each transit dependent population group for specific Regions depending on when the transportation resources are mobilized, and passengers are loaded.

For example: Using Figure 7-8, the evacuation time out of the Fire 1923 region can be computed as the sum of time associated with Activities A→B→C, C→D, and D→E as follows:

- Schools/Preschools/Colleges – $90 + 15 + 80 = 190$ minutes or 3:10 (Here, 80 minutes is the difference of the ETE curve and the trip generation curve at 105 minutes (1:45) into the evacuation. First find 1:45 on the x axis; follow a straight line up to when it hits the red curve; estimate the percentage of evacuating demand [about 94%]; follow a straight line to when the blue curve reaches 94% [3:10]; the travel time is the distance between these two curves = $3:10 - 1:45 = 80$ minutes.)
- Transit-Dependent Population – $180 + 30 + 40 = 250$ minutes or 4:10
- Medical Facilities:
 - Ambulatory Patients – $90 + 30 + 85 = 205$ minutes or 3:25
 - Wheelchair Bound Patients – $90 + 10 + 80 = 180$ minutes or 3:00
 - Bedridden Patients – $90 + 60 + 75 = 225$ minutes or 3:45
- Access and/or Functional Needs:
 - Ambulatory People – $180 + 45 + 25 = 250$ minutes or 4:10
 - Wheelchair Bound People – $180 + 45 + 25 = 250$ minutes or 4:10
 - Bedridden People – $180 + 50 + 20 = 250$ minutes or 4:10

This methodology could be applied to all the facilities and population groups shown in Appendix H for Region R02 for a more *facility-specific* ETE.

It should be noted that ETE for schools can vary slightly depending on the efficiency of parent pick-up procedures and the resulting traffic flow around school zones.

8.3 Public Transit Evacuation

The demand that relies on public transit – both bus service and rail (Bay Area Rapid Transit or Amtrak) should be evaluated against those resources. The scope of this study is limited to vehicular evacuation and does not integrate evacuation time estimates for people evacuating on rapid transit (rail).

Table 8-1. Summary of Transportation Needs

Transportation Resource	Rail	Buses	Wheelchair Accessible Vans	Ambulances
Resources Needed (Citywide - Region R01)				
School and Preschool/Day Care Center Transportation Needs (Table 3-7):	0	112	0	0
College/University Transportation Needs (Table 3-8):	255 (people)	125	0	0
Medical Facility Transportation Needs (Table 3-6):	0	20	111	128
Specialized Transportation Assistance Needs (Section 3.8):	0	0	50	125
Transit-Dependent Transportation Needs (Section 3.7 and Table 3-9):	0	115	0	0
Employee Transportation Needs (Section 3.4 and Table 3-10):	3,799 (people)	88	0	0
Visitor Transportation Needs (Section 3.4 and Table 3-10):	6,629 (people)	111	0	0
TOTAL TRANSPORTATION NEEDS:	10,683 (people)	571	161	253
Resources Needed (1923 Fire Repeat - Region R02 and 1923 Fire Repeat Phased - Region R03)				
School and Preschool/Day Care Center Transportation Needs:	0	19	0	0
College/University Transportation Needs:	255 (people)	118	0	0
Medical Facility Transportation Needs:	0	3	32	27
Specialized Transportation Assistance Needs (Section 3.8):	0	0	16	39
Transit-Dependent Transportation Needs:	0	34	0	0
Employee Transportation Needs:	2,303 (people)	54	0	0
Visitor Transportation Needs:	2,002 (people)	34	0	0
TOTAL TRANSPORTATION NEEDS:	4,560 (people)	262	48	66
Resources Needed (Panoramic Hill Fire - Region R04)				
School and Preschool/Day Care Center Transportation Needs:	0	2	0	0
College/University Transportation Needs:	0	0	0	0
Medical Facility Transportation Needs:	0	3	25	21
Specialized Transportation Assistance Needs (Section 3.8):	0	0	3	6
Transit-Dependent Transportation Needs:	0	5	0	0
Employee Transportation Needs:	0	0	0	0
Visitor Transportation Needs:	163 (people)	3	0	0

Transportation Resource		Rail	Buses	Wheelchair Accessible Vans	Ambulances
TOTAL TRANSPORTATION NEEDS:		163 (people)	13	28	27
Resources Needed (Fire Zones 2 & 3 Combined - Region R05)					
School and Preschool/Day Care Center Transportation Needs:		0	11	0	0
College/University Transportation Needs:		0	0	0	0
Medical Facility Transportation Needs:		0	4	32	27
Specialized Transportation Assistance Needs (Section 3.8):		0	0	20	50
Transit-Dependent Transportation Needs:		0	38	0	0
Employee Transportation Needs:		26 (people)	1	0	0
Visitor Transportation Needs:		1,897 (people)	32	0	0
TOTAL TRANSPORTATION NEEDS:		1,923 (people)	86	52	77
Resources Needed (Tsunami Warning - Phase 3 - Region R06)					
School and Preschool/Day Care Center Transportation Needs:		0	0	0	0
College/University Transportation Needs:		0	0	0	0
Medical Facility Transportation Needs:		0	0	0	0
Specialized Transportation Assistance Needs (Section 3.8):		0	0	1	3
Transit-Dependent Transportation Needs:		0	3	0	0
Employee Transportation Needs:		19 (people)	1	0	0
Visitor Transportation Needs:		417 (people)	7	0	0
TOTAL TRANSPORTATION NEEDS:		436 (people)	11	1	3
Resources Needed (Tsunami Warning - Max Phase - Region R07)					
School and Preschool/Day Care Center Transportation Needs:		0	4	0	0
College/University Transportation Needs:		0	0	0	0
Medical Facility Transportation Needs:		0	0	0	0
Specialized Transportation Assistance Needs (Section 3.8):		0	0	4	8
Transit-Dependent Transportation Needs:		0	8	0	0
Employee Transportation Needs:		532 (people)	13	0	0
Visitor Transportation Needs:		874 (people)	15	0	0

Transportation Resource	Rail	Buses	Wheelchair Accessible Vans	Ambulances
TOTAL TRANSPORTATION NEEDS:	1,406 (people)	40	4	8



Event	
A	Evacuation Order
B	Bus Dispatched from Depot
C	Bus Arrives at Facility/Transit Bus Stop
D	Bus Departs Facility/ Transit Bus Stop
E	Bus Exits Evacuated Area
Activity	
A→B	Driver Mobilization
B→C	Travel to Facility or Transit Bus Stop
C→D	Passengers Board the Bus
D→E	Bus Travels Toward Boundary of the Evacuated Area

Figure 8-1. Chronology of Transit Evacuation Operations

9 HIGHEST CAPACITY ROUTES, EVACUATION SIGNAGE, AND PARKING RESTRICTIONS

This section documents main thoroughfares within the City of Berkeley that can serve the most vehicles in an evacuation. It discusses potential impacts to evacuation times and traffic flow from “red curbing.” It also provides considerations on evacuation signage based on Berkeley’s situation and current traffic engineering standards.

9.1 Highest Capacity Routes

In suburban and rural areas there may be relatively few routes that can lead evacuees out of a hazard area. In these situations, it is critical to designate these roadways as “Evacuation Routes” and to direct the community to those specific routes. Alternatively, in urban environments such as Berkeley, there will generally be multiple roadways that can transport vehicles out of hazard areas to safety.

Even Berkeley’s highest-capacity roadways are not designed to handle a large volume of vehicles associated with a large-scale evacuation alone. It is important that evacuating vehicles are distributed across all available roadways to improve overall evacuation times. When multiple routes are available for evacuation, each with inadequate capacity alone, designating particular roadways as “Evacuation Routes” and directing community members to them will slow down overall evacuation times by not using all available roadway capacity.

As such, this study considers all roadways in Berkeley to potentially serve as evacuation routes, and identifies roadways with the highest capacity based on their characteristics. Emergency management personnel may use information from this analysis to prioritize available traffic management resources during evacuations. City leaders may also consider prioritizing preservation of vehicular capacity on these roadways when analyzing future roadway improvement projects.

Evacuees will select routes within the city in such a way as to minimize their risk exposure. This expectation is met by the DYNEV II model routing traffic away from the location of the wildfire, tsunami, or other hazard to the extent practicable. The DTRAD model¹ satisfies this behavior by routing traffic so as to balance traffic demand relative to the available highway capacity (the number of vehicles that can be processed in a given amount of time) to the extent possible.

¹ <https://kldassociates.com/wp-content/uploads/2024/10/DTRAD-DYNEV.pdf>

9.1.1 Highest Capacity Roadways

Although the city has numerous exit routes, the following roadways possess the greatest capacity for vehicular traffic. Thus, they are likely to carry the greatest number of vehicles in an evacuation:

- Interstate 580 (I-580)
- San Pablo Ave (SR 123)
- Sacramento St
- Martin Luther King Jr Way
- Adeline St/Shattuck Ave
- Telegraph Ave
- College Ave
- Arlington Ave
- Grizzly Peak Blvd
- Ashby Ave

The following roadways do not provide direct exits out of the city, but connect into those that do and are likely to also carry the greatest number of vehicles in an evacuation:

- Solano Ave
- Marin Ave
- Hopkins St
- Durant Ave
- Oxford St
- Spruce Street
- Bancroft Way
- Haste St
- Cedar St
- University Ave
- Dwight Way
- Euclid Ave

These roadways are highlighted in Figure 9-1. While numerous roadways exit the city, these are the roadways that can process the most vehicles. **These routes are not designated “Evacuation Routes” at the exclusion of other roadways. All available roadways should be considered evacuation routes.** These routes, along with others will be used by the general population evacuating in private vehicles. Because of their high capacity, these routes are preferable for use by transit-dependent population evacuating on buses. The general population may evacuate to some alternate destination (e.g., lodging facilities, relative’s home, emergency shelter) outside the city or evacuated area. Transit-dependent evacuees will be routed to safety, outside of the evacuation area.

Figure 9-7 through Figure 9-9 display the public transit routes within the City of Berkeley, which were obtained from the California State Geoportal², which includes routes from all transit operators (including UC Berkeley Bear Transit and Alameda-Contra Costa Transit District, or AC Transit). It is assumed that transit-dependent people will gather at the transit stops along the routes shown to evacuate using a bus. This does not imply that these exact routes would be used in an emergency. It would also be prudent to send buses along routes serving major population centers to pick up transit-dependent individuals who do not live close to existing routes and/or bus stops.

For the purpose of this study, schools, preschools/day care centers, colleges/universities, medical facilities and juvenile homes were routed along the most likely path from the facility being evacuated to the boundary of the evacuation region, which may not have been along a high-capacity route. A single route was used for facilities that would use a similar path for evacuation.

²https://gis.data.ca.gov/datasets/dd7cb74665a14859a59b8c31d3bc5a3e_0/explore?location=37.865645%2C-122.267599%2C14.84

See Section 3.5, Section 3.6, and Section 3.7 for more information on Berkeley's transit dependent population and Section 8 for transit dependent resource needs.

9.2 Evacuation Signage

Evacuation signage can help people quickly and safely find their way to safety in an emergency. In a chaotic situation, evacuation route signage can help people stay calm and focused, and they can prevent people from getting lost or feeling trapped.

However, evacuees can generally head in a generic direction (north toward Albany, south toward Oakland, east toward the hills, west toward the water) to get to safety. For optimal throughput, evacuees should be distributed on all available roadways as equitably as possible. Furthermore, posting signage directing people to Berkeley's highest capacity roadways may actually increase overall evacuation times. There can be issues with evacuation signage, including:

- Evacuation routes and direction of travel change depending on the type of emergency (fire, flood, earthquake, etc.). A sign that's useful for one situation might be useless or even dangerous in another.
- Generic signs lack specificity. These signs often say, "Evacuation Route" and provide a general direction of travel, as shown in Figure 9-10. However, these signs don't tell people *where* to go. In a large-scale emergency, people may need directions to specific reception sites, which in large-scale emergencies may be outside the city limits.
- Generally, cities are full of signs. Adding more signs can create "sign pollution" and make it harder to spot the truly critical directions.
- Most city residents are already familiar with the major roads and thoroughfares. Adding evacuation signs might not provide much new information.
- Moving evacuees onto specific designated roadways does not increase the capacity of those roadways. As Evacuation Cases show (see Section 7), evacuees will experience traffic congestion. Human behavior dictates that drivers will re-route in order to avoid gridlock. This redistribution of traffic to include lower-capacity roadways can ultimately improve both individual and overall evacuation times.

This report does not specify the precise locations for evacuation signage. Chapter 2N of the 2023 MUTCD³ presents guidelines for placing emergency management signs. The installation of evacuation route signage, however, must comply with the guidance provided in the MUTCD.

Whether or not evacuation signage is implemented, it is still crucial to have a comprehensive evacuation plan that includes:

- Emergency alerts to provide real-time instructions and updates.
- Trained personnel to guide people and manage the evacuation.
- Pre-identified priority routes to receive evacuation management resources. Adaptable strategies to respond to the specific needs of different emergencies.

³ Manual on Uniform Traffic Control Devices for Streets and Highways, 2023 Edition, US Department of Transportation, Federal Highway Administration

Ultimately, effective evacuation relies on a multi-faceted approach that considers the strengths and limitations of evacuation signage, even in a well-organized grid system.

9.3 Parking Restrictions

Implementing parking restrictions (red curbing) in the Berkeley hills is unlikely to substantially improve evacuation flow. The principal limitations to vehicle movement are not primarily due to reduced roadway widths caused by parked cars. Instead, bottlenecks occur at intersections, which have a finite capacity to manage the merging of traffic from multiple directions. Widening lanes by prohibiting parking would likely cause vehicles to arrive at these already congested intersections more rapidly, potentially worsening the congestion. Moreover, the inherent geometric characteristics of Berkeley's hillside roadways, including their curvature and steepness, impose natural speed limitations, further reducing the impact of on-street parking on evacuation times. Additionally, during an evacuation, most privately owned vehicles currently parked along roadways will be in active use for egress, thereby diminishing the effect of side street parking on overall evacuation speed in the hills.

It's possible that parking restrictions could improve the ingress of emergency responders both in day-to-day response and during evacuations. The City could consider the strategic implementation of parking restrictions along arterial roadways in the hills, with a focus on those roadways predominantly utilized by emergency response vehicles for ingress during emergency response. This targeted approach would optimize maneuverability and reduce potential impedance for essential services without imposing broad restrictions that are unlikely to significantly improve overall evacuation egress flow.

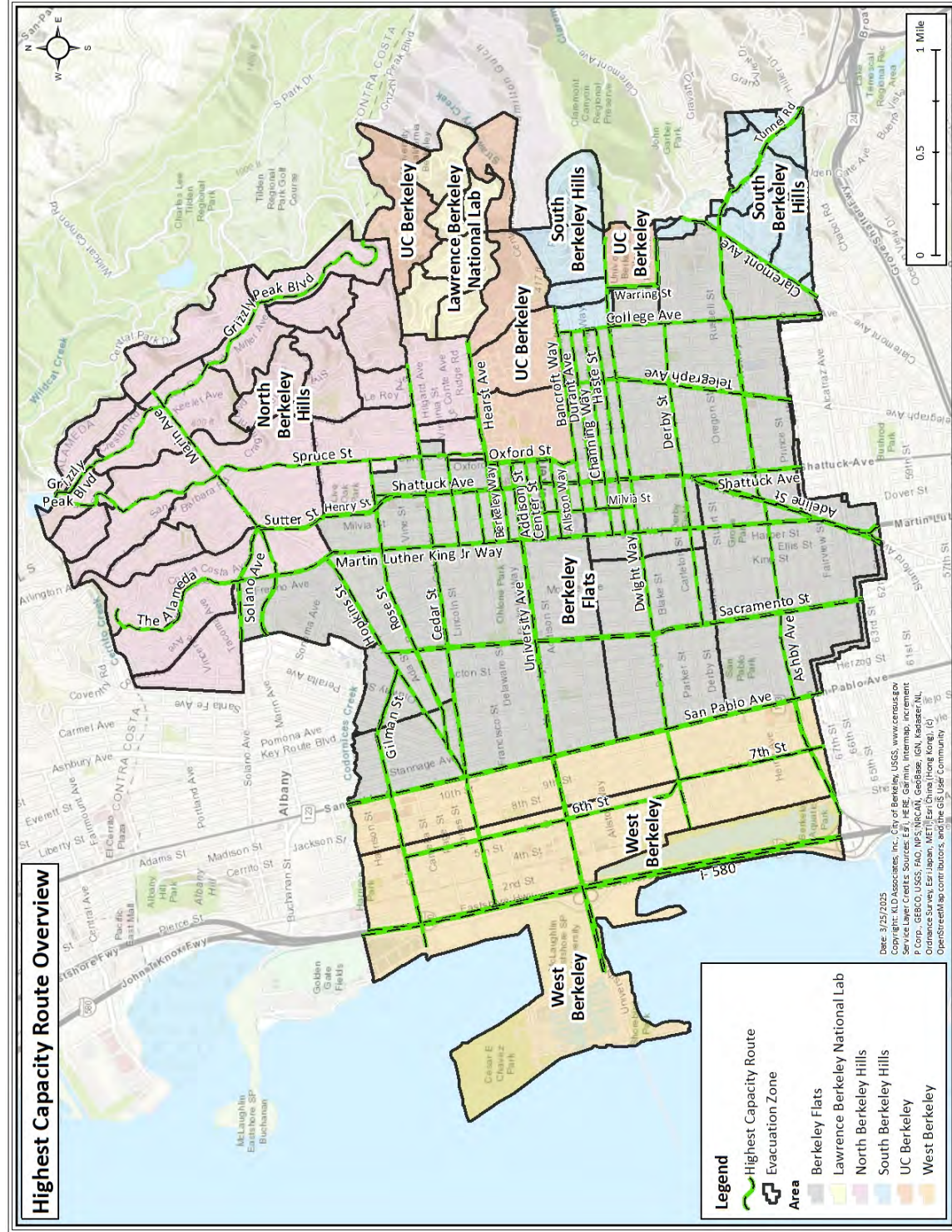
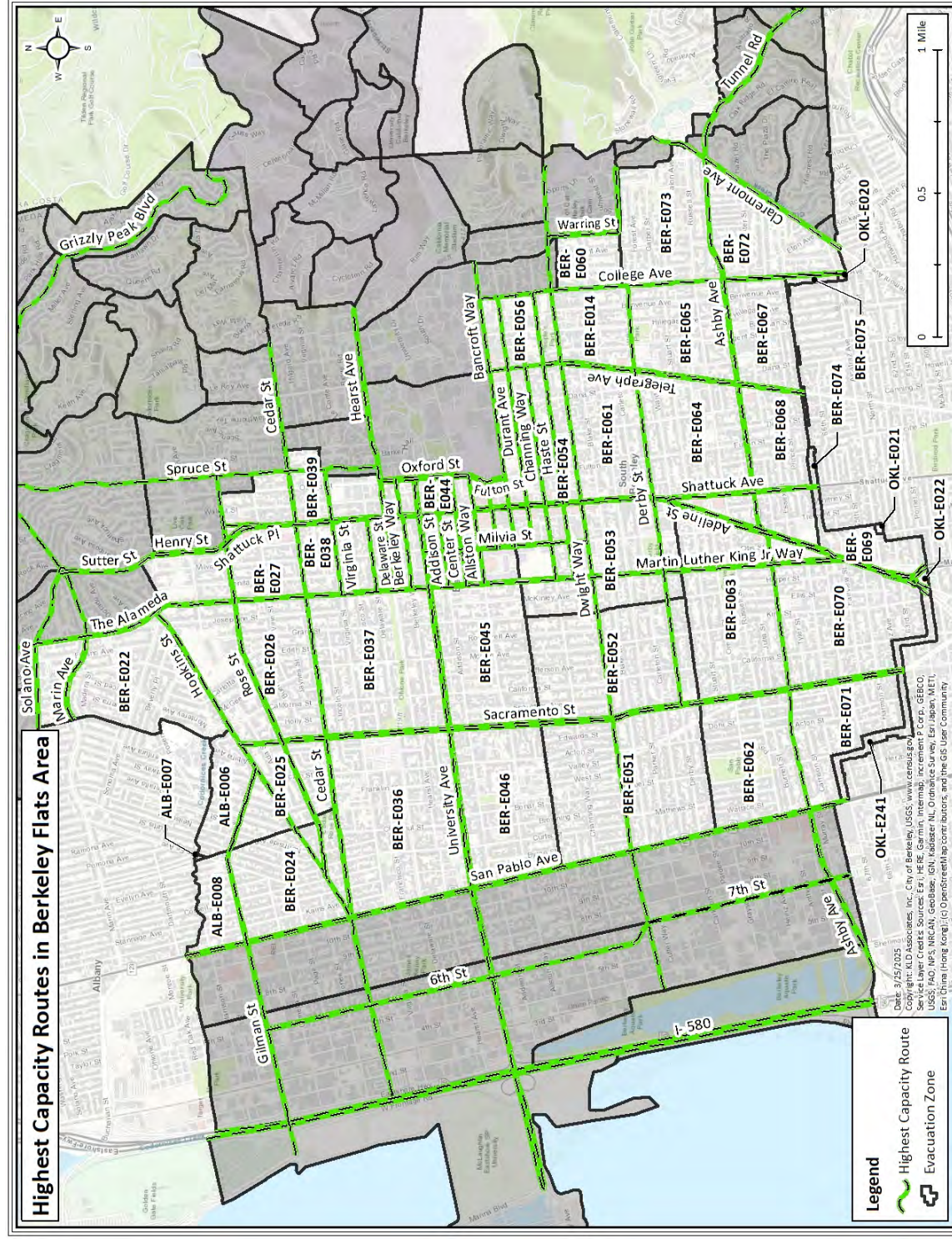


Figure 9-1. Highest Capacity Routes - Overview



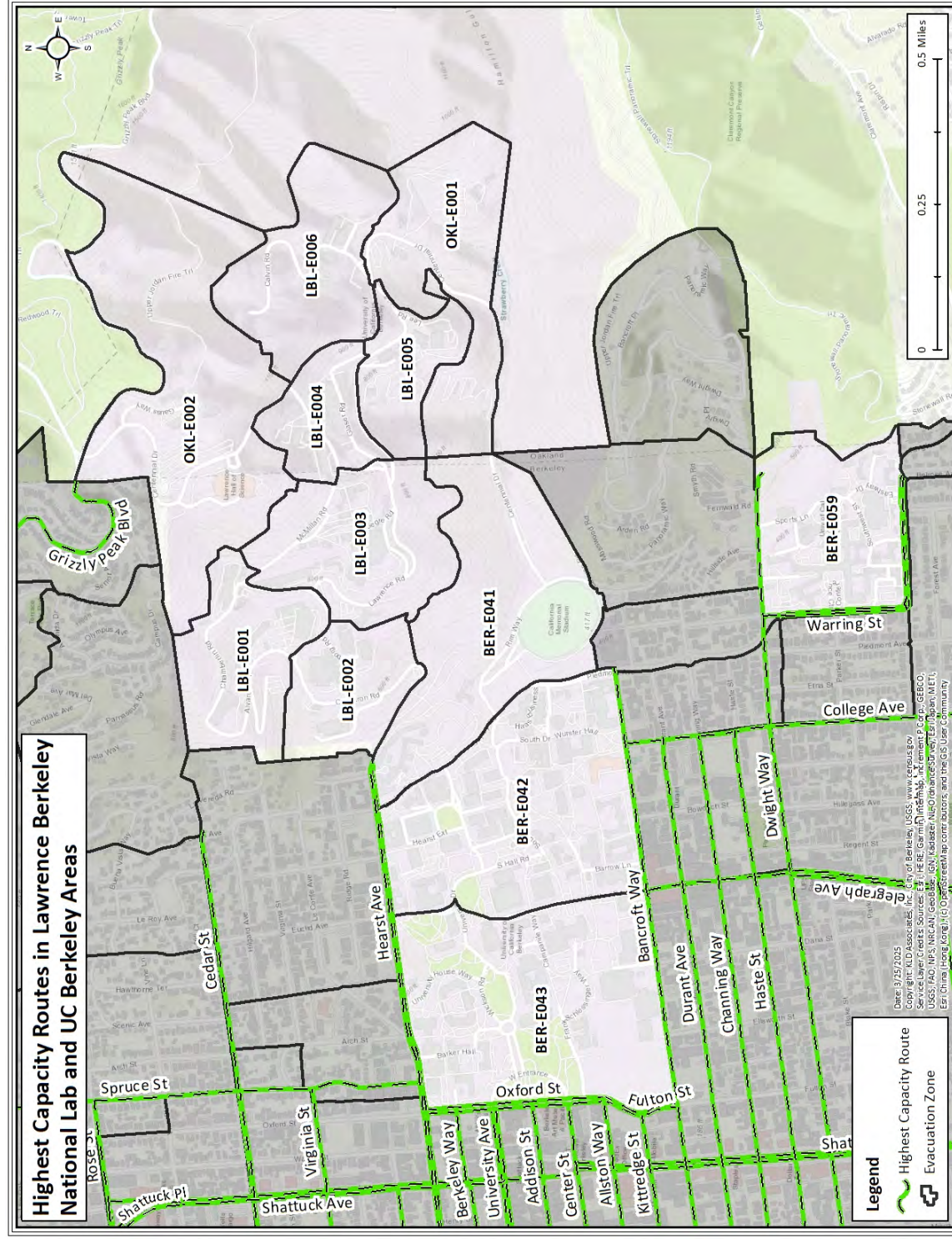
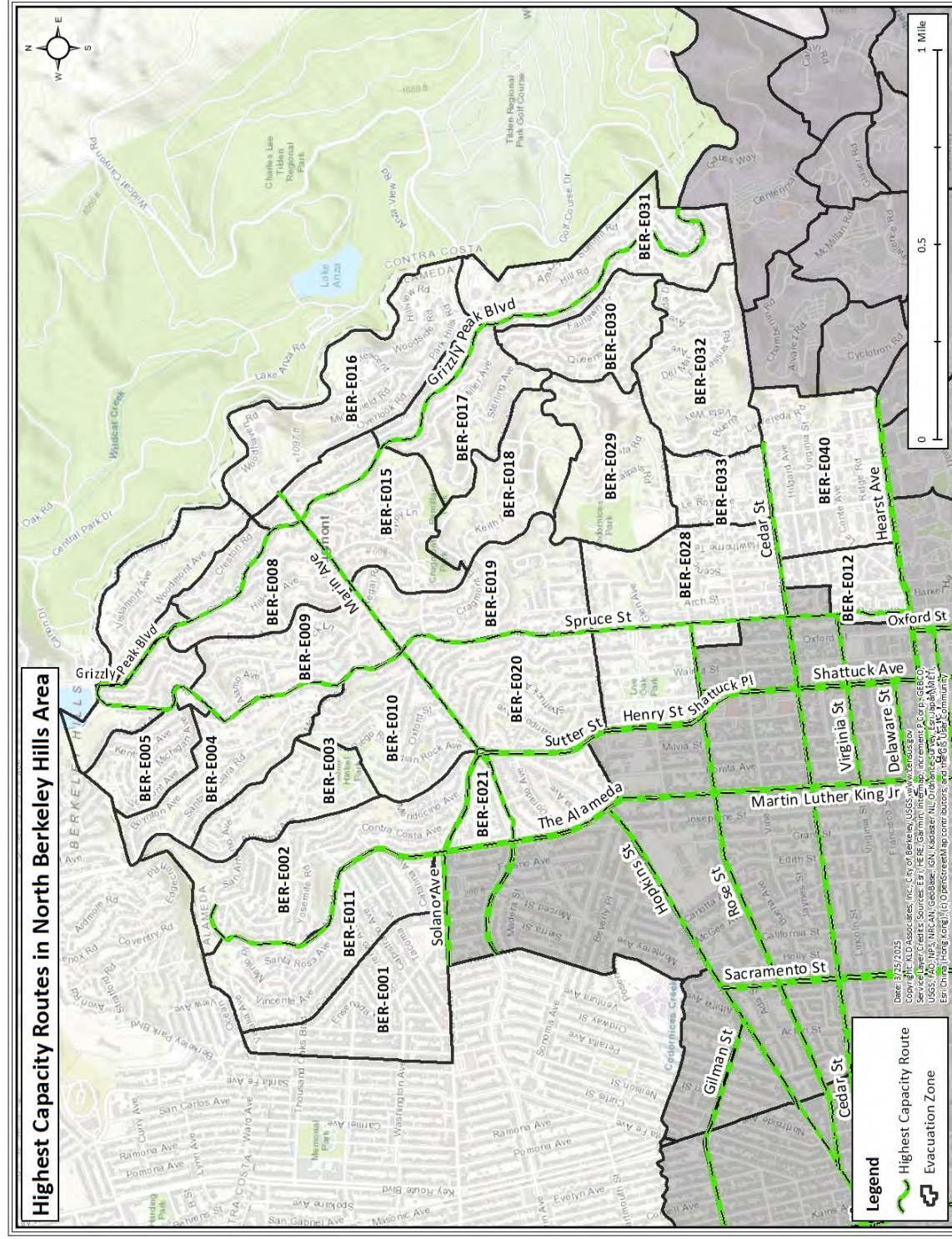


Figure 9-3. Highest Capacity Routes from Lawrence Berkeley National Lab and UC Berkeley



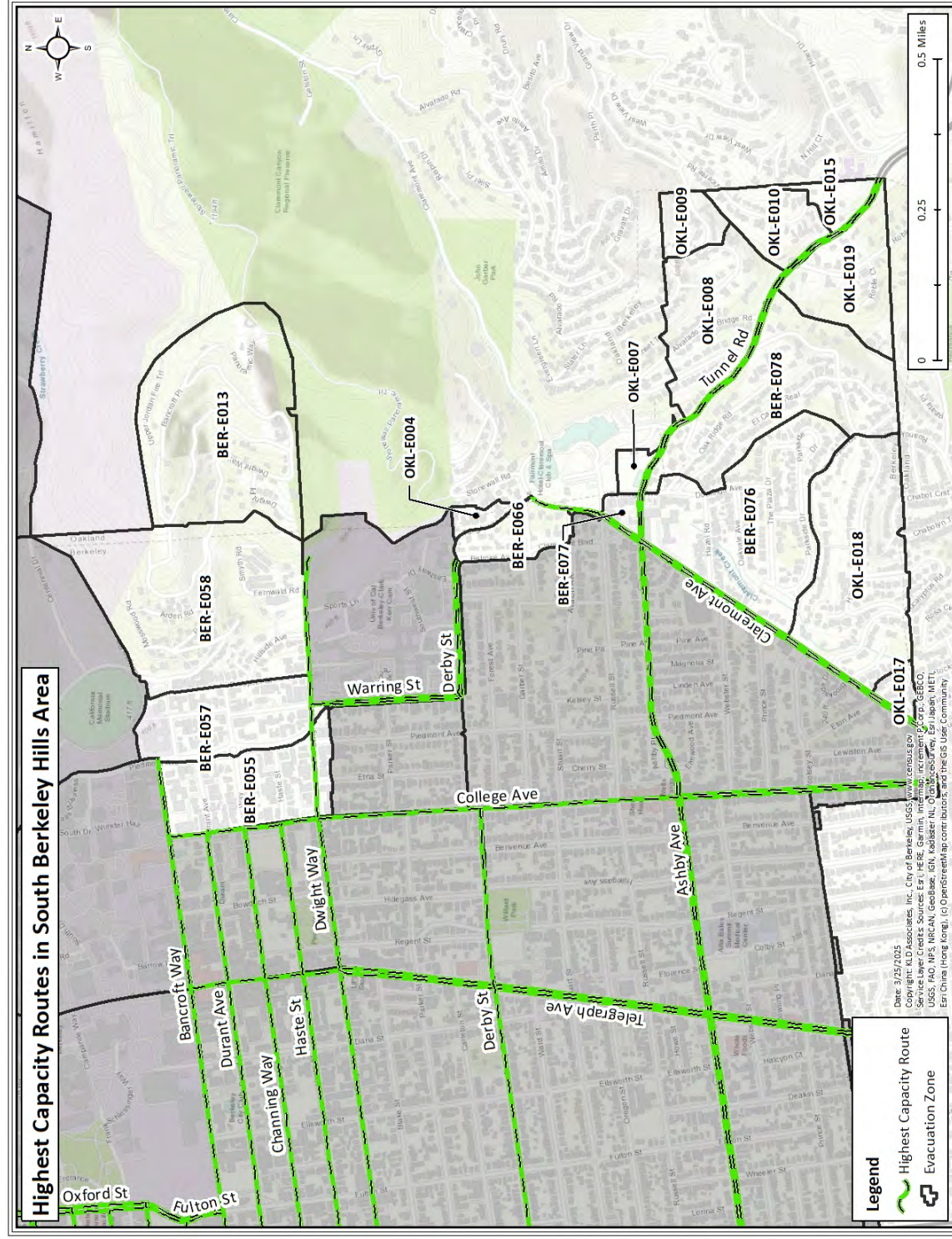




Figure 9-6. Highest Capacity Routes – West Berkeley

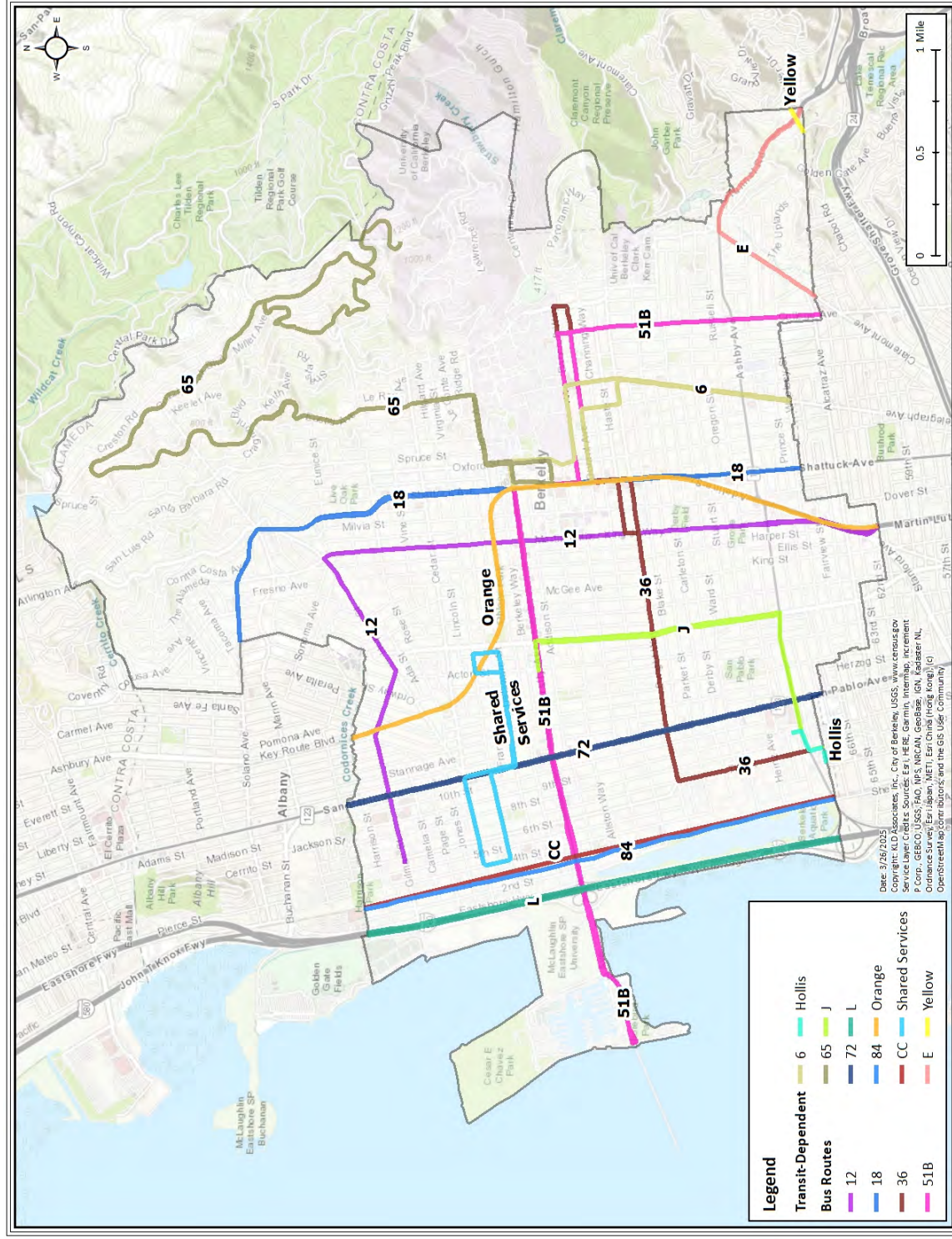


Figure 9-7. Transit-Dependent Bus Routes - 1

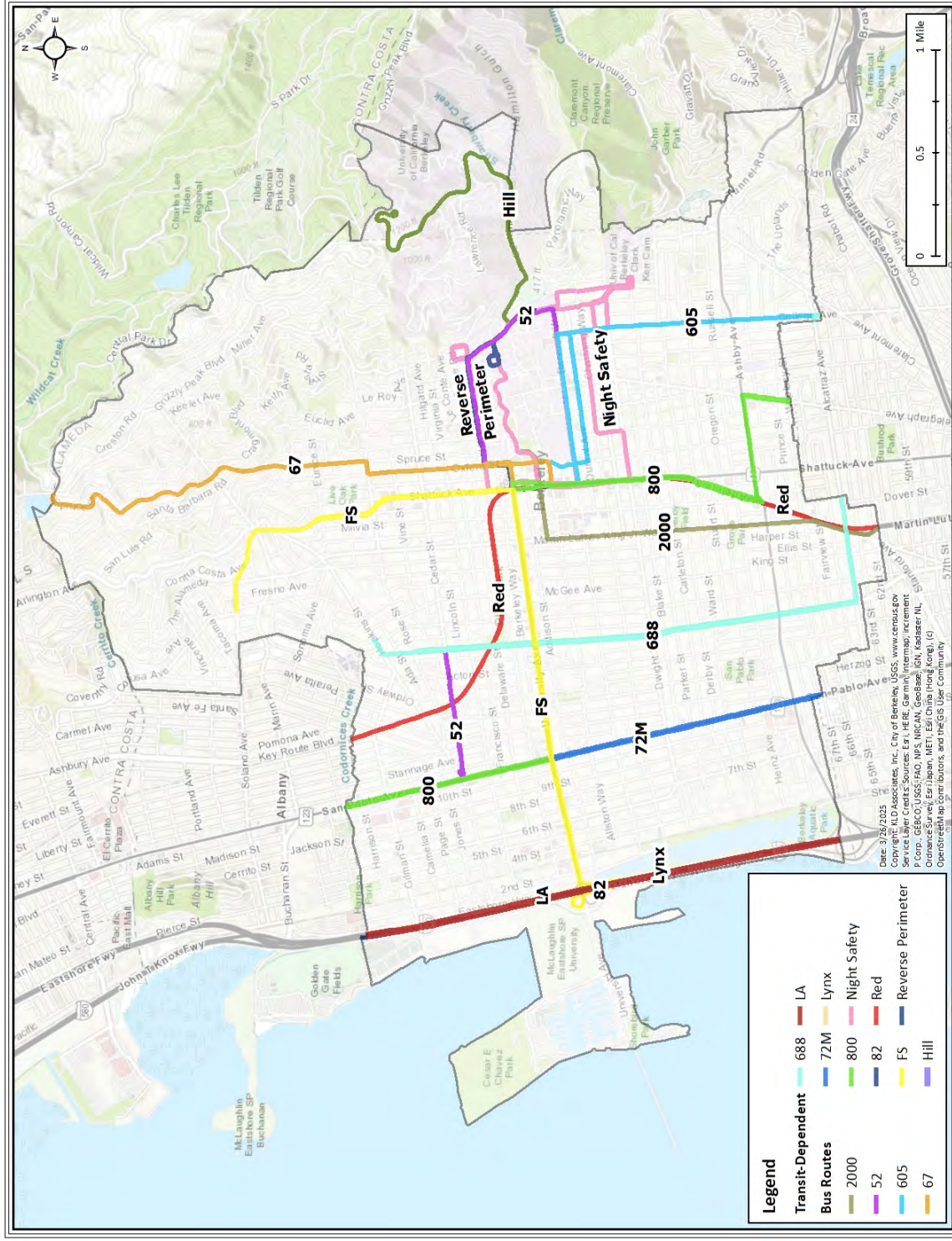


Figure 9-8. Transit-Dependent Bus Routes - 2

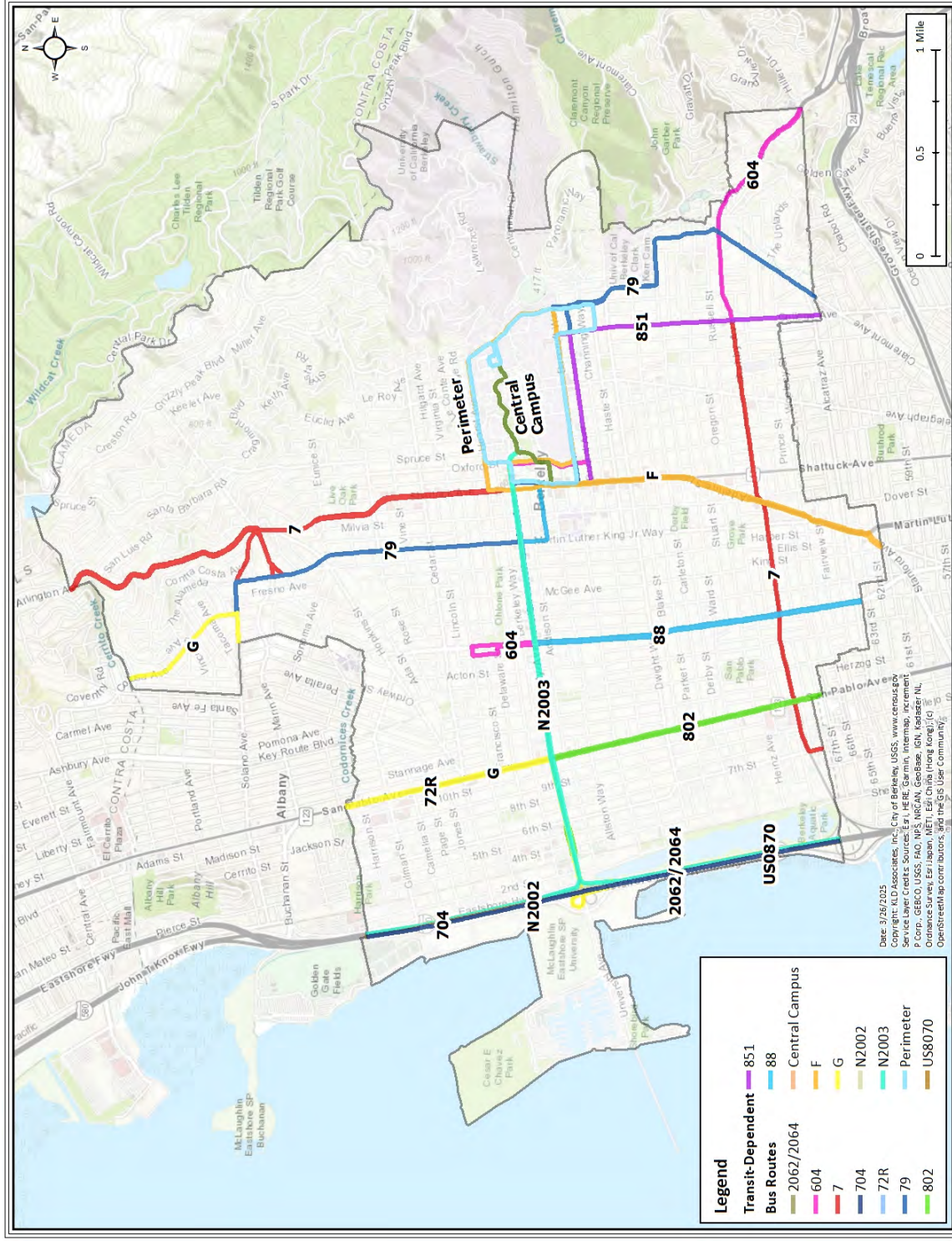


Figure 9-9. Transit-Dependent Bus Routes - 3



Figure 9-10. Evacuation Route Sign Example

10 EVACUATION SENSITIVITY STUDIES

This section presents the results of a series of sensitivity analyses, or “what-if” analyses. These analyses are designed to identify the sensitivity of the ETE to changes in some base evacuation conditions. The cases that were selected are based on special interests from City of Berkeley as well as KLD’s expertise in evacuations.

10.1 Evacuation Readiness

A sensitivity study was performed to determine whether changes in the estimated trip generation (mobilization) time influence the ETE for an evacuation. Specifically, if the tail of the mobilization distribution were truncated (i.e., if those who responded most slowly to the Evacuation Order, could be persuaded to respond much more rapidly) how would the ETE be affected? Optimization of evacuation mobilization may be achieved through pre-emptive readiness protocols, facilitated by public education initiatives promoting 'go-bag' preparedness during periods of elevated wildfire risk. Furthermore, scenarios where urgent mobilization is necessary, and evacuees have little to no time to prepare to evacuate (no-notice evacuations) were also considered. All Scenarios for 1923 Fire (Region R02), 1923 Fire Phased (Region R03) and Panoramic Hill Fire (Region R04) were simulated for this sensitivity study. The results are tabulated in Table 10-1 and Table 10-2.

For the 1923 Fire case, a 1-hour reduction in mobilization time reduces the 90th percentile ETE by approximately 3%, as shown in Table 10-1. The 90th percentile ETE for this case is dictated by traffic congestion and a reduction in the time needed to perform pre-evacuation activities results in minimal change to the ETE. Furthermore, an urgent (30-minute mobilization time) mobilization can actually increase the ETE (specifically for the peak demand case) since the demand is now loaded onto the roadway network in a smaller time period, overwhelming the roadway system, resulting in more congestion and delay and, ultimately, longer ETE.

The 100th percentile ETE for the 1923 Fire case is reduced by approximately 9%¹ at most with a 1-hour reduction in mobilization for the 1923 Fire case, as shown in Table 10-2. When the mobilization time is reduced to 30 minutes, the ETE for the 1923 Fire is dictated by the time for transit vehicles to mobilize. In the base case, 100th percentile ETE for the fall midweek (Scenario 4) scenario increases due to the compression of the mobilization time overwhelming the roadway system.

When the 1923 Fire region is phased, the 90th percentile and 100th percentile ETE are reduced by at most 9% and 29%, respectively, when the mobilization time is reduced by 1-hour. However, when the mobilization time is reduced by 3 hours, there are at most 65% changes in both the 90th and 100th percentile ETE for the 1923 Fire phased region. The ETE decreases by over 4 hours (nighttime scenarios for certain phases).

¹ The mobilization time for transit-dependent population groups remains constant at 180 minutes following an evacuation order. Consequently, for scenarios where the ETE is governed by mobilization time, the 100th percentile ETE is 3 hours and 10 minutes.

For Panoramic Hill (Region R04), the 90th percentile ETE decreases by at most 5% and the 100th percentile ETE is reduced by 14% for all cases when the mobilization time is reduced by 1-hour (dictated by transit dependent mobilization time). However, when the mobilization time is reduced by 3 hours, the 90th percentile ETE is reduced by at most 55% at the 90th percentile ETE. When the mobilization time for Panoramic Hill is 30 minutes, the 90th percentile ETE is dictated by congestion and no longer the mobilization time of evacuees. The 100th percentile ETE becomes dictated by the time needed to mobilize transit vehicles. When buses can be more quickly mobilized to support evacuation of transit-dependent evacuees, the overall ETE can also be reduced.

10.2 Effect of Changes in the Number of People who Voluntarily Relocate

A sensitivity study was conducted to measure the effects on ETE due to changes in the percentage of people who decide to relocate from the Shadow Region (see Figure 7-1) and areas within the city not under Evacuation Order. The movement of people outside of the area being evacuated has the potential to impede vehicles from leaving areas that are ordered to evacuate. Refer to Sections 3.2 and 7.1 for additional information on Shadow and Voluntary Evacuation. A Citywide Evacuation (Region R01), 1923 Fire (Region R02), Panoramic Hill Fire (Region R04), Tsunami Phase 3 (Region R06) and Tsunami Max Phase (Region R07) were considered for this sensitivity study.

Table 10-3 and Table 10-4 present the ETE for the simulated scenarios. The results indicate that reducing the shadow population to 10% yields a 7% reduction on ETE across all regions, with the notable exception of Region R06, Tsunami – Phase 3. A Phase 3 tsunami represents a Warning-level tsunami that requires evacuation of the Berkeley Marina and Waterfront areas up to Interstate 80. In this specific region, a reduction in shadow and voluntary evacuation percentages results in 48% decrease in the 90th percentile ETE. Evacuees from Region R06 rely on Frontage Road and University Avenue as primary egress routes. As a result, this evacuation region is particularly sensitive to shadow and voluntary evacuee traffic that may utilize these roadways, which can impede Tsunami Phase 3 evacuation.

Furthermore, increasing the shadow population (to 60% or 100%, for example) for Region R06 results in 309% increase at the 90th percentile with a 100% shadow population participation.

For other regions, the 90th percentile ETE increases by 21% and 66%, on average, when the shadow percentage is increased to 60% and 100%, respectively. The most noticeable impacts to ETE are on weekdays during the day (Scenarios 1 and 4) as these cases have the highest number of evacuating vehicles.

The 100th percentile ETE exhibits minimal sensitivity to a reduction in shadow population to 10%, primarily due to the ETE being predominantly constrained by mobilization time. Conversely, increasing the shadow population to 60% and 100% results in 100th percentile ETE increases of as much as 17% and 68%, respectively.

The more people that voluntarily evacuate but are not ordered to do so, the less roadway capacity is available for evacuees. As such, specifically for the Berkeley area, voluntary evacuations by those not under evacuation warning or order contribute to traffic congestion, increasing evacuation times

for those who are ordered to evacuate. Public information and public messaging as to who is at risk should be clear before and during an emergency so that community members who are not at risk are less likely to contribute to traffic congestion.

10.3 Leaving Early (Reduction in Evacuation Demand)

The relationship between supply and demand is very important in computing ETE. The evacuation travel supply is the ability of the roadway network to serve the traffic demand (number of evacuating vehicles) during an emergency. In this context, when the demand exceeds the supply (available capacity), congestion occurs, causing delay and prolonging the evacuation. The roadway capacity is often challenging to increase as it is expensive and difficult to widen existing infrastructure or build additional roadways. An effective way of reducing evacuation demand is to have people leave during high-risk fire weather, before a fire starts. To that end, the City of Berkeley recommends that residents of the Berkeley hills (Fire Zones 2 & 3) leave the hills during Extreme Fire Weather.

For the purposes of this sensitivity study, Fire Zones 2 & 3 were considered to be ‘high-risk’ and residents in these areas were assumed to leave early. Thus, the evacuation demand was reduced. To account for those who would leave early, the vehicular demand for Fire Zones 2 & 3 was reduced by 10%, 50% and 75%. Of these people that left early (during Extreme Fire Weather but before a fire ignited and evacuations were ordered), it was assumed that 50% would stay in the Berkeley Flats Area outside of the evacuated region and the remaining 50% would relocate outside of the city limits. As such, these people would, therefore, become part of the shadow and voluntary evacuating population when a fire ignites. All Scenarios for 1923 Fire (Region R02) and Panoramic Hill Fire (Region R04) were considered. Table 10-5 and Table 10-6 summarize the results of this sensitivity study.

There are approximately 27,830 vehicles evacuating from Region R02 (1923 Fire). But a significant portion of Region R02 is not in Fire Zones 2 and 3, so only 10,330 of those vehicles would belong to households subject to Berkeley’s leave early recommendation. Scenarios involving 10%, 50%, and 75% early evacuation result in 1,033, 5,165, and 7,748 vehicles within Region R02, respectively, departing early (leaving 26,797, 22,665, and 20,082 evacuating vehicles, respectively, upon the order to evacuate). As such, the effective demand of the 1923 Fire region (Region R02) decreases by 3.7%, 19%, and 28%, respectively. Furthermore, of the vehicles that departed early, half of them were included within Berkeley Flats and will subsequently participate in voluntary evacuation following the issuance of an Evacuation Order. The other half were assumed to be out of the study area, increasing the voluntary and shadow demand.

All of the evacuated portions of Region R04 are located within Fire Zones 2 and 3. As such, a 10%, 50%, and 75% reduction in high-risk evacuees due to those leaving early reduces the effective demand of the region by 10%, 50%, and 75%, respectively.

As shown in Table 10-5 and Table 10-6, relative to the Base Case, the 90th percentile ETE exhibits a maximum reduction of 3%, 14%, and 14% for the 10%, 50%, and 75% leave early cases, respectively. The 100th percentile ETE demonstrates a maximum reduction of 4%, 10%, and 10% for the 10%, 50%, and 75% leave early cases, respectively.

The reduced demand reduces traffic congestion in the simulated cases. As a result, the 90th percentile ETE becomes dictated by trip generation time, rather than traffic congestion. The ETE only drops as low as the mobilization will allow and, as a result, the reduction in ETE due to the reduction in evacuation demand for those that leave early is limited and incremental.

As discussed in Section 10.1, reducing the mobilization time to 30 minutes can decrease ETE (except for an evacuation of the 1923 Fire region (Region R02) under a Fall, Midweek, Midday Scenario (Scenario 4) where congestion actually worsens and increases ETE). To analyze the impact of people leaving early with compressed mobilization (30-minutes), these cases were simulated and the results are presented in Table 10-7 and Table 10-8.

Comparing values within Table 10-7 and Table 10-8, it can be seen that under urgent mobilization (30 minutes) conditions, the 90th percentile ETE exhibits a maximum reduction of 20%, 23%, and 40% for the 10%, 50%, and 75% leave early cases, respectively. The 100th percentile ETE demonstrates a maximum reduction of 13% and 22% for the 50% and 75% leave early cases, respectively. There is no change at the 10% leave early level.

When comparing the combined leave early and compressed mobilization approaches (shown in Table 10-7 and Table 10-8 to the base cases simulated (first two rows of Table 10-5 and Table 10-6), it can be seen that compressing the mobilization and encouraging residents in Fire Zones 2 and 3 to leave early provides a benefit of up to 68% at the 90th percentile and up to 14% at the 100th percentile. Once again, it should be noted that compressing the mobilization (with a 10% reduction in ETE) still increases congestion and increases ETE for the 1923 Fire case (by up to 25 minutes at the 100% percentile) as discussed in Section 10.1. A reduction in demand of 10% is not enough to outweigh the increase in congestion caused by the compressed mobilization time for the Fall, midweek, midday scenario for the 1923 Fire case (Region R02).

10.4 Second Egress Out from Panoramic Hill

The steep, single-access, and curvilinear road network of Panoramic Hill, coupled with its proximity to the Claremont Canyon Regional Preserve, presents critical logistical constraints for emergency egress. The area's unique topography and natural setting pose substantial evacuation challenges for residents in the event of wildfire. This sensitivity analysis investigates the impact of a secondary egress point, connecting Dwight Way to Dwight Place, on the ETE for Panoramic Hill, which is currently served by a single egress route, Panoramic Way. All Scenarios for the 1923 Fire (Region R02) and Panoramic Hill Fire (Region R04) were considered. Even though Panoramic Hill is included inside both Regions R02 and R04, the ETE presented for this sensitivity study shows when vehicles have evacuated beyond either Panoramic Way or Dwight Way, rather than the final times when the entire evacuating Regions are clear. This focuses the analysis on the specific impact from an additional route out of Panoramic Hill.

As shown in Table 10-9 and Table 10-10, when mobilization times are not altered, the addition of a secondary egress point from Panoramic Hill does not alter the 90th or 100th percentile ETE (compare the “Two Ways out of Panoramic Hill” to “One Way out of Panoramic Hill (Base)”). The ETE in this case is dictated by the 3 hour and 30 minute-maximum mobilization period, rather

than traffic congestion. Consequently, the introduction of a second egress point does not yield a reduction in ETE.

However, a fast-moving wildfire that threatens the Panoramic Hill area may not allow evacuees 3.5 hours to mobilize. To explore the impact of a secondary egress route on a fast-spreading fire, a combination of urgent mobilization was combined with a secondary egress route. When an urgent mobilization is ordered (mobilization time of 30 minutes for population groups with personal vehicles)² and there are two ways out of Panoramic Hill, the 90th percentile ETE reduces by at most 29% for the 1923 Fire and 33% for Panoramic Hill Fire (compared to the urgent mobilization case with one way out).

10.5 Accessory Dwelling Units and Middle Housing Developments

The purpose of this sensitivity study is to provide analysis of any public safety impacts resulting from the maximum potential amount of new residential development of accessory dwelling units (ADUs), junior accessory dwelling units (JADUs), and their associated vehicles in the Hillside Overlay, which encompasses the Very High Fire Hazard Severity Zones (VHFHSZ)³, under the current interpretation of State law per the Department of Housing and Community Development (HCD), as well as a projection of likely development that could result from implementation of the “Middle Housing” zoning changes evaluated in the 2023-2031 Housing Element Update. The Middle Housing zoning changes would amend the Berkeley Municipal Code to allow for multi-unit development on individual parcels that are zoned for lower-density residential development. The zoning districts under consideration in the Hillside Overlay are:

- Single-family Residential (R-1),
- Limited Two-family Residential (R-1A),
- Restricted Two-family Residential (R-2), and
- Restricted Multiple-family Residential (R-2A).

The results of this study will inform the City’s approach to regulating development of ADUs, JADUs, and Middle Housing in the Hillside Overlay, which encompasses the City’s VHFHSZ.

To determine the public safety impact of the projected development resulting from ADUs, JADUs, and Middle Housing, this report considers: Region R01 – Citywide Evacuation, Region R02 – 1923 Fire, Region R04 – Panoramic Hill Fire, and Region R05 – Fire Zones 2 & 3 Combined. All temporal variations (Scenarios) were simulated.

The results for Accessory Dwelling Units and Middle Housing Developments are presented in Table 10-12 through Table 10-15. Table 10-14 and Table 10-15 illustrate the change in ETE between the 'Future Case' scenario and the proposed development cases. These tables utilize a

² It should be noted that these results do not account for transit-dependent populations within Panoramic Hill requiring bus transportation (walking down the hill to an AC Transit – or similar – stop). Despite the potential presence of such individuals, transit dependent bus routes were not modeled within Panoramic Hill as detailed in Section 9. Consequently, the 180-minute mobilization time associated with bus deployment does not influence the calculated ETE for Panoramic Hill.

³ Since this analysis was performed, Fire Hazard Severity Zone boundaries have been updated. The Hillside Overlay encompasses both the old and updated Fire Hazard Severity Zone boundaries.

color gradient, ranging from white (minimal ETE difference) to blue (maximum ETE difference), to facilitate visual interpretation of the results.

10.5.1 Future Case: No Middle Housing or ADU/JADU

The Future Case represents the projected conditions without any Middle Housing or ADU/JADU developments. Based on the population projection assumptions used in the 2023-2031 Housing Element EIR, by 2031, the City of Berkeley is projected to have 18,205 additional units excluding any increases resulting from ADUs, JADUs, or Middle Housing. Based on the average household size and vehicle evacuation rates established in the base ETE study (Section 3) from the results of the demographic survey, these number of units equate to 43,146 additional people and 20,754 additional evacuating vehicles (Table 10-11) for the Future Case.

As shown in Table 10-14 and Table 10-15, analysis of the Future Case indicates that this increased vehicle volume results in a maximum increase in ETE of 40% at the 90th percentile (Region R01, Scenario 3) and 39% at the 100th percentile (Region R01, Scenario 3). Given the absence of planned roadway infrastructure improvements (e.g. increasing capacity by converting a stop-controlled intersection to a signalized intersection to help facilitate or improve traffic flow) to accommodate an increase in projected demand, the additional vehicle volume contributes to increased congestion and a corresponding rise in ETE for most cases, specifically at the 90th percentile.

10.5.2 Future Build Case - Accessory Dwelling Units and Junior Accessory Dwelling Units Only

This case considers the 2031 population increase plus the maximum theoretical development of new ADUs and JADUs only (no Middle Housing considered). According to the data provided, there are approximately 9,020 parcels located in the Hillside Overlay that are eligible for ADUs and JADUs. The Hillside Overlay is located within North and South Berkeley Hills. Each parcel can accommodate at maximum 2 ADUs and 1 JADU, consistent with the current interpretation of State law per HCD. Taking into account existing ADUs and JADUs based on permit data, this totals 27,060 total units (Table 10-11). Using the average household size and vehicle evacuation rates established as part of this study, this case considers an additional 107,278 people (64,132 people from ADU/JADU and 43,146⁴ people from future population growth) and 51,602 evacuating vehicles (30,848 vehicles from ADU/JADU and 20,754 from future growth) in the Hillside Overlay when compared to the base cases considered.

Compared to the Future Case, development of the maximum possible number of ADUs & JADUs in the Hillside Overlay results in 25% or more increases in ETE, as detailed in Table 10-15 and Table 10-14. Specifically, the 90th percentile ETE for a citywide evacuation (Region R01) increases by approximately 54% on average, for the 1923 Fire (Region R02) by 102% on average, for Panoramic Hill Fire (Region R04) by 52% on average, and for Fire Zones 2 & 3 Combined (Region

⁴ It is important to note that the 2031 future growth data encompass the entire city, whereas the analysis of new ADU, JADU, Middle Housing developments is specifically focused on the Hillside Overlay. Consequently, the 18,205 new units projected for 2031 represent the city as a whole, and only a subset of these units will be located within the Hillside Overlay. Of these 18,205 new units, it is estimated that 4,238 of them would be within the Hillside Overlay.

R05) by about 154% on average. Similarly, at the 100th percentile, ETE increases by approximately 114% on average for Region R01 and Region R05 and 121% for Region R02. Region R04 experiences minimal impact at the 100th percentile, as its 100th percentile ETE remains primarily determined by trip mobilization time rather than congestion. Improvements to roadway capacity would need to be made in order to offset these increases. To mitigate these projected increases, significant roadway network modifications and/or changes in the vicinity of these ADU/JADU developments would be necessary, as the current infrastructure capacity is insufficient to accommodate the anticipated additional demand.

10.5.3 Future Build Case - Middle Housing Developments Only

This case considers the 2031 population increase plus the projected likely development under the proposed Middle Housing zoning changes only (no ADUs or JADUs considered). There are approximately 6,440 parcels within the Hillside Overlay (generally the North and South Berkeley Hills) and of those parcels, only 4.5% of them are likely to develop by 2031, resulting in 290 ($6,440 \times 0.045 = 289.8$) available parcels that are eligible for Middle Housing developments. Each hillside parcel can accommodate a maximum of 3 units, totaling 870 potential new Middle Housing units within the Hillside Overlay, for a total of 19,075⁴ units citywide, 45,208 people (2,062 people from Middle Housing and 43,146 people from future population growth), and 21,746 evacuating vehicles (992 vehicles from Middle Housing and 20,754 from future growth) more than the amount considered under the base cases (Table 10-11).

As shown in Table 10-14 and Table 10-15, implementation of new housing under the Middle Housing zoning changes results in increases of up to 8% at the 90th [Region R05, Scenario 3] and 100th percentile [Region R01, Scenario 5] to the ETE compared to the Future Case. Specifically, the additional 992 vehicles associated with Middle Housing could add between 5 and 10 minutes overall to ETEs for a repeat of the 1923 Fire (R02). This suggests that the Middle Housing developments should be further assessed in the context of fire spread scenarios. By overlaying fire spread data with evacuation time estimates, the City can better understand potential impacts to public health and safety from Middle Housing zoning changes.

10.5.4 Future Build Case - Accessory Dwelling Units, Junior Accessory Dwelling Units, & Middle Housing Developments

The combined implementation of development with the maximum possible amount of ADU/JADU units and likely Middle Housing units projects a total of 27,930 new housing units in the Hillside Overlay. This results in an additional 46,135 units⁴, 109,340 residents and 52,594 evacuating vehicles by 2031 citywide. Increases in ETE are observed at both the 90th and 100th percentiles. Specifically, the 90th percentile ETE increases by about 61% on average for a Citywide Evacuation (Region R01), 105% on average for a 1923 Fire (Region R02), 166% on average for Fire Zones 2 & 3 Combined (Region R05), and about 54% on average for Panoramic Hill Fire (Region R04), as shown in Table 10-14 and Table 10-15. At the 100th percentile, ETE increases by 102% for Region R01, 126% for Region R02 and 147% for Region R05. Region R04 shows at most 2% increase at the 100th percentile, with its 100th percentile ETE remaining primarily influenced by

trip mobilization time. To address these substantial increases, comprehensive roadway network improvements in the vicinity of these developments are essential, as the current infrastructure is inadequate to handle the projected demand.

10.5.5 Future Build Case - Accessory Dwelling Units and Junior Accessory Dwelling Units Only including Public Transit Parking Standard Exemption

In accordance with State law, JADUs are not required to provide off-street parking spaces, and ADUs are only required to provide off-street parking spaces if the parcel is located more than 1/2 mile walking distance of public transit, which is defined as “a location, including, but not limited to, a bus stop or train station, where the public may access buses, trains, subways, and other forms of transportation that charge set fares, run on fixed routes, and are available to the public.” This case assumes that any ADU or JADU resident living on a parcel that is not required to have off-street parking would not have a personal vehicle and would instead rely on public transit to evacuate. Of the total 9,020 ADU/JADU parcels, 4,434 of them fall within the transit exemption zone. It was conservatively assumed that people living on these 4,434 parcels would utilize a public transit bus to leave the area during an emergency. Using the standard assumptions of household size and vehicle occupancies in this study, a total of 13,302 units ($4,434 \times 3 = 13,302$), which would house 31,526 people, would require buses to evacuate. Using an assumption of 30 people per bus, an additional 1,051 buses are estimated to be needed to evacuate the new ADU/JADU residents that do not have a personal vehicle above the base cases. The remaining 4,586 parcels would evacuate in personal vehicles. In total for this case, there are an additional 15,681 personal vehicles and 1,051 buses when compared to the Future Case.

Even with the estimation that approximately half of the eligible parcels will utilize public transportation for evacuation instead of a personal vehicle, the 90th and 100th percentile ETE exhibit increases compared to the Future Case, as shown in Table 10-14 and Table 10-15. Specifically, the 90th percentile ETE increases by about 28% on average for Citywide Evacuation (Region R01), 65% on average for the 1923 Fire (Region R02), 70% on average for Panoramic Hill Fire (Region R04) and 129% on average for Fire Zones 2 & 3 Combined (Region R05). Compared to the 'Future Build - ADU/JADU Only' case without the parking exemption, the 100th percentile ETE demonstrates a decrease of approximately 9% on average for Regions R01, R02 and R05. This reduction is attributed to the presence of 1,051 buses (2,102 personal car equivalents) and a decrease of 15,167 vehicles on the road.

10.5.6 Future Build Case - Accessory Dwelling Units, Junior Accessory Dwelling Units, & Middle Housing including Public Exemption

This case represents a similar scenario discussed in Section 10.5.5 with the Middle Housing units. Unlike State law governing the development of ADUs and JADUs, development under the proposed Middle Housing zoning changes does not include a parking exemption within transit-rich areas. For this reason, it is assumed that all Middle Housing developments are evacuated in personal vehicles. As shown in Table 10-11, there are approximately 16,673 additional evacuating vehicles and 1,051 buses for this case compared to the Future Case.

When compared to the Future Case, the 90th percentile ETE increases by 29% on average for Citywide Evacuation (Region R01), 68% on average for the 1923 Fire (Region R02), 69% on average for Panoramic Hill Fire (Region R04) and 135% on average for Fire Zones 2 & 3 Combined (Region R05). Compared to the 'Future Build - ADU/JADU and Middle Housing' case without the parking exemption, the 100th percentile ETE demonstrates a decrease of approximately 11% on average for Regions R01, R02 and R05. This reduction is attributed to the presence of 1,051 buses and a decrease of 16,673 vehicles on the road.

10.6 Optimized Signals

As discussed in Section 7 and Appendix F, there are some pre-timed signals within the city. Pre-timed signals utilize a fixed timing plan, rather than allowing the signal to optimize the splits between directions based on the demand at each approach. Actuated signals allow the signal to choose the appropriate timing plan based on the demand on each approach, with some limits to minimum and maximum green time. A sensitivity study was conducted to determine the impact to ETE if the pre-timed signals in the city were changed to actuated signals. The two fire cases (Fire 1923 non-phased [R02] and Panoramic Hill [R04]) were simulated for urgent mobilization (since many cases are dictated by trip generation time and the results of this sensitivity analysis would likely show no impact on the regular mobilization cases). All scenarios were considered. The results are presented in Table 10-16 and Table 10-17 at the 90th and 100th percentile, respectively.

When compared to Table 10-1 and Table 10-2, respectively, it can be seen that converting the pre-timed signals to actuated signals can improve evacuation times by up to 13% at the 90th percentile and up to 4% at the 100th percentile. In most cases, the 100th percentile ETE remains dictated by the time needed to mobilize transit vehicles. When buses can be more quickly mobilized to support evacuation of transit-dependent evacuees, the 100th percentile ETE can also be reduced.

Table 10-1. 90th Percentile Evacuation Time Estimates for Evacuation Readiness Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
30 Minute Mobilization Time						
R02	2:25	1:50	1:35	3:20	1:45	1:35
R03 Phase a	2:05	1:40	1:25	2:45	1:25	1:35
R03 Phase b	2:10	1:50	1:40	2:40	1:30	1:40
R03 Phase c	3:35	3:45	1:40	3:50	1:30	1:40
R04	1:05	0:50	0:45	1:45	0:50	0:50
2 Hour and 30 Minute Mobilization Time						
R02	2:20	1:50	1:45	2:55	1:50	1:45
R03 Phase a	2:05	1:40	1:40	2:30	1:35	2:10
R03 Phase b	2:10	2:00	2:15	2:45	2:10	2:25
R03 Phase c	4:05	4:15	4:25	4:00	4:20	4:30
R04	1:35	1:30	1:35	1:40	1:35	1:35
3 Hour and 30 Minute Mobilization Time (Base)						
R02	2:25	1:50	1:45	2:55	1:50	1:45
R03 Phase a	2:05	1:40	1:40	2:45	1:35	2:10
R03 Phase b	2:15	2:00	2:15	2:45	2:10	2:30
R03 Phase c	4:10	4:20	4:30	4:00	4:25	4:35
R04	1:40	1:35	1:40	1:45	1:35	1:40

Table 10-2. 100th Percentile Evacuation Time Estimates for Evacuation Readiness Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
30 Minute Mobilization Time						
R02	3:25	3:10	3:10	4:35	3:10	3:10
R03 Phase a	2:30	2:10	2:05	3:30	2:10	2:10
R03 Phase b	4:00	4:00	2:05	4:00	2:10	2:10
R03 Phase c	4:30	4:25	2:15	4:45	2:10	2:10
R04	3:10	3:10	3:10	3:10	3:10	3:10
2 Hour and 30 Minute Mobilization Time						
R02	3:20	3:10	3:10	4:10	3:10	3:10
R03 Phase a	3:20	3:20	3:20	3:20	3:20	3:20
R03 Phase b	5:15	5:15	5:20	5:20	5:15	5:10
R03 Phase c	5:20	5:20	5:20	5:20	5:20	5:20
R04	3:10	3:10	3:10	3:10	3:10	3:10
3 Hour and 30 Minute Mobilization Time (Base)						
R02	3:40	3:25	3:25	4:10	3:25	3:25
R03 Phase a	4:25	4:30	4:40	4:30	4:15	4:35
R03 Phase b	6:10	5:55	6:00	6:15	6:00	6:10
R03 Phase c	6:20	6:20	6:20	6:20	6:20	6:20
R04	3:40	3:25	3:25	3:40	3:25	3:25

Table 10-3. 90th Evacuation Time Estimates for Voluntary Evacuation Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Evening	Midday	Midday	Evening
10 Percent Shadow (Demographic Survey)						
R01	3:30	3:05	2:30	4:00	2:50	2:25
R02	2:20	1:50	1:45	2:55	1:50	1:45
R04	1:40	1:35	1:35	1:40	1:35	1:40
R06	1:15	1:20	0:50	0:55	0:55	0:50
R07	2:05	2:00	1:50	2:05	2:00	1:50
20 Percent Shadow (Base)						
R01	3:40	3:10	2:30	4:00	2:55	2:30
R02	2:25	1:50	1:45	2:55	1:50	1:45
R04	1:40	1:35	1:40	1:45	1:35	1:40
R06	1:20	1:20	1:05	1:45	0:55	1:10
R07	2:15	2:10	1:50	2:15	2:05	1:50
60 Percent Shadow						
R01	4:00	3:30	2:55	4:30	3:20	2:45
R02	3:10	2:30	2:05	3:35	2:20	2:00
R04	2:00	1:40	1:45	2:50	1:45	1:45
R06	3:10	3:05	2:15	3:15	3:00	2:15
R07	3:05	2:50	2:05	3:10	2:45	2:10
100 Percent Shadow						
R01	4:25	3:55	3:15	4:55	3:45	3:05
R02	4:20	3:30	2:55	4:40	3:20	2:40
R04	3:35	3:00	2:20	4:40	2:35	2:15
R06	4:15	3:55	3:05	4:25	3:45	3:15
R07	4:15	3:55	3:20	4:25	3:45	3:15

Table 10-4. 100th Evacuation Time Estimates for Voluntary Evacuation Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
10 Percent Shadow (Demographic Survey)						
R01	5:10	4:15	3:25	5:35	3:45	3:25
R02	3:40	3:25	3:25	4:10	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
R06	3:40	3:25	3:25	3:40	3:25	3:25
R07	3:40	3:25	3:25	3:40	3:25	3:25
20 Percent Shadow (Base)						
R01	5:10	4:25	3:25	5:35	4:00	3:25
R02	3:40	3:25	3:25	4:10	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
R06	3:40	3:25	3:25	3:40	3:25	3:25
R07	3:40	3:25	3:25	3:40	3:25	3:25
60 Percent Shadow						
R01	5:45	5:05	3:55	6:10	4:40	3:50
R02	4:15	3:25	3:25	4:35	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
R06	3:40	3:40	3:25	3:45	3:25	3:25
R07	3:55	3:55	3:25	4:00	3:25	3:25
100 Percent Shadow						
R01	7:20	5:55	4:35	7:35	5:40	4:30
R02	6:10	5:00	3:55	6:45	4:35	3:30
R04	3:40	3:40	3:25	5:25	3:25	3:25
R06	5:25	4:55	4:00	6:05	4:40	4:00
R07	5:45	5:15	4:15	6:10	5:05	4:10

Table 10-5. 90th Evacuation Time Estimates for Leaving Early Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
No One Leaves Early (Base)						
R02	2:25	1:50	1:45	2:55	1:50	1:45
R04	1:40	1:35	1:40	1:45	1:35	1:40
10% Leave Early						
R02	2:20	1:50	1:45	2:50	1:50	1:45
R04	1:40	1:35	1:40	1:40	1:35	1:40
50% Leave Early						
R02	2:10	1:35	1:35	2:45	1:40	1:35
R04	1:40	1:35	1:40	1:35	1:35	1:40
75% Leave Early						
R02	2:05	1:35	1:35	2:40	1:35	1:35
R04	1:35	1:35	1:40	1:35	1:35	1:40

Table 10-6. 100th Evacuation Time Estimates for Leaving Early Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
No One Leaves Early (Base)						
R02	3:40	3:25	3:25	4:10	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
10% Leave Early						
R02	3:40	3:25	3:25	4:00	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
50% Leave Early						
R02	3:40	3:25	3:25	3:45	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
75% Leave Early						
R02	3:40	3:25	3:25	3:45	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25

Table 10-7. 90th Evacuation Time Estimates for Leaving Early & Urgent Mobilization Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
No One Leaves Early (Urgent Mobilization)						
R02	2:25	1:50	1:35	3:20	1:45	1:35
R04	1:05	0:50	0:45	1:45	0:50	0:50
10% Leave Early						
R02	2:25	1:50	1:35	3:10	1:40	1:25
R04	0:55	0:50	0:45	1:45	0:50	0:40
50% Leave Early						
R02	2:15	1:35	1:25	2:55	1:30	1:20
R04	0:50	0:45	0:40	1:40	0:40	0:40
75% Leave Early						
R02	2:05	1:30	1:15	2:45	1:25	1:15
R04	0:50	0:40	0:35	1:35	0:30	0:40

Table 10-8. 100th Evacuation Time Estimates for Leaving Early & Urgent Mobilization Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
No One Leaves Early (Urgent Mobilization)						
R02	3:25	3:10	3:10	4:10	3:10	3:10
R04	3:10	3:10	3:10	3:10	3:10	3:10
10% Leave Early						
R02	3:25	3:10	3:10	4:10	3:10	3:10
R04	3:10	3:10	3:10	3:10	3:10	3:10
50% Leave Early						
R02	3:25	3:10	3:10	4:00	3:10	3:10
R04	3:10	3:10	3:10	3:10	3:10	3:10
75% Leave Early						
R02	3:25	3:10	3:10	3:35	3:10	3:10
R04	3:10	3:10	3:10	3:10	3:10	3:10

Table 10-9. 90th Evacuation Time Estimates for Panoramic Hill Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
Two Ways Out of Panoramic Hill (Urgent Mobilization)						
R02	0:50	0:50	0:35	1:00	0:40	0:30
R04	0:45	0:50	0:35	0:40	0:35	0:30
Two Ways Out of Panoramic Hill						
R02	1:20	1:15	1:20	1:30	1:20	1:30
R04	1:20	1:15	1:20	1:30	1:20	1:30
One Way Out of Panoramic Hill (Urgent Mobilization)						
R02	1:05	1:10	0:45	1:25	0:55	0:35
R04	1:00	1:00	0:40	1:00	0:45	0:30
One Way Out of Panoramic Hill (Base)						
R02	1:20	1:15	1:20	1:30	1:20	1:30
R04	1:20	1:15	1:20	1:30	1:20	1:30

Table 10-10. 100th Evacuation Time Estimates for Panoramic Hill Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
Two Ways Out of Panoramic Hill (Urgent Mobilization)						
R02	1:00	1:00	0:45	1:15	0:45	0:40
R04	0:55	1:00	0:40	0:50	0:40	0:40
Two Ways Out of Panoramic Hill						
R02	3:40	3:25	3:25	3:40	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
One Way Out of Panoramic Hill (Urgent Mobilization)						
R02	1:10	1:20	0:55	1:35	1:00	0:45
R04	1:05	1:05	0:45	1:10	0:50	0:40
One Way Out of Panoramic Hill (Base)						
R02	3:40	3:25	3:25	3:40	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25

Table 10-11. ADU/JADU/Middle Housing Units, People and Number of Evacuation Vehicles

Case	Number of Units	Number of People	Number of Vehicles	Number of Buses ⁵
Future Case (City Wide)	18,205	43,146	20,754	0
Future Case (Hillside)	4,238	10,044	4,831	0
Future Build – ADU/JADUs Only	27,060	64,132	30,848	0
Future Build - Middle Housing Only	870	2,062	992	0
Future Build – ADUs/JADUs and Middle Housing	27,930	66,194	31,840	0
Future Build – ADUs/JADUs only with Transit Exemption	27,060	64,132	15,681	1,051
Future Build – ADU/JADUs and Middle Housing with Transit Exemption	27,930	66,194	16,673	1,051

Notes

Future Case (City Wide): Includes housing units that are projected to be built by the year 2031 for the City of Berkeley. Excludes any future ADU/JADU and Middle Housing developments.

Future Case (Hillside): Includes the estimated number of housing units to be built in the Hillside Overlay by the year 2031. Excludes any future ADU/JADU and Middle Housing developments.

Future Build – ADU/JADUs Only: The maximum number of ADU/JADUs that can be built within the Hillside Overlay.

Future Build – Middle Housing Only: The estimated number of Middle Housing units that will be built in the Hillside Overlay.

Future Build – ADUs/JADUs and Middle Housing: Combined number of ADU/JADUs and Middle Housing units in the Hillside Overlay.

Future Build – ADUs/JADUs only with Transit Exemption: Residents living on an ADU/JADU parcel that is not required to have off-street parking would not have a personal vehicle and would instead rely on public transit to evacuate.

Future Build – ADU/JADUs and Middle Housing with Transit Exemption: Same as “Future Build – ADUs/JADUs only with Transit Exemption” case with the addition of Middle Housing units.

⁵ Represented as 2 pce's in the simulations.

Table 10-12. 90th Evacuation Time Estimates for ADU/JADU/Middle Housing Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
Base						
R01	3:40	3:10	2:30	4:00	2:55	2:30
R02	2:25	1:50	1:45	2:55	1:50	1:45
R04	1:40	1:35	1:40	1:45	1:35	1:40
R05	2:05	1:55	1:45	2:20	1:55	1:45
Future Case						
R01	4:30	4:00	3:30	4:55	4:00	3:25
R02	2:55	2:30	2:10	3:20	2:20	2:10
R04	1:50	1:45	1:45	2:00	1:45	1:45
R05	2:30	2:30	2:10	2:45	2:15	2:10
Future ADUs and JADUs						
R01	6:40	6:15	5:55	6:25	6:05	5:45
R02	5:40	5:10	4:50	5:15	5:00	4:40
R04	2:55	2:55	2:40	2:30	2:45	2:40
R05	6:20	6:05	6:00	5:25	6:10	6:05
Future Middle Housing						
R01	4:40	4:10	3:35	5:00	4:05	3:30
R02	3:05	2:30	2:15	3:30	2:20	2:15
R04	1:50	1:45	1:45	2:00	1:45	1:45
R05	2:40	2:30	2:20	2:50	2:25	2:10
Future Combined						
R01	6:55	6:30	6:15	6:40	6:20	6:05
R02	5:40	5:10	5:00	5:20	5:05	4:45
R04	2:50	2:55	2:45	2:35	2:50	2:45
R05	6:35	6:50	6:10	5:35	6:20	6:20
Future ADU with Transit Exemption Zones						
R01	5:40	5:10	4:45	5:50	4:50	4:40
R02	4:25	4:15	4:00	4:20	4:05	3:50
R04	3:00	3:05	3:05	3:00	3:05	3:05
R05	5:55	5:40	5:30	4:30	5:50	5:05
Future Combined with Transit Exemption Zones						
R01	5:45	5:10	4:50	5:45	5:05	4:35
R02	4:30	4:20	4:05	4:30	4:10	3:50
R04	3:00	3:00	3:05	3:00	3:05	3:05
R05	5:50	5:45	5:35	5:00	5:50	5:25

Table 10-13. 100th Evacuation Time Estimates for ADU/JADU/Middle Housing Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
Base						
R01	5:10	4:25	3:25	5:35	4:00	3:25
R02	3:40	3:25	3:25	4:10	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
R05	3:40	3:25	3:25	3:40	3:25	3:25
Future Case						
R01	6:10	5:35	4:45	7:05	5:15	4:35
R02	4:05	3:25	3:25	4:35	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
R05	4:00	4:05	3:30	4:15	3:30	3:25
Future ADUs and JADUs						
R01	11:25	11:15	9:50	10:10	11:05	9:35
R02	8:35	8:25	8:05	7:45	8:15	7:40
R04	3:40	3:25	3:25	3:40	3:25	3:25
R05	8:55	9:15	9:15	7:55	9:30	8:20
Future Middle Housing						
R01	6:25	5:40	5:05	7:15	5:40	4:35
R02	4:10	3:40	3:25	4:40	3:25	3:25
R04	3:40	3:25	3:25	3:40	3:25	3:25
R05	4:00	4:10	3:45	4:20	3:40	3:25
Future Combined						
R01	11:30	11:15	10:15	10:30	11:05	11:20
R02	8:50	8:30	8:10	7:50	8:25	8:00
R04	3:40	3:30	3:25	3:40	3:25	3:25
R05	9:20	9:45	10:15	7:55	9:35	8:50
Future ADU with Transit Exemption Zones						
R01	10:35	9:50	9:10	9:30	9:50	9:00
R02	8:10	7:40	7:10	7:05	7:25	6:50
R04	3:40	3:25	3:25	3:40	3:25	3:25
R05	8:10	8:30	8:10	6:50	8:15	8:05
Future Combined with Transit Exemption Zones						
R01	10:45	10:05	9:50	9:40	9:50	9:05
R02	8:10	7:40	7:15	7:20	7:35	7:00
R04	3:40	3:30	3:25	3:40	3:25	3:25
R05	8:10	8:30	8:35	6:55	8:25	8:05

Table 10-14. 90th Evacuation Time Estimates Differences Between Build and Future Cases

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
ADUs and JADUs Compared to Future Case						
R01	2:10	2:15	2:25	1:30	2:05	2:20
R02	2:45	2:40	2:40	1:55	2:40	2:30
R04	1:05	1:10	0:55	0:30	1:00	0:55
R05	3:50	3:35	3:50	2:40	3:55	3:55
Middle Housing Compared to Future Case						
R01	0:10	0:10	0:05	0:05	0:05	0:05
R02	0:10	0:00	0:05	0:10	0:00	0:05
R04	0:00	0:00	0:00	0:00	0:00	0:00
R05	0:10	0:00	0:10	0:05	0:10	0:00
Combined Compared to Future Case						
R01	2:25	2:30	2:45	1:45	2:20	2:40
R02	2:45	2:40	2:50	2:00	2:45	2:35
R04	1:00	1:10	1:00	0:35	1:05	1:00
R05	4:05	4:20	4:00	2:50	4:05	4:10
ADU with Transit Exemption Zones Compared to Future Case						
R01	1:10	1:10	1:15	0:55	0:50	1:15
R02	1:30	1:45	1:50	1:00	1:45	1:40
R04	1:10	1:20	1:20	1:00	1:20	1:20
R05	3:25	3:10	3:20	1:45	3:35	2:55
Combined with Transit Exemption Zones Compared to Future Case						
R01	1:15	1:10	1:20	0:50	1:05	1:10
R02	1:35	1:50	1:55	1:10	1:50	1:40
R04	1:10	1:15	1:20	1:00	1:20	1:20
R05	3:20	3:15	3:25	2:15	3:35	3:15

Table 10-15. 100th Evacuation Time Estimates Differences Between Build and No Build Cases

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Nighttime	Midday	Midday	Nighttime
ADUs and JADUs Compared to Future Case						
R01	5:15	5:40	5:05	3:05	5:50	5:00
R02	4:30	5:00	4:40	3:10	4:50	4:15
R04	0:00	0:00	0:00	0:00	0:00	0:00
R05	4:55	5:10	5:45	3:40	6:00	4:55
Middle Housing Compared to Future Case						
R01	0:15	0:05	0:20	0:10	0:25	0:00
R02	0:05	0:15	0:00	0:05	0:00	0:00
R04	0:00	0:00	0:00	0:00	0:00	0:00
R05	0:00	0:05	0:15	0:05	0:10	0:00
Combined Compared to Future Case						
R01	5:20	5:40	5:30	3:25	5:50	6:45
R02	4:45	5:05	4:45	3:15	5:00	4:35
R04	0:00	0:05	0:00	0:00	0:00	0:00
R05	5:20	5:40	6:45	3:40	6:05	5:25
ADU with Transit Exemption Zones Compared to Future Case						
R01	4:25	4:15	4:25	2:25	4:35	4:25
R02	4:05	4:15	3:45	2:30	4:00	3:25
R04	0:00	0:00	0:00	0:00	0:00	0:00
R05	4:10	4:25	4:40	2:35	4:45	4:40
Combined with Transit Exemption Zones Compared to Future Case						
R01	4:35	4:30	5:05	2:35	4:35	4:30
R02	4:05	4:15	3:50	2:45	4:10	3:35
R04	0:00	0:05	0:00	0:00	0:00	0:00
R05	4:10	4:25	5:05	2:40	4:55	4:40

Table 10-16. 90th Evacuation Time Estimates for Signal Optimization (Urgent Mobilization) Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Evening	Midday	Midday	Evening
City of Berkeley						
R02	2:25	1:50	1:35	3:05	1:45	1:30
R04	1:05	0:50	0:40	1:45	0:45	0:45

Table 10-17. 100th Evacuation Time Estimates for Signal Optimization (Urgent Mobilization) Sensitivity Study

	Summer			Fall		
	Midweek	Weekend	Midweek Weekend	Midweek	Weekend	Midweek Weekend
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)
Region	Midday	Midday	Evening	Midday	Midday	Evening
City of Berkeley						
R02	3:20	3:10	3:10	4:25	3:10	3:10
R04	3:10	3:10	3:10	3:10	3:10	3:10

11 RECOMMENDATIONS

This evacuation study explores how Berkeley's alerting systems, anticipated evacuee behaviors, estimated transportation resource needs, and roadway capacity and design will interact in large-scale emergencies. The results of this report can help inform Berkeley's disaster response planning, transportation and roadway planning, housing and land use development policies, and the individual evacuation plans of Berkeley households. This section uses the findings of this report to highlight recommendations for consideration by City officials.

Recommendations are summarized in Table 11-1.

11.1 Integrate Evacuation Study Concepts into City Policies and Response Planning

11.1.1 Emergency Response Strategies

It is recommended that the City consider integrating concepts from this Evacuation Study into emergency response plans and strategy development as described below.

The City can further contextualize evacuation time estimates in this report by overlaying evacuation time estimates with hazard-specific data (such as fire spread rates for fire regions, and tsunami arrival times on tsunami warning regions.) This integration of ETE and hazard data will help clarify the risk to the community from hazard events requiring large-scale evacuation.

The City can work to quantify likely resource shortfalls associated with the evacuation scenarios in this report through planning partnerships with transit providers serving Berkeley and the region, as well as emergency management and mutual aid partners at the Operational Area (County) and State. Section 8 identifies resource needs for transit-dependent evacuees. Planning partners can clarify regional and State capacity to provide support, as well as time estimates to mobilize those resources in localized and regional disaster scenarios.

The City can use congestion diagrams from this study (see Appendix F) to prioritize specific locations for Traffic Control Points (staff intersections and help improve traffic flow) during evacuations. Among the numerous competing life-safety needs associated with large-scale evacuations, responders can prioritize these locations for available traffic management resources to improve traffic flow and/or to reduce evacuation times. External traffic or pass-through traffic are vehicles with origins and destinations outside of the area being evacuated that pass through the area being evacuated during their trip. This traffic consumes the available roadway and transit capacity, reducing the available capacity to those most at risk, increasing congestion and prolonging ETE. During emergency evacuations, City responders can coordinate with partners to reduce or eliminate external/pass-through traffic. This can include use of electronic roadside signage, closure of off-ramps into Berkeley, and/or diversion of through traffic to other routes.

The City can encourage schools to develop and communicate site evacuation plans that enable parents and guardians to pick up their children at sites outside the evacuation zone. Making provisions for parents to pick up children outside the evacuation zone will reduce traffic congestion around schools in evacuation zones and will improve families' mobilization times.

11.1.2 Extreme Fire Weather Leave Early Policy

The Berkeley Fire Department should maintain its Leave Early Policy for extreme fire weather. Study results indicate population-level improvements such as the leave early policy could improve evacuation times by as much as 68% (Section 10.3). On the household level, Berkeley's Leave Early approach provides a targeted way for wildfire-exposed households to avoid fire evacuations. In a wildfire evacuation, fire may be present along the evacuation route, producing scorching radiant heat and oxygen-displacing gases. All evacuations involve potential for injury or death, if only from collisions and crashes.

In addition, the Fire Department may consider how the results of this study could be used to target Leave Early outreach efforts to residents who are most likely to have extended evacuation times. The policy is currently applied to all residents in Berkeley Fire Zones 2 & 3; staff may consider focusing on households at relatively greater risk due to extended mobilization times and/or on neighborhoods with extended driving times due to severe congestion.

11.1.3 Housing Development Policies

The City used this study to better understand how potential development in the Berkeley Hills could impact evacuation times (see Section 10.5). It is noted that these studies assessed impacts from the maximum potential levels of new residential development from ADUs/JADUs. These analyses therefore illustrate an upper bound of potential long-term impacts from ADU/JADU development in the Hillside Overlay. Based on the results of the study, it is recommended that the City institute separate, more restrictive ADU/JADU development provisions in the Hillside Overlay.

In addition, these studies identified impacts to evacuation times from a projection of likely development that could result from implementation of "Middle Housing" zoning changes. The results of this study indicated that in a repeat of the 1923 Fire (R02), Middle Housing could add between 5 and 10 minutes overall to ETEs. It is recommended that the City examine these increases in the context of fire spread scenarios. By overlaying fire spread data with evacuation time estimates, the City can better contextualize potential impacts to public health and safety from Middle Housing zoning changes.

Studies in Section 10.5 illustrate how increasing population density in an area, even when the added people do not own vehicles, can increase emergency evacuation times and create public safety impacts. More broadly, the City should consider impacts to evacuation when implementing zoning changes that could result in an increase in demand on roadways used by wildfire or tsunami evacuees. Simulation modeling could be employed to assess the impact of proposed development policies on evacuation times and congestion levels under emergency scenarios. This proactive approach can ensure that policymakers are able to consider emergency evacuation as part of the decision-making process.

11.2 Community Education and Household Evacuation Planning

Evacuation times, both for households and general populations at risk, are influenced by how quickly community members are alerted to an Evacuation Warning or Order, how quickly they can mobilize to begin their evacuation trips, and how quickly they can navigate the roadways to escape the hazard area. Reducing time in any of these three areas will speed individual and overall evacuation times and improve community safety in hazard events.

11.2.1 Community Alerting

The City of Berkeley maintains multiple emergency alerting systems for coordinated use in emergency evacuations, as described in Section 5.

It is recommended that the City consider conducting community education about Berkeley's evacuation zones, as well as the emergency alerting systems that will provide evacuation orders/warnings, and how community members can register for/opt-in to those systems. If the public is ready to receive emergency alerts, they can more quickly move into mobilization.

Additionally, the City should consider education to encourage potential evacuees to monitor evolving conditions and advisory announcements as well as maintain ongoing contact and communications with neighbors, friends, family members, support teams, and social media networks. These social connections will improve the distribution of the City's emergency alert information within the affected population. These social connections may also reduce mobilization time by connecting an evacuee to help with packing, carpooling, or ensuring they have an evacuation location ready with friends or family.

During an emergency evacuation, people outside the hazard area, who are not under evacuation order or warning, may still voluntarily evacuate. These voluntary evacuations reduce the available roadway capacity and contribute to traffic congestion. This increases evacuation times for people trying to escape the hazard area.¹ Public information and public messaging about who is at risk should be clear before and during an emergency so that community members who are not at risk are less likely to contribute to traffic congestion. The City may also consider including explicit instructions for people outside the hazard area to shelter in place, in order to reduce demand on roadways.

11.2.2 Improving Household Mobilization and Evacuation Travel Times

Mobilization is how quickly evacuees prepare to leave and enter the roadway system. Berkeley community members could take as long as 3.5 hours to mobilize. Higher mobilization times are associated with particular household decisions, such as waiting for commuters to return home, picking up children at school, or returning to the evacuation zone for any reason.

Evacuation travel time, or how long a vehicle is on the road, is increased with roadway

¹ Voluntary evacuation during an active wildfire is distinct from Berkeley Hills residents following Fire Department recommendations to leave early due to extreme fire weather, before a fire starts.

congestion. Reductions in vehicular traffic during emergency evacuations will help reduce congestion and speed evacuation travel times.

11.2.2.1 Community Education

The City should consider the results of this study when designing community education about household-level evacuation readiness. Community education may include the following concepts:

- Evacuees with vehicles should carpool (i.e., evacuate as a household in a single vehicle) to the extent possible to reduce the number of vehicles on the road, which will lessen traffic congestion and could reduce evacuation time. Evacuees with vehicle access should also be encouraged to include transit-dependent neighbors in their evacuation plans. Similarly, transit-dependent evacuees should be encouraged to improve their mobilization times by connecting with neighbors and making plans to carpool in an emergency evacuation.
- Evacuees should understand and practice using primary, secondary, and tertiary evacuation routes. An ability to react to changing conditions will improve a household's evacuation travel time and will contribute to a reduction in overall evacuation times by distributing traffic on available roadways (see Section 9).
- Parents and guardians should engage with their children's schools regarding evacuation plans, with the goal of reducing trips to pick up children from schools within an evacuation zone. Making provisions for parents to pick up children outside the evacuation zone will reduce traffic congestion around schools in evacuation zones and will improve families' mobilization times.
- Households should plan for commuters to remain outside of the evacuation zone and reunite with other household members outside the hazard area, instead of returning to the evacuation zone. This will reduce the household mobilization time.

11.2.3 Evacuating on Bicycle and Foot

The analysis in this document focuses on simulating and measuring vehicular traffic: 96.6% of Berkeley community members report that they plan to use a vehicle to evacuate. This high percentage is unsurprising, as many people will want to bring their valuable and sentimental items with them in an evacuation, and many people are not physically able and/or equipped to quickly leave on bike or foot.

However, some Berkeley community members plan to use bicycles or to walk during an evacuation. According to the demographic survey, citywide 2.2% of Berkeley residents, employees, and college students plan to evacuate on foot and 1.4% of people plan to evacuate on bicycle. In the hills specifically, these numbers decrease to 1.5% on foot and 0.5% on bicycle. This distinction could reflect the characteristics of the road network, which is winding, narrow, with significant elevation changes, versus relatively flat, wide, and gridded in the flats.

In addition to location, community members might be opting to walk or bike out for different reasons. Some households use bicycles and walking as their primary means of transportation. Others may not own or have access to a vehicle (which was the case for 7.5% of survey respondents Citywide). Still others may believe they will be able to evacuate more quickly on a bike or on foot than they could a vehicle. Past experience from the 1991 Oakland-Berkeley Hills Fire, as well as the analysis in this document, demonstrate the likelihood of significant traffic congestion in a fire, leading to the possibility that a fire could move faster than evacuating vehicles and overtake them.

From an individual evacuee perspective, the key issues to weigh in a cycling or pedestrian evacuation are speed and safety. The risks of driving out of an evacuating area are well-understood: collisions and traffic congestion can impede the evacuee's ability to escape the hazard area, creating the potential for exposure to the hazard while evacuating. Stated simply, there is an understood possibility that evacuees in vehicles could be stuck in traffic and overtaken by fire.

The assumption is that evacuating on foot or bike might be faster than evacuating in a vehicle. This analysis was not in the scope of this project.

The second key issue relates to evacuee safety. The risks present for people evacuating in vehicles (collisions and exposure to the hazard) are present for cyclists and pedestrians, and because of the lack of basic protections provided by the metal frame of a vehicle, they are heightened. Collisions are likely during evacuations, considering the high volume of people sharing the roadway under highly stressful conditions. The same collision may cause minor injuries/damage for a driver in a vehicle while a cyclist or pedestrian experiences serious injury or death. In addition, a significant injury would also divert critical emergency resources away from firefighting to attend to and transport patient(s) to the emergency room.

Secondly, exposure to the hazard at hand is also heightened for the cyclist or pedestrian. For instance, in a wildfire evacuation, fire may be present along the evacuation route, producing radiant heat and gases. Evacuees in vehicles have some protection from surrounding environmental conditions, reducing the initial impact of proximal wildfire. Evacuees on foot or bicycle will be exposed to scorching radiant heat and oxygen-displacing gases that are likely to significantly impact their ability to successfully evacuate an impacted area.

Berkeley's public safety officials recommend that biking and walking be considered as part of a household evacuation plan for a tsunami. This analysis does not assess the relative speeds of walking/biking compared to driving. Berkeley's public safety officials recommend that in some cases, for some individuals, walking or biking will provide a faster means of egress than driving. However, the circumstances under which walking or biking should be considered a primary means of egress are very specific and very limited.

Tsunami

In a tsunami, the potential area of impact has distinct geographic boundaries. If an evacuee can get outside of the inundation zone, they can reasonably assume that they will have made it to safety. In a tsunami, the arrival time and predicted location of the danger can be pre-defined.

These are advantages when evacuating on a bike or on foot – as long as the tsunami has not arrived, the fastest mode of travel that works for the individual will be the best option.

Depending on a tsunami's origin, an evacuee may be notified multiple hours in advance of its arrival onshore, allowing time with which they can safely navigate Berkeley's roadways on bike or on foot before a tsunami arrives. This means that a pedestrian or bicycling evacuation could be integrated as a primary option for a household or business tsunami evacuation plan. People who plan to bike or walk as their primary means of egress should evacuate at the earliest possible opportunity.

Wildfire

Wildfire presents a very different set of challenges from tsunami. The area of potential wildfire impact is not clearly defined and is highly dynamic due to the nature of wildfire spread. In a wildfire, the potential ignition locations are endless. A wildfire may start far away from Berkeley and grow before it impacts the community. Alternately, it may start within Berkeley. The speed of fire spread is variable depending on topography, fuel, and weather conditions. Ember cast can also ignite spot fires in advance of the main flame front.

Berkeley's public safety officials do not currently recommend biking or walking as a primary evacuation plan for wildfire. While, under some circumstances for some people, pedestrian or bicycle evacuation could potentially provide a faster means of egress than using a car, there are significant safety risks associated with this approach.

Ultimately, the decisions about when and how to evacuate belong to individuals, who will decide based on their own risk tolerance. All evacuations involve potential for injury or death, if only from collisions and crashes. The lowest-risk option is to pre-emptively leave the Berkeley Hills on days when the Berkeley Fire Department has declared extreme fire weather.

Cycling and walking: Impacts to overall evacuation times

This study does not specifically explore how overall roadway evacuation times change with a multimodal evacuation because of the 3.6% of evacuees citywide who plan to bike or walk instead of using a vehicle.

It could be posited that fewer cars on the roadway reduce vehicular congestion and could increase driving speeds. But it is beyond the scope of the study to identify how the interactions among cars, cyclists, and pedestrians leaving together sharing a roadway would change with additional cyclists/pedestrians and fewer vehicles. It is unknown whether a significant increase in people opting to evacuate via bicycle or on foot will significantly change overall evacuation times.

If it were assumed that cyclists and pedestrians could be considered removed from the roadways based on their chosen mode of egress, the sensitivity study examining the impacts to evacuation times from community members leaving the Berkeley hills early during extreme fire weather could serve as a proxy to define what kind of impacts on vehicular evacuation times would be created from more people opting to evacuate on foot or bike. (See Section 10.3 for details.)

While community members' evacuation plans may differ, it is critical that each household has a

plan that all members understand, that they practice the plan together, and that each person is able to perform their role under significant stress.

11.3 Increasing Roadway Capacity and Connectivity

These recommendations focus on how the roadway capacity (number of vehicles that can be processed in a given amount of time) and connectivity (route choice for evacuating vehicles) can be increased. The higher the roadway capacity and connectivity, the lower the evacuation time (with the same evacuating demand).

11.3.1 Traffic Calming Devices

This analysis indicates that the Traffic Calming Devices (TCDs) throughout the city are performing as designed, effectively reducing vehicular speeds and thus reducing the risk of severe injury and/or fatality traffic crashes. However, this intended function conflicts with the goal of evacuation, which is to expedite the egress of individuals from the affected area.

Appendix F identifies patterns of traffic congestion during evacuation and Appendix G highlights particular roadway constraints and traffic calming devices with notable impacts across various evacuation regions studied. It is strongly recommended that the City of Berkeley consider the following actions:

- Existing Infrastructure: Develop a citywide connectivity and evacuation capacity improvement strategy, integrating approaches such as actuated or adaptive signal timing and replacing TCDs with removable/retractable options, and other evolving technologies.
- Future infrastructure: Develop and implement a methodology to evaluate and consider evacuation efficiency and roadway capacity during the planning and implementation phases of future roadway infrastructure development, including TCD installations.
- First Responder response times: Develop and implement a methodology to assess impacts from TCDs to first responder response times in daily traffic environments.

11.3.2 Traffic Signal Improvements

Traffic signals are essential to the safe and efficient functioning of the roadway network and play a critical role during emergency evacuations. Their effectiveness in such scenarios is greatly enhanced when they remain operational during power outages and feature signal timing plans that are both optimized and adaptable to real-time traffic conditions. These capabilities help minimize the need for emergency personnel to manually direct traffic, allowing those resources to be deployed to more urgent, lifesaving duties.

To improve the resilience, coordination, and functionality of the City's traffic signal infrastructure, the following actions are recommended:

- Optimize Signal Timing Plans: Evaluate and implement improved signal timing strategies, including actuated and/or adaptive systems, to better manage traffic flow day-to-day and during emergencies. (See Section 10.6.) Many existing signals in the city are pre-timed

and lack flexibility. Adaptive signal control is particularly valuable during evacuations, as it can automatically adjust signal timings in response to real-time traffic conditions, helping to move large volumes of vehicles more efficiently and reduce congestion along key evacuation corridors.

- **Install Battery Backup Systems:** Upgrade all traffic signal cabinets to include battery backup systems that can operate for a minimum of 6-8 hours, ensuring continued signal operation during power outages and maintaining safe and coordinated traffic movement during evacuations.
- **Enhance Emergency Vehicle Pre-emption:** Evaluate potential improvements to traffic signal system to have the latest pre-emption equipment and capabilities. Pre-emption for Fire and Police Department vehicles is essential during day-to-day emergencies and evacuation events, as it allows responders to override normal signal operations, receive immediate green lights, and avoid delays. This capability ensures faster responder access to hazardous areas, supports evacuation logistics, and improves overall public safety and emergency response times.
- **Strengthen Communications Infrastructure:** Install a robust fiber-optic network to improve the reliability and speed of traffic signal communications. A strong communications backbone enables real-time monitoring and coordination, even if parts of the system experience disruptions.
- **Deploy Smart Traffic Cameras:** Install smart traffic cameras at key intersections and corridors to provide real-time detection, monitoring, and traffic data collection. These technologies support situational awareness, enable quicker response to traffic conditions, and facilitate adaptive signal control during emergencies.
- **Implement Transit Signal Priority (TSP):** Upgrade traffic signal system along Berkeley's highest capacity routes to ensure that public transit vehicles can move efficiently through congested corridors, reducing delays, and maximizing their ability to transport large numbers of people during day-to-day operations as well as evacuations.
- **Coordinate Regionally:** Work closely with surrounding jurisdictions to ensure interoperability and synchronization of traffic signal systems during emergency evacuations. Coordinated regional signal operations will help maintain consistent traffic flow, reduce delays at jurisdictional boundaries, and support broader evacuation strategies.
- **Traffic Signal Software for Centralized Control:** Assess the need for traffic signal software upgrades to enable full communication with external systems and centralized command through the City's envisioned Traffic Management Center (TMC). This ensures operators can remotely monitor and adjust traffic signals citywide during emergencies.

11.4 Parking Restrictions

Although temporary and permanent parking restrictions (such as red curbing) are unlikely to substantially improve evacuation flow (see Section 9), the City could consider the strategic implementation of parking restrictions along arterial roadways in the Berkeley Hills, with a focus on those roadways predominantly utilized by emergency response vehicles for ingress during

emergency response. This targeted approach would optimize maneuverability and reduce potential impedance for essential services without imposing broad restrictions that are unlikely to significantly improve overall evacuation egress flow.

The City may also evaluate and determine if temporary parking restrictions implemented on certain roadway segments only during hazardous conditions (e.g., fire weather) could improve responder ingress times during evacuation.

Table 11-1. Summary of Recommendations for Consideration by the City of Berkeley

Recommendation	Reasoning
1 Emergency Response Strategies	
1.1 Overlay evacuation time estimates with hazard-specific data (such as fire spread rates for fire regions, and tsunami arrival times on tsunami warning regions.)	This integration of ETE and hazard data will help clarify the risk to the community from hazard events requiring large-scale evacuation.
1.2 Develop regional/State planning partnerships to quantify resource shortfalls for transit-dependent evacuees.	Understanding resource shortfalls will inform approaches to address evacuation needs for transit-dependent evacuees.
1.3 Use study results to prioritize specific locations for Traffic Control Points (staffed intersections that help improve traffic flow) during evacuations.	Reduce congestion and improve traffic flow in evacuations.
1.4 During evacuations, reduce or eliminate external/pass-through traffic. This can include use of electronic roadside signage, closure of I-80 and CA-24 off-ramps into Berkeley, and/or diversion of through traffic to other routes.	Reduce roadway demand to reduce congestion and improve traffic flow in evacuations.
1.5 Encourage schools to develop and communicate site evacuation plans that enable parents and guardians to pick up their children at sites outside the evacuation zone.	Reduce traffic congestion around schools in evacuation zones and improve families' mobilization times.
2 Extreme Fire Weather Leave Early Policy	
2.1 Maintain Berkeley Fire Department Leave Early Policy for extreme fire weather. Focus on households at relatively greater risk due to extended mobilization times and/or on neighborhoods with extended driving times due to severe congestion.	<p>Improve population-level evacuation times by reducing roadway demand.</p> <p>Reduce hazard exposure to evacuees by avoiding emergency evacuation altogether.</p> <p>Focus on populations most likely to have poor evacuation outcomes.</p>

3 Housing Development Policies	
3.1 Institute separate, more restrictive ADU/JADU development provisions in the Hillside Overlay.	Mitigate potential impacts to evacuation times from ADU/JADU development in Berkeley's Hillside Overlay.
3.2 Examine ETE increases from Middle Housing zoning changes in the Hillside Overlay in the context of fire spread scenarios.	Contextualize potential impacts to public health and safety from Middle Housing zoning changes in order to mitigate potential impacts to evacuation times from Middle Housing development in Berkeley's Hillside Overlay.
3.3 Consider impacts to evacuation when implementing zoning changes that could result in an increase in demand on roadways used by wildfire or tsunami evacuees.	Provide data measuring public safety impacts from increased population density to decisionmakers. Update response plans to account for changes to evacuation time estimates.
4 Community Alerting	
4.1 Conduct community education about Berkeley's evacuation zones, the emergency alerting systems that will provide evacuation orders/warnings, and how community members can register for/opt-in to those systems.	If the public is ready to receive emergency alerts, they can more quickly move into mobilization.
4.2 Conduct community education to encourage potential evacuees to monitor evolving conditions and stay in contact with social networks.	Improve distribution of the City's emergency alert information within the affected population. Connecting potential evacuees to people who can help with evacuation preparedness to reduce mobilization times.
4.3 Clearly define areas at risk as well as areas not at risk in public alerts. Include explicit instructions for people outside the hazard area to shelter in place.	Reduce roadway demand.

5 Improving Household Mobilization and Evacuation Travel Times	
5.1 Encourage carpooling.	Lessen traffic congestion and reduce evacuation times. Reduce mobilization times for transit-dependent populations.
5.2 Encourage familiarity with primary, secondary, and tertiary evacuation routes.	Improve household evacuation time. Help reduce overall evacuation times by distributing traffic on available roadways.
5.3 Parents should make provisions with schools to pick up children outside the evacuation zone.	Reduce traffic congestion around schools in evacuation zones. Improve families' mobilization times.
5.4 Commuters should plan to remain outside of the evacuation zone and reunite with other household members outside the hazard area, instead of returning to the evacuation zone.	Reduce household mobilization times.
6 Evacuating on Bicycle and Foot	
6.1 Encourage community members to explore walking or cycling for household/business tsunami evacuation plans.	Walking or cycling may provide a faster escape from the tsunami inundation zone than vehicular evacuation. Tsunami areas of impact/locations of danger are clearly defined. Tsunami arrival times can be anticipated, often with multiple hours of advanced notice.
7 Traffic Calming Devices	

7.1	Existing Infrastructure: Develop a citywide connectivity and evacuation capacity improvement strategy, integrating approaches such as actuated or adaptive signal timing and replacing TCDs with removable/retractable options, and other evolving technologies.	Improve traffic flow and reduce congestion during evacuations while retaining pedestrian and cyclist protections for day-to-day use.
7.2	Future infrastructure: Develop and implement a methodology to evaluate and consider evacuation efficiency and roadway capacity during the planning and implementation phases of future roadway infrastructure development, including TCD installations.	Improve traffic flow and reduce congestion during evacuations while retaining pedestrian and cyclist protections for day-to-day use.
7.3	First Responder response times: Develop and implement a methodology to assess impacts from TCDs to first responder response times in daily traffic environments.	Provide data on public safety impacts of TCDs to decisionmakers.
8	Traffic Signal Improvements	
8.1	Optimize Signal Timing Plans: Evaluate and implement improved signal timing strategies, including actuated and adaptive systems.	Better manage traffic flow day-to-day and during emergencies.
8.2	Install Battery Backup Systems: Upgrade all traffic signal cabinets to include battery backup systems that can operate for a minimum of 6-8 hours.	Ensure continued signal operation during power outages and maintain safe and coordinated traffic movement during evacuations.
8.3	Enhance Emergency Vehicle Pre-emption: Evaluate potential improvements to traffic signal system to have the latest pre-emption equipment and capabilities.	Ensures faster emergency response times in both day-to-day and evacuation scenarios.

8.4	Strengthen Communications Infrastructure: Install a robust fiber-optic network to improve the reliability and speed of traffic signal communications.	Enable real-time monitoring and coordination, even if parts of the system experience disruptions.
8.5	Deploy Smart Traffic Cameras: Install smart traffic cameras at key intersections and corridors to provide real-time detection, monitoring, and traffic data collection.	Support situational awareness, enable quicker response to traffic conditions, and facilitate adaptive signal control during emergencies.
8.6	Implement Transit Signal Priority (TSP) for public transit vehicles: Upgrade traffic signal system along Berkeley's highest capacity routes.	Ensure that public transit vehicles can move efficiently through congested corridors, reducing delays, and maximizing their ability to transport large numbers of people during day-to-day operations as well as evacuations.
8.7	Coordinate Regionally: Work closely with surrounding jurisdictions to ensure interoperability and synchronization of traffic signal systems during emergency evacuations.	Help maintain consistent traffic flow, reduce delays at jurisdictional boundaries, and support broader evacuation strategies.
8.8	Traffic Signal Software for Centralized Control: Assess the need for traffic signal software upgrades to enable full communication with external systems and centralized command through the City's envisioned Traffic Management Center (TMC).	Ensure operators can remotely monitor and adjust traffic signals citywide during emergencies.
9	Parking Restrictions	
9.1	Explore parking restrictions along arterial roadways in the Berkeley Hills utilized by emergency response vehicles for ingress during emergency response.	Improve emergency responder ingress times during evacuations.

<p>9.2 Explore temporary parking restrictions implemented on certain roadway segments only during hazardous conditions (e.g., fire weather).</p>	<p>Improve emergency responder ingress times during evacuations.</p>
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APPENDIX A

Glossary of Traffic Engineering Terms

A. GLOSSARY OF TRAFFIC ENGINEERING TERMS

This appendix provides a glossary of traffic engineering terms that are used throughout this report.

Table A-1. Glossary of Traffic Engineering Terms

Term	Definition
Analysis Network	A graphical representation of the geometric topology of a physical roadway system, which is comprised of directional links and nodes.
Link	A network link represents a specific, one-directional section of roadway. A link has both physical (length, number of lanes, topology, etc.) and operational (turn movement percentages, service rate, free-flow speed) characteristics.
Measures of Effectiveness	Statistics describing traffic operations on a roadway network.
Node	A network node generally represents an intersection of network links. A node has control characteristics, i.e., the allocation of service time to each approach link.
Origin	A location attached to a network link, within the city or Shadow Region, where trips are generated at a specified rate in vehicles per hour (vph). These trips enter the roadway system to travel to their respective destinations.
Prevailing Roadway and Traffic Conditions	Relates to the physical features of the roadway, the nature (e.g., composition) of traffic on the roadway and the ambient conditions (weather, visibility, pavement conditions, etc.).
Service Rate	Maximum rate at which vehicles, executing a specific turn maneuver, can be discharged from a section of roadway at the prevailing conditions, expressed in vehicles per second (vps) or vph.
Service Volume	Maximum number of vehicles which can pass over a section of roadway in one direction during a specified time period with operating conditions at a specified Level of Service (The Service Volume at the upper bound of Level of Service, E, equals Capacity). Service Volume is usually expressed as vph.
Signal Cycle Length	The total elapsed time to display all signal indications, in sequence. The cycle length is expressed in seconds.

Term	Definition
Signal Interval	A single combination of signal indications. The interval duration is expressed in seconds. A signal phase is comprised of a sequence of signal intervals, usually green, yellow, red.
Signal Phase	A set of signal indications (and intervals) which services a particular combination of traffic movements on selected approaches to the intersection. The phase duration is expressed in seconds.
Traffic (Trip) Assignment	A process of assigning traffic to paths of travel in such a way as to satisfy all trip objectives (i.e., the desire of each vehicle to travel from a specified origin in the network to a specified destination) and to optimize some stated objective or combination of objectives. In general, the objective is stated in terms of minimizing a generalized "cost". For example, "cost" may be expressed in terms of travel time.
Traffic Density	The number of vehicles that occupy one lane of a roadway section of specified length at a point in time, expressed as vehicles per mile (vpm).
Traffic (Trip) Distribution	A process for determining the destinations of all traffic generated at the origins. The result often takes the form of a Trip Table, which is a matrix of origin-destination traffic volumes.
Traffic Simulation	A computer model designed to replicate the real-world operation of vehicles on a roadway network, so as to provide statistics describing traffic performance. These statistics are called Measures of Effectiveness (MOE).
Traffic Volume	The number of vehicles that pass over a section of roadway in one direction, expressed in vph. Where applicable, traffic volume may be stratified by turn movement.
Travel Mode	Distinguishes between private auto, bus, rail, pedestrian and air travel modes.
Trip Table or Origin-Destination Matrix	A rectangular matrix or table, whose entries contain the number of trips generated at each specified origin, during a specified time period, that are attracted to (and travel toward) each of its specified destinations. These values are expressed in vph or in vehicles.
Turning Capacity	The capacity associated with that component of the traffic stream which executes a specified turn maneuver from an approach at an intersection.

APPENDIX B

Detailed Description of Study Procedure

B. DETAILED DESCRIPTION OF STUDY PROCEDURE

This appendix describes the activities that were performed to compute the Evacuation Time Estimates. The individual steps of this effort are represented as a flow diagram in Figure B-1. Each numbered step in the description that follows corresponds to the numbered element in the flow diagram.

Step 1

The first activity was to obtain Evacuation Zone information and create a geographic information system (GIS) base map. The study area is bounded by I-580, Piedmont Avenue, Moraga Avenue, State Route 13 and State Route 24 to the south and southeast, by the boundary of Tilden Park to the east, by Moeser Lane, San Pablo Avenue, Potrero Avenue, S 55th Street, and Bayview Avenue to the North, and by San Francisco Bay and I-580 to the West. The area that is outside of the city limits but within the study area boundary is called the Shadow Region. The base map incorporates the local roadway topology, a suitable topographic background and the Evacuation Zone boundaries.

Step 2

2020 Census block population and Census population growth (using 2023¹ population estimates published by the US Census) information was obtained in GIS format. This information was used to project the permanent resident population within the Evacuation Zones and Shadow Region to the year 2024 and to define the spatial distribution and demographic characteristics of the population within the study area.

Employee data were provided by the city and supplemented by the U.S. Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool².

Visitor information is based on parking lot capacities within the city and the average annual tourists that visit the City of Berkeley.

Schools, medical facilities and juvenile homes data were provided by the City of Berkeley supplemented with internet searches.

Step 3

A kickoff meeting was conducted with major stakeholders. The purpose of the kickoff meeting was to present an overview of the work effort, identify key agency personnel, and indicate the data requirements for the study. Specific requests for information were presented to the city. Unique features of the study area were discussed to identify the local concerns that should be addressed by the ETE study.

¹ The annual population estimates prepared by the Census Bureau for the entire U.S. involves an extensive data gathering process. As such, population estimates are a year behind – 2024 data will be released in 2025. Thus, this 2024 update uses the 2023 census population estimates. The schedule for release of Census data is provided on the Census website: <https://www.census.gov/programs-surveys/popest/about/schedule.html>

²<https://onthemap.ces.census.gov/>

Step 4

Next, a physical survey of the roadway system in the study area was conducted to determine the geometric properties of the roadway sections, the channelization of lanes on each section of roadway, whether there are any turn restrictions or special treatment of traffic at intersections, the type and location of traffic calming devices, the type and functioning of traffic control devices, gathering signal timings for pre-timed traffic signals, and to make the necessary observations needed to estimate realistic values of roadway capacity.

Step 5

A demographic survey of households within the City of Berkeley was conducted to identify household dynamics, trip generation characteristics, and evacuation-related demographic information of the city population. This information was used to determine important study factors including the average number of evacuating vehicles used by each household, and the time required to perform pre-evacuation mobilization activities.

Step 6

A computerized representation of the physical roadway system, called a link-node analysis network, was developed using the UNITES software developed by KLD (See Section 1.3). Once the geometry of the network was completed, the network was calibrated using the information gathered during the road survey (Step 4). Estimates of roadway capacity for each link and other link-specific characteristics were introduced to the network description. Traffic signal timings were input accordingly. The link-node analysis network was imported into a GIS map. Census data was overlaid in the map, and origin centroids where trips would be generated during the evacuation process were assigned to appropriate links.

Step 7

The study area includes 106 Evacuation Zones. Regions (groupings of Evacuation Zones) that may be ordered to evacuate, were developed.

The need for evacuation can occur over a range of times, or variations of time-of-day, day-of-week, and season. Scenarios were developed to capture the variation in evacuation demand, roadway capacity and mobilization time, for different times of day, days of the week, and times of year.

Step 8

The input stream for the DYNEV II model, which integrates the dynamic traffic assignment and distribution model, DTRAD, with the evacuation simulation model, was created for a prototype evacuation case – the evacuation of all Evacuation Zones for a representative scenario.

Step 9

After creating this input stream, the DYNEV II System was executed on the prototype evacuation case to compute evacuating traffic routing patterns. DYNEV II contains an extensive suite of data diagnostics which check the completeness and consistency of the input data

specified. The analyst reviews all warning and error messages produced by the model and then corrects the database to create an input stream that properly executes to completion.

The model assigns destinations to all origin centroids consistent with a (general) outbound evacuation of the Evacuation Zones and Shadow Region, away from the hazard. The analyst may optionally supplement and/or replace these model-assigned destinations, based on professional judgment, after studying the topology of the analysis roadway network. The model produces link and network-wide measures of effectiveness as well as estimates of evacuation time.

Step 10

The results generated by the prototype evacuation case are critically examined. The examination includes observing the animated graphics (using the Evacuation Animator (EVAN) software which operates on data produced by DYNEV II) and reviewing the statistics output by the model. This is a labor-intensive activity, requiring the direct participation of skilled engineers who possess the necessary practical experience to interpret the results and to determine the causes of any problems reflected in the results.

Essentially, the approach is to identify those bottlenecks in the network that represent locations where congested conditions are pronounced and to identify the cause of this congestion. This cause can take many forms, either as excess demand due to high rates of trip generation, improper routing, a shortfall of capacity (as in a traffic calming device), or as a quantitative flaw in the way the physical system was represented in the input stream. This examination leads to one of two conclusions:

- The results are satisfactory; or
- The input stream must be modified accordingly.

This decision requires, of course, the application of the user's judgment and experience based upon the results obtained in previous applications of the model and a comparison of the results of the latest prototype evacuation case iteration with the previous ones. If the results are satisfactory in the opinion of the user, then the process continues with Step 13. Otherwise, proceed to Step 11.

Step 11

There are many "treatments" available to the user in resolving apparent problems. These treatments range from decisions to reroute the traffic by assigning additional evacuation destinations for one or more sources, imposing turn restrictions where they can produce significant improvements in capacity, changing the control treatment at critical intersections so as to provide improved service for one or more movements, or in prescribing specific treatments for channelizing the flow so as to expedite the movement of traffic along major roadway systems. Such "treatments" take the form of modifications to the original prototype evacuation case input stream. All treatments are designed to improve the representation of evacuation behavior.

Step 12

As noted above, the changes to the input stream must be implemented to reflect the modifications undertaken in Step 11. At the completion of this activity, the process returns to Step 9 where the DYNEV II System is again executed.

Step 13

The prototype evacuation case was used as the basis for generating all region and scenario-specific evacuation cases to be simulated. This process was automated through the UNITES user interface. For each specific case, the population to be evacuated, the trip generation distributions, the roadway capacity and speeds, and other factors are adjusted to produce a customized case-specific data set.

Step 14

All evacuation cases are executed using the DYNEV II System to compute ETE. Once results were available, quality control procedures were used to assure the results were consistent, dynamic routing was reasonable, and traffic congestion/bottlenecks were addressed properly.

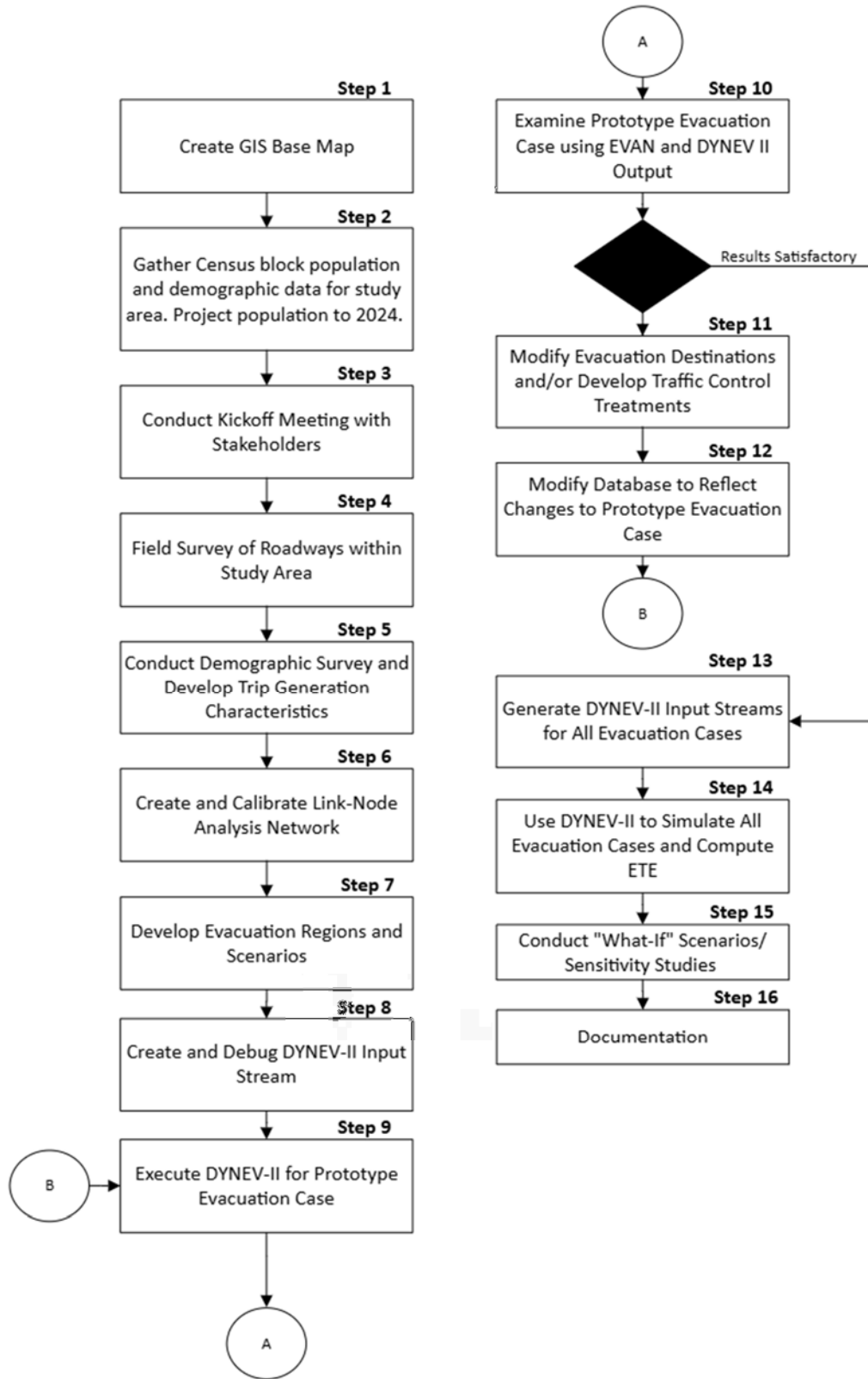
Step 15

Several ETE sensitivity studies were conducted to consider the impact on ETE based on “what if” scenarios. These scenarios were then compared to the baseline ETE (if possible) to test if certain tactics could be used to reduce evacuation time or to see the impact of changes in evacuating demand or roadway supply.

Step 16

The simulation results are analyzed, tabulated and graphed. The results were then documented.

Figure B-1. Flow Diagram of Activities



APPENDIX C

Facility Data

C. FACILITY DATA

This appendix lists population information, as of December 2024, for special facilities that were used in this study. Special facilities are defined as schools, preschools/day care centers, medical facilities, and juvenile homes. Maps of each school, preschool/day care center, medical facility, and juvenile home are provided. The estimates of tourist and employee population (see Section 3, Sub-sections 3.3 and 3.4, respectively) are summarized in the tables below.

Table C-1. K-12 Schools and Higher Education Sites within the City of Berkeley

Area(s)	Evacuation Zone	School Name	Street Address	Municipality	Enrollment
Berkeley Flats	BER-E014	Berkeley Rose Waldorf School	2515 Hillegass Ave	Berkeley	97
Berkeley Flats	BER-E014	Berkeley School of Theology	2606 Dwight Way	Berkeley	65
Berkeley Flats	BER-E025	Ruth Acty Elementary School	1400 Ada St	Berkeley	433
Berkeley Flats	BER-E025	The Crowden School	1475 Rose St	Berkeley	75
Berkeley Flats	BER-E026	Martin Luther King Middle School	1781 Rose St	Berkeley	1,007
Berkeley Flats	BER-E027	School of the Madeleine	1225 Milvia St	Berkeley	337
Berkeley Flats	BER-E038	Bayhill High School	1940 Virginia St	Berkeley	73
Berkeley Flats	BER-E038	Berkeley Arts Magnet at Whittier School	1645 Milvia St	Berkeley	407
Berkeley Flats	BER-E044	Berkeley City College	2050 Center St	Berkeley	6,519
Berkeley Flats	BER-E044	Berkeley High School	1980 Allston Way	Berkeley	3,427
Berkeley Flats	BER-E044	California Jazz Conservatory	2087 Addison St	Berkeley	88
Berkeley Flats	BER-E044	Pacific Boychoir Academy	215 Ridgeway Ave	Berkeley	30
Berkeley Flats	BER-E045	Berkwood Hedge School	1809 Bancroft Way	Berkeley	128
Berkeley Flats	BER-E046	Oxford Elementary at West Campus	1222 Univ Ave	Berkeley	256
Berkeley Flats	BER-E046	The Berkeley School	1310 University Ave	Berkeley	236
Berkeley Flats	BER-E052	Longfellow Arts and Technology Middle School	1500 Derby St	Berkeley	504
Berkeley Flats	BER-E053	Acupuncture and Integrative Medicine College-Berkeley	2550 Shattuck Ave	Berkeley	153
Berkeley Flats	BER-E053	Berkeley Technology Academy	2701 Milk Jr. Way	Berkeley	36
Berkeley Flats	BER-E053	Walden Center & School	2446 McKinley Ave	Berkeley	84
Berkeley Flats	BER-E053	Washington Elementary School	2300 Milk Jr. Way	Berkeley	416
Berkeley Flats	BER-E054	East Bay School for Boys	2340 Durant Ave	Berkeley	105
Berkeley Flats	BER-E054	Institute of Buddhist Studies	2140 Durant Ave	Berkeley	53
Berkeley Flats	BER-E064	Sylvia Mendez Elementary School	2840 Ellsworth St	Berkeley	409
Berkeley Flats	BER-E065	The Elmwood Academy	2722 Benvenue Ave	Berkeley	100
Berkeley Flats	BER-E065	Willard Middle School	2425 Stuart St	Berkeley	669
Berkeley Flats	BER-E070	Malcolm X Elementary School	1731 Prince St	Berkeley	552

Area(s)	Evacuation Zone	School Name	Street Address	Municipality	Enrollment
Berkeley Flats	BER-E071	Escuela Bilingue Internacional School	410 Alcatraz Ave	Berkeley	324
Berkeley Flats	BER-E073	Emerson Elementary School	2800 Forest Ave	Berkeley	323
Berkeley Flats	BER-E073	Maybeck High School	2727 College Ave	Berkeley	121
North Berkeley Hills	BER-E001	Thousand Oaks Elementary School	840 Colusa Ave	Berkeley	382
North Berkeley Hills	BER-E009	Cragmont Elementary School	830 Regal Rd	Berkeley	331
North Berkeley Hills	BER-E016	Pacific Lutheran Theological Seminary	2770 Marin Ave	Berkeley	50
North Berkeley Hills	BER-E028	Dominican School of Philosophy & Theology	2301 Vine St	Berkeley	100
North Berkeley Hills	BER-E040	Church Divinity School of the Pacific	2451 Ridge Rd	Berkeley	122
North Berkeley Hills	BER-E040	Graduate Theological Union	2400 Ridge Rd	Berkeley	275
North Berkeley Hills	BER-E040	Jesuit School of Theology	1735 LeRoy Ave	Berkeley	112
North Berkeley Hills	BER-E040	Pacific School of Religion	1798 Scenic Ave	Berkeley	139
North Berkeley Hills	BER-E040	Zaytuna College	1712 Euclid Ave	Berkeley	43
South Berkeley Hills	BER-E055	The Wright Institute	2728 Durant Ave	Berkeley	638
South Berkeley Hills	BER-E076	John Muir Elementary School	2955 Claremont Ave	Berkeley	306
UC Berkeley	BER-E042	University of California - Berkeley	Oxford St	Berkeley	44,075
West Berkeley	BER-E047 East	Black Pine Circle School	2027 7th St	Berkeley	347
West Berkeley	BER-E047 East	Rosa Parks Environmental Science School	920 Allston Way	Berkeley	442
West Berkeley	BER-E047 West	VIA Center	2126 6th St	Berkeley	20
TOTAL:				64,409	

Table C-2. Preschools and Day Care Centers within the City of Berkeley

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Enrollment
Berkeley Flats	BER-E014	Berkeley Rose Waldorf School	2515 Hillegass Ave	Berkeley	24
Berkeley Flats	BER-E014	Hearts Leap Beginnings	2640 College Ave	Berkeley	40
Berkeley Flats	BER-E014	Hearts Leap ICRI Preschool	2638 College Ave	Berkeley	70
Berkeley Flats	BER-E022	Berkeley Little School	1611 Hopkins St	Berkeley	42
Berkeley Flats	BER-E024	Ala Costa Center for the Developmentally Disabled	1300 Rose St	Berkeley	58
Berkeley Flats	BER-E026	BUSD - Hopkins Street	1810 Hopkins St	Berkeley	140
Berkeley Flats	BER-E026	Mustard Seed Preschool	1640 Hopkins St	Berkeley	66
Berkeley Flats	BER-E027	Jewish Community Ctr of The East Bay-Berkeley	1414 Walnut St	Berkeley	75
Berkeley Flats	BER-E036	Cedar Creek Montessori School	1600 Sacramento St	Berkeley	40
Berkeley Flats	BER-E036	Woolly Mammoth Childcare & Preschool	1333 University Ave	Berkeley	69
Berkeley Flats	BER-E038	Berkeley Montessori School	2030 Francisco St	Berkeley	119
Berkeley Flats	BER-E038	The New School of Berkeley	1606 Bonita	Berkeley	48
Berkeley Flats	BER-E038	The New School of Berkeley-Schoolage	1924 Cedar St	Berkeley	45
Berkeley Flats	BER-E039	Hearts Leap North	2220 Cedar St	Berkeley	45
Berkeley Flats	BER-E045	Berkeley Special Education Preschool	2134 Milk Jr. Way	Berkeley	90
Berkeley Flats	BER-E045	Berkeley YMCA EHS - Vera Casey	2246 Martin Luther King Jr Way	Berkeley	26
Berkeley Flats	BER-E045	Congregation Beth Israel-Gan Shalom	2230-32 Jefferson St	Berkeley	32
Berkeley Flats	BER-E045	Little Elephant Montessori, Inc.	2008 McGee Ave	Berkeley	24
Berkeley Flats	BER-E045	Shu Ren International School	2125 Jefferson Ave	Berkeley	179
Berkeley Flats	BER-E046	Berkeley International Montessori School	1227 Bancroft Way	Berkeley	21
Berkeley Flats	BER-E046	Child Education Center	2112 Browning St	Berkeley	107
Berkeley Flats	BER-E046	Congregation Netivot Shalom	1316 University Ave	Berkeley	30
Berkeley Flats	BER-E046	Little Beans Preschool	2117 Acton St	Berkeley	40
Berkeley Flats	BER-E046	Rosemarie's Motivational Preschool	1141 Bancroft Way	Berkeley	22
Berkeley Flats	BER-E053	BUSD - King Child Development Center	1939 Ward St	Berkeley	108
Berkeley Flats	BER-E054	Cornerstone Children's Center	2407 Dana St	Berkeley	112

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Enrollment
Berkeley Flats	BER-E054	UCB - Dwight Way Center	2427 Dwight Way	Berkeley	42
Berkeley Flats	BER-E054	UCB - Harold E. Jones Child Study Ctr/Childcare	2425 Atherton St	Berkeley	56
Berkeley Flats	BER-E054	UCB - Haste Street Child Development Center	2339 Haste St	Berkeley	92
Berkeley Flats	BER-E063	Berkeley YMCA Head Start - South YMCA	2901 California St	Berkeley	94
Berkeley Flats	BER-E068	Model School Comprehensive Humanistic Learning Ctr	2330 Prince St	Berkeley	63
Berkeley Flats	BER-E068	Through the Looking Glass Early Head Start	3075 Adeline Ave	Berkeley	24
Berkeley Flats	BER-E069	American International Montessori School	3339 Martin Luther King Jr Way	Berkeley	117
Berkeley Flats	BER-E069	Ephesian Children's Center	1907 Harmon Ave	Berkeley	36
Berkeley Flats	BER-E069	Mi Mundo Preschool	1866 Alcatraz Ave	Berkeley	29
Berkeley Flats	BER-E070	VIA Nova Children's School	3032 Martin Luther King Jr Way	Berkeley	45
Berkeley Flats	BER-E073	The Monteverde School	2727 College	Berkeley	30
Berkeley Flats	BER-E073	St. John's Child Care Center	2717 Garber St	Berkeley	45
North Berkeley Hills	BER-E006	Step One School	499 Spruce St	Berkeley	108
North Berkeley Hills	BER-E017	Berkeley Hills Nursery School	1161 Sterling Ave	Berkeley	40
North Berkeley Hills	BER-E020	Childrens Community Center	1140 Walnut St	Berkeley	52
North Berkeley Hills	BER-E021	Dandelion Nursery School, Inc	941 The Alameda	Berkeley	24
North Berkeley Hills	BER-E028	Beth El Nursery School	1301 Oxford St	Berkeley	74
UC Berkeley/South Berkeley Hills	BER-E059	UCB - Clark Kerr Campus Children's Center	2900 Dwight Way, Bldg. #5	Berkeley	29
UC Berkeley/South Berkeley Hills	BER-E059	UCB - Clark Kerr Preschool	2601 Warring St, Bldg. 15	Berkeley	29
South Berkeley Hills	BER-E076	Kids In Motion	2955 Claremont Ave	Berkeley	70
South Berkeley Hills	OKL-E008	Arbor Preschool East	207 Alvarado St	Berkeley	22
West Berkeley	BER-E023 East	BUSD - Franklin Preschool	1460 - 8th St	Berkeley	192
West Berkeley	BER-E023 East	Centro Vida Bilingual Childcare Center	1000 Camelia St	Berkeley	64
West Berkeley	BER-E023 West	Duck's Nest - Berkeley	1411 - 4th St	Berkeley	91
West Berkeley	BER-E023 West	Golden Gate Learning Center	1450 Sixth St	Berkeley	57

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Enrollment
West Berkeley	BER-E035 East	Bahia School Age Program	1718 - 8th St	Berkeley	65
West Berkeley	BER-E035 East	Dolma Child Care Center	1700 - 7th St	Berkeley	14
West Berkeley	BER-E047 East	Berkeley YMCA Head Start - West	2009 10th St	Berkeley	86
West Berkeley	BER-E047 East	Nia House Learning Center	2234 - 9th St	Berkeley	94
West Berkeley	BER-E050 East	Ecole Bilingue De Berkeley	1009 Heinz Ave	Berkeley	426
West Berkeley	BER-E050 East	Global Montessori International School	2830 - 9th St	Berkeley	90
West Berkeley	BER-E050 East	Pixar Child Development Center	2600 10th St	Berkeley	108
West Berkeley	BER-E050 East	Sunshine Preschool (CEID)	1035 Grayson St, Rm #8	Berkeley	45
West Berkeley	BER-E050 West	Aquatic Park School	830 Heinz Ave	Berkeley	77
				TOTAL:	4,202

Table C-3. Medical Facilities within the City of Berkeley

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Current Census	Ambulatory Patients	Wheel-chair Patients	Bed-ridden Patients
Berkeley Flats	BER-E045	Silverado Memory Care Center	2235 Sacramento St	Berkeley	87	37	22	28
Berkeley Flats	BER-E046	Chaparral House	1309 Allston Way	Berkeley	42	6	18	18
Berkeley Flats	BER-E047 East	Elegance Berkeley	2100 San Pablo Ave	Berkeley	47	20	12	15
Berkeley Flats	BER-E053	Alta Bates Summit Medical Center - Herrick Campus	2001 Dwight Way	Berkeley	58	58	0	0
Berkeley Flats	BER-E061	Kyakameena Care Center	2131 Carleton St	Berkeley	60	26	15	19
Berkeley Flats	BER-E064	Berkeley Pines Care Center	2223 Ashby Ave	Berkeley	32	4	18	10
Berkeley Flats	BER-E064	Elmwood Care Center	2829 Shattuck Ave	Berkeley	77	33	19	25
Berkeley Flats	BER-E067	Alta Bates Summit Medical Center - Alta Bates Campus	2450 Ashby Ave	Berkeley	183	73	37	73
Berkeley Flats	BER-E068	Ashby Care Center	2270 Ashby Ave	Berkeley	29	5	14	10
North Berkeley Hills	BER-E012	New Bridge Foundation	2325 Hearst Ave & 1816 Scenic Ave	Berkeley	45	20	14	11
UC Berkeley/South Berkeley Hills	BER-E059	Redwood Gardens Apartments	2951 Derby St	Berkeley	168	76	50	42
Berkeley Flats	BER-E061	Other medical facilities within the city ¹		Berkeley	10	10	-	-
Berkeley Flats	BER-E068			Berkeley	23	23	-	-
TOTAL:					861	391	219	251

¹ In addition to the medical facilities identified by the City of Berkeley, this table also includes data obtained from the 2020 Census, which gathered population data for skilled nursing facilities at the census block level. See Section 3, Sub-section 3.5.1 for additional information.

Table C-4. Juvenile Homes² within the City of Berkeley

Area	Evacuation Zone	Facility Name	Street Address	Municipality	Current Census
Berkeley Flats	BER-E070	Juvenile homes within the city		Berkeley	2
West Berkeley	BER-E047 West			Berkeley	3
West Berkeley	BER-E047 East			Berkeley	4
TOTAL:					9

Table C-5. Major Employers³ within the City of Berkeley

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Employees Commuting into the City by Public Transit	Employees Commuting into the City by Private Vehicles
Berkeley Flats	BER-E026	Various Locations throughout the city		111	40	71
Berkeley Flats	BER-E027			92	33	59
Berkeley Flats	BER-E036			271	97	174
Berkeley Flats	BER-E037			107	38	69
Berkeley Flats	BER-E038			578	206	372
Berkeley Flats	BER-E044			246	88	158
Berkeley Flats	BER-E044			157	56	101
Berkeley Flats	BER-E044			144	51	93
Berkeley Flats	BER-E044			124	44	80
Berkeley Flats	BER-E044			116	41	75
Berkeley Flats	BER-E044			90	32	58
Berkeley Flats	BER-E045			146	52	94
Berkeley Flats	BER-E053			261	93	168

² The 2020 Census data indicates that 9 people live at juvenile homes within the City of Berkeley. See Section 3, Sub-section 3.5.2 for additional information.

³ The major employer locations identified by the City of Berkeley are shown in Figure C-12. The locations are represented by circles which increase in size proportional to the number of employees commuting into the city. See Section 3, Sub-section 3.4 for detailed information.

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Employees Commuting into the City	Employees Commuting into the City by Public Transit	Employees Commuting into the City by Private Vehicles
Berkeley Flats	BER-E053				87	31	56
Berkeley Flats	BER-E053				87	31	56
Berkeley Flats	BER-E061				89	32	57
Berkeley Flats	BER-E064				179	64	115
Berkeley Flats	BER-E065				288	103	185
Berkeley Flats	BER-E065				116	41	75
Berkeley Flats	BER-E067				1,289	460	829
Berkeley Flats	BER-E067				301	107	194
Berkeley Flats	BER-E067				119	42	77
Berkeley Flats	BER-E067				97	35	62
Berkeley Flats	BER-E068				130	46	84
Berkeley Flats	BER-E069				119	42	77
Berkeley Flats	BER-E069				115	41	74
Berkeley Flats	BER-E069				94	34	60
Lawrence Berkeley National Lab	LBL Zones				3,028	1,081	1,947
South Berkeley Hills	BER-E055				172	61	111
UC Berkeley	BER-E043				11,435	4,082	7,353
UC Berkeley	BER-E043				118	42	76
West Berkeley	BER-E023 East				249	89	160
West Berkeley	BER-E023 East				100	36	64
West Berkeley	BER-E023 East				102	36	66
West Berkeley	BER-E023 West				358	128	230
West Berkeley	BER-E023 West				168	60	108
West Berkeley	BER-E023 West				180	64	116
West Berkeley	BER-E023 West				159	57	102

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Employees Commuting into the City	Employees Commuting into the City by Public Transit	Employees Commuting into the City by Private Vehicles
West Berkeley	BER-E034				126	45	81
West Berkeley	BER-E035 West				728	260	468
West Berkeley	BER-E035 West				142	51	91
West Berkeley	BER-E047 East				341	122	219
West Berkeley	BER-E047 West				837	299	538
West Berkeley	BER-E047 West				209	75	134
West Berkeley	BER-E047 West				158	56	102
West Berkeley	BER-E047 West				89	32	57
West Berkeley	BER-E050 East				279	100	179
West Berkeley	BER-E050 East				129	46	83
West Berkeley	BER-E050 East				106	38	68
West Berkeley	BER-E050 East				95	34	61
West Berkeley	BER-E050 East				87	31	56
West Berkeley	BER-E050 West				164	59	105
West Berkeley	BER-E050 West				139	50	89
West Berkeley	BER-E050 West				90	32	58
TOTAL:					25,341	9,046	16,295

Table C-6. Tourists⁴ within the Study Area

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Tourists
Berkeley Flats	ALB-E006	Various Locations	throughout the city		151

⁴ The locations of the tourists are unavailable. It is assumed that tourists can visit any tourist attractions within the City of Berkeley and their vehicles are located along streets where street parking is allowed as well as in the parking garages available. See Section 3, Sub-section 3.3 for more details.

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Tourists
Berkeley Flats	ALB-E007				1
Berkeley Flats	ALB-E008				130
Berkeley Flats	BER-E014				207
Berkeley Flats	BER-E022				549
Berkeley Flats	BER-E024				395
Berkeley Flats	BER-E025				271
Berkeley Flats	BER-E026				600
Berkeley Flats	BER-E027				445
Berkeley Flats	BER-E036				751
Berkeley Flats	BER-E037				624
Berkeley Flats	BER-E038				362
Berkeley Flats	BER-E039				180
Berkeley Flats	BER-E044				351
Berkeley Flats	BER-E045				467
Berkeley Flats	BER-E046				500
Berkeley Flats	BER-E051				765
Berkeley Flats	BER-E052				609
Berkeley Flats	BER-E053				612
Berkeley Flats	BER-E054				357
Berkeley Flats	BER-E056				184
Berkeley Flats	BER-E060				119
Berkeley Flats	BER-E061				344
Berkeley Flats	BER-E062				408
Berkeley Flats	BER-E063				569
Berkeley Flats	BER-E064				497
Berkeley Flats	BER-E065				331
Berkeley Flats	BER-E067				246
Berkeley Flats	BER-E068				322

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Tourists
Berkeley Flats	BER-E069				142
Berkeley Flats	BER-E070				568
Berkeley Flats	BER-E071				315
Berkeley Flats	BER-E072				330
Berkeley Flats	BER-E073				397
Berkeley Flats	BER-E074				13
Berkeley Flats	BER-E075				19
Berkeley Flats	OKL-E020				2
Berkeley Flats	OKL-E021				3
Berkeley Flats	OKL-E022				9
Berkeley Flats	OKL-E241				85
Lawrence Berkeley National Lab	LBL-E001				0
Lawrence Berkeley National Lab	LBL-E002				0
Lawrence Berkeley National Lab	LBL-E003				0
Lawrence Berkeley National Lab	LBL-E004				0
Lawrence Berkeley National Lab	LBL-E005				0
Lawrence Berkeley National Lab	LBL-E006				0
North Berkeley Hills	BER-E001				341
North Berkeley Hills	BER-E002				446
North Berkeley Hills	BER-E003				200
North Berkeley Hills	BER-E004				256
North Berkeley Hills	BER-E005				145
North Berkeley Hills	BER-E006				164
North Berkeley Hills	BER-E007				199
North Berkeley Hills	BER-E008				268
North Berkeley Hills	BER-E009				264
North Berkeley Hills	BER-E010				270
North Berkeley Hills	BER-E011				345

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Tourists
North Berkeley Hills	BER-E012				138
North Berkeley Hills	BER-E015				351
North Berkeley Hills	BER-E016				422
North Berkeley Hills	BER-E017				271
North Berkeley Hills	BER-E018				250
North Berkeley Hills	BER-E019				327
North Berkeley Hills	BER-E020				358
North Berkeley Hills	BER-E021				232
North Berkeley Hills	BER-E028				544
North Berkeley Hills	BER-E029				316
North Berkeley Hills	BER-E030				203
North Berkeley Hills	BER-E031				353
North Berkeley Hills	BER-E032				327
North Berkeley Hills	BER-E033				133
North Berkeley Hills	BER-E040				369
South Berkeley Hills	BER-E013				245
South Berkeley Hills	BER-E055				106
South Berkeley Hills	BER-E057				95
South Berkeley Hills	BER-E058				266
UC Berkeley/South Berkeley Hills	BER-E059				220
South Berkeley Hills	BER-E066				38
South Berkeley Hills	BER-E076				193
South Berkeley Hills	BER-E077				10
South Berkeley Hills	BER-E078				178
South Berkeley Hills	OKL-E004				11
South Berkeley Hills	OKL-E007				13
South Berkeley Hills	OKL-E008				115
South Berkeley Hills	OKL-E009				28

Area(s)	Evacuation Zone	Facility Name	Street Address	Municipality	Tourists
South Berkeley Hills	OKL-E010				51
South Berkeley Hills	OKL-E015				22
South Berkeley Hills	OKL-E017				13
South Berkeley Hills	OKL-E018				180
South Berkeley Hills	OKL-E019				82
UC Berkeley	BER-E041				354
UC Berkeley	BER-E042				404
UC Berkeley	BER-E043				439
UC Berkeley	OKL-E001				239
UC Berkeley	OKL-E002				483
West Berkeley	BER-E023 East				427
West Berkeley	BER-E023 West				680
West Berkeley	BER-E034				1,920
West Berkeley	BER-E035 East				316
West Berkeley	BER-E035 West				492
West Berkeley	BER-E047 East				418
West Berkeley	BER-E047 West				512
West Berkeley	BER-E048				537
West Berkeley	BER-E049				85
West Berkeley	BER-E050 East			527	
West Berkeley	BER-E050 West			513	
Shadow Region		Tilden Park Golf Course ⁵	10 Golf Course Dr	Berkeley	260
Shadow Region		Tilden Regional Park ⁵	2501 Grizzly Peak Blvd	Orinda	993
TOTAL:					32,187

⁵ Tilden Park Golf Course and Tilden Regional Park are located in the Shadow Region and considered in this study due to the close proximity to the city.

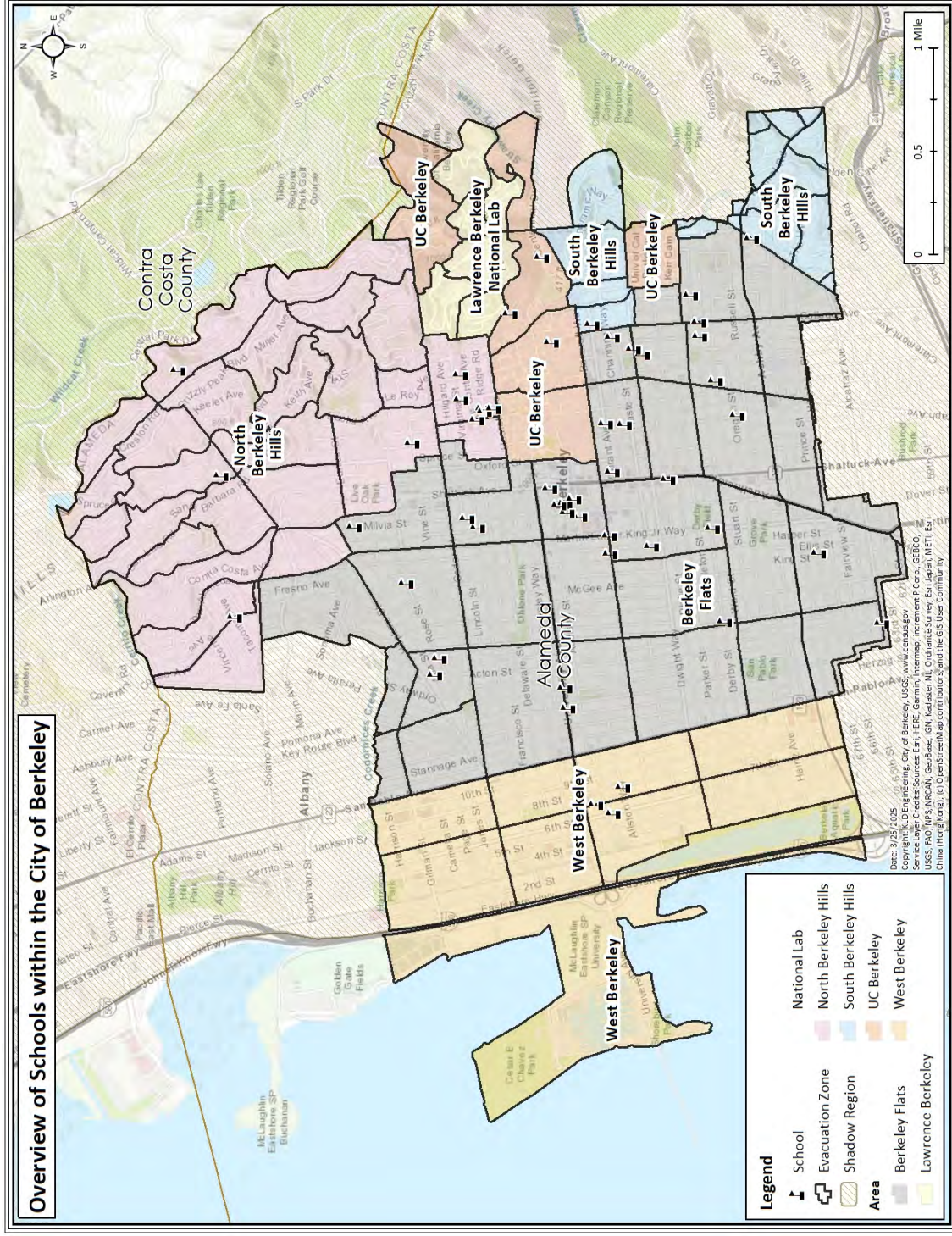


Figure C-1. Overview of K-12 Schools and Higher Education Sites within the City of Berkeley

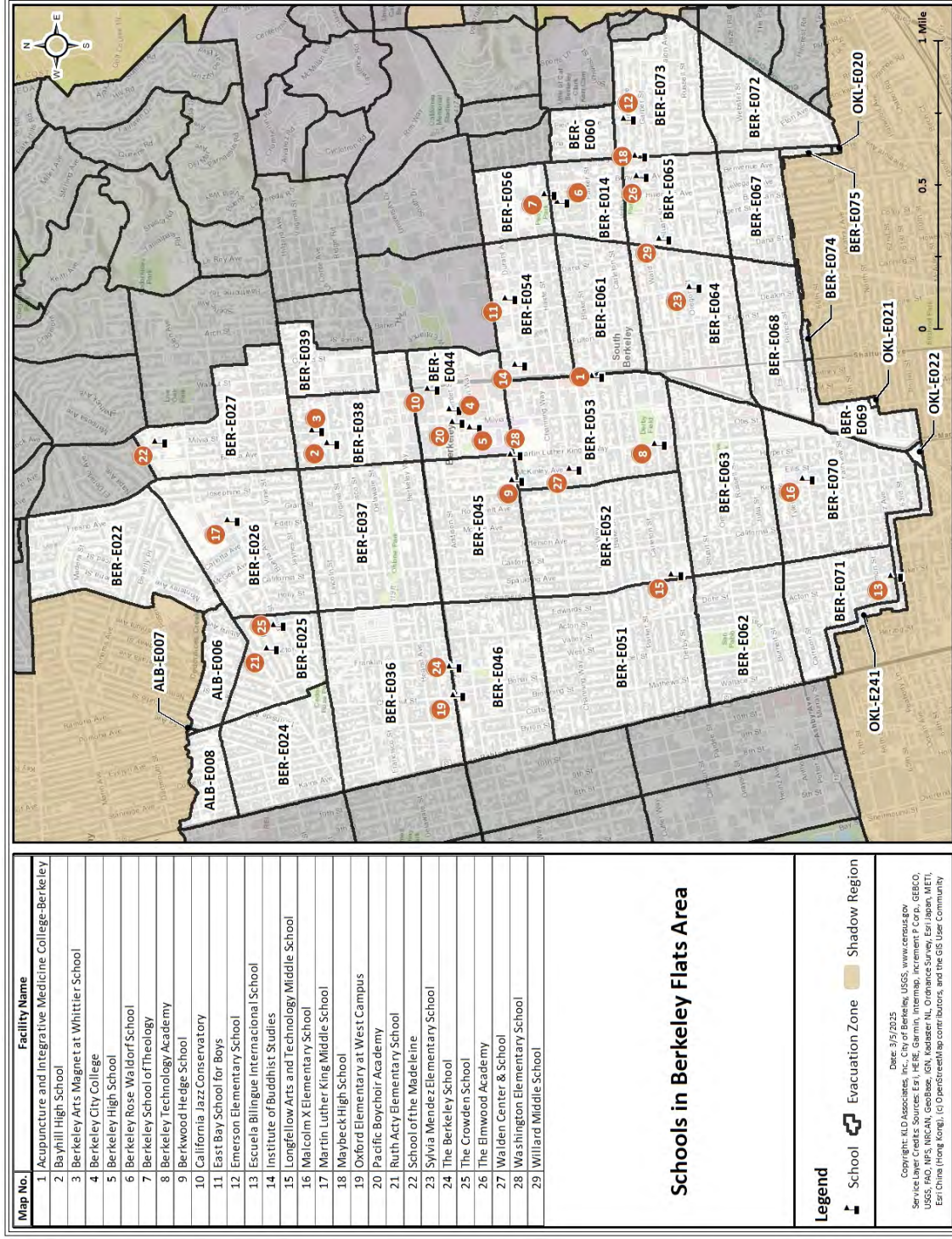


Figure C-2. K-12 Schools and Higher Education Sites in Berkeley Flats Area

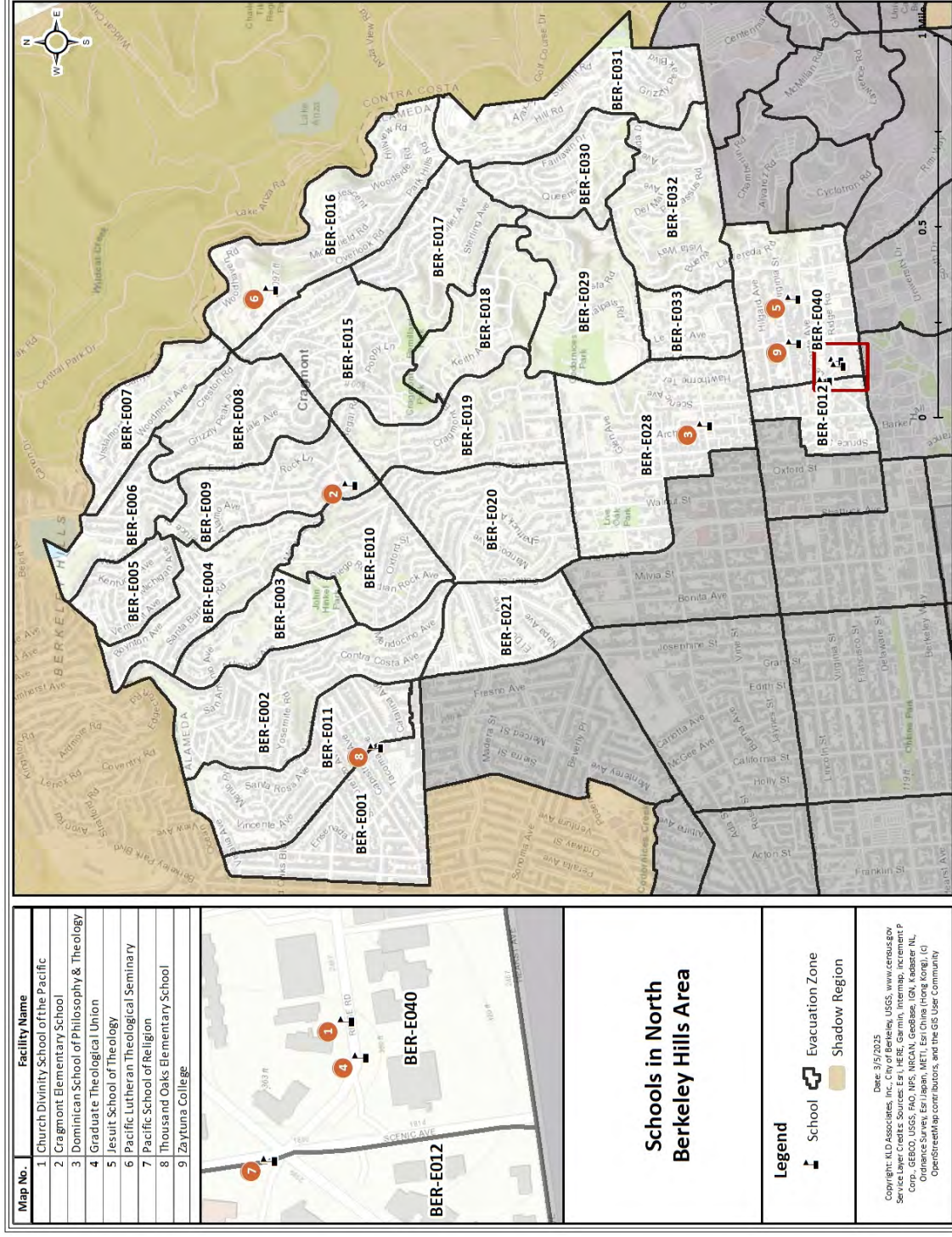
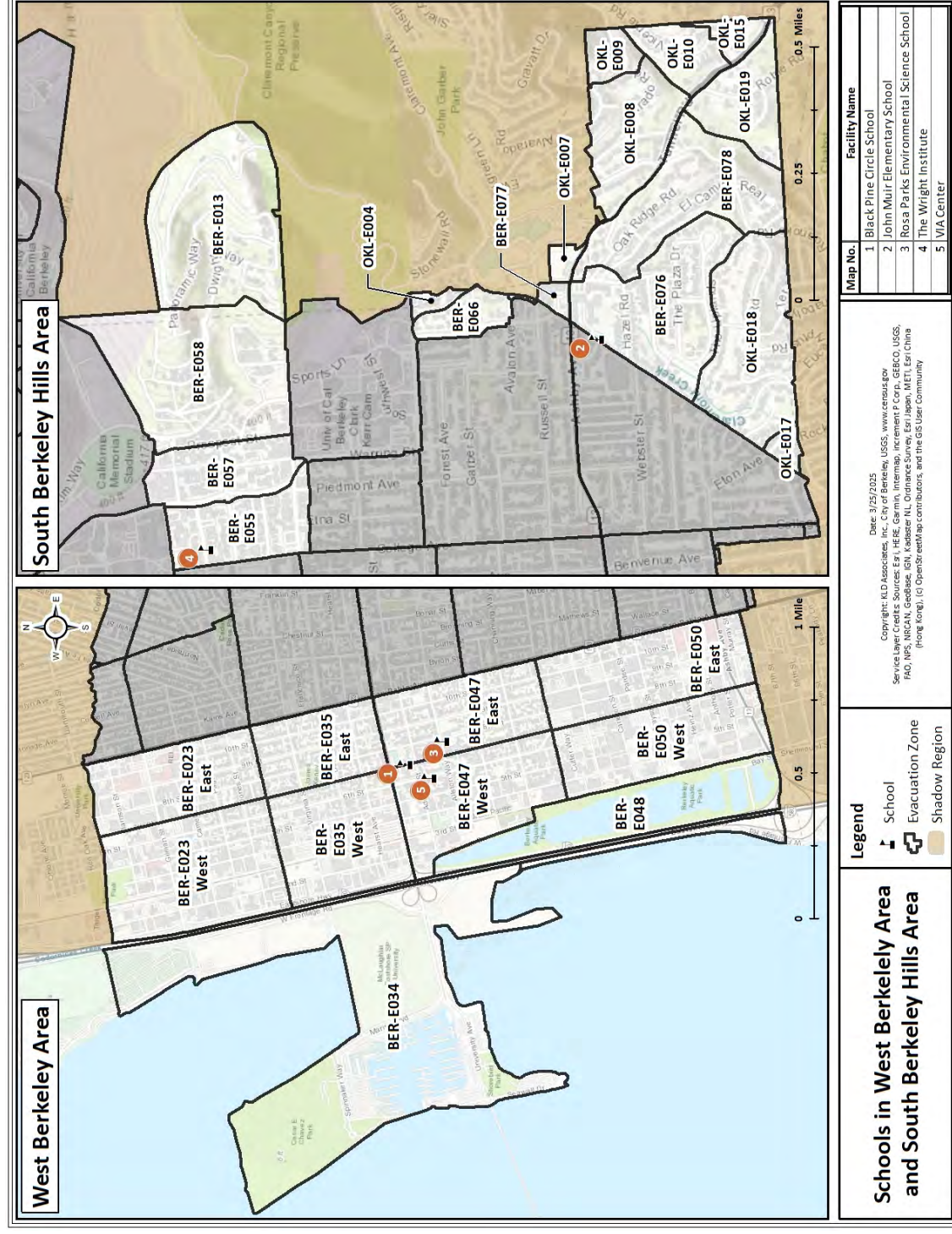


Figure C-3. K-12 Schools and Higher Education Sites in North Berkeley Hills Area



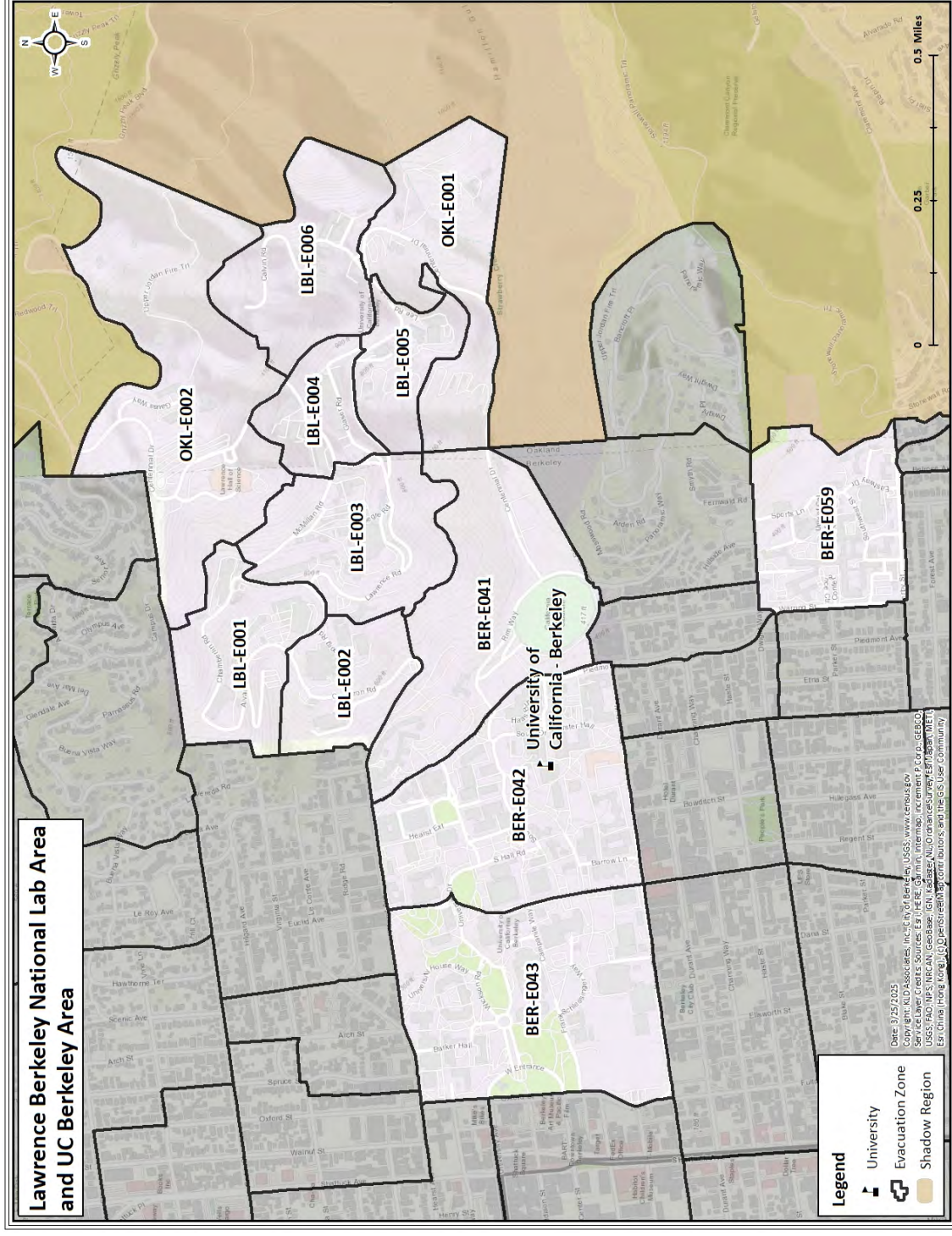


Figure C-5. S K-12 Schools and Higher Education Sites in Lawrence Berkeley National and UC Berkeley Areas

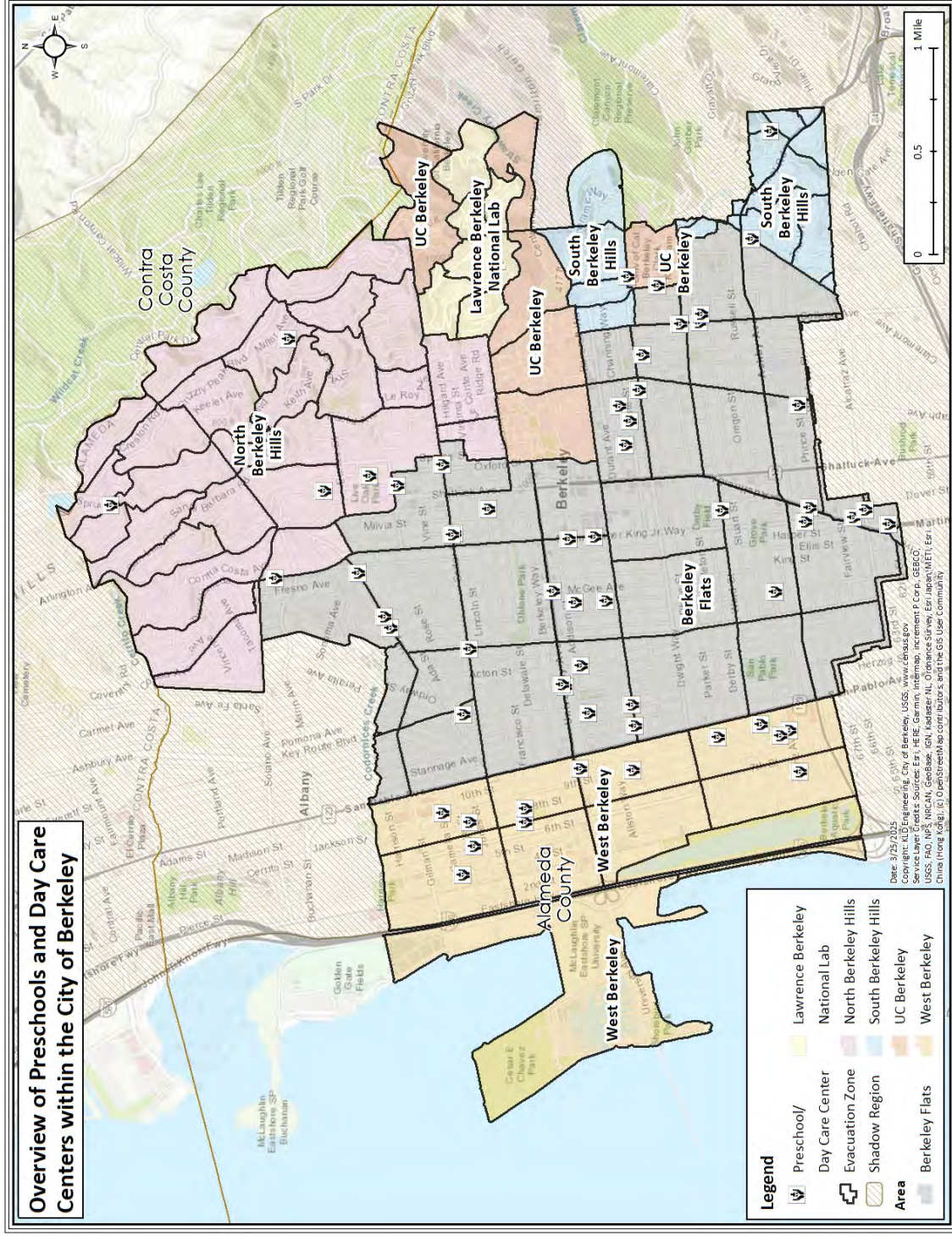
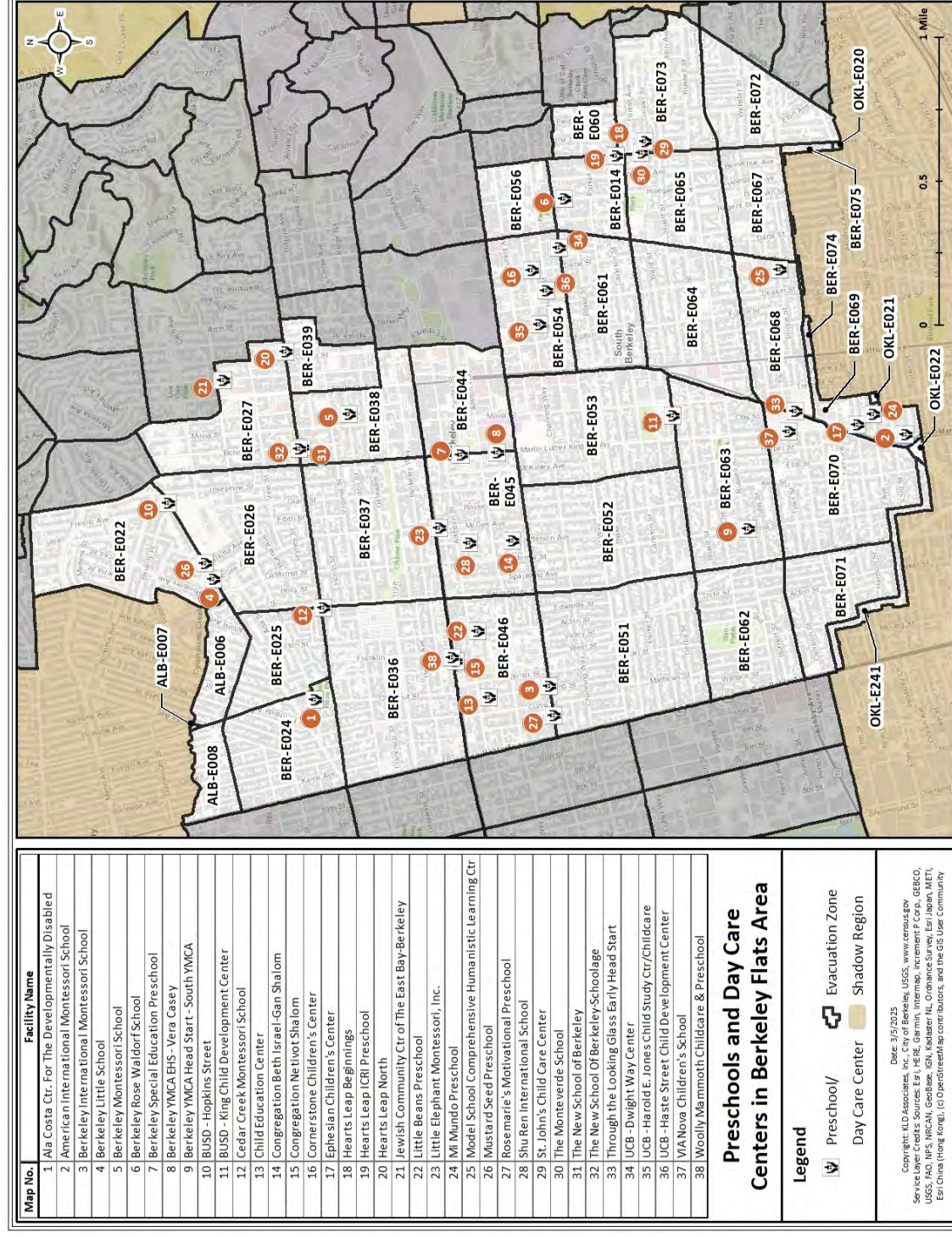


Figure C-6. Overview of Preschools and Day Care Centers within the City of Berkeley



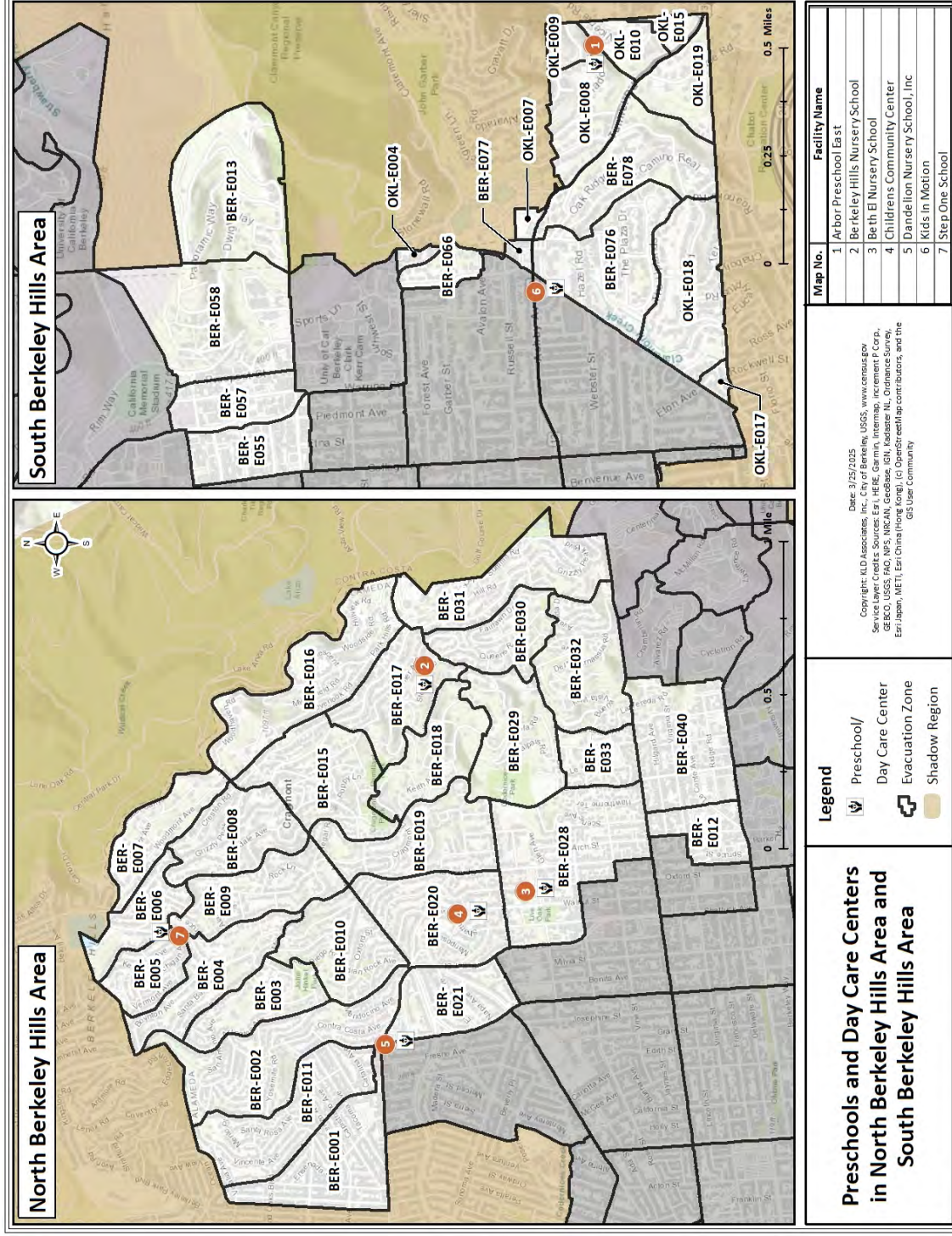
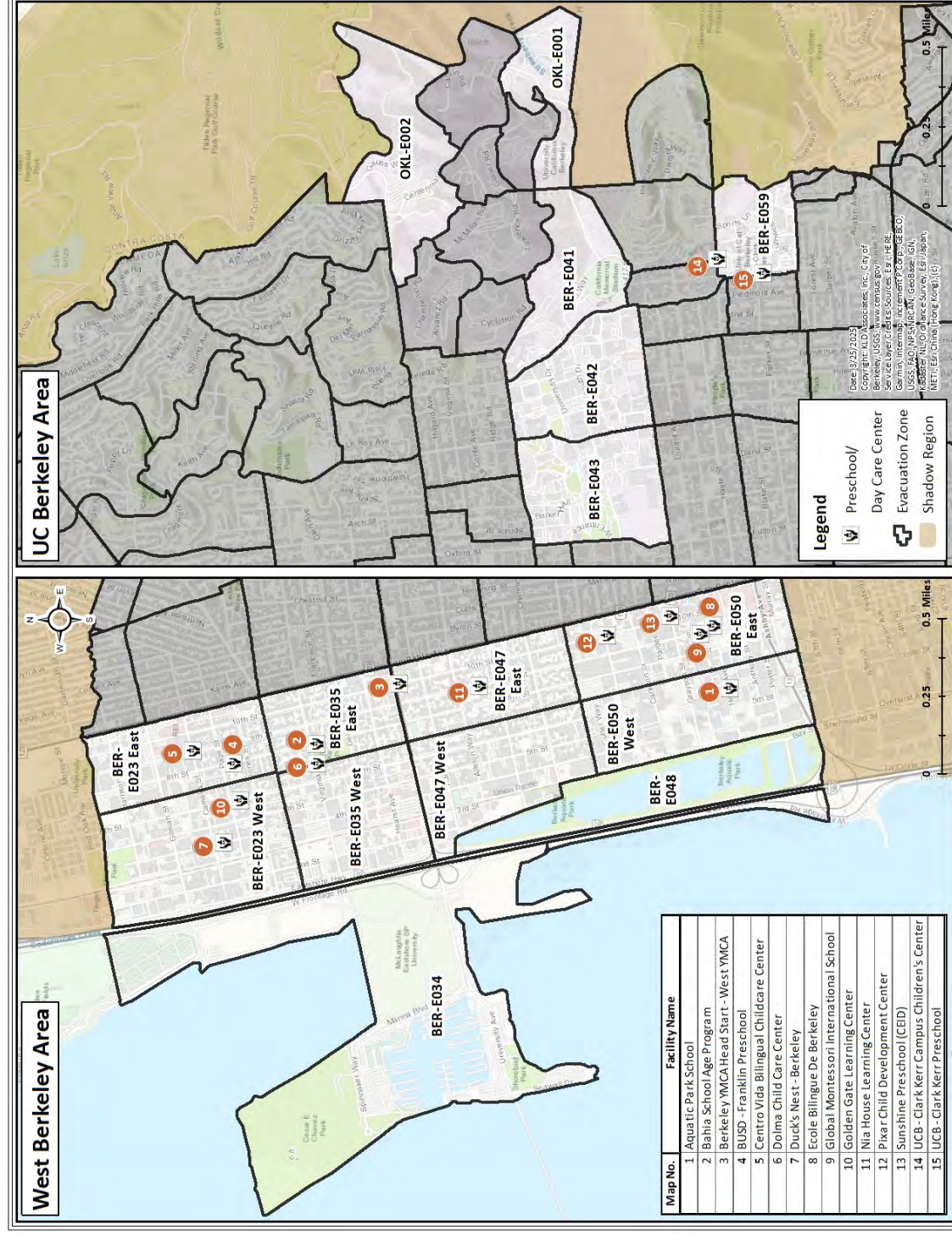


Figure C-8. Preschools and Day Care Centers in North Berkeley Hills and South Berkeley Hills Areas



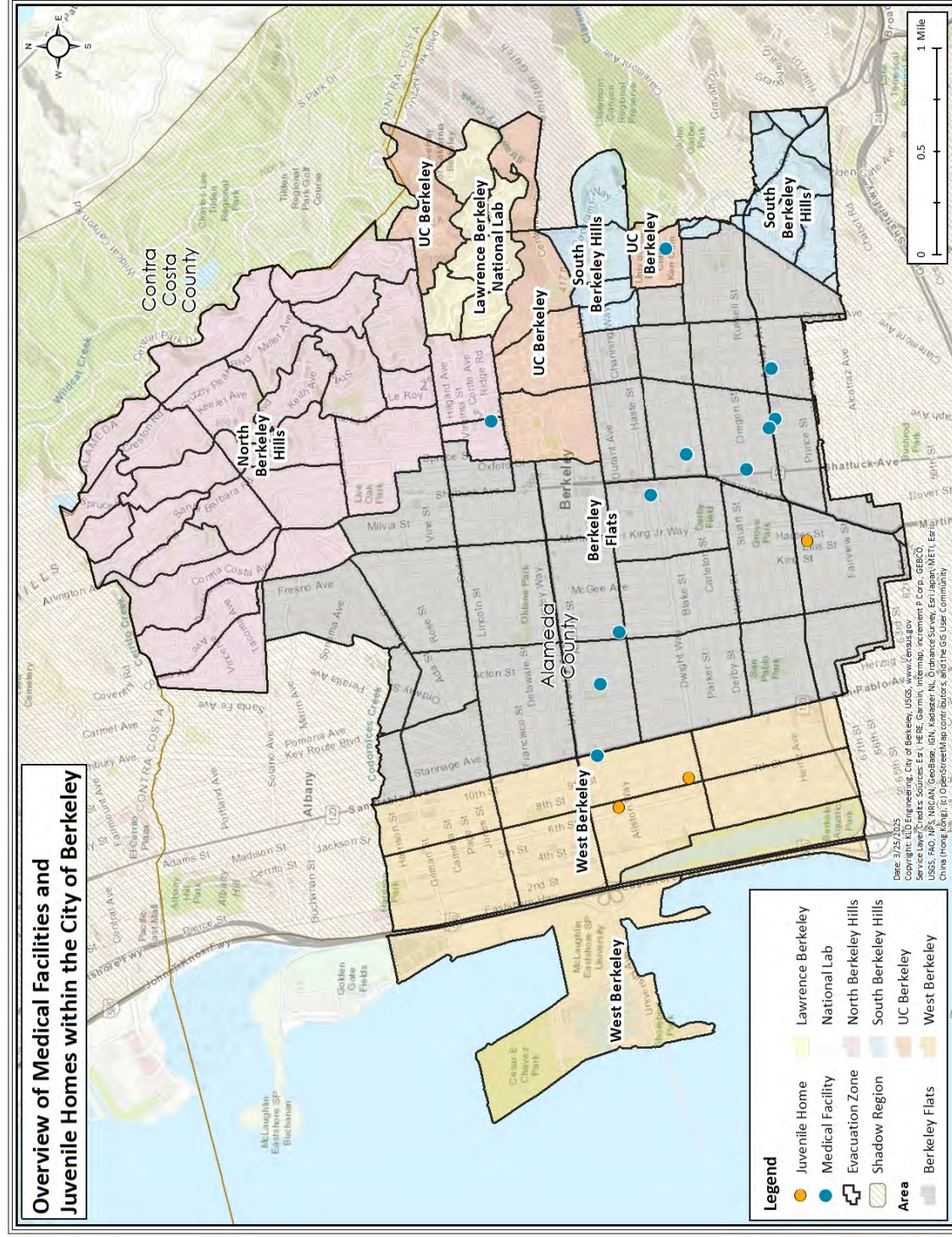


Figure C-10. Overview of Medical Facilities and Juvenile Homes within the City of Berkeley

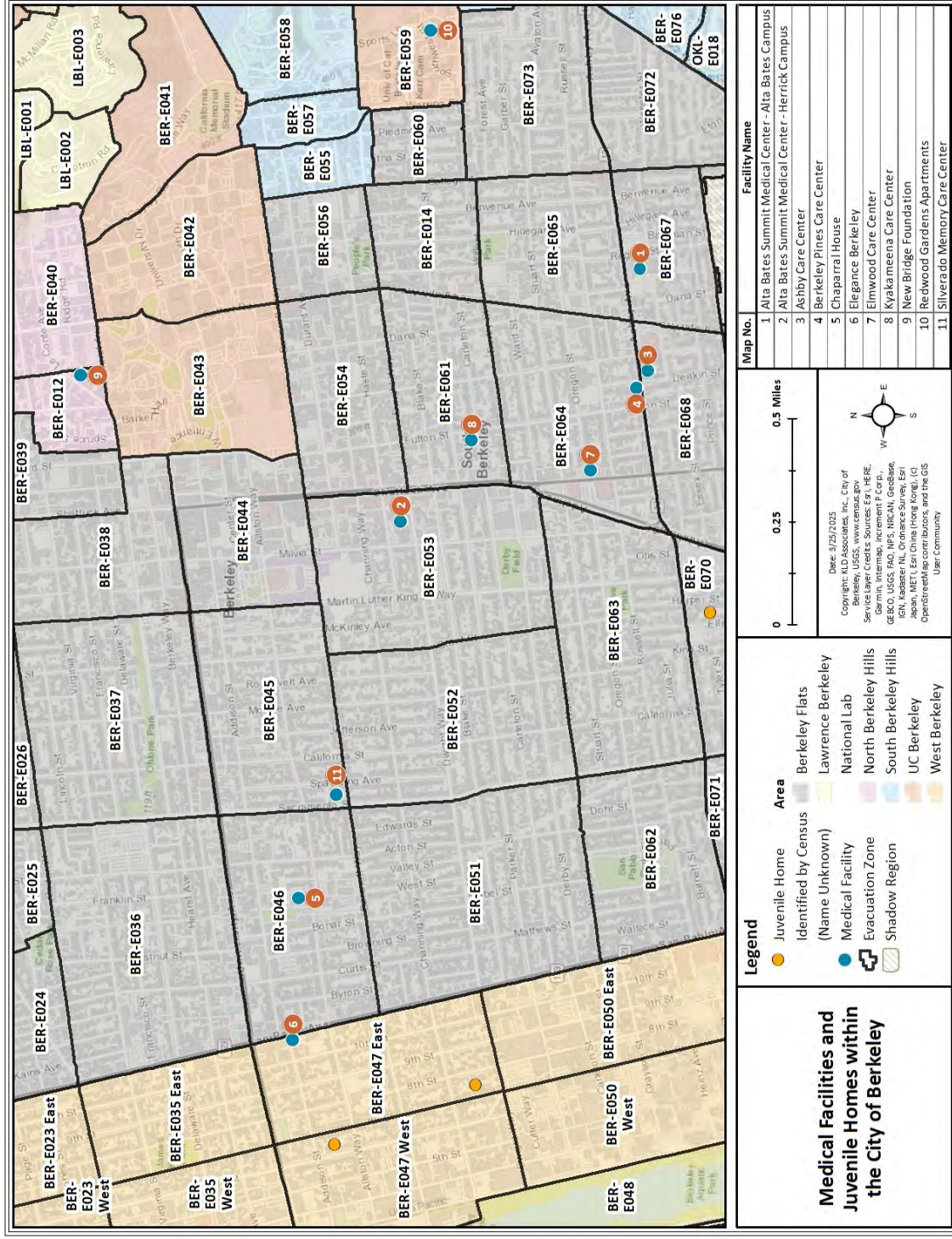


Figure C-11. Medical Facilities and Juvenile Homes within the City of Berkeley

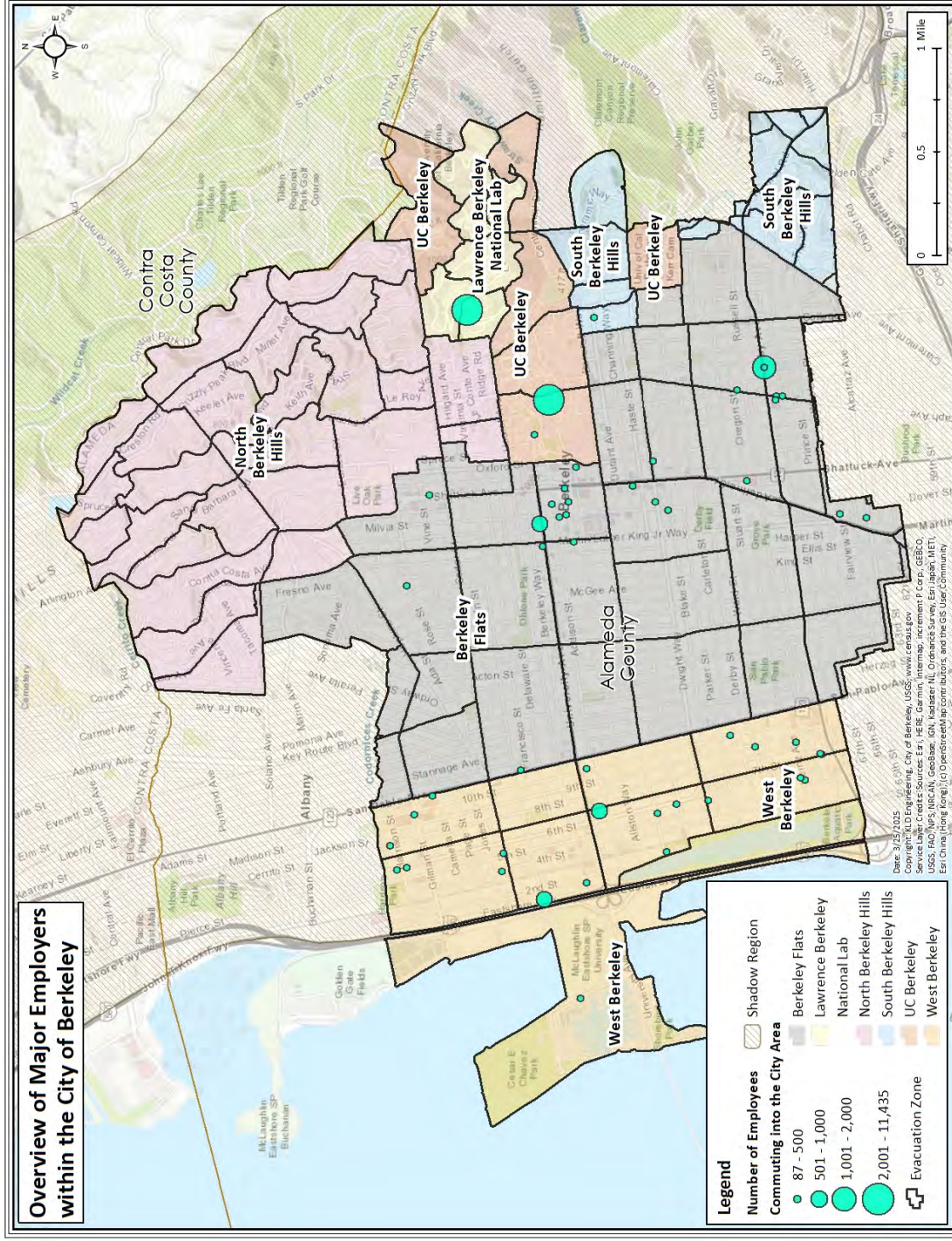


Figure C-12. Overview of Major Employers within the City of Berkeley

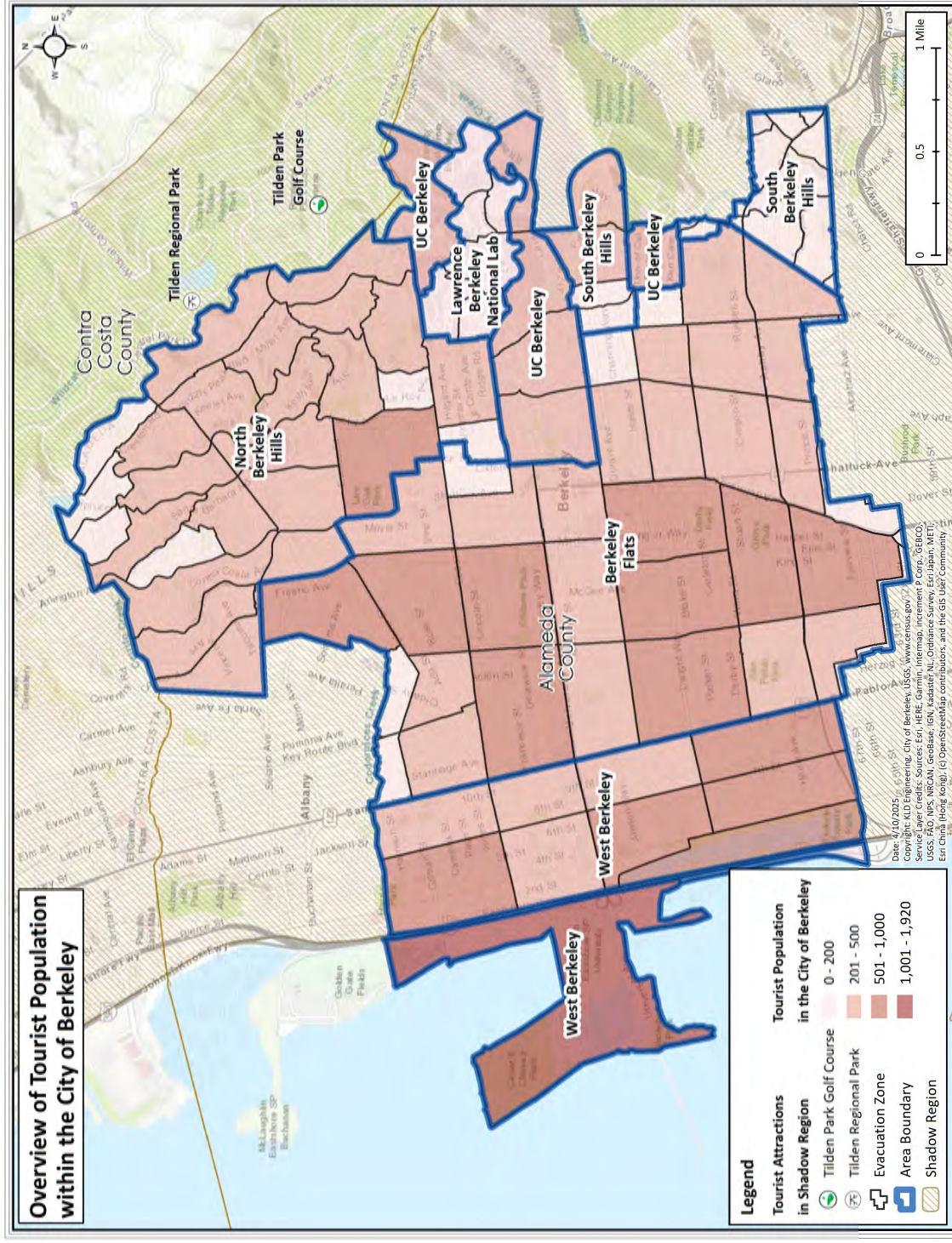


Figure C-13. Overview of Tourist Population within the City of Berkeley

APPENDIX D

Demographic Survey

D. DEMOGRAPHIC SURVEY

This appendix presents the results obtained from a Demographic Survey that was conducted from August 10 – October 8, 2023 in support of this study. Outlined below is the survey sampling plan, results obtained, and survey instrument (See Attachment A).

D.1 Introduction

The analyses conducted in this study require the identification of travel patterns, car ownership and household size of the population. Demographic information can be obtained from Census data; however, the use of this data has several limitations when applied to emergency planning. First, the Census data do not encompass the range of information needed to identify the time required for preliminary activities (mobilization) that must be undertaken prior to evacuating the area. Secondly, Census data do not contain attitudinal responses needed from the population within the city and consequently may not accurately represent the anticipated behavioral characteristics of the evacuating populace.

These concerns are addressed by conducting a demographic survey of a representative sample of the study area population. The survey is designed to elicit information from the public concerning family demographics and estimates of response times to well defined events. The design of the survey includes a limited number of questions of the form “What would you do if ...?” and other questions regarding activities with which the respondent is familiar (“How long does it take you to...?”).

D.2 Survey Instrument and Sampling Plan

Attachment A presents the final survey instrument used in this study for the demographic survey. A draft of the instrument was submitted to stakeholders for comment. Comments were received and the survey instrument was modified accordingly, prior to conducting the survey.

The survey results were drawn from the various subdivisions within the city and a statistically reliable sample was obtained Citywide, for residents of the Berkeley Flats, and for residents of the Berkeley hills. A total of 1,453 completed surveys were obtained within the city, which corresponds to a sampling error of $\pm 2.5\%$ at the 95% confidence level based on the 2020 Census household data.

D.3 Survey Results

The results of the survey fall into three categories. The first category is household demographic results. Household demographic information includes such factors as household size, automobile ownership, automobile availability, and commuters. The second category of survey results is about evacuation responses. This section contains results regarding how residents in the study area would respond to an evacuation. The third category of results contains time distributions for performing certain pre-evacuation activities. These data are processed to develop the trip generation distributions used in the evacuation modeling effort, as discussed in Section 5.

A review of the survey instrument reveals that several questions have a “Don’t Know” (DK) or “Prefer Not to Say” option for a response. It is accepted practice in conducting surveys of this type to accept the answers of a respondent who offers a DK or “Prefer Not to Say” response for a few questions. To address the issue of occasional DK responses from a large sample, the practice is to assume that the distribution of these responses is the same as the underlying distribution of the positive responses. In effect, the DK responses are ignored, and the distributions are based upon the positive data that is acquired.

D.3.1 Household Demographic Results

Household Size

Figure D-1 presents the distribution of household size within each Area, based on the responses to the demographic survey. The average household contains 2.39¹ people according to the survey results.

Automobile Ownership

The average number of automobiles available per household in the study area is 1.55. The distribution of automobile ownership is presented in Figure D-2. It should be noted that only 7.5% responded that they do not have access to a vehicle. Figure D-3 and Figure D-4 present the automobile availability by household size. As expected, the majority (approximately 97%) of households of 2 or more people have access to at least one vehicle.

Ridesharing

Approximately 87% of the households surveyed responded that they would share a ride with a neighbor, relative, or a friend, if a car was not available to them when advised to evacuate in the event of an emergency (49.1% specified that they would only be able to rideshare if their neighbor/friend were home). Approximately 13% of the households would not rideshare with a neighbor, relative, or friend. Figure D-5 displays these results.

Evacuation Assistance and Specialized Transportation Needs

Six percent of households indicated that someone in the household would need help from someone outside the household (caretaker, personal attendant) to prepare to evacuate or to get to a vehicle.

Figure D-6 presents the percentage of people citywide who will need outside help as described above, along with specialized transportation assistance. Approximately 1.6% require a wheelchair accessible van, 0.2% require an ambulance and 0.4% require other modes of transportation. The remaining 3.8% do not require a specialized vehicle to evacuate.

Note that when compared to the emPOWER data described in Section 3.8 the survey results show lower estimates for people requiring an ambulance to evacuate and higher estimates for people requiring a wheelchair accessible van to evacuate.

¹ The average household size of 2.39 is only reported for informational purposes and was not used in the study. The average household size of 2.61 was used instead, which was taken from the 2020 U.S., as stated in Section 3.1.

Commuters

Figure D-7 presents the distribution of the number of commuters in each household. Commuters are defined as household members who travel to work or college on a daily basis. The data shows the majority of households (58%) do not have commuters who travel to work or college on a daily basis. There is an average of 0.64 commuters per household in the study area, and approximately 42% of households have at least one commuter who travels to work or college on a daily basis.

Berkeley Marina & UC Berkeley

A question was asked to estimate the respondents who lived in the Berkeley Marina, and/or if they were a UC Berkeley undergraduate student, graduate student, visiting scholar, student researcher, or postdoctoral. 10 respondents live at Berkeley Marina, 31 are UC Berkeley undergraduate students, and 24 are graduate students at UC Berkeley. See Figure D-10.

Commuter Travel Modes

Figure D-8 presents the mode of travel that commuters use on a daily basis. The majority (44.3%) of commuters use their private automobiles to travel to work. 25.3% of commuters walk/bicycle, 6.8% of commuters take a bus, 11.2% of commuters utilize BART, 8.7% use a combination of public transit, and 3.7% of commuters carpool to travel to work. The data shows an average of 1.08 employees per vehicle, assuming 2 people per vehicle – on average – for carpools.

Commuter Work Location

Approximately 51% of households with commuters responded that they work within Zip Codes that belong to the Areas. The other 49% commute outside of the Areas to work.

Number of Days Commuting to Work/College

Figure D-9 presents the distribution of the number of days each commuter travels to work or college. Approximately, 64% of commuters travel to work at least 4 days or more a week, 21% of commuters travel 3 times a week and the remaining 15% travel once or twice a week.

D.3.2 Evacuation Response

Several questions were asked to gauge the population's response to an emergency. These are now discussed:

“Do you have any children attending K-12 school/childcare? If an evacuation is ordered for my home area during the school day, I would:” Approximately 22% of households have children within Areas. Of the 22% of households, as shown in Figure D-10, 83.4% of them will pick up their children at the school during an emergency, 2.5% would wait for buses to bring their children home if there is an early dismissal, 4.8% would not be home and would have a trusted guardian pick up their children from school/childcare, 0.6% would not be home and would have a trusted guardian pick up their children after they get off if the bus if there is an early dismissal, 4.5% would not pick up their children or send a guardian to pick up their children, 2.9% would wait for their children to walk/bike home, and the remaining 1.3% have other plans for reuniting with their children.

“How many cars would your household use during an evacuation?” The response is shown in Figure D-11. On average, evacuating households would use 1.14 vehicles.

“Would your family await the return of other family members prior to evacuating the area?”

Of the survey participants who responded, approximately 30% said they would await the return of other family members before evacuating and the remaining 70% indicated that they would not await the return of other family members before evacuating.

“An evacuation is occurring in parts of Berkeley and you are worried. Emergency officials say that your area is not in danger. People in your area are told to stay off the roads to help the evacuation of areas in danger. Would you evacuate/not evacuate?” This question is designed to elicit information regarding compliance with instructions to shelter-in-place (not evacuate).

The results indicate that approximately 90% of households who are advised to shelter at home would do so; the remaining 10% would choose to evacuate the area.

“Emergency officials advise you to evacuate due to an emergency. Where would you evacuate to?” Based on the responses, approximately 61% would evacuate to a friend/relative’s home.

Approximately 6% would evacuate to an evacuation shelter, 23% would evacuate to a hotel, motel, short-term rental (ex. AirBnB/VRBO), or campground, about 5% would evacuate to a second/seasonal home, about 2% responded that it depends on the emergency, and about 2% answered the question as other (work/office, vehicle, UC Berkeley campus, Berkeley marina, etc.). The remaining 1% of households would not evacuate. See Figure D-12 for complete results.

“If emergency officials told your area to evacuate, would you also tell a neighbor or friend in your area to evacuate?” This question is designed to elicit information regarding notification between residents in the study area. Approximately 95% of respondents said they would notify a neighbor or a friend. The remaining 5% said they would not.

“How would you tell your neighbor or friend to evacuate?” This question is designed to see how respondents in the study area would notify neighbors or friends during an evacuation, if they chose to do so. From the respondents who elected to notify a neighbor or friend during an evacuation (approximately 95% of respondents), 33.1% would notify using text message, 20.6% would make a phone call, 2.6% would use social media outlets, 42.6% of respondents would notify their neighbors in person, 0.8% of respondents would notify using a neighborhood email group, and 0.3% indicated they would use other methods. Figure D-13 displays these results.

“How would you rate your cell phone coverage near your home?” Figure D-14 presents how the respondents rated the cell phone coverage within their area. The purpose of this question was to gain insight into how well a cell phone-based alert and/or notification would be received. This question was added for informational purposes only and was not used in this study. As shown in the figure, the data is more heavily weighted towards good or better with 75% of respondents rating their cell phone reception in their area as good, very good, or excellent. Approximately 24% rated cell phone coverage as fair, poor or very poor in their area and the remaining 1% indicated that they do not have a cell phone.

“Do you have an AT&T landline?” Approximately 27% of the households have an AT&T landline, and 73% do not have an AT&T landline.

“Do you have any pet(s) and/or animal(s)? What type(s) of pet and/or animal do you have?”

Approximately 50% of households have pets. Approximately 38.4% of households have small pets/animals and 11.3% have large pets/animals, and less than 0.1% report having large livestock. Figure D-15 displays these results.

“What would you do with your pet(s) and/or animal(s) if you had to evacuate?” Due to an error in the questionnaire, the responses to this question are omitted from the report.

D.3.3 Time Distribution Results

The survey asked several questions about the amount of time it takes to perform certain pre-evacuation activities. These activities involve actions taken by residents during the course of their day-to-day lives. Thus, the answers fall within the realm of the responder’s experience.

The mobilization distributions provided below are the result of having applied the analysis described in Section 5.4.1 on the component activities of the mobilization.

“How long would it take you to notify a neighbor or friend to evacuate?” This question is designed to see how long it would take respondents to notify a neighbor or friend should they choose to do so. This distribution is displayed in Figure D-16 from the respondents who elected to notify a neighbor or friend during an evacuation. Approximately 85% of respondents can notify a neighbor or friend within 10 minutes; 100% within 20 minutes.

“How long would it take you to pick up your children from school?” This question is designed to see how long it would take respondents to pick up their children from school. This distribution is displayed in Figure D-17 from the respondents have school children, approximately 64% can pick up their school children within 20 minutes and all (100%) children are pick up within 45 minutes.

“How long does it take the commuter to complete preparation for leaving work/college?” Figure D-18 presents the cumulative distribution; in all cases, the activity is completed by 35 minutes. Approximately 90% can leave in less than 25 minutes.

“How long would it take the commuter to travel home?” Figure D-19 presents the work to home travel time for the Areas. Approximately 80% of commuters can arrive home within 40 minutes of leaving work; all within 90 minutes.

“If an emergency evacuation was ordered for your area, how long would it take your household to get ready to leave? Think about time to pack clothing, medications, other critical items, to prepare your pets, secure your home, and pack the car?” Figure D-20 presents the time required to prepare for leaving on an evacuation trip. In many ways this activity mimics a family’s preparation for a short holiday or weekend away from home. Hence, the responses represent the experience of the responder in performing similar activities. The distribution shown in Figure D-20 has a long “tail.” Approximately 90% of households can be ready to leave home within 75 minutes; the remaining 10% of households require up to an additional 60 minutes.

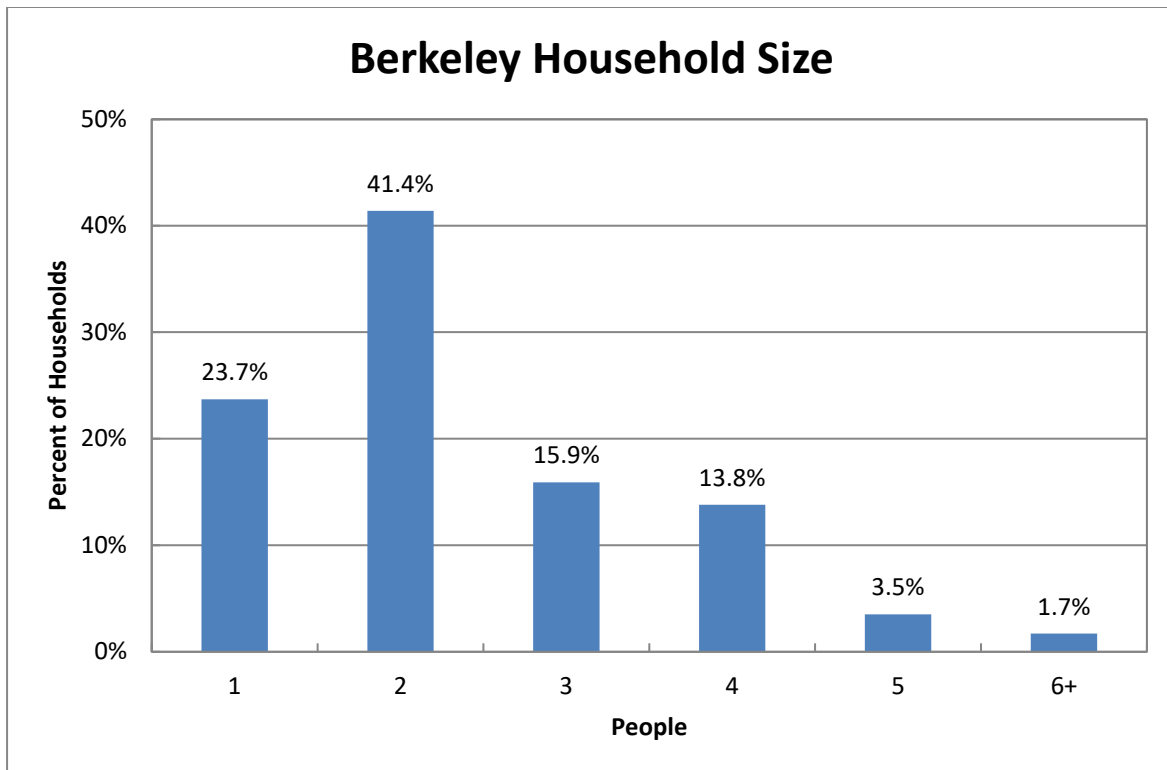


Figure D-1. Household Size in the Study Area

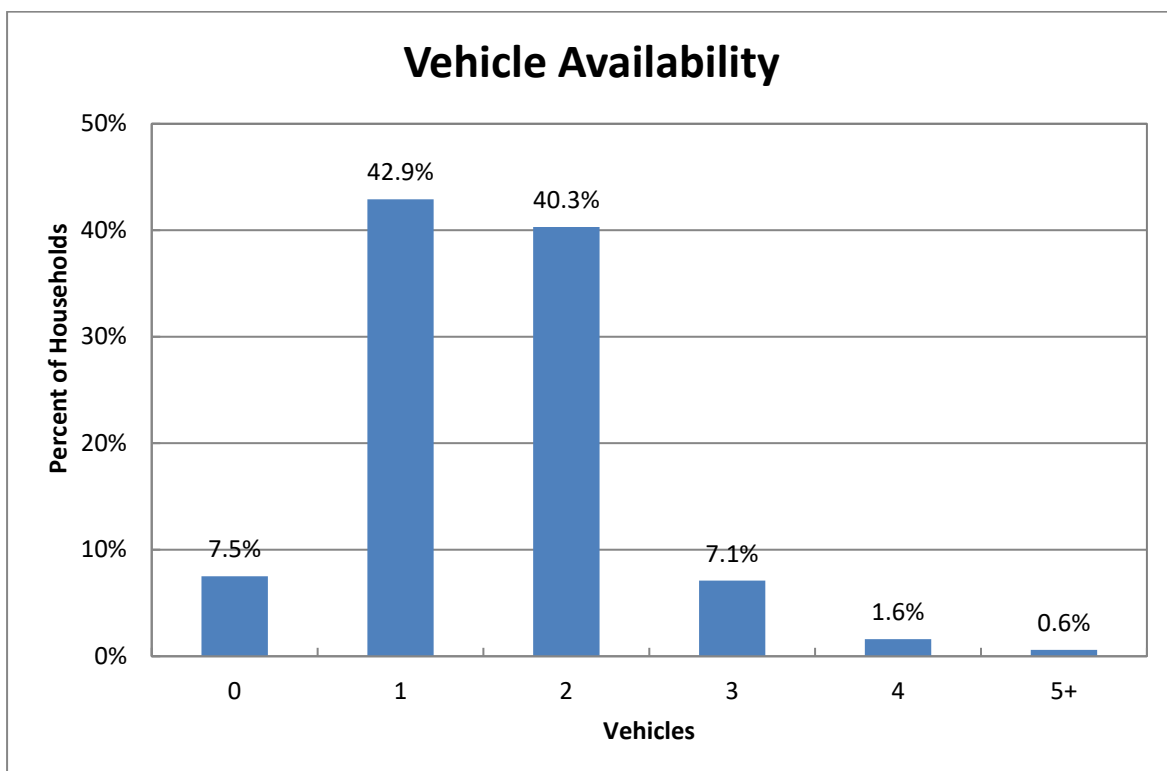


Figure D-2. Vehicle Availability

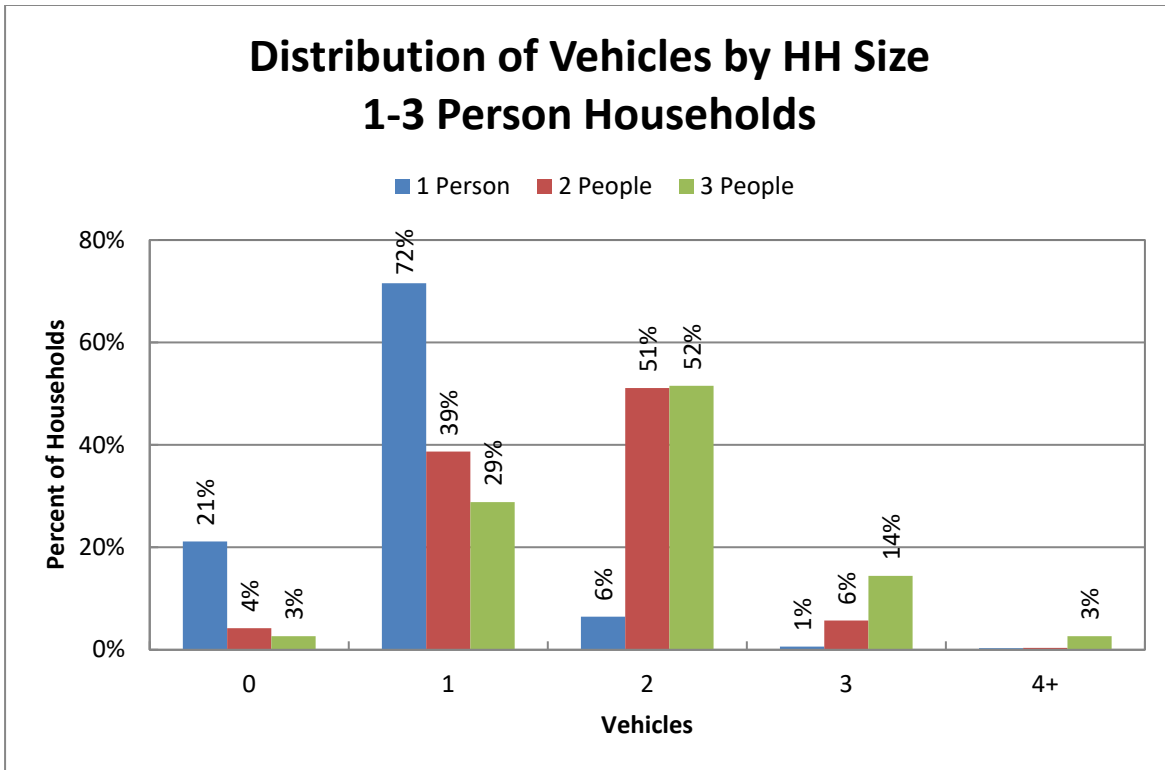


Figure D-3. Vehicle Availability - 1 to 3 Person Households

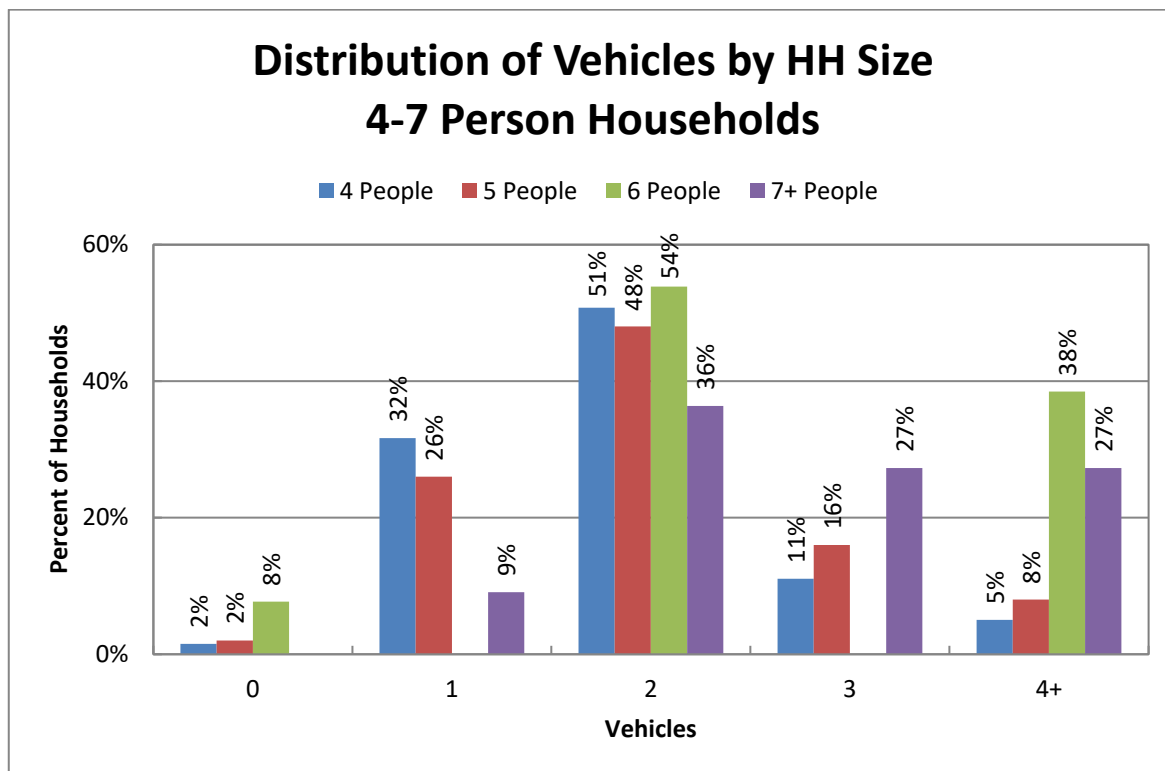


Figure D-4. Vehicle Availability – 4 to 7 Person Households

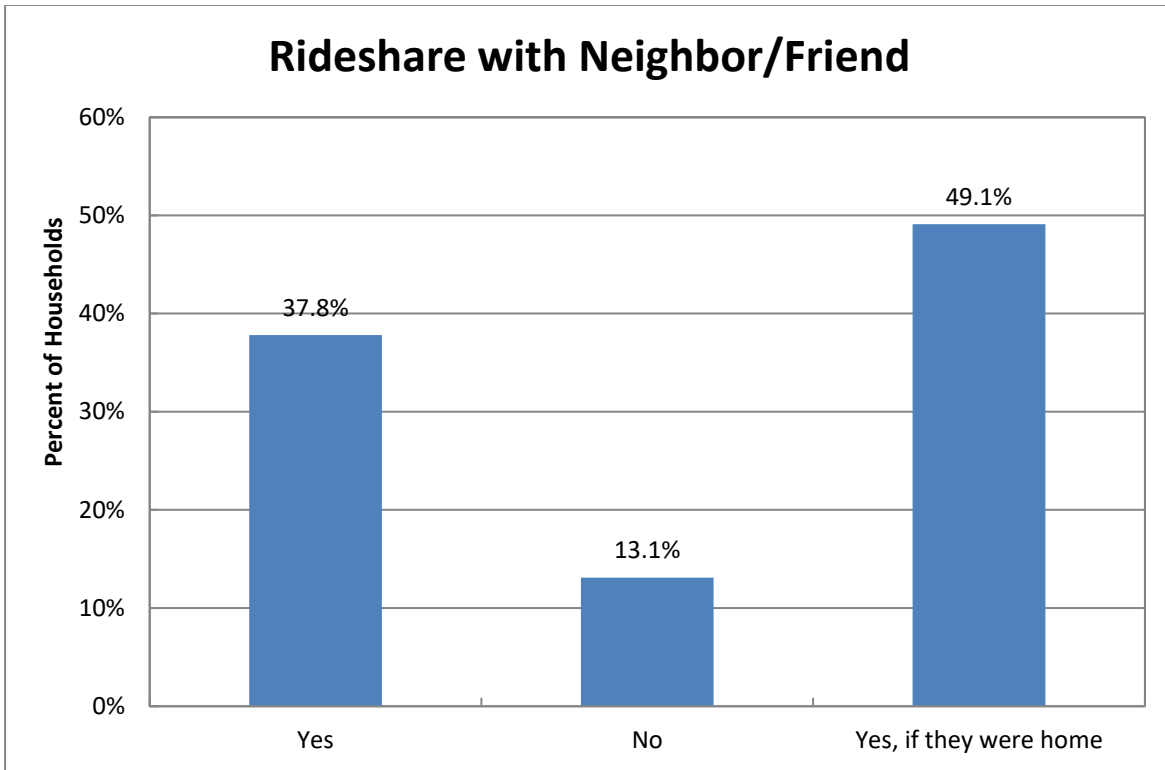


Figure D-5. Rideshare with Neighbor/Friend

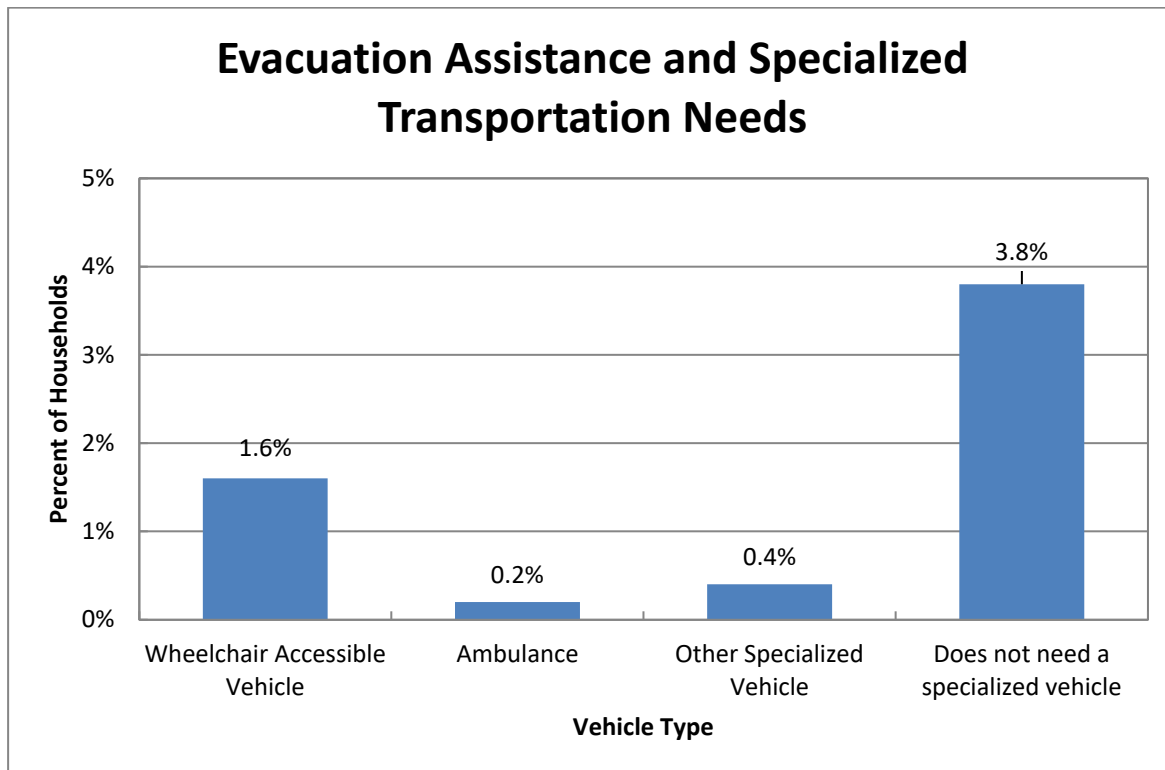


Figure D-6. Specialized Transportation Needs for Households Requiring Evacuation Assistance

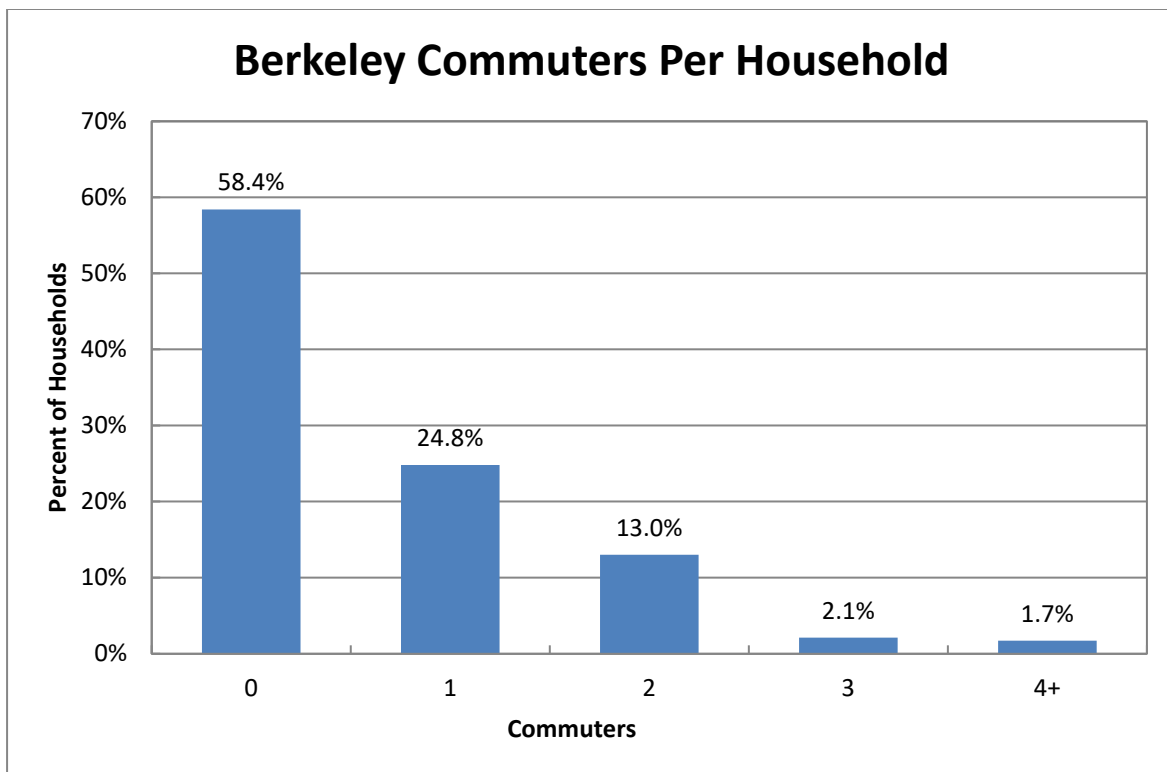


Figure D-7. 5-Day-per-Week Commuters in Households in the Study Area

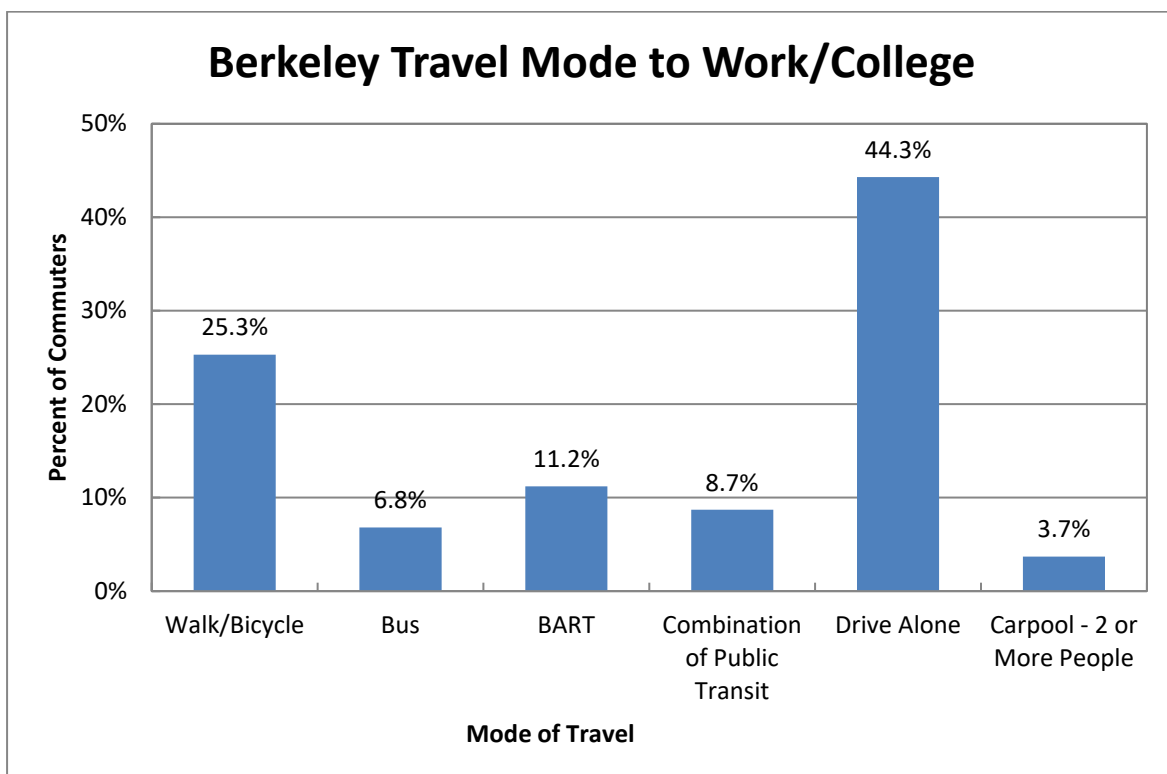


Figure D-8. Travel Modes to Work/College in the Study Area

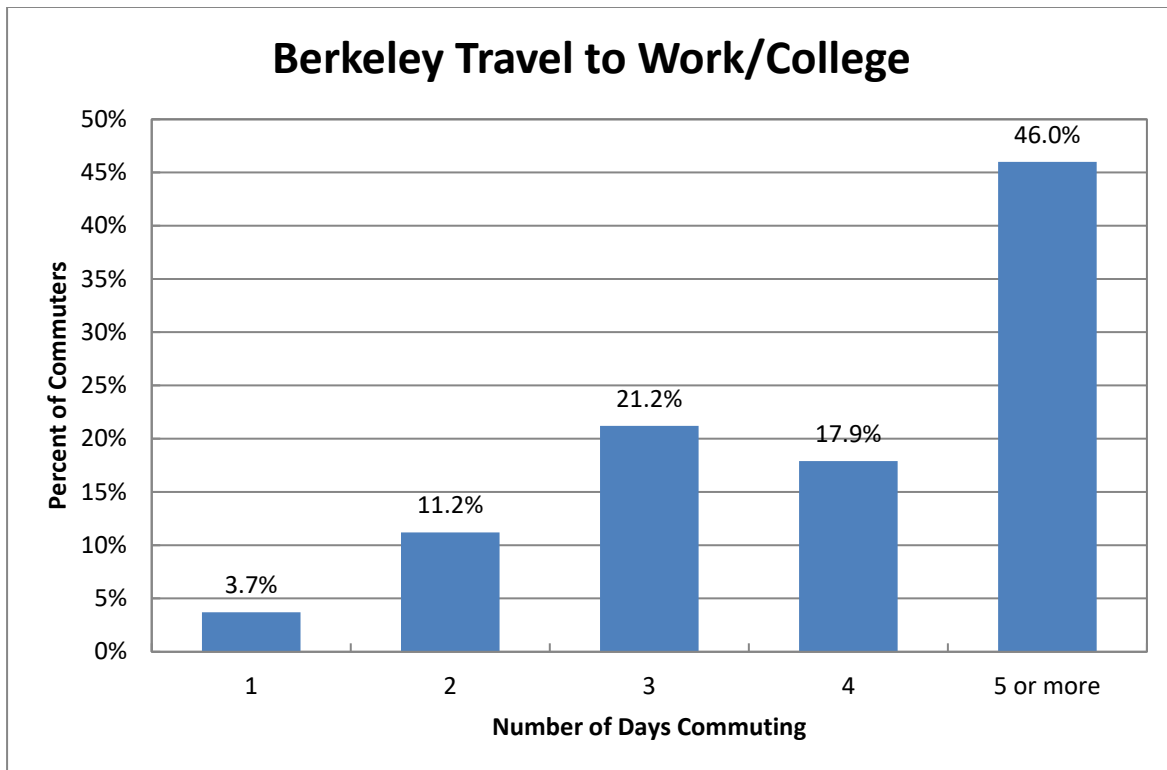


Figure D-9. Number of Days Commuting to Work/College

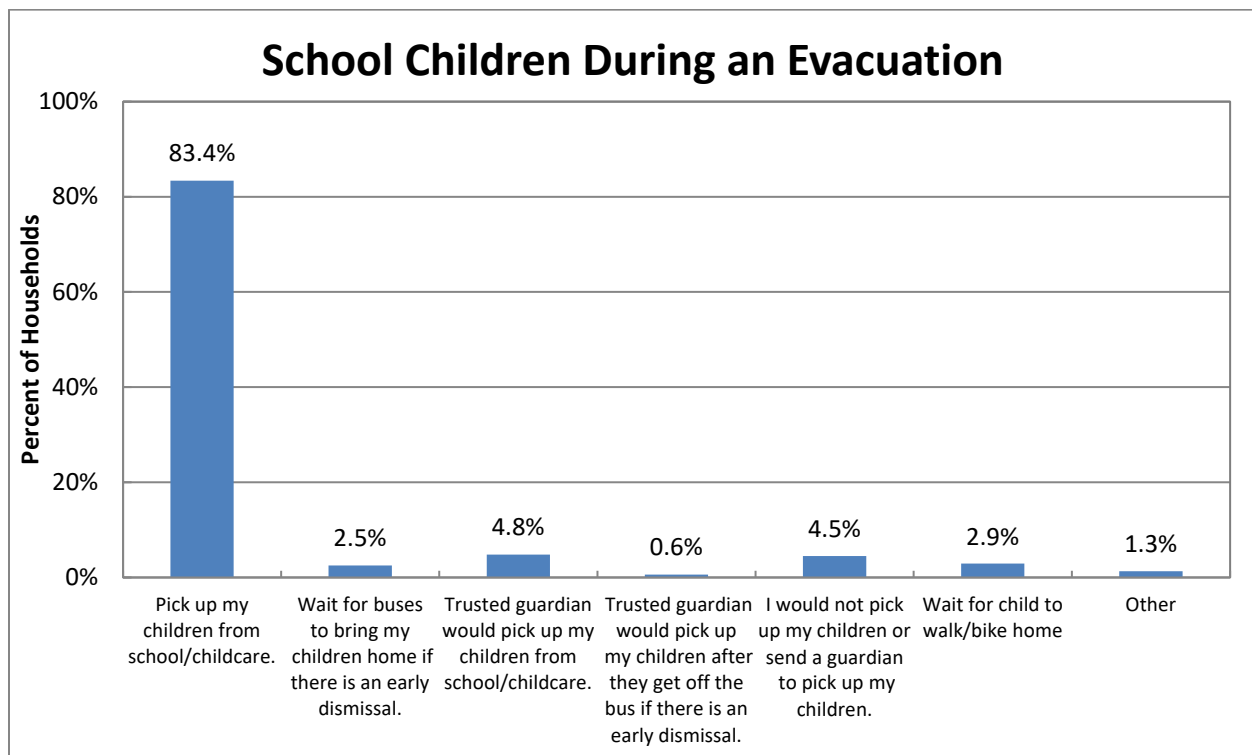


Figure D-10. School Children During an Evacuation

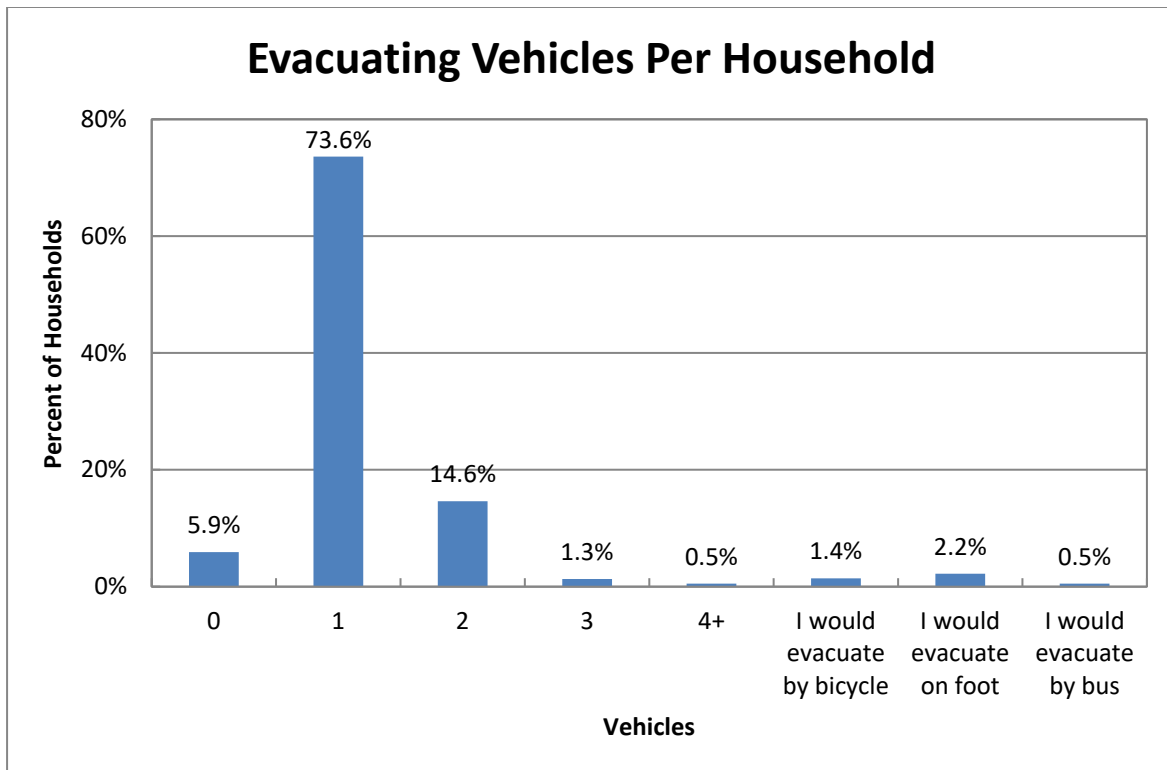


Figure D-11. Number of Vehicles Used for Evacuation

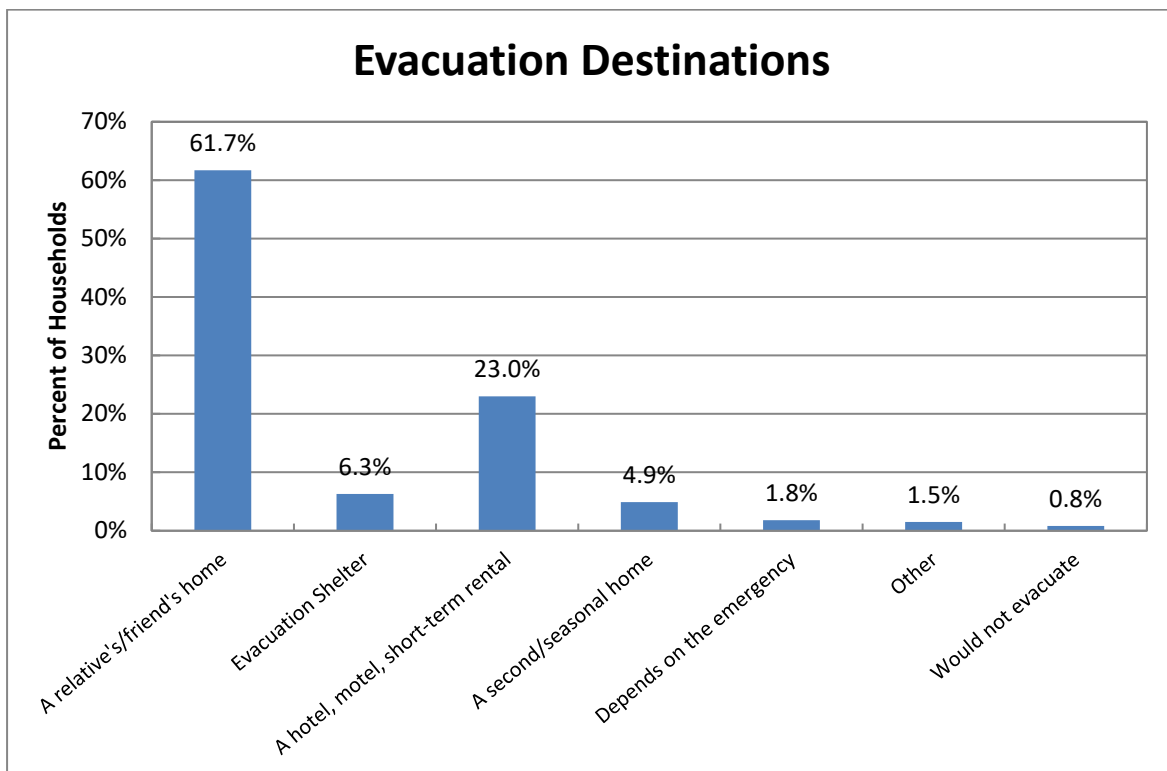


Figure D-12. Study Area Evacuation Destinations

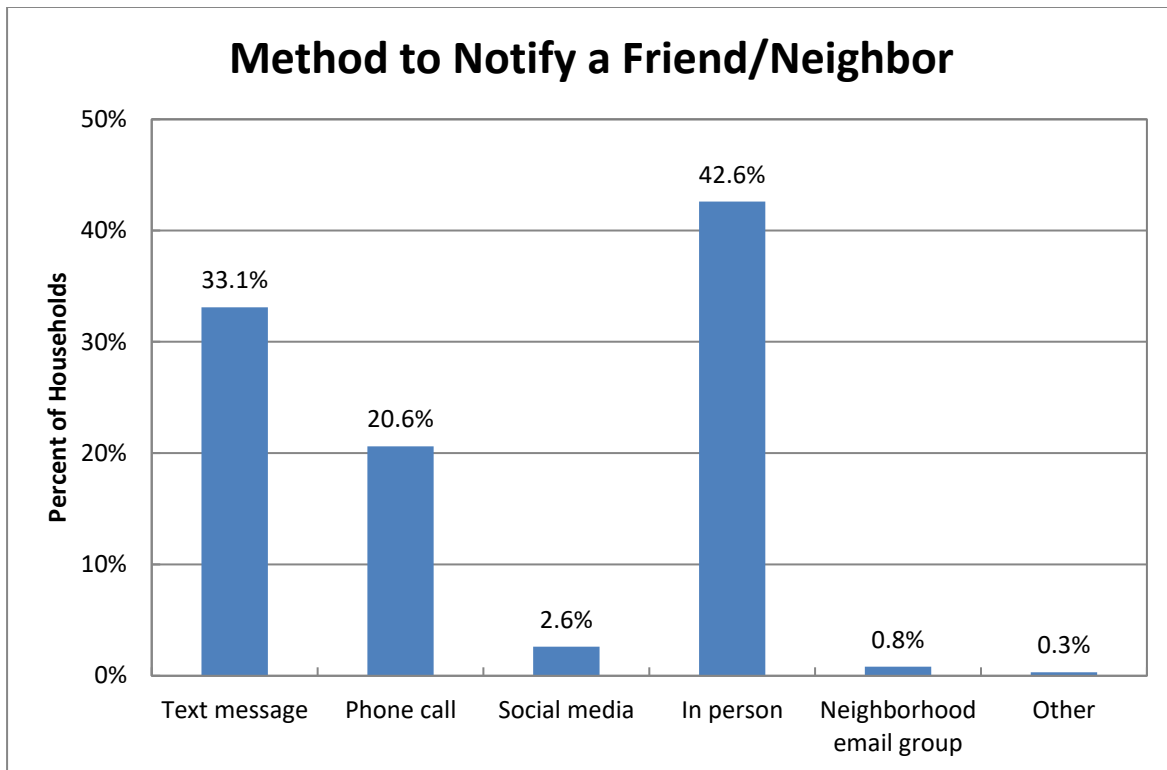


Figure D-13. Method to Notify a Friend/Neighbor

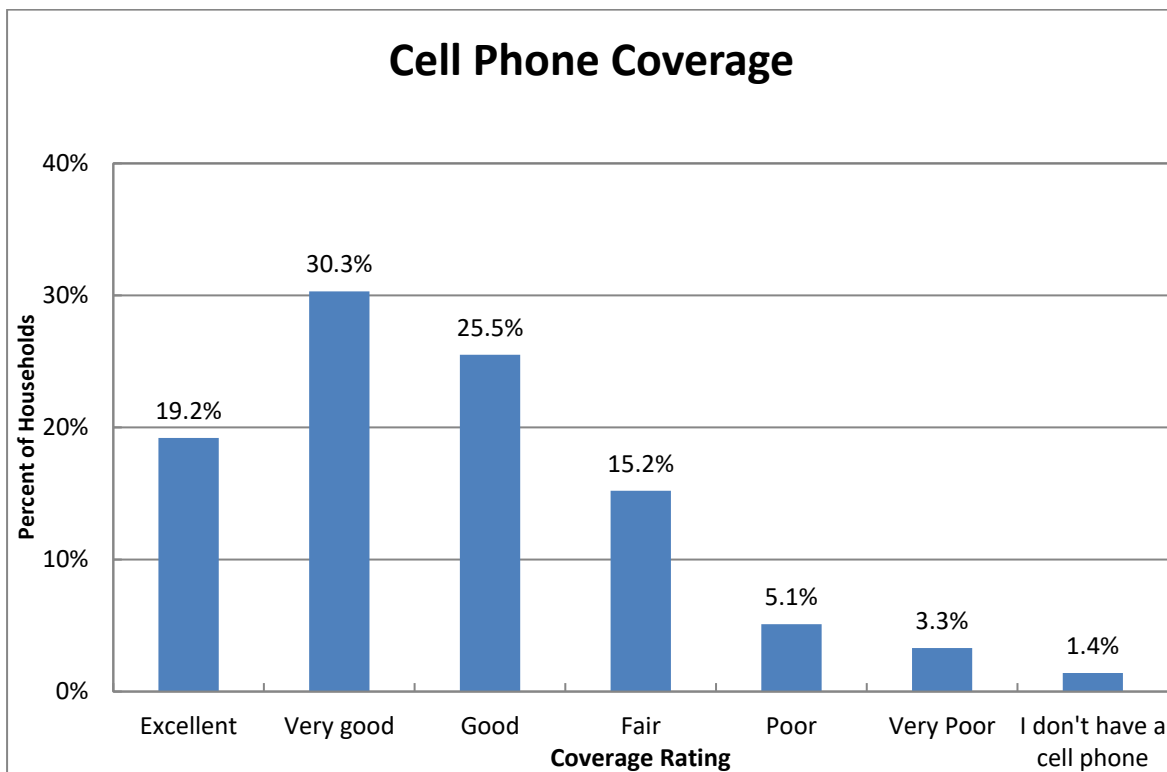


Figure D-14. Cell Phone Coverage

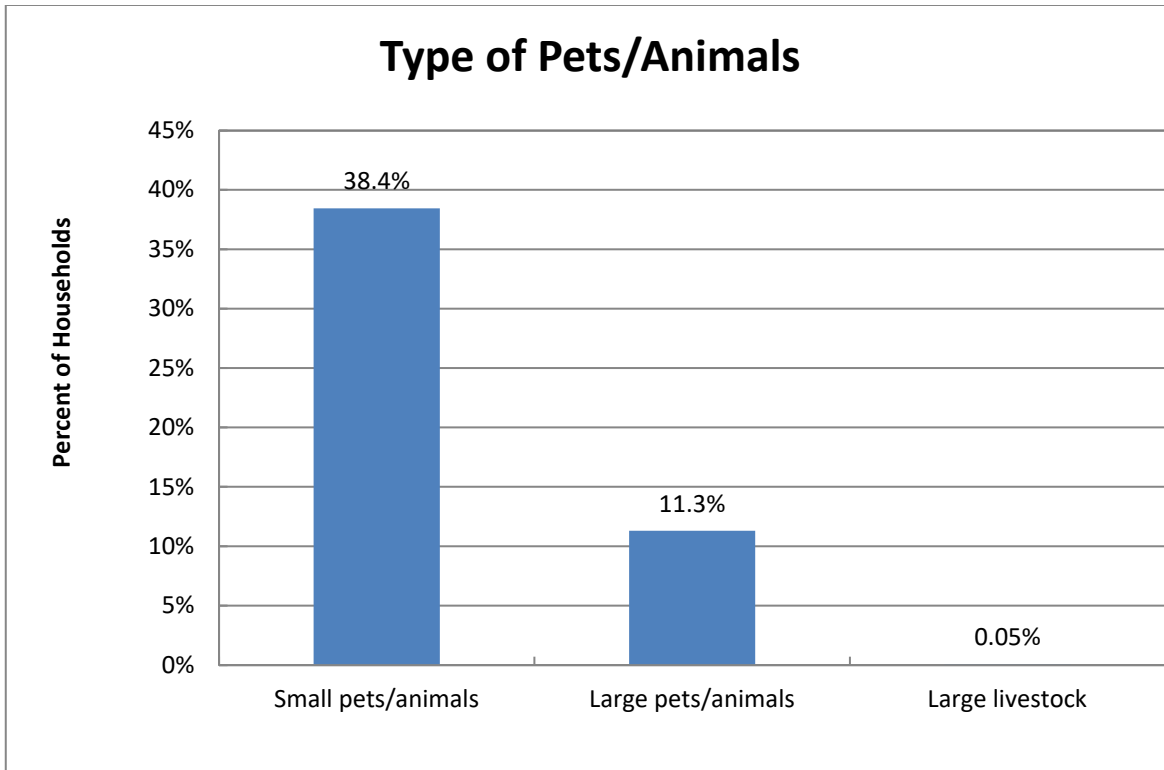


Figure D-15. Pet Ownership in Study Area

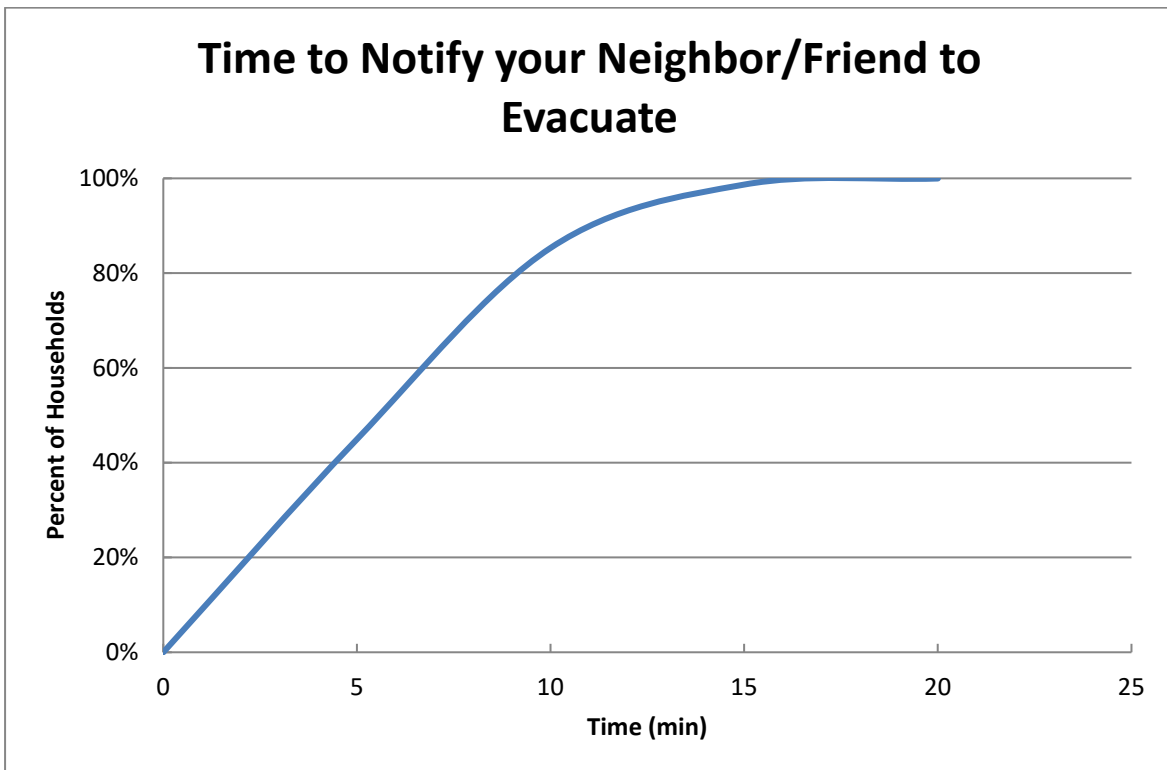


Figure D-16. Time to Take to Notify a Neighbor/Friend to Evacuate

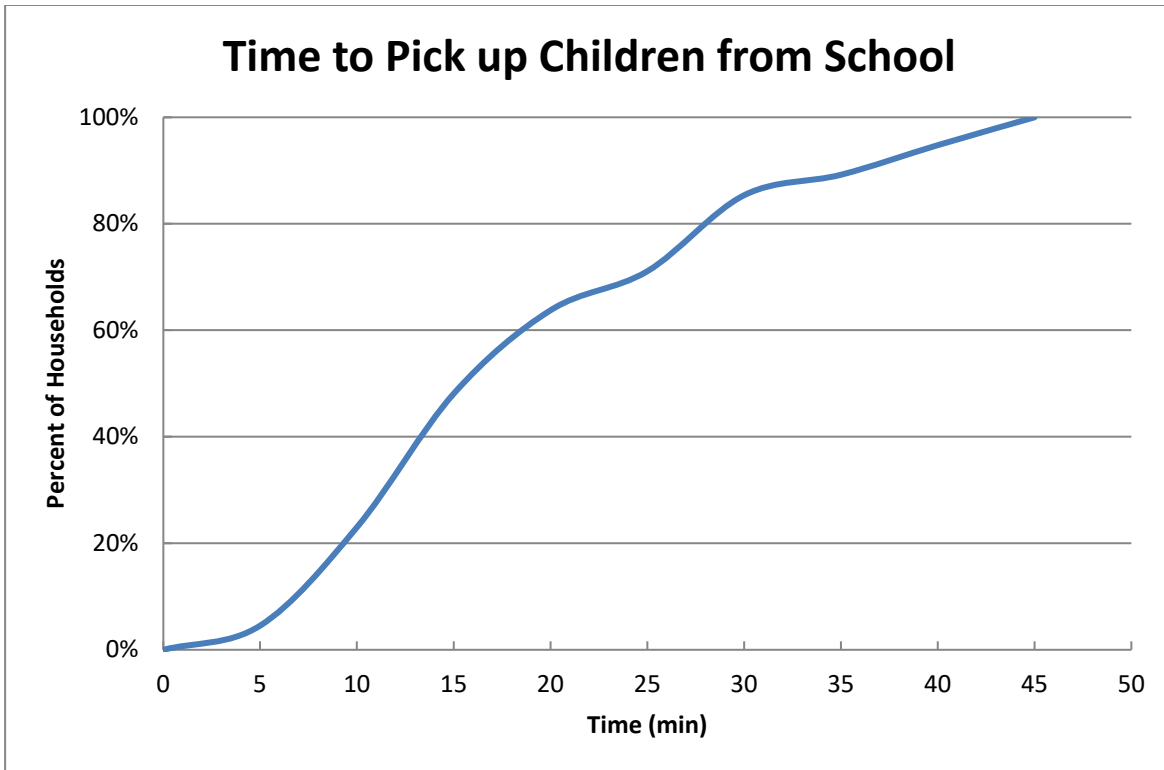


Figure D-17. Time to Pick Up Children from School

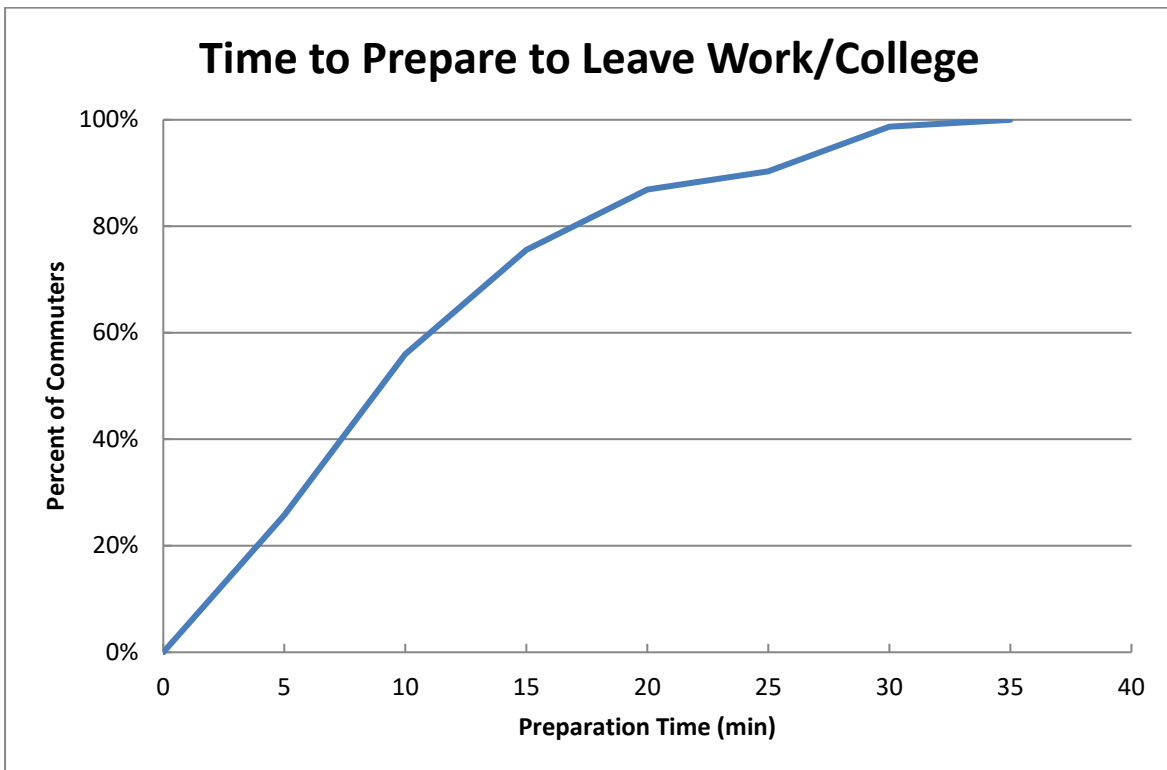


Figure D-18. Time Required to Prepare to Leave Work/College

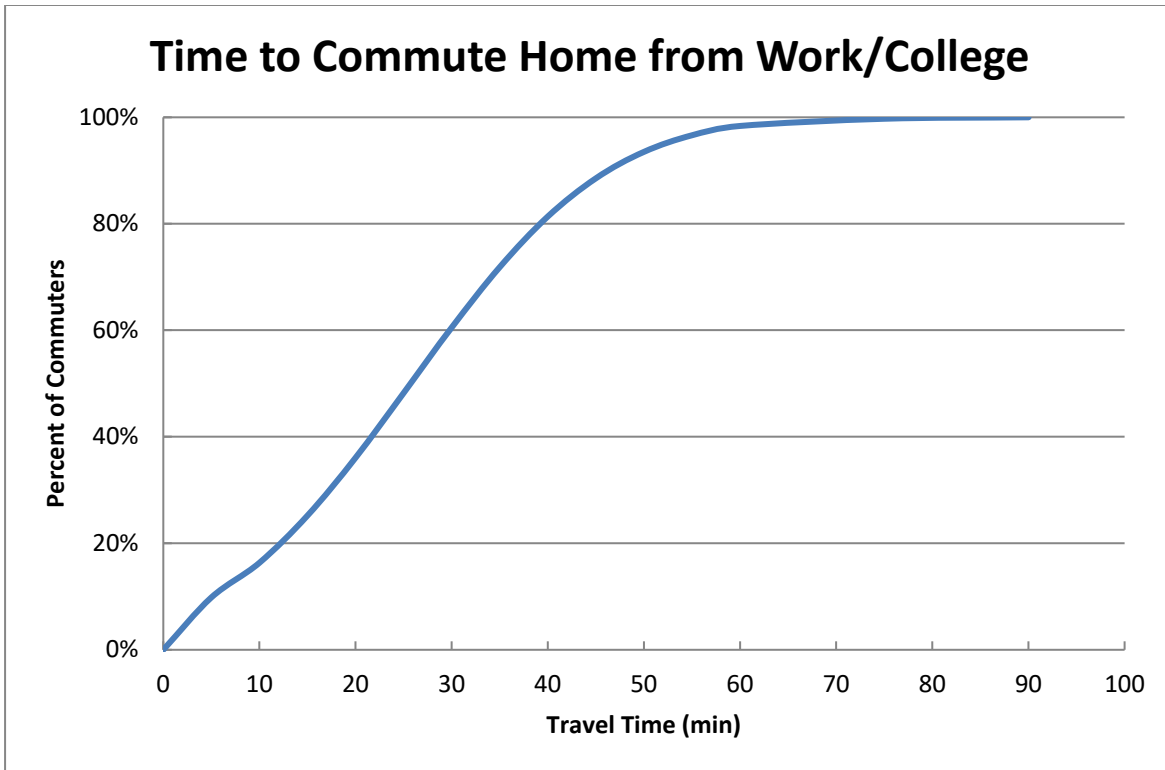


Figure D-19. Time to Travel Home from Work/College



Figure D-20. Time to Prepare Home for Evacuation

ATTACHMENT A

Demographic Survey Instrument



City of Berkeley Community Evacuation Survey

Welcome!

Please help us improve Berkeley's emergency evacuation plans by completing this 10-minute survey. Your responses will help us predict how long it will take people in Berkeley to get out of the path of a fire, tsunami, or other hazard. With this information, we can provide better instructions on how to stay safe in emergencies.

This survey includes prize giveaways to 7 (seven) randomly chosen respondents! There will be 3 (three) first prize winners with a \$100 Visa gift card and 4 (four) second prize winners with a \$50 Visa gift card. In order to win a prize, please provide your address, phone number and/or email address at the end of the survey. If you wish to not participate, you may opt to not provide your personal information but still complete the survey to help improve our local emergency planning. PLEASE PROVIDE ONLY ONE RESPONSE PER HOUSEHOLD. MULTIPLE ENTRIES WILL BE DISQUALIFIED FOR THE PRIZE GIVEAWAY. Thank you for taking the time to do this survey. If you have questions please reach out to the Berkeley Fire Department's Office of Emergency Services: oes@berkeleyca.gov. All your answers will be kept strictly confidential. City of Berkeley staff, its consulting team for this project, and their families are not eligible for the prize giveaways.

1A. What is your home zip code? *

1B: Check off any boxes that describe you. (Leave blank if none of these options describe you):

- ☐ I am a UC Berkeley undergraduate student.
- ☐ I am a UC Berkeley graduate student, visiting scholar, student researcher, or postdoc.
- ☐ I live in the Berkeley Marina.

2. How many people usually live in your household (including roommates)?

Please Select

3A. How many running cars does your household have?

Please Select

3B. How many cars would your household use during an evacuation?

Please Select

4. If you didn't have your own transportation, could you get a ride out of the area with a neighbor or friend in an emergency?

- ☐ Yes
- ☐ No
- ☐ Yes, if they were home
- ☐ Not sure/prefer not to say

5A. Does anyone in your household need help from someone outside the household (caretaker, personal attendant) to prepare to evacuate or to get to a vehicle?

- ☐ Yes
- ☐ No
- ☐ Don't Know/Prefer not to say

If you would like to provide more details on your answer to Question 5A, please describe below:

5B. How many people in your household require a specialized vehicle to evacuate? For each person, choose the vehicle that they would need to evacuate.

	0	1	2	3	4	More than 4
Wheelchair Accessible Vehicle	☐	☐	☐	☐	☐	☐
Ambulance	☐	☐	☐	☐	☐	☐
Other Specialized Vehicle	☐	☐	☐	☐	☐	☐

If you chose "Other Specialized Vehicle" for Question 5B, please describe the vehicle:

6. How many adults in your household commute to work or college on a daily basis? *

Please Select

Travel to Work or College

7. How many days a week does each commuter travel to work?

	1	2	3	4	5 or more
Commuter 1	☐	☐	☐	☐	☐
Commuter 2	☐	☐	☐	☐	☐
Commuter 3	☐	☐	☐	☐	☐
Commuter 4	☐	☐	☐	☐	☐

8. How does each commuter usually travel to work or college on those days?

	Walk/Bicycle	Bus	BART	Combination of Public Transit	Drive Alone	Carpool - 2 or More People	Don't Know
Commuter 1	☐	☐	☐	☐	☐	☐	☐
Commuter 2	☐	☐	☐	☐	☐	☐	☐
Commuter 3	☐	☐	☐	☐	☐	☐	☐
Commuter 4	☐	☐	☐	☐	☐	☐	☐

9-1. What zip code does Commuter #1 commute to for work or college?

9-2. What zip code does Commuter #2 commute to for work or college?

9-2. What zip code does Commuter #2 commute to for work or college?

9-4. What zip code does Commuter #4 commute to for work or college?

Getting Ready to Leave Work or College

10-1. On a normal day, how long does it take Commuter #1 to pack up and leave their worksite or college?

If you answered "Over 2 Hours" for Question 10-1, please tell us how many hours:

10-2. On a normal day, how long does it take Commuter #2 to pack up and leave their worksite or college?

Please Select

If you answered "Over 2 Hours" for Question 10-2, please tell us how many hours:

10-3. On a normal day, how long does it take Commuter #3 to pack up and leave their worksite or college?

Please Select

If you answered "Over 2 Hours" for Question 10-3, please tell us how many hours:

10-4. On a normal day, how long does it take Commuter #4 to pack up and leave their worksite or college?

Please Select

If you answered "Over 2 Hours" for Question 10-4, please tell us how many hours:

Travel Home From Work or College

11-1. How long does it usually take Commuter #1 to travel home from work or college?

Please Select

If you answered "Over 2 Hours" for Question 11-1, please tell us how many hours:

11-2. How long does it usually take Commuter #2 to travel home from work or college?

Please Select

If Over 2 Hours for Question 11-2, please tell us how many hours:

11-3. How long does it usually take Commuter #3 to travel home from work or college?

Please Select

If Over 2 Hours for Question 11-3, please tell us how many hours:

11-4. How long does it usually take Commuter #4 to travel home from work or college?

Please Select

If Over 2 Hours for Question 11-4, please tell us how many hours:

Household Evacuation Plan

12. If an emergency evacuation was ordered for your area, how long would it take your household to get ready to leave? Think about time to pack clothing, medications, other critical items, to prepare your pets, secure your home, and pack the car.

Please Select

13. Please choose one of the following:

- ☐ During an emergency, I would await the return of household members to evacuate together.
- ☐ During an emergency, I would evacuate independently and meet other household members later.
- ☐ Don't know

14A. Emergency officials advise you to evacuate due to an emergency. Where would you evacuate to?

- ☐ A relative's or friend's home
- ☐ Wait for an evacuation shelter to be set up, then go there
- ☐ A hotel, motel, short-term rental (ex: AirBnB/VRBO), or campground
- ☐ A second/seasonal home
- ☐ Would not evacuate
- ☐ Don't know
- ☐ Prefer not to say
- ☐ Other

If you answered "Other" for Question 14A, please tell us more:

14B. An evacuation is occurring in parts of Berkeley and you are worried. Emergency officials say that your area is not in danger. People in your area are told to stay off the roads to help the evacuation of areas in danger. Would you:

- ☐ Not evacuate
- ☐ Evacuate
- ☐ Don't know/prefer not to say

Children in School/Childcare

15A. Do you have any children attending K-12 school/childcare?

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

15B. If an evacuation is ordered for my home area during the school day, I would:

- ☐ Pick up my children from school/childcare.
- ☐ Wait for buses to bring my children home if there is an early dismissal.
- ☐ I will not be home - I would have a trusted guardian pick up my children from school/childcare.
- ☐ I will not be home - I would have a trusted guardian pick up my children after they get off the bus if there is an early dismissal.
- ☐ I would not pick up my children or send a guardian to pick up my children.
- ☐ Other

15C. How long would it take you or a guardian to pick up your children from school?

If you answered "Other" to Question 15B and this question does not apply, please leave it blank.

Pet Questions

16A. Do you have any pet(s) and/or animal(s)? *

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

16B. What type(s) of pet and/or animal do you have?

- ☐ Small pets/animals
- ☐ Large pets/animals
- ☐ Large livestock
- ☐ Prefer not to say

16C. What would you do with your pet(s) and/or animal(s) if you had to evacuate?

- ☐ Leave pet at home
- ☐ Take pet with me
- ☐ Take pet/animal to a different place than I will go
- ☐ I have different plans for each pet/animal
- ☐ Don't know/Prefer not to say

Emergency Alerting Systems

17. How would you rate the cell phone coverage near your home?

- ☐ Excellent
- ☐ Very Good
- ☐ Good
- ☐ Fair
- ☐ Poor
- ☐ Very Poor
- ☐ I don't have a cell phone
- ☐ Prefer not to say

18. Do you have an AT&T landline?

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

Sharing Evacuation Instructions

19A. If emergency officials told your area to evacuate, would you also tell a neighbor or friend in your area to evacuate?

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

19B. How would you tell your neighbor or friend to evacuate?

- ☐ Text message
- ☐ Phone call
- ☐ Social media
- ☐ In person

- ☐ Neighborhood email group
- ☐ Don't know/prefer not to say
- ☐ Other

19C. How long would it take you to tell your neighbor or friend to evacuate?

Prize Giveaway Information

Please only fill this out if you wish to be eligible for the prize giveaways. Please provide an email, mailing address, and/or a phone number to be contacted.

Name

First Name

Last Name

Email

example@example.com

Address

Street Address

Street Address Line 2

City

State / Province

Postal / Zip Code

Phone Number

Please enter a valid phone number.

Please press "Submit" below to complete the survey!

Submit

Thank you for taking the time to complete this survey.

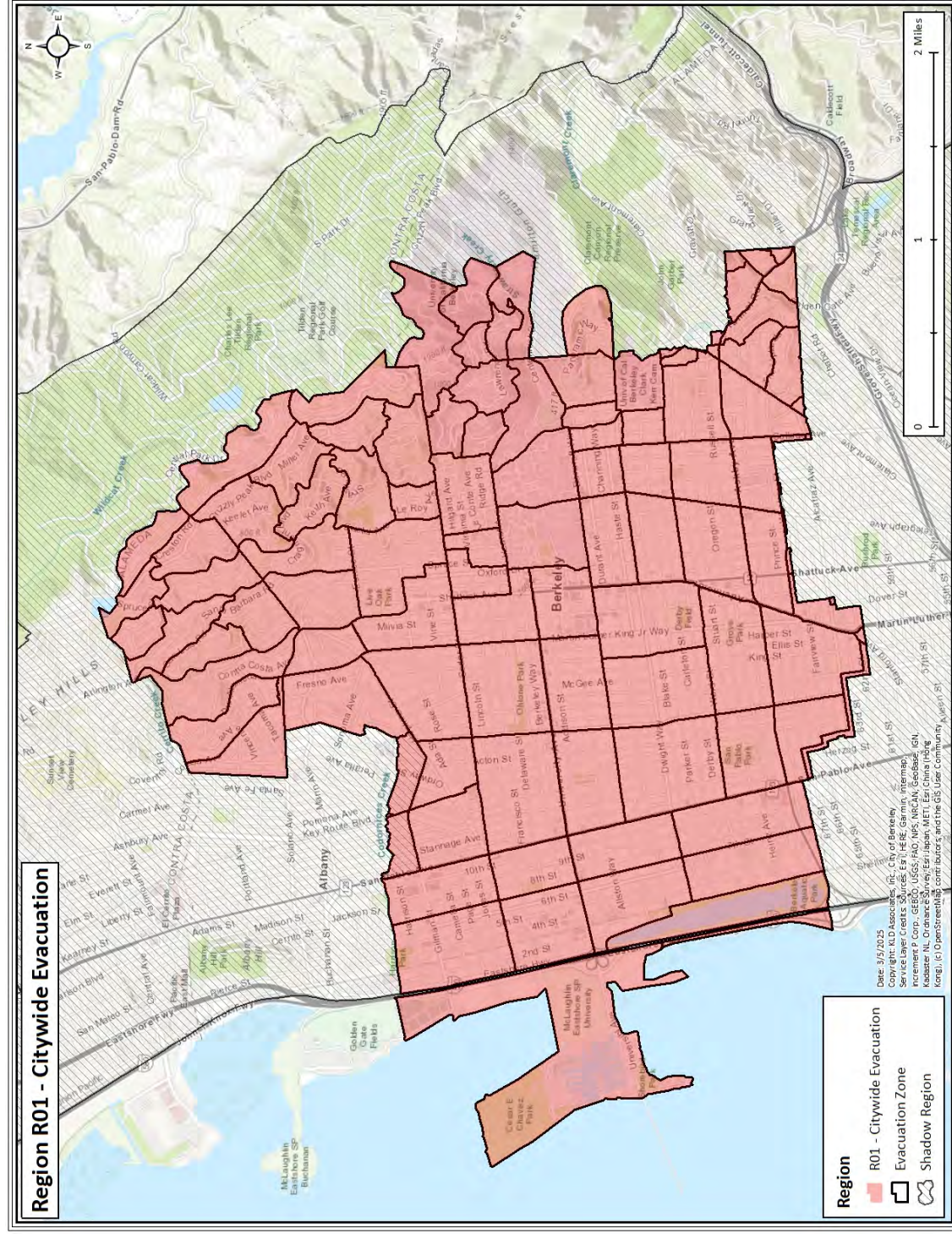
If you would like to learn more about Fire Weather and Evacuations, please visit our website at <https://berkeleyca.gov/safety-health/fire/fire-weather-evacuation>.

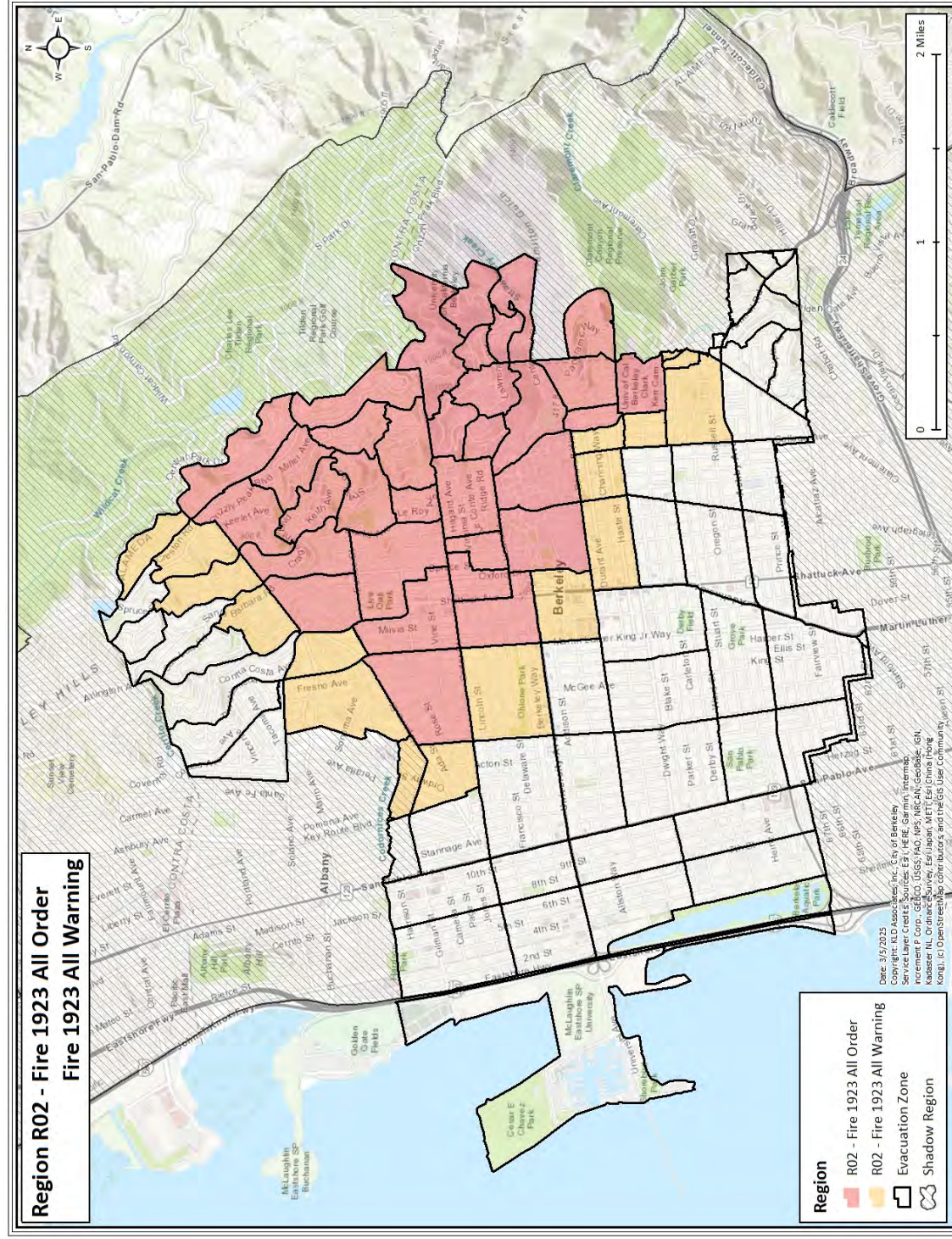
If you have questions or concerns, please email the City of Berkeley Fire Department - Office of Emergency Services: oes@berkeleyca.gov.

APPENDIX E
Evacuation Regions

E EVACUATION REGIONS

This appendix presents maps of all of the Evacuation Regions (groupings of Genasys Zones) considered for this study. These evacuation regions were developed in consultation with the City of Berkeley. They are based on historical evacuation data and represent areas expected to evacuate together in response to a given hazard or emergency.





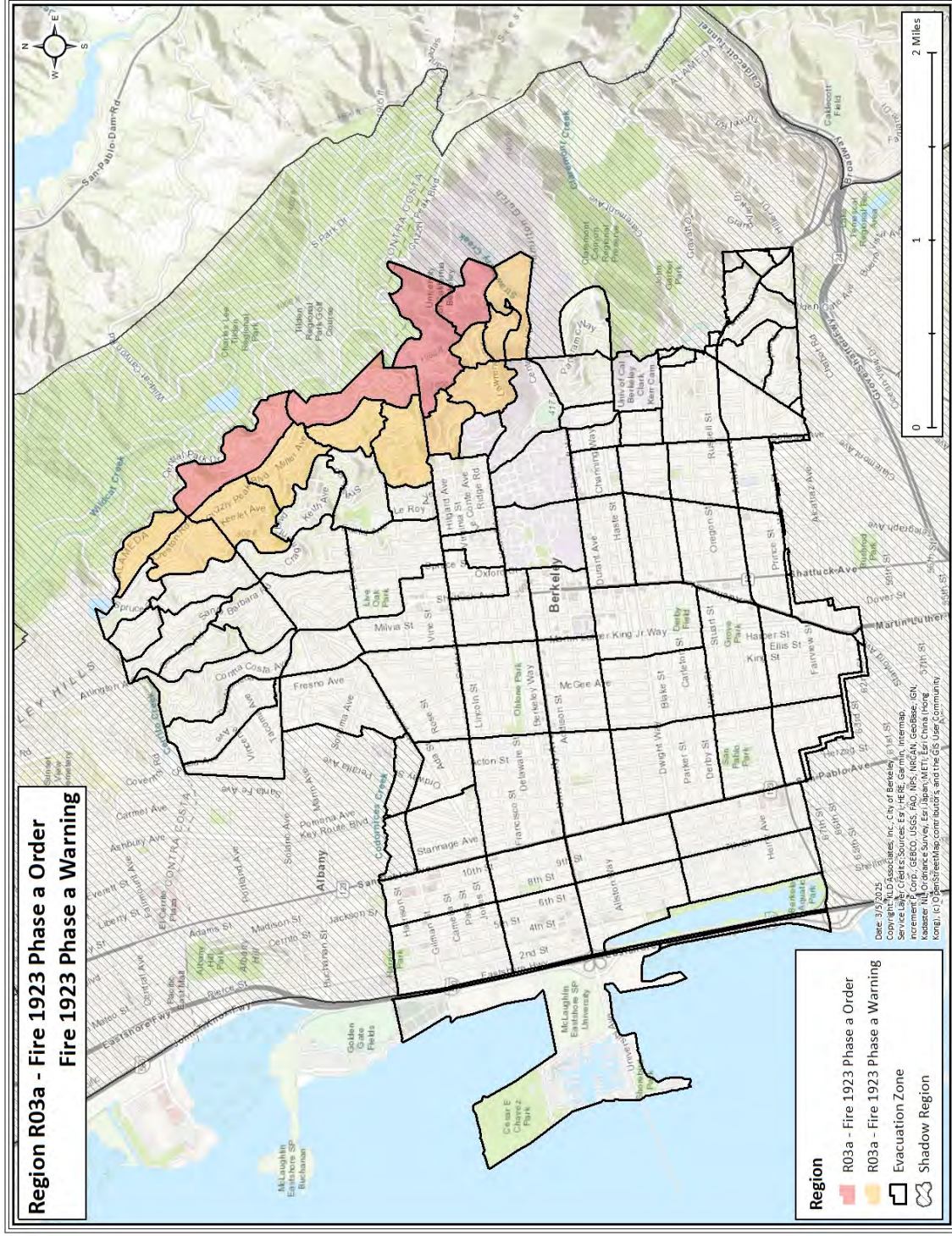
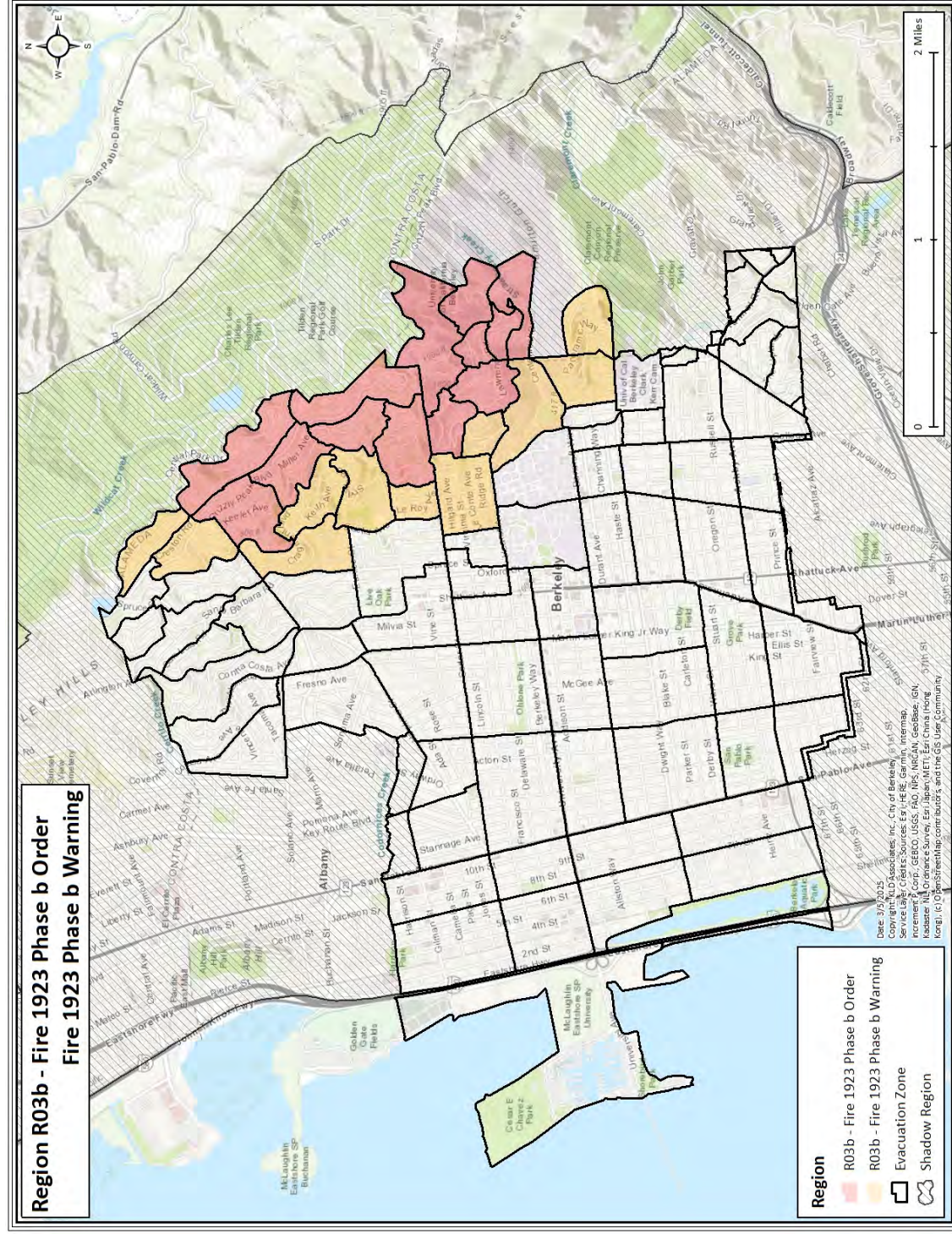
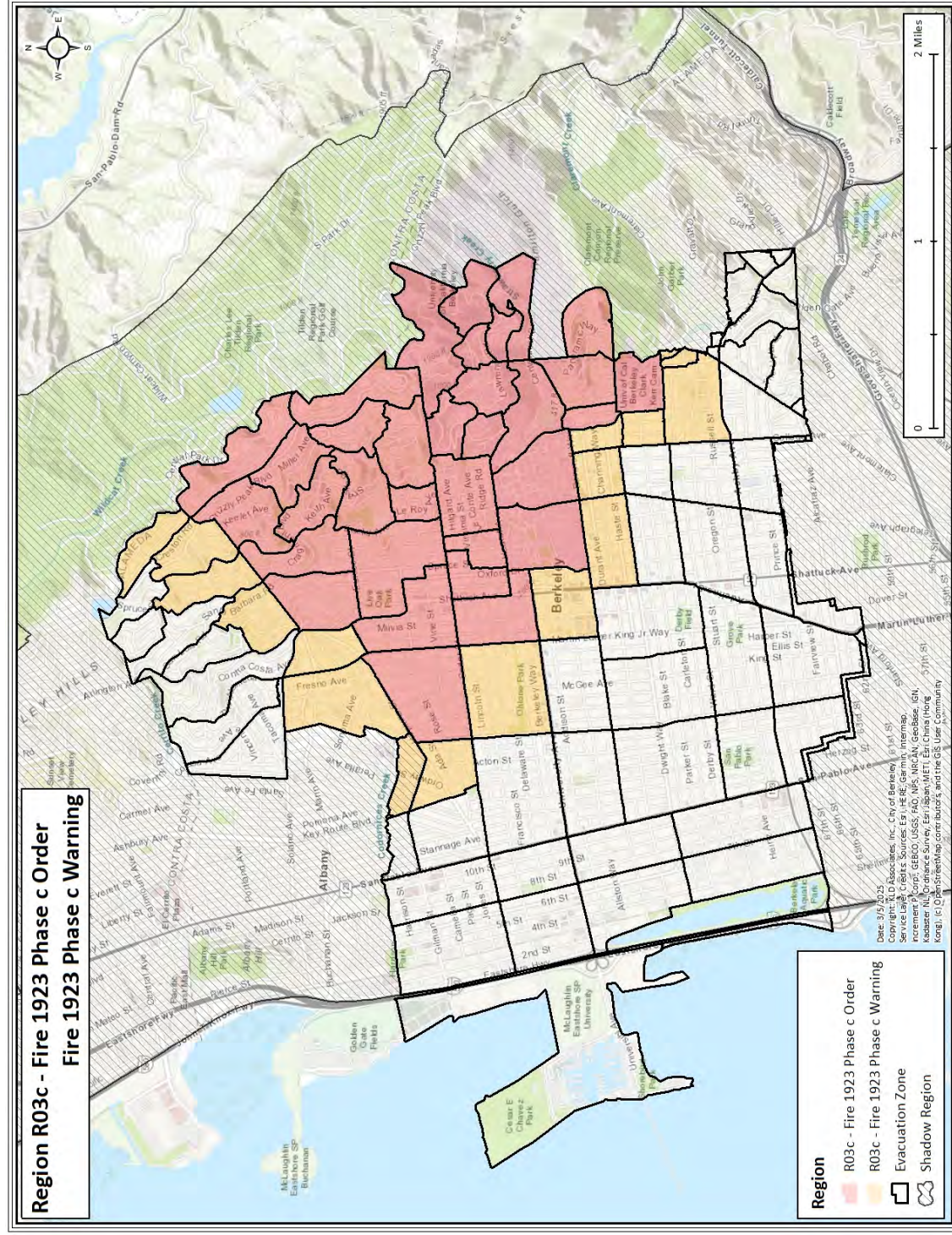
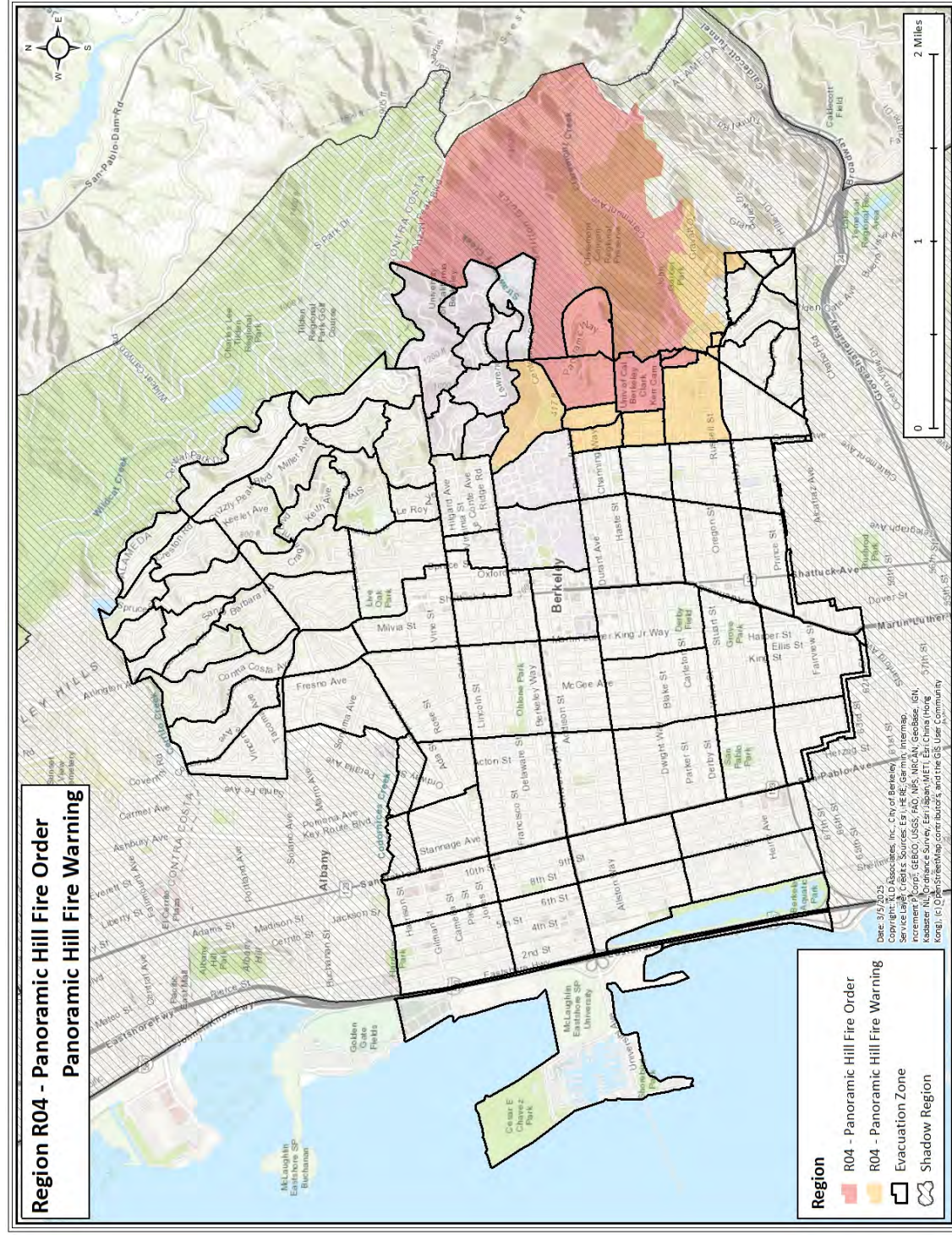


Figure E-3. Fire 1923 Phase a







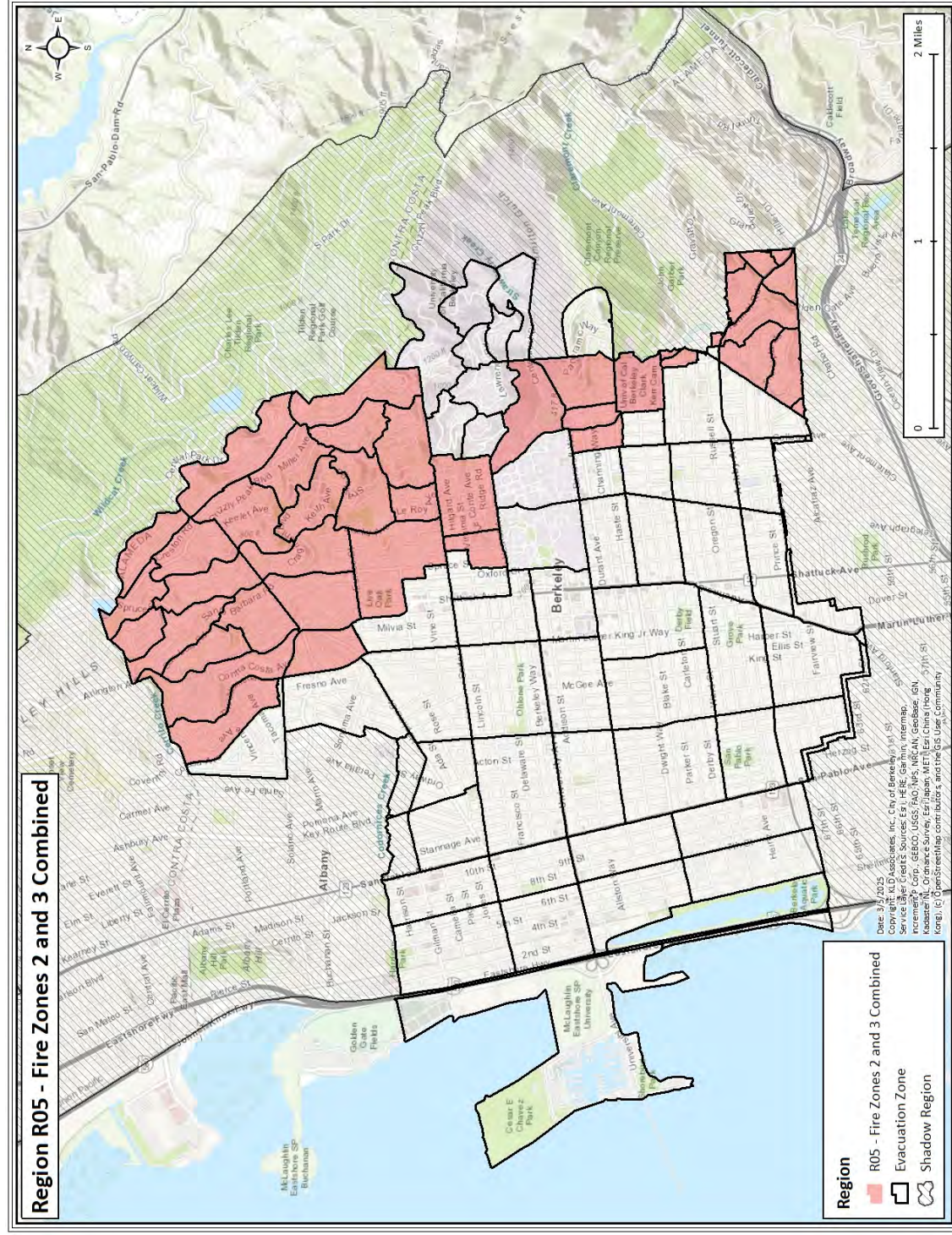
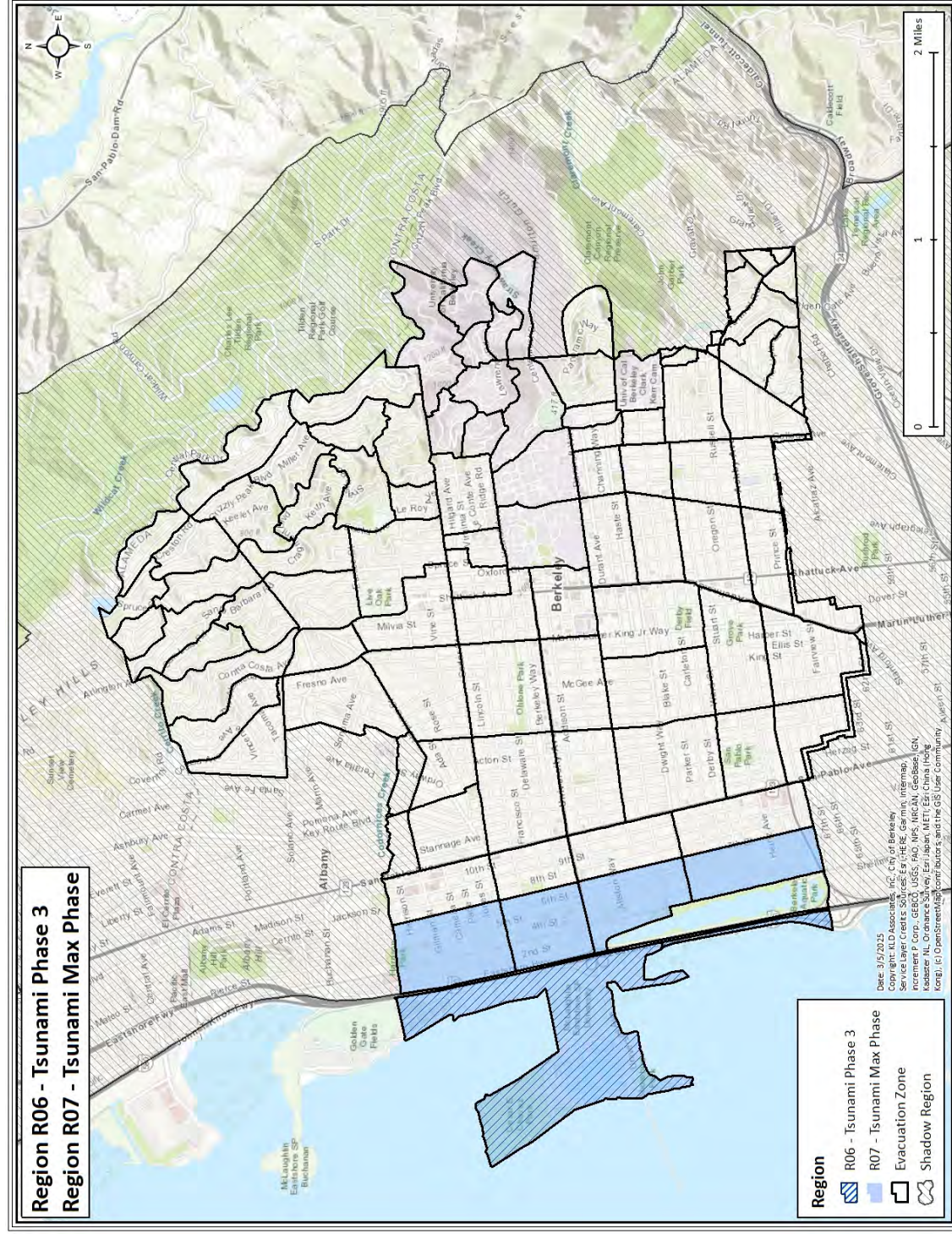
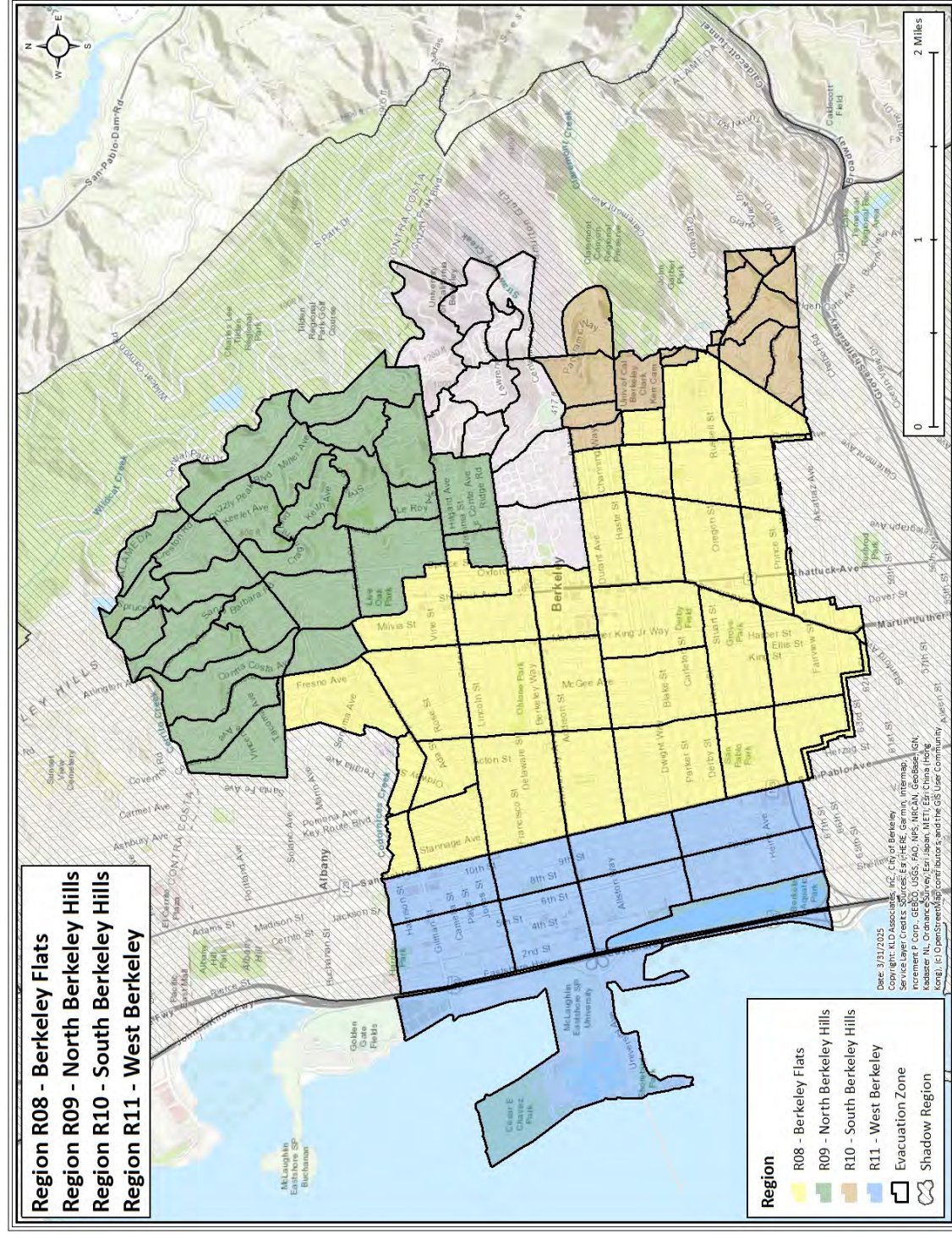
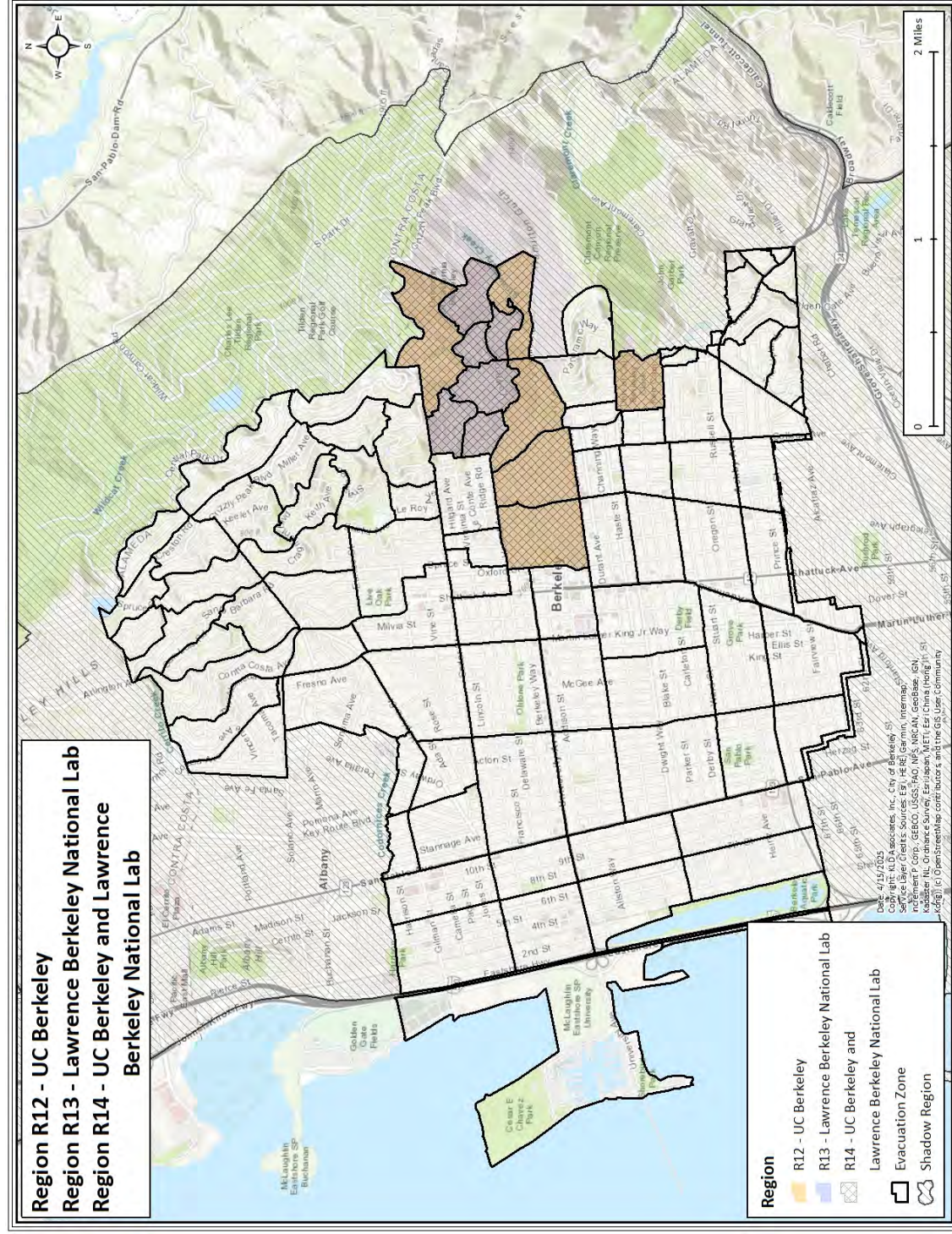


Figure E-7. Fire Zone 2 and 3 Combined







APPENDIX F

Patterns of Traffic Congestion During Evacuation

F. PATTERNS OF TRAFFIC CONGESTION DURING EVACUATION

This appendix provides patterns of traffic congestion during an evacuation. Traffic congestion, as the term is used here, is defined as Level of Service (LOS) F. LOS F is defined as follows (HCM 2022, page 5-5):

The HCM uses LOS F to define operations that have either broken down (i.e., demand exceeds capacity) or have reached a point that most users would consider unsatisfactory, as described by a specified service measure value (or combination of service measure values). However, analysts may be interested in knowing just how bad the LOS F condition is, particularly for planning applications where different alternatives may be compared. Several measures are available for describing individually, or in combination, the severity of a LOS F condition:

- *Demand-to-capacity ratios* describe the extent to which demand exceeds capacity during the analysis period (e.g., by 1%, 15%).
- *Duration of LOS F* describes how long the condition persists (e.g., 15 min, 1 h, 3 h).
- *Spatial extent measures* describe the areas affected by LOS F conditions. They include measures such as the back of queue and the identification of the specific intersection approaches or system elements experiencing LOS F conditions.

All highway "links" which experience LOS F are delineated in these figures by a thick red line; all others are lightly indicated. Congestion develops around concentration of population and traffic bottlenecks. The congestion patterns are presented for the regions specified below for Scenario 4 (fall midweek midday) as it's the scenario with highest vehicular demand and therefore greatest levels of congestion.

F.1 Citywide Evacuation (Region R01)

As is noted in Section 7, **Region R01 does not reflect a realistic emergency or disaster**. An event requiring simultaneous evacuation of all of Berkeley would have regional impacts to roadway and transportation systems that are far beyond the scope of this analysis.

Rather, Citywide evacuation was included in this document in order to stress Berkeley's roadway network to identify areas of potential traffic congestion that may not have been apparent from other evacuation cases.

Figure F-1 displays congestion patterns just 15 minutes after the Evacuation Order. At this time, 8.1% of vehicles have begun their evacuation trip and 6% of evacuating vehicles have successfully evacuated Berkeley. Initial congestion patterns are developing, particularly in the eastern portion of the Berkeley Flats and surrounding the UC Berkeley campus. As vehicles begin to mobilize, the increased traffic volume is already exceeding the capacity of key roadways in this area. This localized congestion is potentially due to the convergence of

multiple evacuation routes, clustered pre-timed signals and traffic calming devices, a series of one-way pairs, and the high density of residential areas adjacent to the university.

1 hour after the initial Evacuation Order, 54.6% of vehicles have begun their evacuation trip and 26.7% of evacuating vehicles have successfully evacuated Berkeley. As shown in Figure F-2, congestion has become fully developed, with near-gridlock conditions prevailing. The Berkeley Flats are now experiencing LOS F on virtually every major street, indicating severely congested flow. This widespread congestion extends into the Berkeley Hills area, impacting key thoroughfares such as Spruce Street, Grizzly Peak Boulevard, Boynton Avenue, and Marin Avenue, all of which are also operating at LOS F. The confluence of evacuating traffic from both the flats and the hills has resulted in a critical bottleneck, effectively impeding movement and significantly reducing the overall evacuation efficiency.

Two hours after the Evacuation Order, 96.7% of vehicles have begun their evacuation trip and 50.1% of evacuating vehicles have successfully evacuated Berkeley. Severe congestion persists, although a slight improvement is observed in the Berkeley Hills area, as shown in Figure F-3. However, the situation has escalated elsewhere, with Interstate 580 (I-580) and its associated ramps now operating at LOS F, effectively creating a major bottleneck for evacuees attempting to leave the area along this freeway. As drivers seek alternative routes, arterial streets such as San Pablo Avenue, Sacramento Street, and Shattuck Avenue are experiencing increased traffic volume. The inherent configuration of Berkeley's road network, characterized by predominantly north-south routes and limited east-west connectivity, exacerbates the congestion, restricting evacuation options and further hindering traffic flow. This constrained network design contributes significantly to the persistent gridlock and poses a considerable challenge to efficient evacuation.

Three hours after the Evacuation Order, nearly all (99.6%) vehicles have begun their evacuation trip and 72.7% of evacuating vehicles have successfully evacuated Berkeley. As shown in Figure F-4, the congestion begins to show some signs of differentiation. While the Berkeley Flats area continues to experience heavy congestion, particularly in the northern sections, conditions in the southeast are starting to improve. In the Berkeley Hills area, the dissipation of congestion continues, though several key arteries, including Woodmont Avenue, Grizzly Peak Boulevard, Spruce Street, Marin Avenue and Boynton Avenue, remain at LOS F, indicating persistent bottlenecks. On I-580, some sections are now operating at LOS C, a significant improvement. However, the ramps connecting to the interstate remain heavily congested and continue to function as the primary bottleneck, impeding the overall flow of evacuating traffic onto the interstate. This persistent ramp congestion suggests that access to and from one of the primary evacuation routes remains a critical bottleneck.

Four hours after the initial Evacuation Order, all evacuating vehicles have begun their evacuation trip and 89.7% of evacuating vehicles have successfully evacuated Berkeley. As shown in Figure F-5, a noticeable reduction in citywide congestion can be observed. LOS F conditions are now primarily concentrated within a defined area bounded by Dwight Way and Hopkins Street to the south and north, and Sacramento Street and Piedmont Avenue to the west and east. The presence of traffic calming devices, such as those on Fulton St, reduces the

efficiency of the evacuation by slowing traffic down. In the Berkeley Hills, while general improvement is evident, Spruce Street continues to experience LOS E, indicating localized congestion. West of San Pablo Ave, roadways show significant improvement as all roadways in the area are operating at LOS C or better, particularly those providing access to I-580.

Four hours and 45 minutes after the Evacuation Order, 96.7% of evacuating vehicles have successfully evacuated Berkeley. Shattuck Avenue and Martin Luther King Jr Way continue to experience significant congestion between Ashby Avenue and Hopkins Street, as shown in Figure F-6. This persistent bottleneck is likely attributable to the pre-timed signal system present throughout these sections of the roadway. The fixed timing of these signals may not be adequately responding to the fluctuating traffic demands of the evacuation, creating inefficiencies and hindering traffic flow.

As shown in Figure F-7, 5 hours and 15 minutes after the Evacuation Order, the final pockets of congestion (LOS F) are on Cedar Street, Hearst Avenue and Shattuck Avenue while all other roads are operating at LOS D or better. The city is clear of congestion approximately 20 minutes later at 5 hours and 35 minutes after the Evacuation Order. This projected clearance time aligns with the overall evacuation time estimate.

F.2 1923 Fire Repeat (Region R02)

Figure F-8 shows the patterns of traffic congestion for a 1923 Fire Repeat at 1 hour and 2 hours after the Evacuation Order. One hour into the evacuation, the majority of the roads within the evacuated area are operating at LOS F conditions, especially surrounding UC Berkeley. Congested conditions develop between Dwight Way and Hopkins Ave and between Sacramento St and Grizzly Peak Blvd. All employees, visitors and college students who evacuate using personal vehicles mobilize within 1 hour after the Evacuation Order. Hence, the congestion that is present at 1 hour into the evacuation is largely caused by these vehicles. Only 20% of the population west of Sacramento St is evacuating for this Region, and for that reason the congestion within the Berkeley Flats is less significant.

Two hours after the Evacuation Order, the congestion near UC Berkeley lessens as the students and employees from the college have mobilized and evacuated. Congestion is present in other parts of the evacuated zones, which are still operating at LOS F conditions, specifically between Bancroft Way and Hopkins Ave and between Martin Luther King Jr Way and Gayley Rd. Congestion along Grizzly Peak Drive and Woodmont Ave has worsened as more residents are mobilizing within Berkeley Hills.

Figure F-9 shows the patterns of traffic congestion for 1923 Fire Repeat at 3 hours and 4 hours after the Evacuation Order. At 3 hours, Gayley Road and Hearst Ave near UC Berkeley are still operating at LOS F conditions within the Evacuation Zones. Both roads are clear of congestion 4 hours after the Evacuation Order. At 3 hours, Marin Ave, Hopkins St, Arlington Ave and Cedar St, which serve the majority of evacuating population leaving the area at risk are also still congested. One hour later at 4 hours after the Evacuation Order, the only road that is operating at LOS F conditions is Cedar St at the pretimed signalized intersection with Martin Luther King Jr Way, which clears of congestion 10 minutes later at 4 hours and 10 minutes.

F.3 1923 Fire Repeat Phased (Region R03)

Figure F-10 displays the patterns of traffic congestion for 1923 Fire Repeat (Phased) at 1 hour and 2 hours after the Evacuation Order. As discussed in Section 6, the residents that live closer to the proximity of the fire are ordered to evacuate first while other areas within the 1923 Fire Repeat Region are ordered to evacuate 90 (Phase b) and 180 minutes (Phase c) after. Since only the evacuations of residents are phased, but employees, college students and visitors in the entire area (including phase b and c) leave when evacuations are initially ordered, the congestion patterns near UC Berkeley are comparable between Figure F-10 and Figure F-8. However, congestion that is closer in proximity to the eastern boundary of Berkeley (closer to Tilden Park) is more pronounced in the phased region due evacuees from outside of Phase a entering Phase a, as is discussed in Section 7.

As shown in Figure F-11, since phase c does not start until 3 hours after the Evacuation Order, the congestion patterns at 3 hours are significantly improved as the demand is distributed over a long period of time, allowing the roadway network to process the demand more effectively. LOS F still exists near UC Berkeley. However, Berkeley Hills roadways are operating at LOS D or better as shown in Figure F-11. Even though residents from phase c are still mobilizing 4 hours after the Evacuation Order, they face little to no congestion leaving the area as all roads within the zones ordered to evacuate are operating at LOS C or better. All phase c evacuees are fully mobilized at 6 hours and 15 minutes after the Evacuation Order. All congestion clears 5 hours and 20 minutes. Because phase c is delayed by 180 minutes, the initial evacuation congestion has cleared by the time phase c is fully mobilized.

F.4 Panoramic Hill Fire (Region R04)

Figure F-12 displays the patterns of traffic congestion for a Panoramic Hill Fire 30 minutes and 1 hour after the Evacuation Order. Congestion within Panoramic Hill is minimal, operating at LOS C or better. As discussed in Section 10, even though Panoramic Hill only has one egress route, evacuees are mobilizing over a long period of time (over 3 hours), hence, the roadway network within the area being ordered to evacuate does not get overwhelmed trying to process the demand. Outside of Panoramic Hill and the evacuated area, near the Channing Way traffic circle, roadways operate at LOS F. The diverter on Derby St between Warring St and College Ave, is problematic for this area as evacuees can't travel westbound on Derby St to reach College Ave. At this point, vehicles on Derby St southbound are essentially forced to continue on Derby St to the congested intersection with Claremont Ave. Thirty minutes later, at 1 hour after the Evacuation Order, congestion persists near the traffic circle on Piedmont Ave and Channing Way. It should be noted that since the fire origin, travel direction and rate of spread is not modeled, Claremont Avenue was modeled as a viable evacuation route. At 1 hour after the evacuation order, this roadway experiences congested conditions due to the low-capacity geometric bends (i.e., hairpin turns) along this path.

Figure F-13 displays the patterns of traffic congestion for Panoramic Hill Fire 1 hour and 30 minutes and 2 hours after the Evacuation Order. Piedmont Ave to Warring St, to Derby St to Belrose Ave to Claremont Blvd is operating at LOS F conditions at 1 hour and 30 minutes after

the Evacuation Order. This congestion is caused by the limited connections in this area. Once evacuees pass the intersection with Dwight Ave on Piedmont Ave, they are essentially forced to stay on Warring St/Derby St/Belrose Ave/Claremont Blvd, as there is only one connection (Forest Ave) to College Ave and other roadways leaving this area. Congestion along these roads clears 30 minutes later, 2 hours after the Evacuation Order.

F.5 Fire Zones 2 & 3 (Region R05)

As is discussed in Section 7, it is unlikely that there would be a simultaneous evacuation of Fire Zones 2 and 3 (the Berkeley hills) in association with a particular emergency or disaster. This region is included to help analyze impacts of the Berkeley Hills from administrative changes that could affect development in the area.

Figure F-14 displays the patterns of traffic congestion for Fire Zones 2 & 3 at 1 hour and 2 hours after the Evacuation Order. One hour into the evacuation, the majority of the roads within the Evacuation Zones are operating at LOS F conditions including Grizzly Peak Blvd, Euclid Ave, Spruce St, Marin Ave, La Loma Ave, Gayley Rd, and Arlington Ave. Outside of the evacuated area, roadways in proximity to UC Berkeley are also congested. Even though the UC Berkeley campus is not ordered to evacuate, 20% of evacuees are assumed to voluntarily evacuate, so the demand exceeds the capacity causing LOS F conditions within this area. To the south, Ashby Rd/Tunnel Rd is heavily congested as it is the highest capacity roadway within the South Berkeley Hills. Two hours into the evacuation, congestion in South Berkeley Hills and UC Berkeley have dissipated somewhat. However, the North Berkeley Hills is still heavily congested. Roads within this area are windy and narrow, resulting in slower speeds and lower capacities. The roundabout that is along Channing Way and Piedmont Ave is slowing down traffic, causing congestion southbound along Piedmont Ave in this area. The five-legged roundabout on Marin Ave is also proving to be a bottleneck as traffic along competing movements attempt to merge into the roundabout at the same time.

Figure F-15 displays the patterns of traffic congestion for Fire Zones 2 & 3 at 2 hours and 30 minutes and 3 hours after the Evacuation Order. The last remnants of congestion within the evacuated area are present along Piedmont Ave/Warring Ave, Euclid Ave, Hearst Ave, Henry St, Spruce St, Grizzly Peak Blvd, and Woodmont Ave. Thirty minutes later, at 3 hours after the Evacuation Order, most of this congestion has cleared. Piedmont Ave is operating at LOS D or better at this time, and all congestion clears 15 minutes later (3 hours and 15 minutes after the Evacuation Order).

F.6 Tsunami Warning Phase 3 (Region R06)

Figure F-16 displays the patterns of traffic congestion for Tsunami Warning Phase 3 at 30 minutes and 1 hour after the Evacuation Order. Just 30 minutes after the Evacuation Order, University Ave and I-580 are already operating at LOS F conditions. University Ave and Frontage Rd are the only two egress routes for this region. Even though Frontage Road is operating at LOS D or better, the traffic circle that gives access to I-580 (near Gilman St) is operating at LOS F at this time. Thirty minutes later, one hour after the Evacuation Order, University Ave is clear of

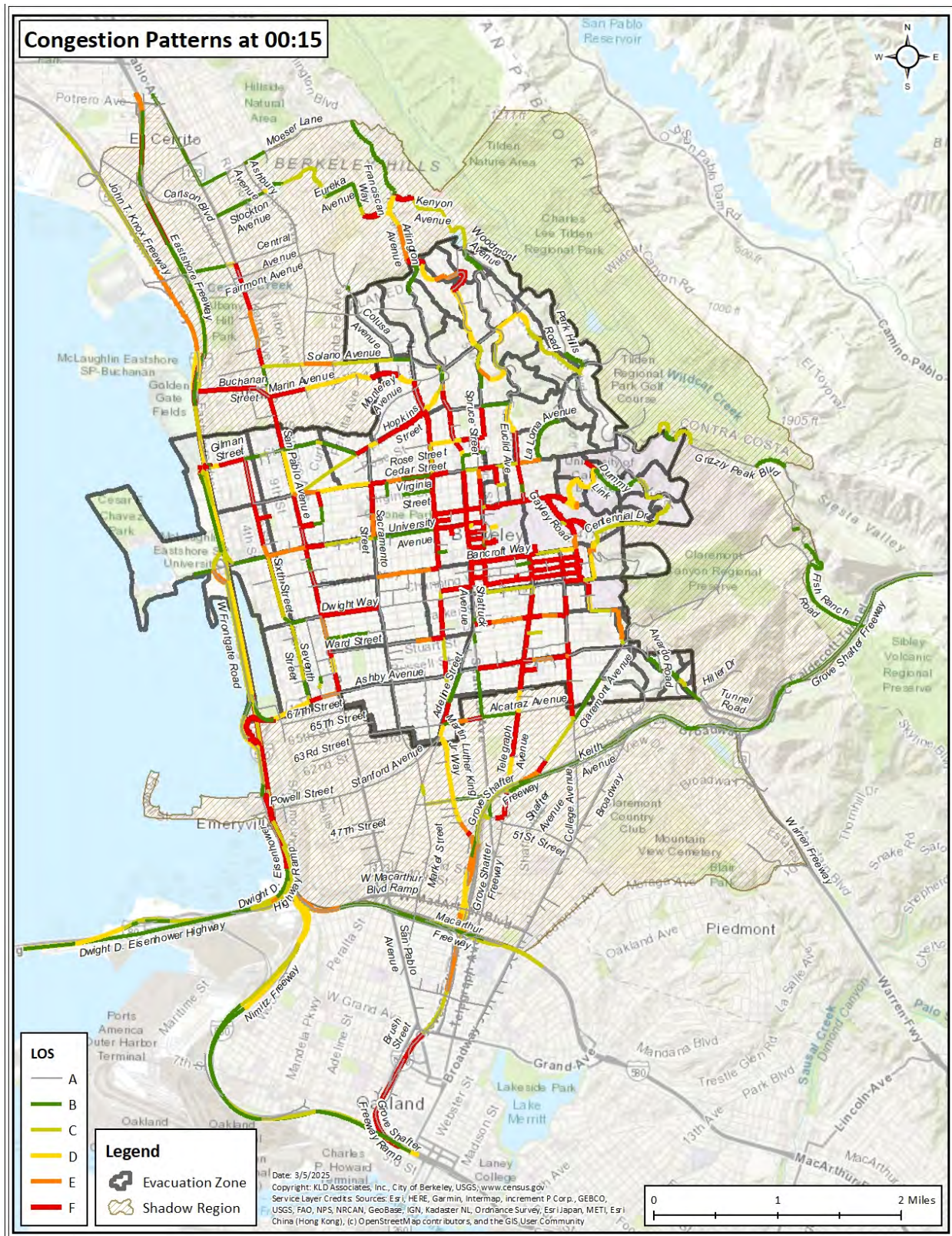
congestion within the region. However, congestion along Frontage Rd (near Gilman St and Ashby Ave) worsens due to low capacity on the traffic circle to the north and the merge between Ashby Ave and Frontage Rd to the south. Traffic along I-580 has also worsened as evacuees utilize this roadway as their primary evacuation route out of the area.

Figure F-17 displays the patterns of traffic congestion for Tsunami Warning Phase 3 at 1 hour and 30 minutes and 2 hours and 30 minutes after the Evacuation Order. I-580 is still heavily congested at 1 hour and 30 minutes into the evacuation, operating at LOS F, but this congestion clears 2 hours and 30 minutes after the Evacuation Order. At both times, Frontage Road is clear of congestion. Even though there are still evacuees mobilizing until 3 hours and 30 minutes after the Evacuation Order, all congestion clears by 2 hours and 30 minutes from the Evacuation Order.

F.7 Tsunami Warning Max Phase (Region R07)

Figure F-18 displays the patterns of traffic congestion for Tsunami Warning Max Phase at 30 minutes and 1 hour after the Evacuation Order. Evacuees in Region R07 can use I-580, University Ave, Gilman St, Ashby Ave and Seventh/Sixth St to leave the evacuated area. All of these roads experience some level of congestion (LOS F conditions) at 30 minutes after the Evacuation Order. Thirty minutes later, at 1 hour after the Evacuation Order, congestion along University Ave and Seventh/Sixth St worsens while congestion along Gilman St dissipates.

Figure F-19 displays the patterns of traffic congestion for Tsunami Warning Max Phase at 1 hour 30 minutes and 2 hours after the Evacuation Order. Congestion has significantly dissipated at 1 hour and 30 minutes after the Evacuation Order. The Ashby Rd on-ramp to I-580 is operating at LOS F conditions. The on-ramp is a capacity restriction in this area as Ashby Ave merges down to a single lane from 2-lanes. The speeds are also lower as the on-ramp is a cloverleaf-style ramp. Frontage Rd northbound experiences congestion as well due to the yield control and right turn movement at the traffic circle at Gilman St. I-580, and many of its on-ramps, experience LOS F conditions as well. An hour later, at 2 hours and 30 minutes after the Evacuation Order, congestion within the region has almost entirely dissipated, except along I-580 southbound, which clears 5 minutes later at 2 hours and 35 minutes. Even though there are still evacuees mobilizing until 3 hours and 30 minutes after the Evacuation Order, all congestion is clear within 2 hours and 35 minutes after the Evacuation Order.



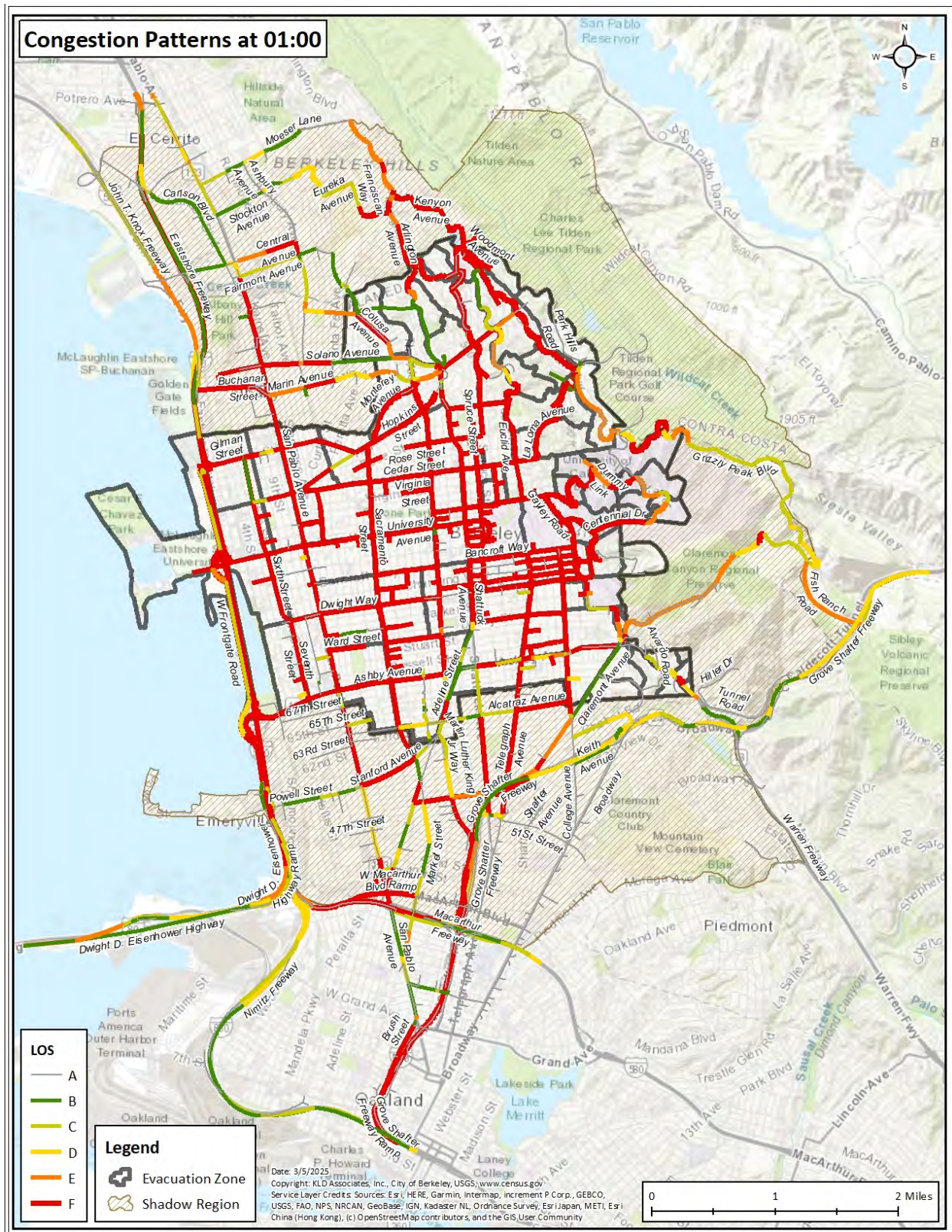


Figure F-2. Region R01 Congestion Patterns 1 Hour after the Evacuation Order

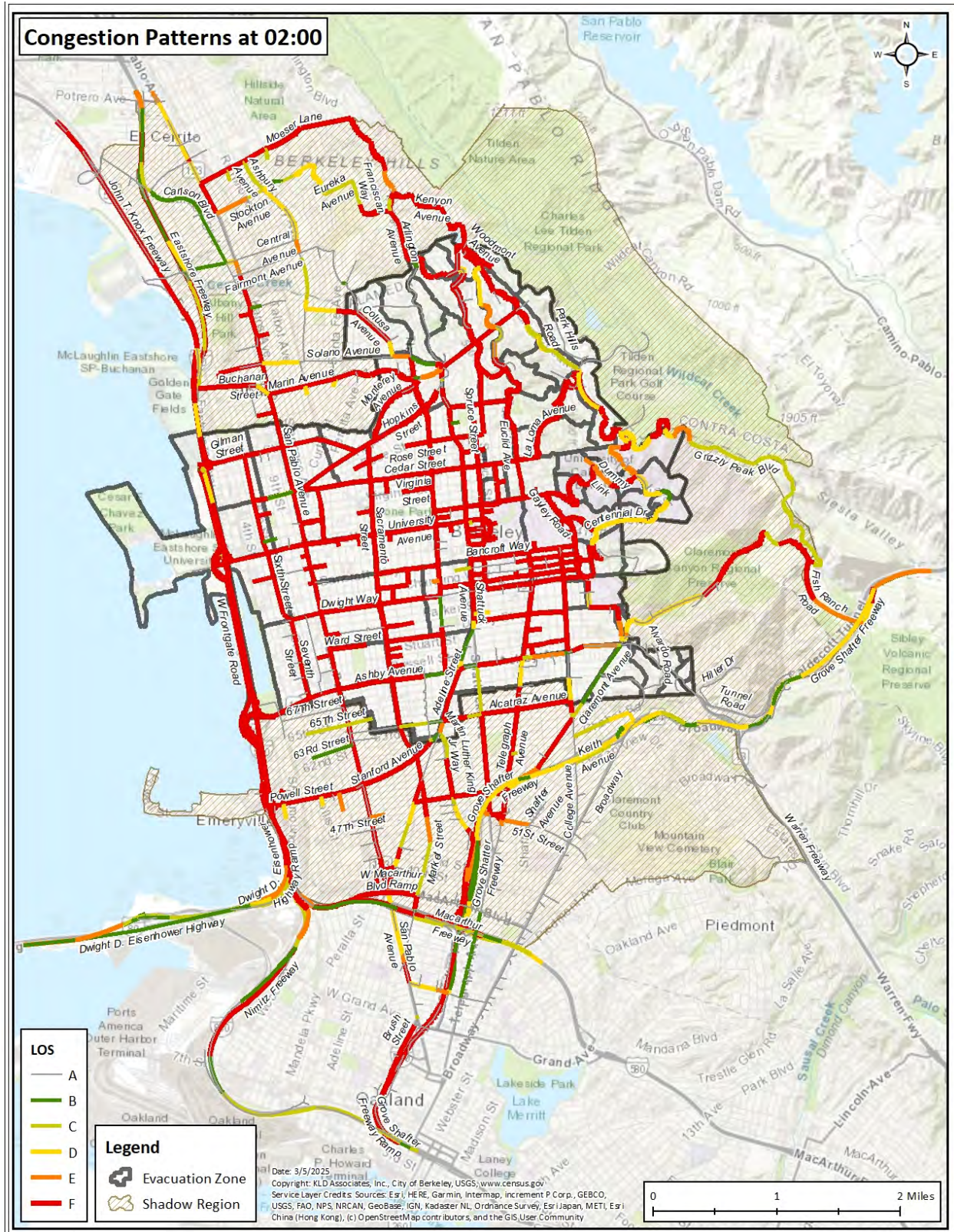


Figure F-3. Region R01 Congestion Patterns 2 Hours after the Evacuation Order

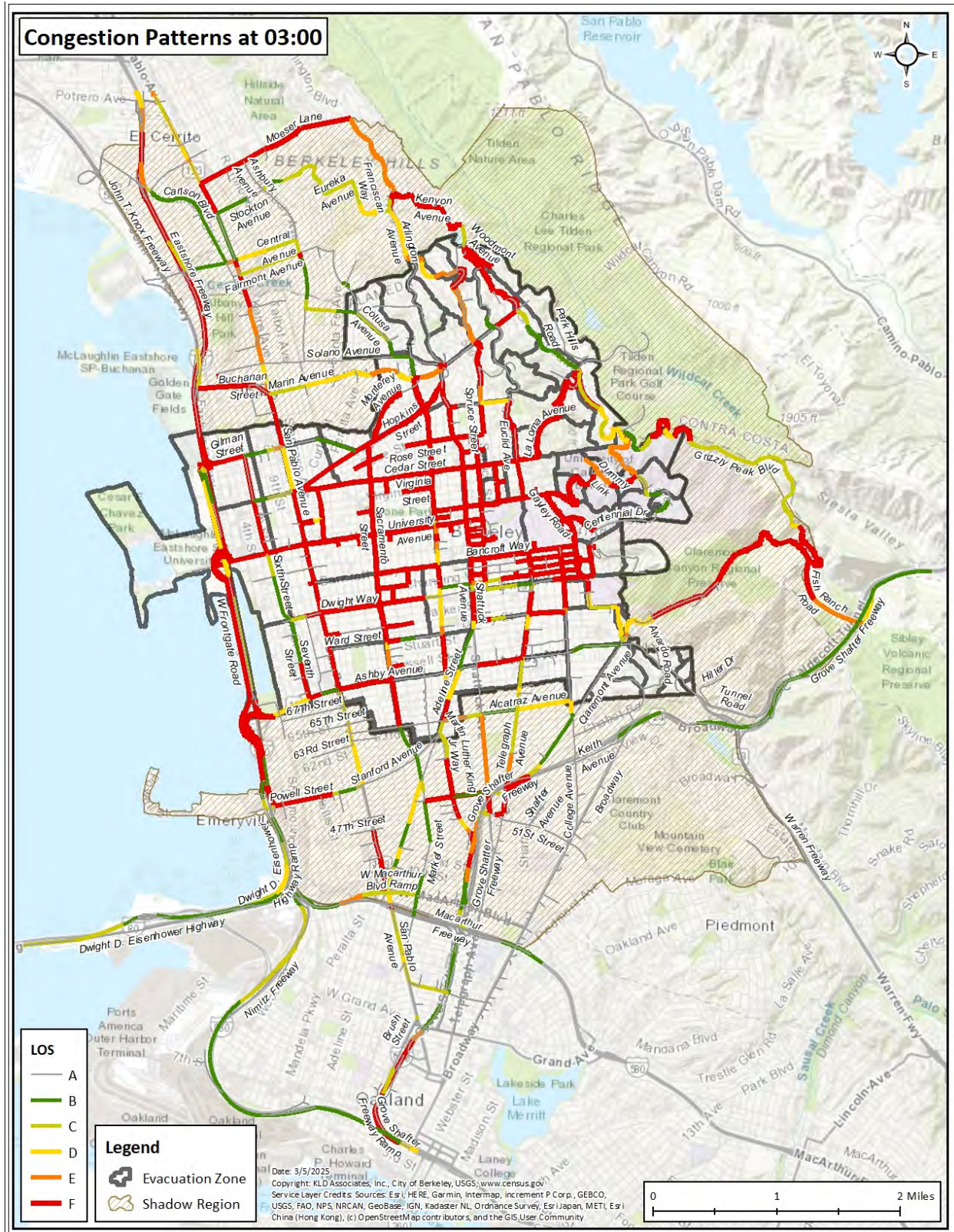


Figure F-4. Region R01 Congestion Patterns 3 Hours after the Evacuation Order

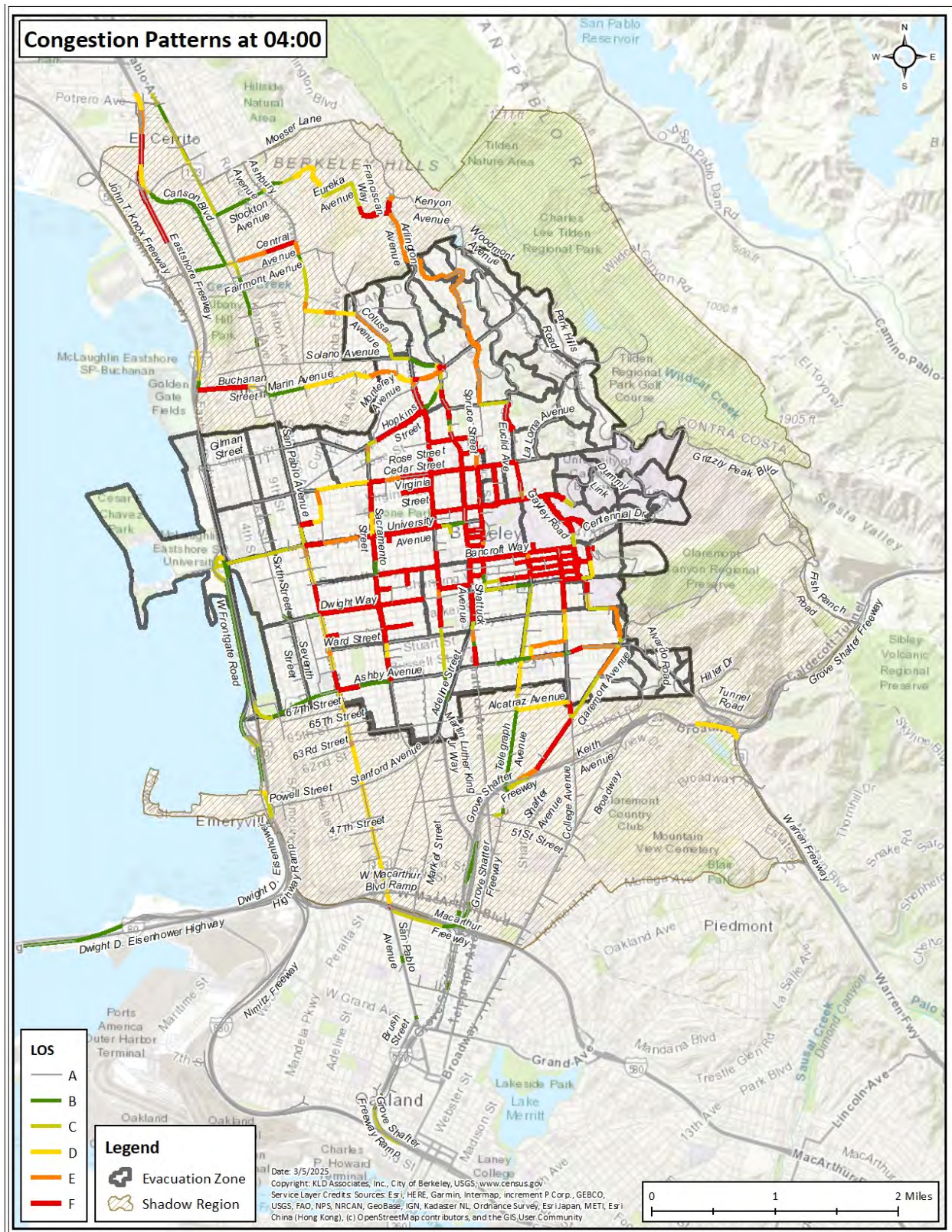


Figure F-5. Region R01 Congestion Patterns 4 Hours after the Evacuation Order

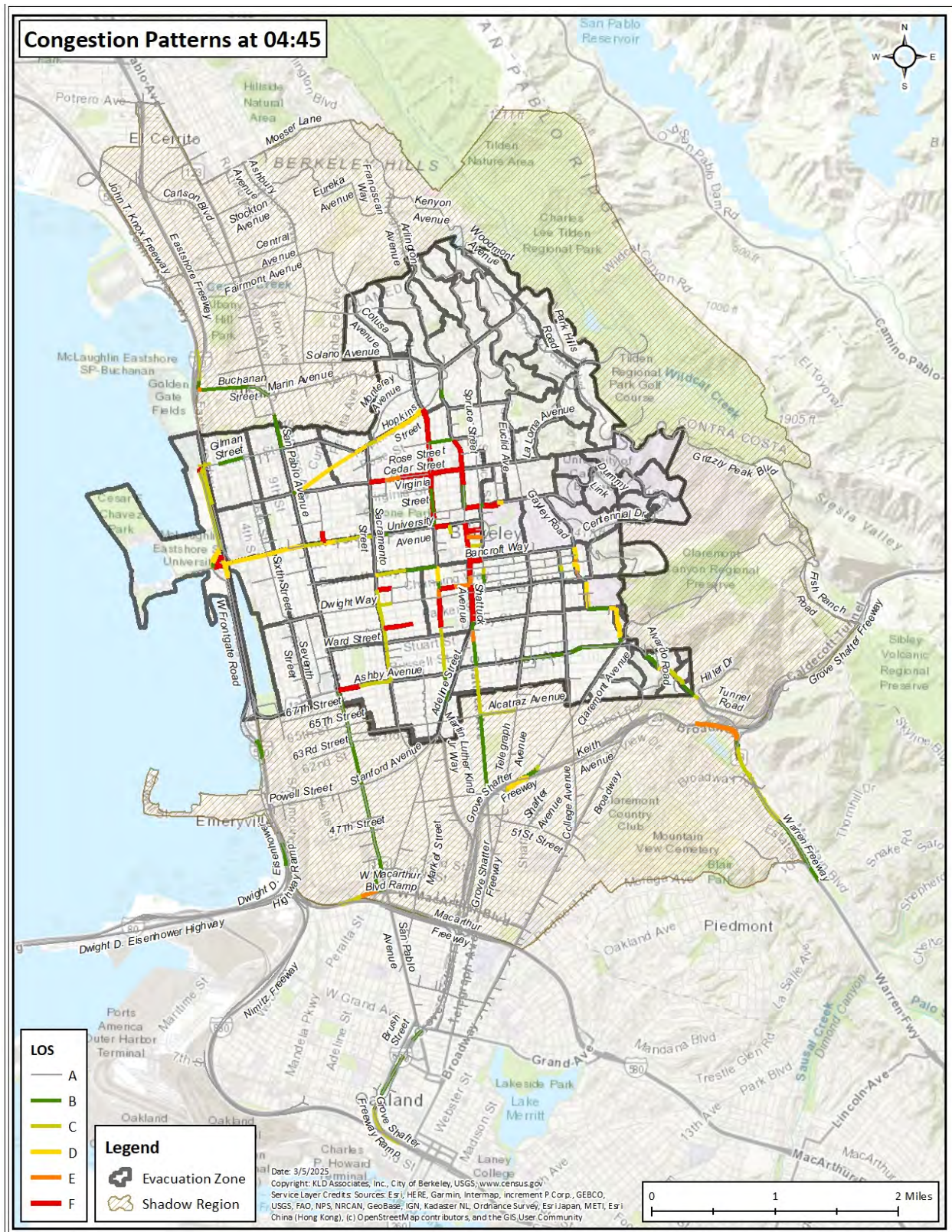


Figure F-6. Region R01 Congestion Patterns 4 Hours and 45 Minutes after the Evacuation Order

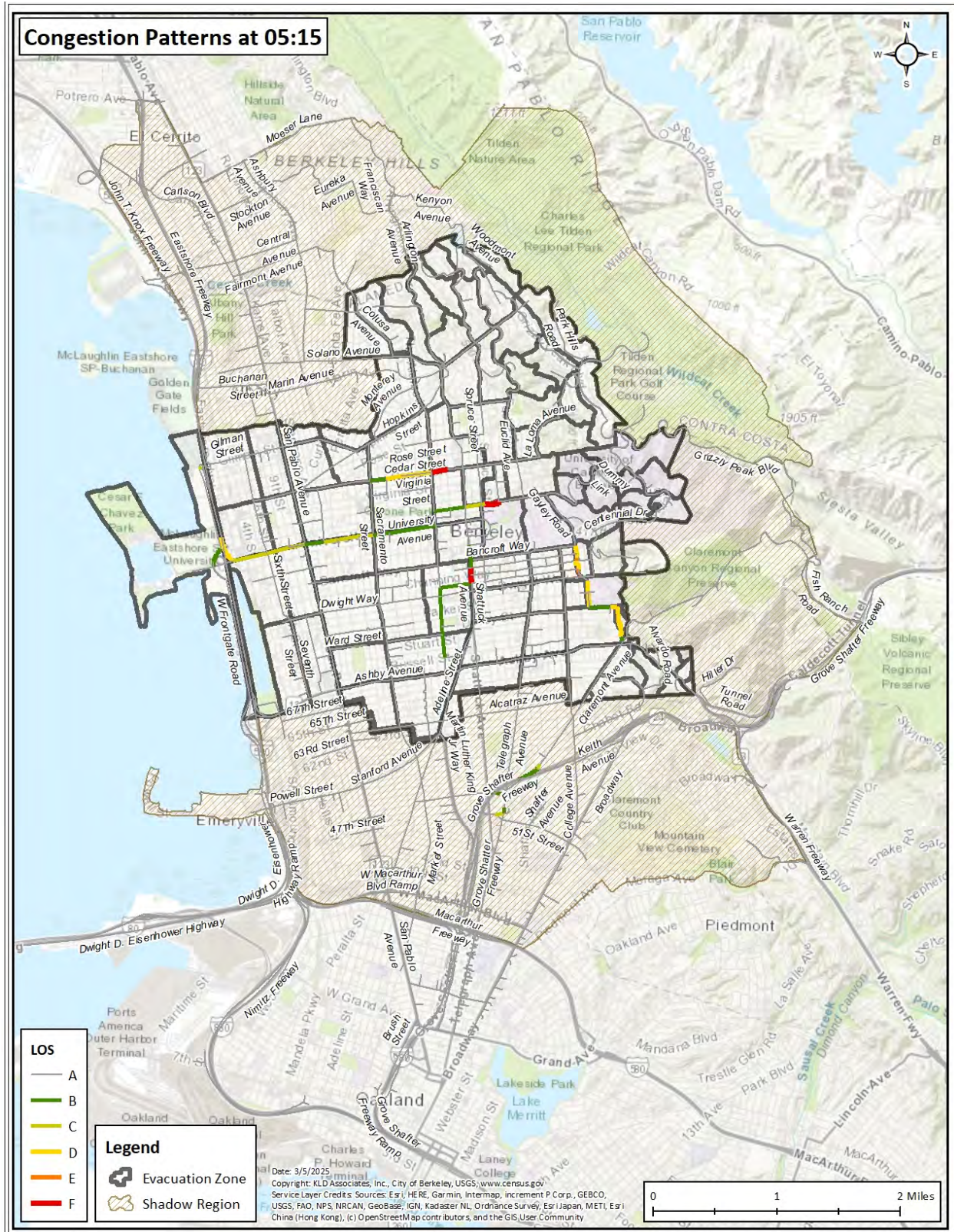


Figure F-7. Region R01 Congestion Patterns 5 Hours and 15 Minutes after the Evacuation Order

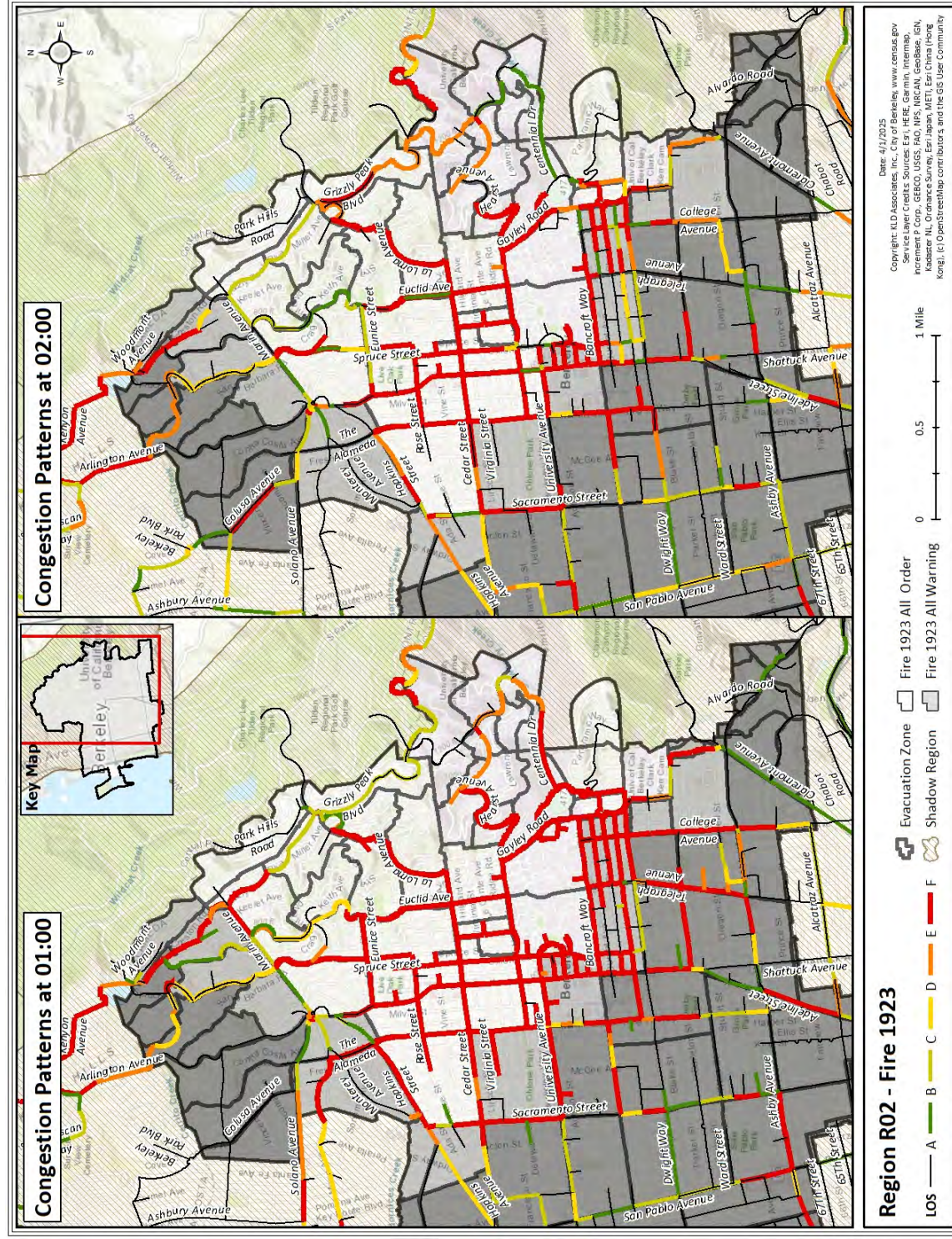


Figure F-8. Region R02 Congestion Patterns 1 Hour and 2 Hours after the Evacuation Order

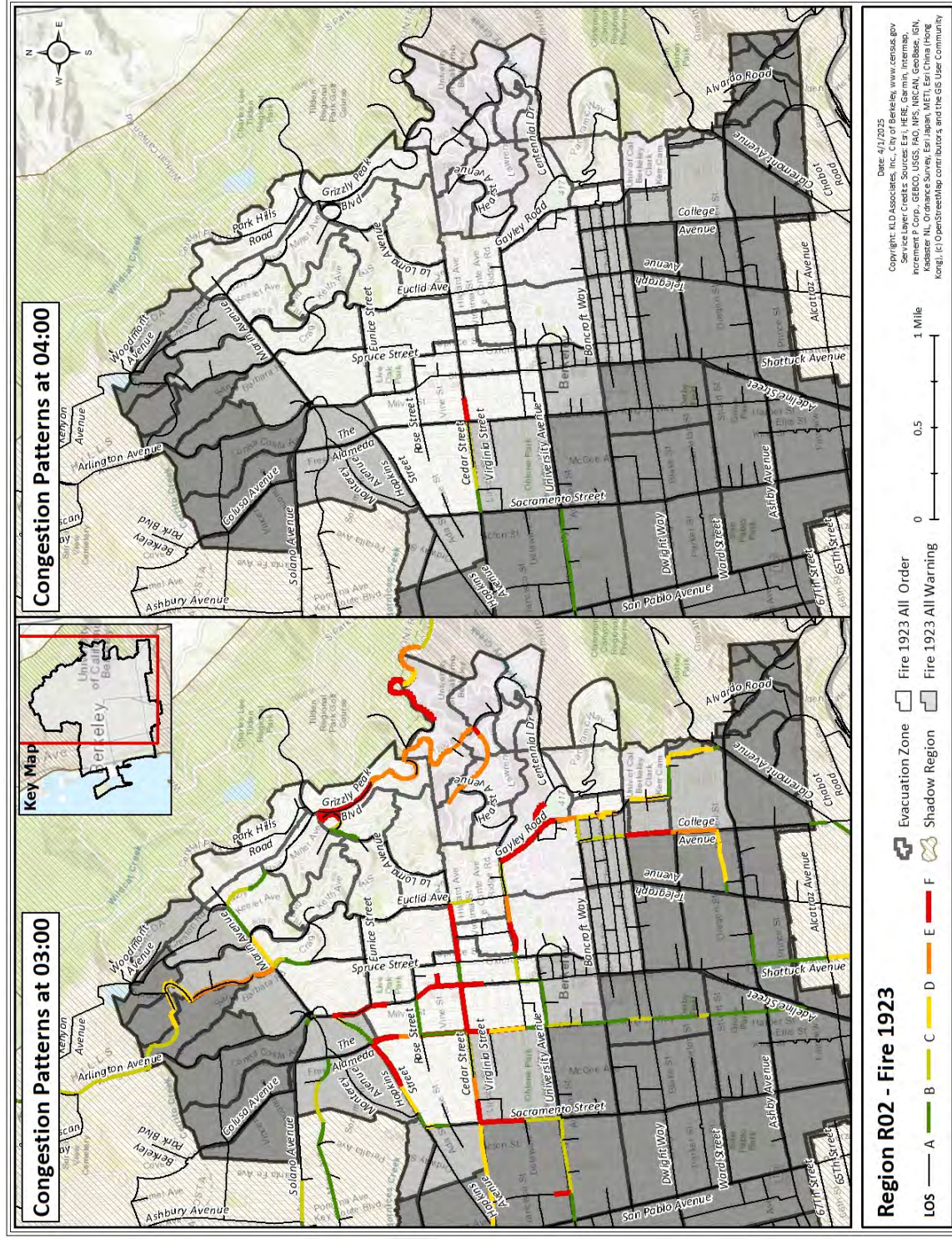


Figure F-9. Region R02 Congestion Patterns 3 Hours and 4 Hours after the Evacuation Order

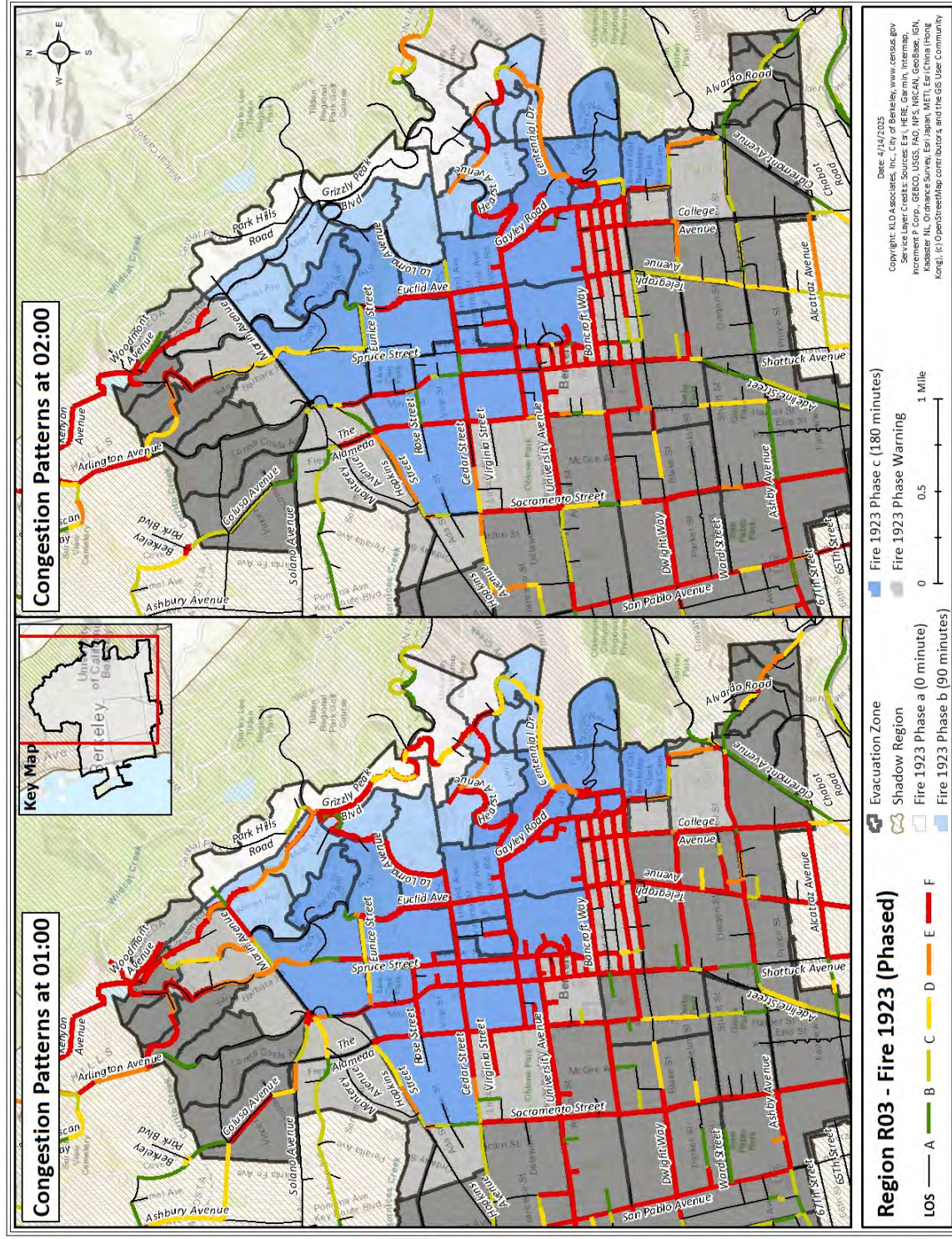


Figure F-10. Region R03 Congestion Patterns 1 Hour and 2 Hours after the Evacuation Order

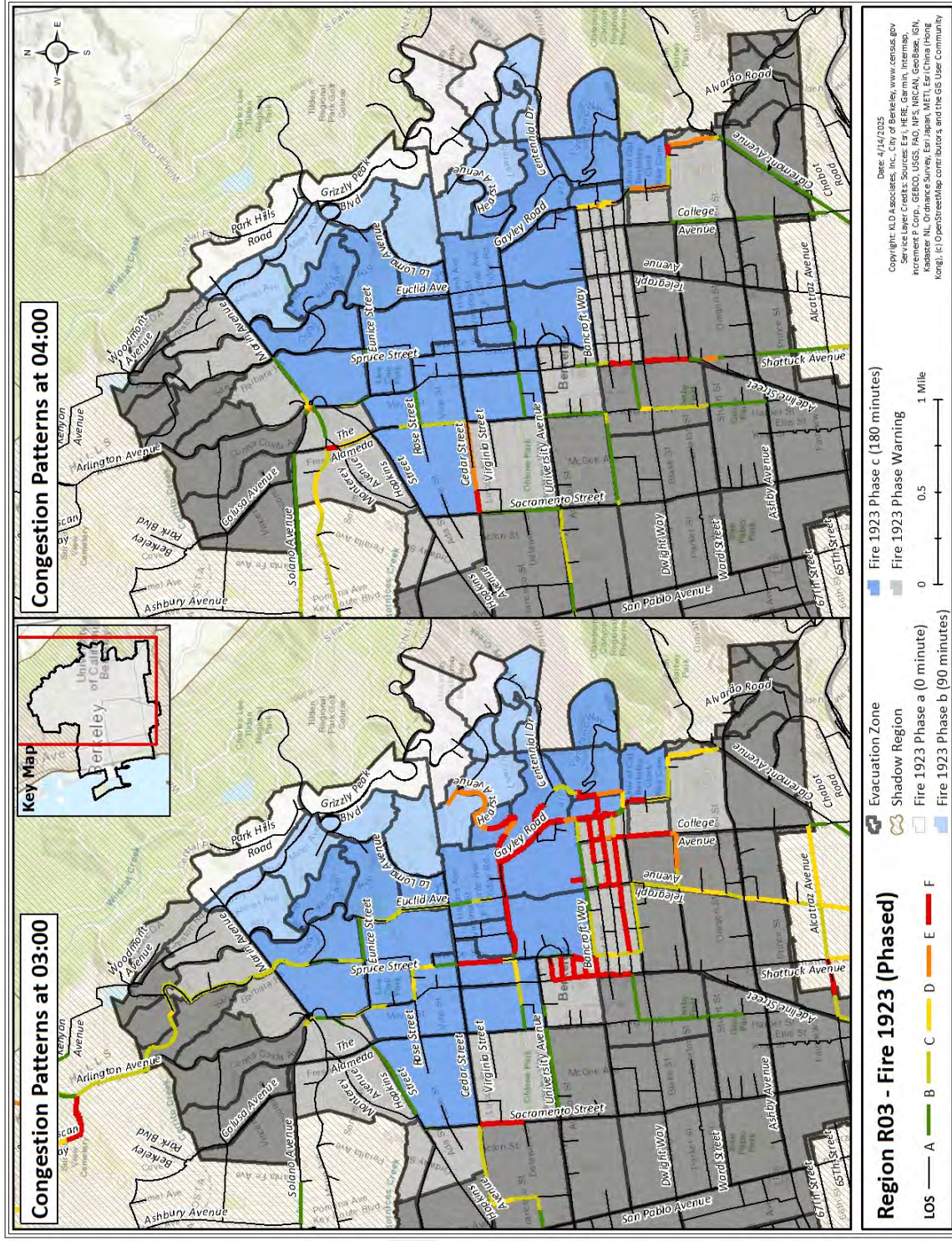


Figure F-11. Region R03 Congestion Patterns 3 Hours and 4 Hours after the Evacuation Order

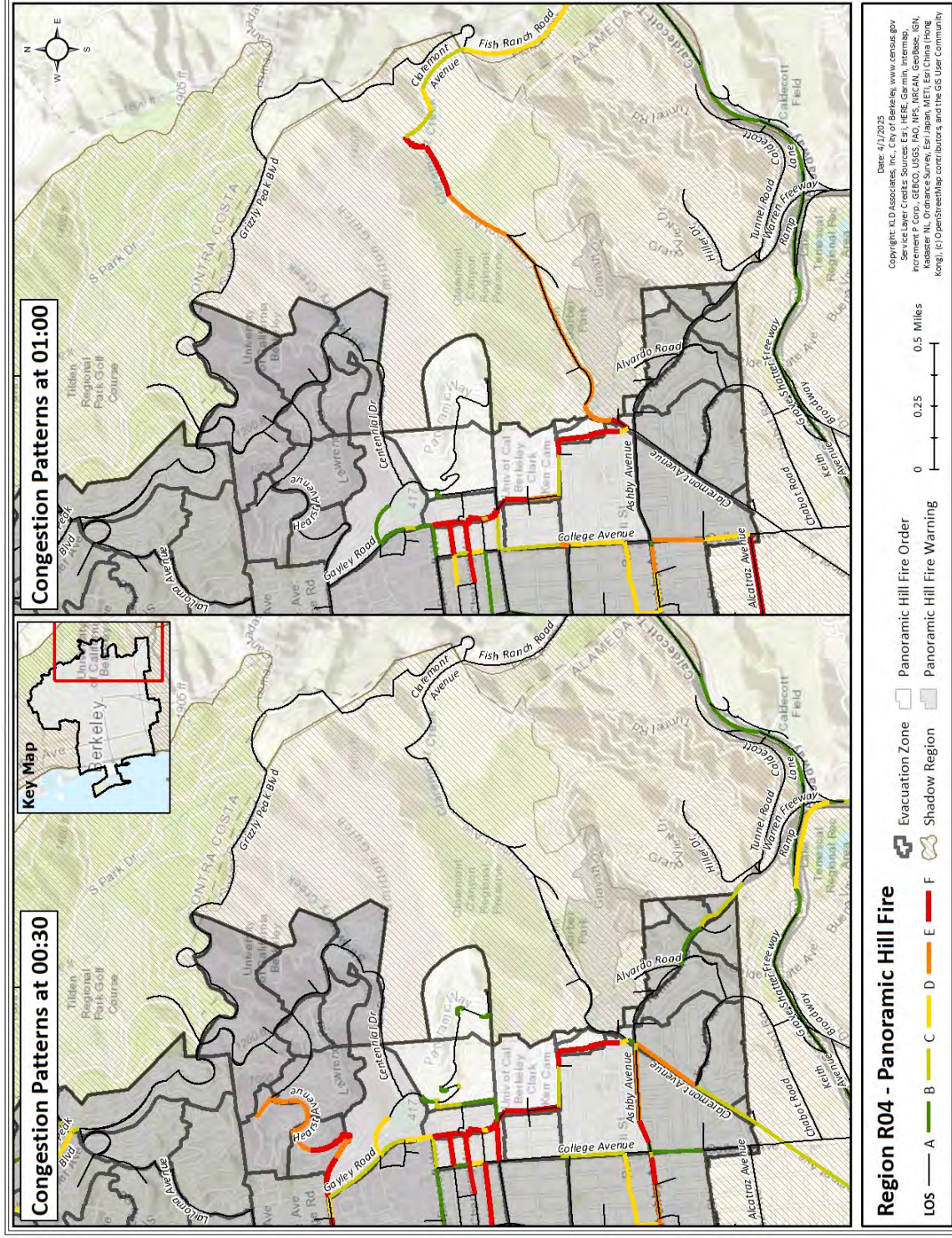


Figure F-12. Region R04 Congestion Patterns 30 Minutes and 1 Hour after the Evacuation Order

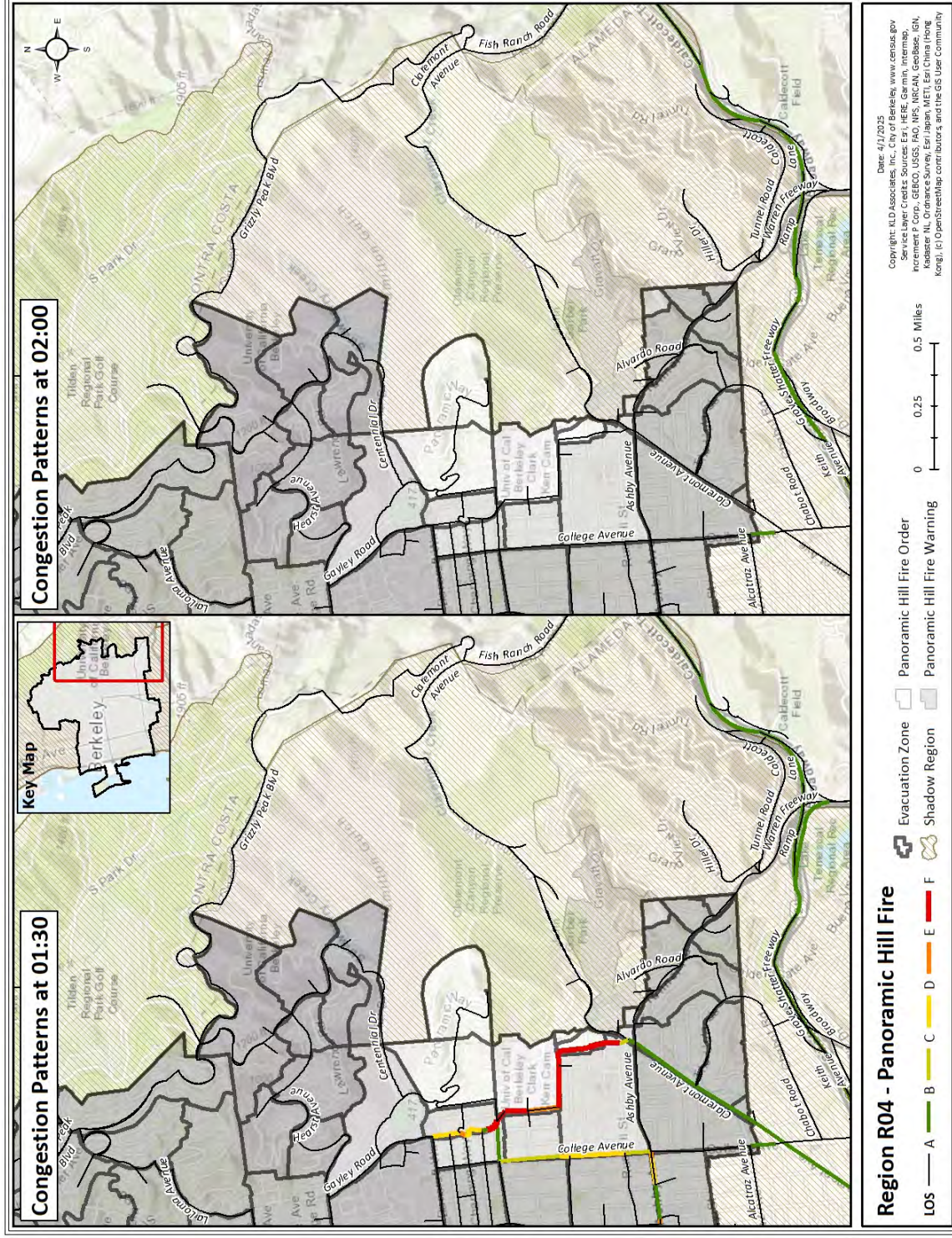


Figure F-13. Region R04 Congestion Patterns 1 Hour and 30 Minutes and 2 Hours after the Evacuation Order

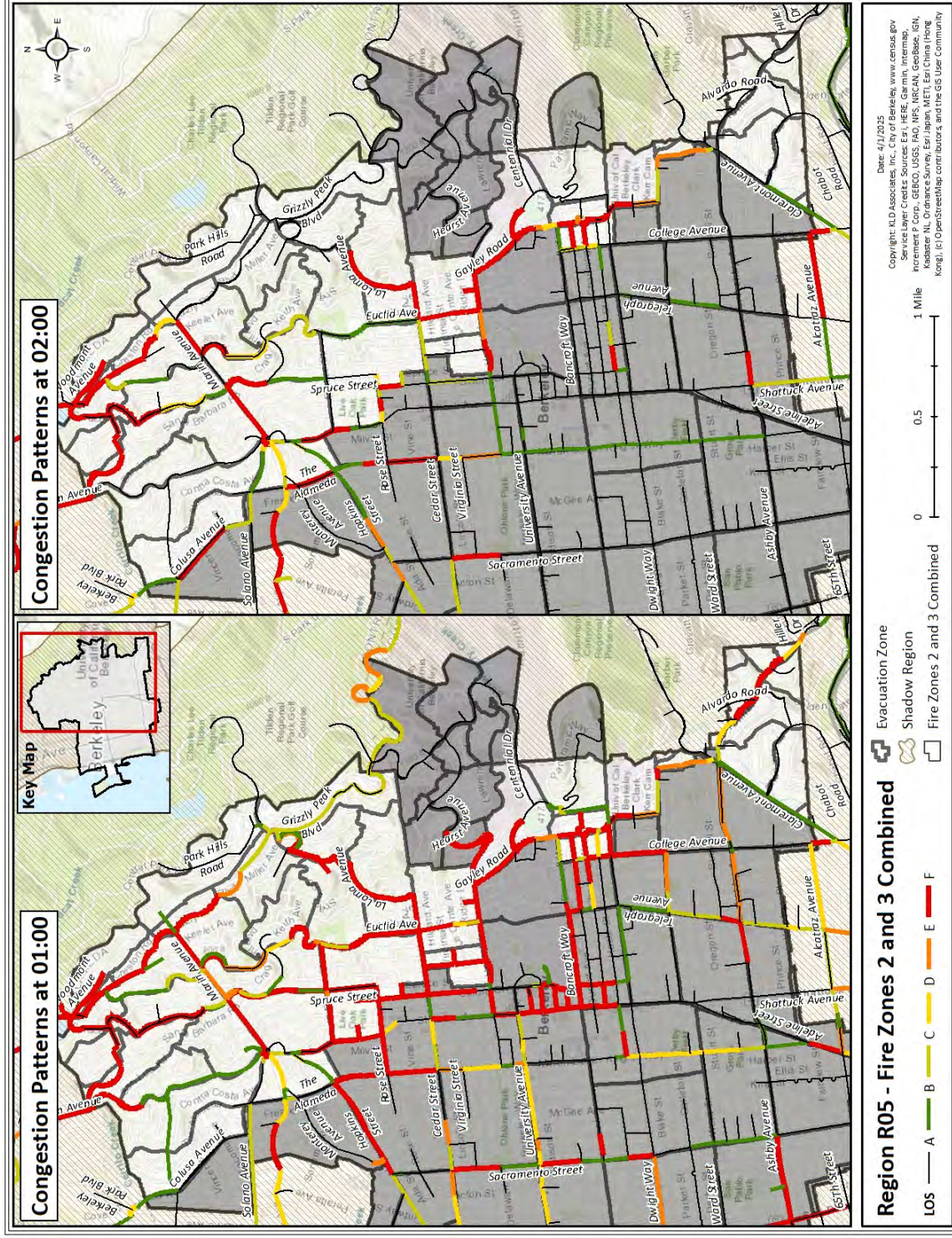


Figure F-14. Region R05 Congestion Patterns 1 Hour and 2 Hours after the Evacuation Order

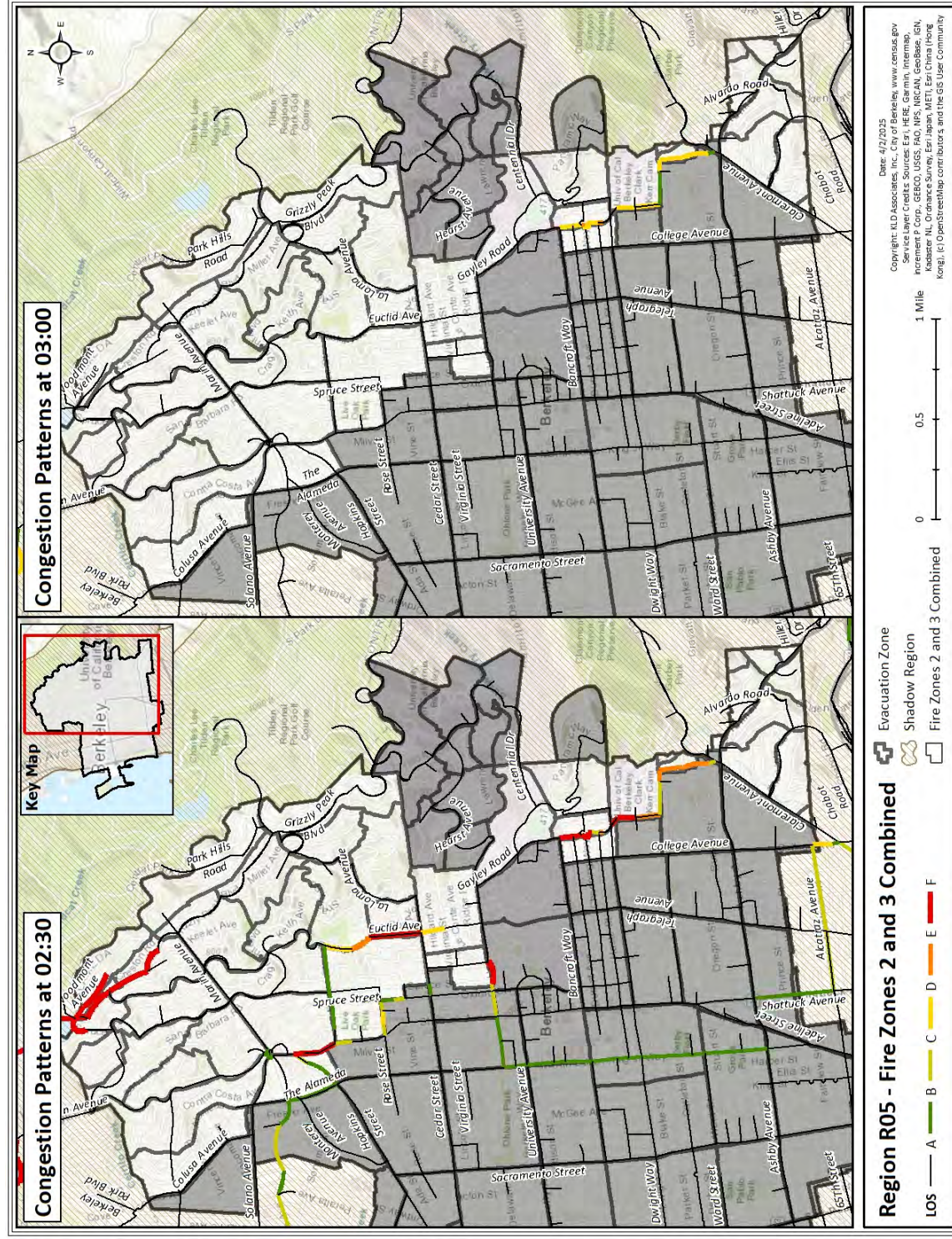




Figure F-17. Region R06 Congestion Patterns 1 Hour and 30 Minutes and 2 Hours and 30 Minutes after the Evacuation Order

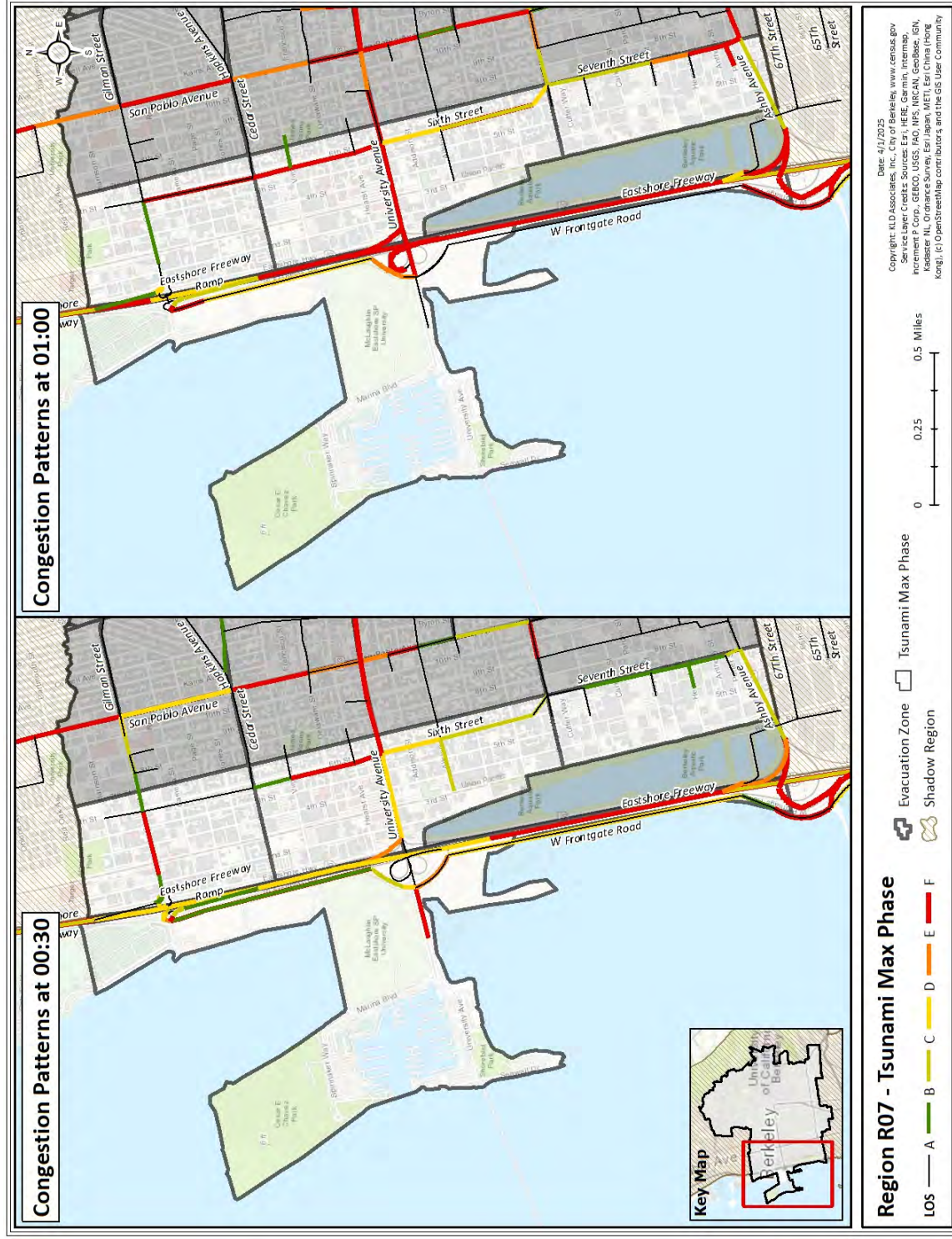


Figure F-18. Region R07 Congestion Patterns 30 Minutes and 1 Hour after the Evacuation Order

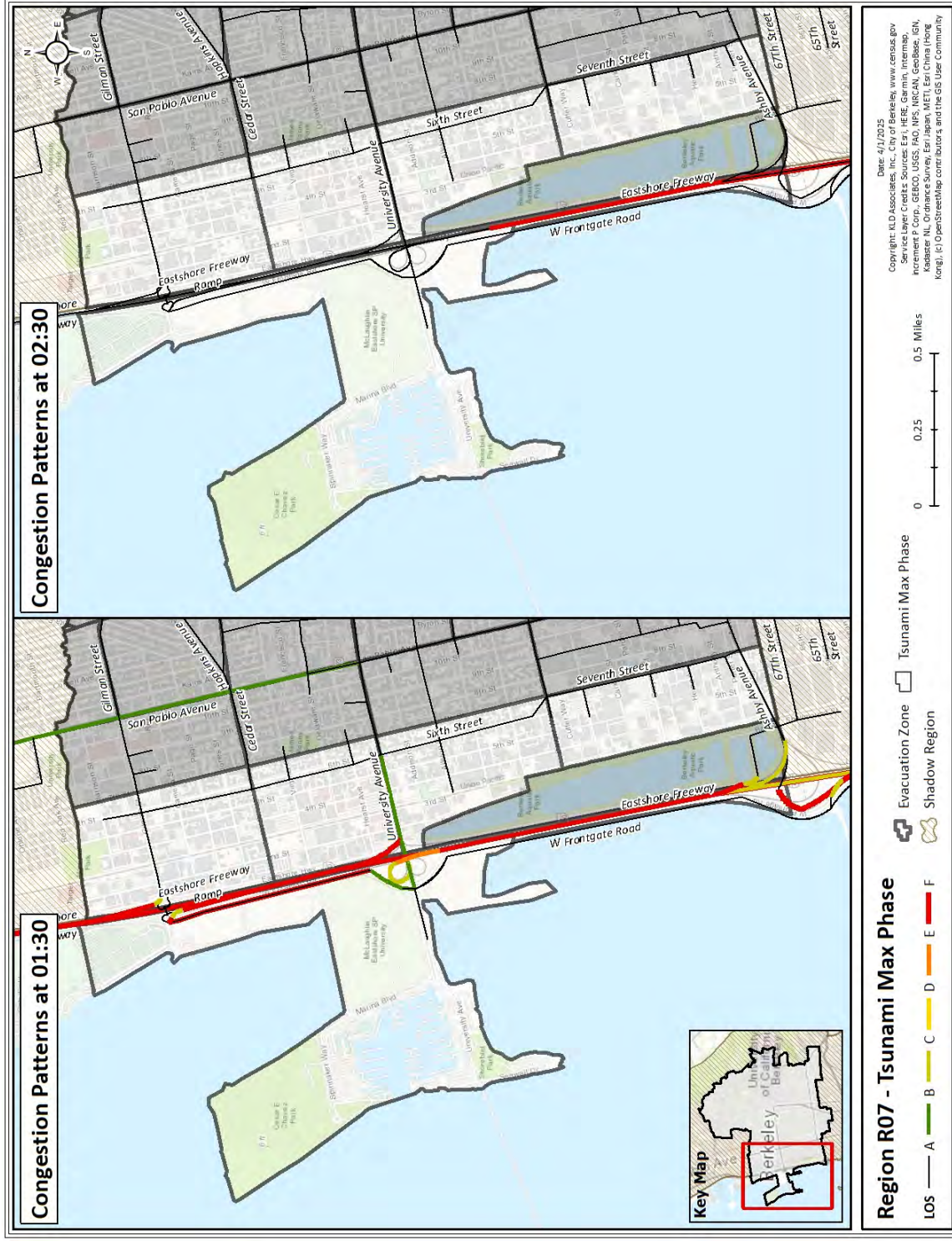


Figure F-19. Region R07 Congestion Patterns 1 Hour and 30 Minutes and 2 Hours and 30 Minutes after the Evacuation Order

APPENDIX G

Traffic Calming Devices, Traffic Signals, and Existing Street Network Characteristics Posing
Challenges to Evacuation

G. TRAFFIC CALMING DEVICES (TCDs), TRAFFIC SIGNALS AND EXISTING STREET NETWORK CHARACTERISTICS POSING CHALLENGES TO EVACUATION

Appendix F provides patterns of traffic congestion during various evacuation cases. The figures in Appendix F were analyzed to identify problem areas, which are explored here in additional detail. This Appendix specifically identifies the impacts to evacuation traffic flow from traffic calming devices (TCDs), pre-timed traffic signals, and other attributes of Berkeley's roadway network or built and natural environment within the identified problem areas.

G.1 TCDs in DYNEV

Figure G-1 shows the TCDs within the City of Berkeley as of January 14, 2025. As discussed in Section 1.3, the traffic simulation model was developed based on the data collected during the field survey which was conducted in May 2023. The existing traffic calming devices (TCDs) were modeled within the network based on their impact to speed and capacity. Below is a summary of how each TCD broadly impacts the simulation of evacuating vehicles:

- Diverters are represented as disconnected links and nodes, effectively blocking routing paths and reflecting their function in preventing through traffic. (This is also applicable for sections of roadway that are for cyclists only.)
- Traffic circles, often functioning as all-way stops within the city, are assigned low capacities (approximately 900 vehicles per hour per lane) due to the inherent delays associated with stopping or yielding.
- Vertical deflection, like speed humps or bumps, are modeled by reducing link speeds as the driver safely navigates them, thereby lowering the effective capacity of those road segments.
- Rectangular rapid flashing beacons (RRFB) and pedestrian hybrid beacons (PHB) only influence vehicle behavior if the surveyor cautiously reduced speed at these locations, otherwise, they are disregarded.¹
- Horizontal deflection affecting only the shoulder or parking lane, such as bulb outs, dedicated bike lanes, and median crossings are also excluded from the model, unless they encroach on travel lanes.

It should be noted that the impact of TCDs on fire apparatus and emergency vehicle response times is being conducted as a separate work effort. The scope of this study is limited to evacuating vehicles and the impacts of these TCDs on evacuation is discussed herein.

¹ Note that RRFB and PHB are not technically traffic calming devices but are described here because in Berkeley RRFB have been used as part of the City's draft traffic calming toolbox.

G.2 Traffic Calming Devices, Traffic Signals, and Other Street Network Characteristics Posing Challenges to Evacuation

Appendix F identifies patterns of traffic congestion expected for various evacuation regions and cases. This Appendix highlights particular roadway constraints and traffic calming devices with notable impacts across various evacuation cases studied.

This section identifies the specific traffic calming devices, traffic signals, and other street network characteristics posing challenges to evacuation, with the goal of identifying opportunities to improve traffic flow in evacuations. Traffic calming devices, by design, reduce vehicle speeds for pedestrian safety, reduce vehicle volumes on residential streets, and/or disrupt network connectivity for vehicles. Consequently, simulation results indicate drivers will have a strong preference for routes devoid of TCDs, which allow for higher speeds, have greater capacities, and have greater route choice availability. This preference, coupled with limited evacuation directions (in order to leave the city, drivers are essentially limited to an evacuation northbound or southbound), concentrates demand onto a reduced set of roadways. This concentrated demand results in congestion with both macroscopic impacts, increasing the overall time to clear the hazard area, as well as impacts to individual evacuees, whose time on the roadway increases.

Section 10 identifies improvements to evacuation traffic flow from a widescale transition to actuated/adaptive traffic signals. This section highlights pre-timed signals with notable impacts across various evacuation cases studied, so that they may be considered for prioritization in a shift to actuated/adaptive signals.

The existing characteristics of the road network are noted to provide a comprehensive analysis of the challenges to evacuation traffic flow. Some are assumed to be fixed, such as preexisting facilities and parks; others are noted as traffic design elements that could be improved for evacuation traffic flow.

Affected Area: South and West of UC Berkeley Campus

As shown in Figure F-2 through Figure F-5, Figure F-8, Figure F-10, and somewhat in Figure F-14, congestion is pronounced in areas of the city to the south and immediate west of the UC Berkeley campus. The area is bounded as follows: Piedmont Ave (east), Dwight Way (south), Shattuck Avenue (west), and University Ave-Oxford St-Bancroft Way (north). This is a result of the following:

Traffic Calming

- Between University and Dwight, there are only two roadways (Addison St and Allston Way) that provide a direct westbound connection for vehicles to access Sacramento St.
 - The diverter at Channing Way and Roosevelt Ave breaks the connection along Channing Way between the two arterials.
 - Addison St and Allston Way are the only roadways that provide the direct westbound connection to Sacramento Street, and they have numerous traffic circles with low capacities (that operate as all way stop intersections) between

Shattuck Ave and Sacramento Ave.

- Fulton St is not a viable southbound option for traffic in Downtown Berkeley and Southside due to diverters that block traffic from traveling southbound.
- Ellsworth St is not a desirable southbound option for traffic in Downtown Berkeley and Southside due to numerous traffic circles that lower the capacity of these roadways.

Traffic Signals

- Pretimed signals along Shattuck Ave exacerbate traffic in this area as vehicles are not efficiently processed through the signals in the north-south direction. This can be seen in Figure F-1 through Figure F-6, Figure F-8, Figure F-10, Figure F-11, and Figure F-14.
- Pretimed signals along Cedar St at the intersections with Sacramento St, Martin Luther King Jr Way, Shattuck Ave and Oxford St and the pretimed signals along Haste St westbound at Dana St, Ellsworth St and Fulton St also prevent efficient traffic flow westbound. This congestion resulting from the pretimed signals along Cedar St can be visually seen in Figure F-5 through Figure F-11.

Existing Street Network Characteristics

- Between University and Dwight, there are only two roadways that provide a direct westbound connection (Addison St and Allston Way) for vehicles to access Sacramento St.
 - Berkeley High School breaks Bancroft Way between Milvia St and Martin Luther King Jr Way.
 - Haste St intersects Martin Luther King Jr Way at a T-intersection and does not continue westbound to connect into Sacramento St.
- The limited desirable westbound connections force traffic south from Downtown Berkeley and Southside to funnel either northbound along Arlington Ave or Oxford St or southbound along Shattuck Ave, Telegraph Ave, College Ave, and Warring St/Derby St/Belrose Ave/Claremont Blvd to evacuate the area.

Affected Area: North of Ohlone Park

The portion of the city that lies between Sacramento St, Cedar St, Martin Luther King Jr Way, and Ohlone Park are in a unique situation for evacuation. This area is limited in the number of outbound paths to choose from.

Traffic Calming

- Between Sacramento Street and Martin Luther King Jr Way, only one street (California St) connects Ohlone Park with Cedar Street.
 - Diverters along Virginia St/McGee Ave and Grant St make northbound evacuation difficult for parts of this area.

Existing Street Network Characteristics

- Roadway design forces westbound traffic to go northbound on Sacramento St at every intersection except Lincoln, which is stop controlled.

- Ohlone Park blocks southbound egress out of this area.
- All eastbound routes meet with Martin Luther King Jr Way at stop signs.
- Southbound traffic must first go northbound to Cedar or go eastbound to Martin Luther King Jr Way (and wait for a break in traffic).
- Between Sacramento Street and Martin Luther King Jr Way, only one street (California St) connects Ohlone Park with Cedar Street. Edith St and Josephine St both stop at Virginia St and do not continue south.

This area is one of the last to clear in an evacuation of the entire city as shown in Figure F-6.

Affected Area: South and West of Clark Kerr Campus

As shown for the Panoramic Fire case (Figure F-12 and Figure F-13), the portion of the city that lies between Ashby Ave (south), College Ave (west), Dwight Way (north), and Warring St/Derby St/Bellrose Ave/Claremont Blvd (east) is also limited in the number of outbound paths to choose from.

Traffic Calming

- The diverter at Piedmont Ave and Parker St prevents traffic from traveling westbound.
- The diverter at Piedmont Ave and Derby St prevents traffic from traveling westbound.
- The diverter at the intersection with Derby St/Tanglewood Rd prohibits traffic from utilizing Tanglewood Rd to access Claremont Ave.
- The diverter at Avalon Ave and Claremont Ave prohibits vehicles from Avalon Ave from accessing Claremont Ave. As such, traveling further south on Bellrose Ave, Claremont Blvd/Garber St and Avalon Ave do not provide westbound or eastbound connections.
- Due to the diverter at Piedmont Ave/Russell St, traffic cannot access College Ave via Russell St.
- Traffic could travel on Claremont Blvd to Forest Ave. The speed table along Forest Ave has a low capacity of this roadway.

Existing Street Network Characteristics

- Evacuees traveling southbound along Piedmont Ave are limited in options once they pass the intersection with Dwight Way.
- Traveling eastbound on any road does not provide a way out of the area.

Affected Area: Lawrence Berkeley National Lab (LBNL)

As discussed in Section 7.3.9, during the midweek during the day, the heavy flow of traffic leaving LBNL combined with the daily background and shadow evacuating traffic in areas just west of LBNL overwhelms the intersection of Gayley Rd/LaLoma Ave and Hearst Ave.

Traffic Signals

- The intersection of Gayley Rd/LaLoma Ave and Hearst Ave is a pretimed traffic signal. Conversion to an actuated signal may provide better throughput at this intersection for an evacuation of LBNL.

G.3 Recommendations

This analysis highlights the TCDs, traffic signals, and existing street network characteristics with potential to reduce overall network capacity and to locally impede flow of evacuees in large-scale evacuations.

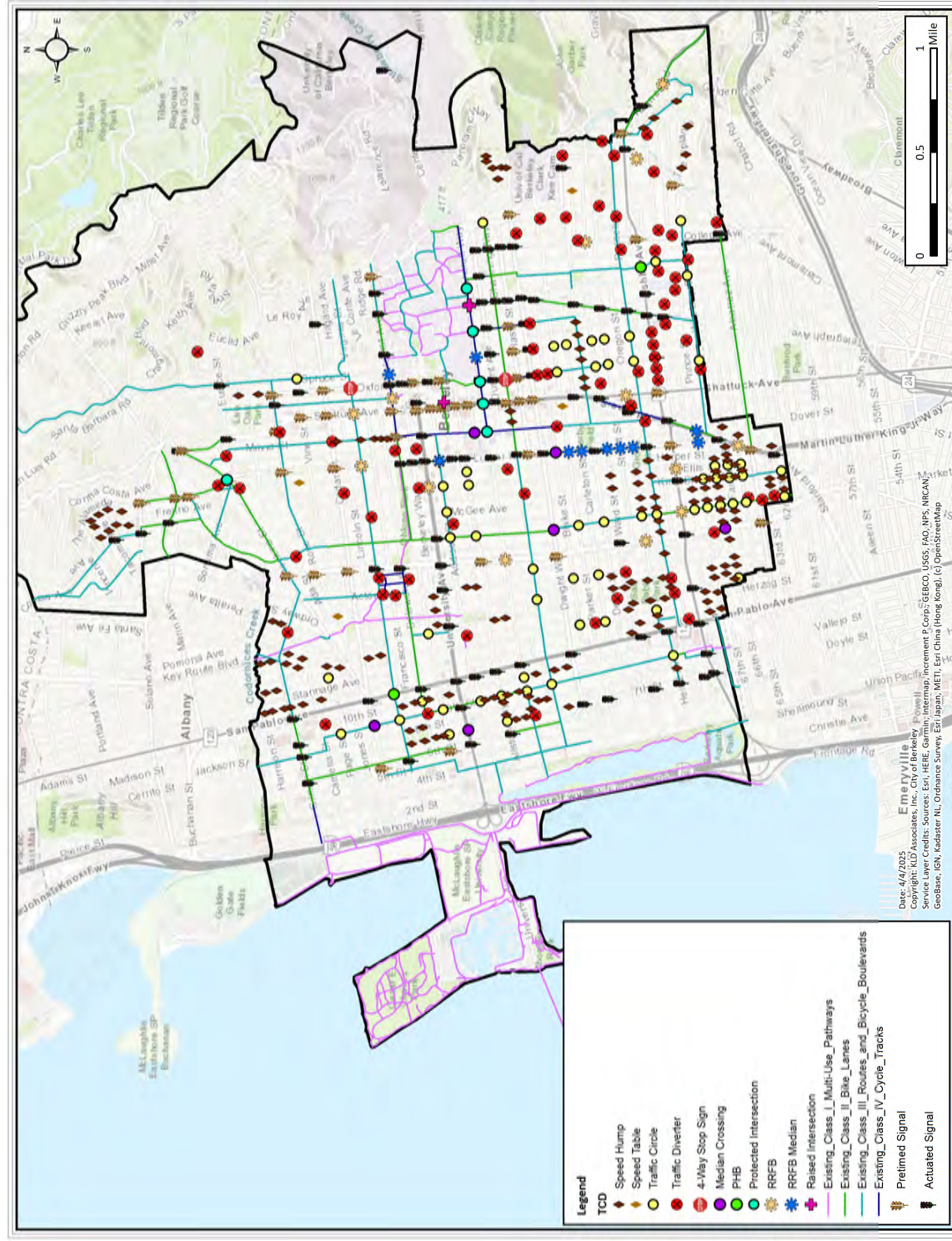
TCDs in particular are vital for pedestrian safety, as well as reduction of speed and traffic volume on neighborhood streets.

For existing infrastructure, the City should develop and implement a citywide connectivity and capacity strategy, potentially integrating approaches such as actuated or adaptive signal timing and replacing TCDs with removable/retractable options. As part of proposed infrastructure changes, City should develop and implement a methodology to conduct a comprehensive capacity analysis, considering peak evacuation demand (as is presented in Appendix F and G of this document), should be conducted. This analysis will attempt to ensure that infrastructure changes will not result in new evacuation bottlenecks, as increased traffic volume of diverting vehicles is redistributed in the roadway network. This proactive approach will attempt to ensure that strategies to improve connectivity and increase roadway capacity do not create downstream impacts.

For future infrastructure, it is strongly recommended that the City develop and implement a methodology to evaluate and consider evacuation efficiency and roadway capacity during the planning and implementation phases of future roadway infrastructure development, including TCD installations. Simulation modeling could be employed to assess the impact of proposed roadway infrastructure development, including TCDs, on evacuation times and congestion levels under emergency scenarios.

In addition to exploring these impacts for evacuation contexts, impacts to first responder response times should also be assessed in daily traffic environments to better understand the full impact of TCDs and other traffic calming measures. This effort is currently underway.

Section 11.3.2 identifies traffic signal improvements that could improve evacuation flow.



APPENDIX H

Region Specific Facility and Transit Dependent Population Data

H. REGION SPECIFIC FACILITY AND TRANSIT DEPENDENT POPULATION DATA

This appendix provides a list of special facility and transit dependent population data for Region R01 through Region R07. The following Sections explain how these numbers are derived for each population group that could be transit dependent:

- Visitors – Section 3.3
- Employees – Section 3.4
- Medical Facilities – Section 3.5.1
- Schools/Preschools/Day Care Centers – Section 3.6.1
- Colleges – Section 3.6.2
- Transit Dependent Residents – Section 3.7
- People Requiring Specialized Transportation Assistance – Section 3.8

Table H-1. Facility and Transit Dependent Population by Region

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R01	Citywide Evacuation	Various locations throughout the region	Transient Attractions	44,192	13,258
		Various locations throughout the region	Major Employers	25,341	9,046
		Various locations throughout the region	Transit Dependent Residents	1,686	1,686
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	348	348
		Alta Bates Summit Medical Center - Alta Bates Campus	Medical Facility	183	183
		Alta Bates Summit Medical Center - Herrick Campus	Medical Facility	58	58
		Ashby Care Center	Medical Facility	29	29
		Berkeley Pines Care Center	Medical Facility	32	32
		Chaparral House	Medical Facility	42	42
		Elegance Berkeley	Medical Facility	47	47
		Elmwood Care Center	Medical Facility	77	77
		Kyakameena Care Center	Medical Facility	60	60
		New Bridge Foundation	Medical Facility	45	45
		Redwood Gardens Apartments	Medical Facility	168	168
		Silverado Memory Care Center	Medical Facility	87	87
		Ala Costa Ctr. For The Developmentally Disabled	Preschool/Day Care Center	58	10
		American International Montessori School	Preschool/Day Care Center	117	20
		Aquatic Park School	Preschool/Day Care Center	77	13
		Arbor Preschool East	Preschool/Day Care Center	22	4
		Bahia School Age Program	Preschool/Day Care Center	65	11
		Berkeley Hills Nursery School	Preschool/Day Care Center	40	7
		Berkeley International Montessori School	Preschool/Day Care Center	21	4
		Berkeley Little School	Preschool/Day Care Center	42	7
		Berkeley Montessori School	Preschool/Day Care Center	119	20
		Berkeley Rose Waldorf School	Preschool/Day Care Center	24	4
		Berkeley Special Education Preschool	Preschool/Day Care Center	90	15
		Berkeley YMCA EHS - Vera Casey	Preschool/Day Care Center	26	4
		Berkeley YMCA Head Start - South YMCA	Preschool/Day Care Center	94	16

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R01	Citywide Evacuation	Berkeley YMCA Head Start - West YMCA	Preschool/Day Care Center	86	15
		Beth El Nursery School	Preschool/Day Care Center	74	13
		BUSD - Franklin Preschool	Preschool/Day Care Center	192	33
		BUSD - Hopkins Street	Preschool/Day Care Center	140	24
		BUSD - King Child Development Center	Preschool/Day Care Center	108	18
		Cedar Creek Montessori School	Preschool/Day Care Center	40	7
		Centro Vida Bilingual Childcare Center	Preschool/Day Care Center	64	11
		Child Education Center	Preschool/Day Care Center	107	18
		Childrens Community Center	Preschool/Day Care Center	52	9
		Congregation Beth Israel-Gan Shalom	Preschool/Day Care Center	32	5
		Congregation Netivot Shalom	Preschool/Day Care Center	30	5
		Cornerstone Children's Center	Preschool/Day Care Center	112	19
		Dandelion Nursery School, Inc	Preschool/Day Care Center	24	4
		Dolma Child Care Center	Preschool/Day Care Center	14	2
		Duck's Nest - Berkeley	Preschool/Day Care Center	91	15
		Ecole Bilingue De Berkeley	Preschool/Day Care Center	426	72
		Ephesian Children's Center	Preschool/Day Care Center	36	6
		Global Montessori International School	Preschool/Day Care Center	90	15
		Golden Gate Learning Center	Preschool/Day Care Center	57	10
		Hearts Leap Beginnings	Preschool/Day Care Center	40	7
		Hearts Leap ICRI Preschool	Preschool/Day Care Center	70	12
		Hearts Leap North	Preschool/Day Care Center	45	8
		Jewish Community Ctr of The East Bay-Berkeley	Preschool/Day Care Center	75	13
		Kids In Motion	Preschool/Day Care Center	70	12
		Little Beans Preschool	Preschool/Day Care Center	40	7
		Little Elephant Montessori, Inc.	Preschool/Day Care Center	24	4
		Mi Mundo Preschool	Preschool/Day Care Center	29	5
		Model School Comprehensive Humanistic Learning Ctr	Preschool/Day Care Center	63	11
		Mustard Seed Preschool	Preschool/Day Care Center	66	11
		Nia House Learning Center	Preschool/Day Care Center	94	16
		Pixar Child Development Center	Preschool/Day Care Center	108	18
		Rosemarie's Motivational Preschool	Preschool/Day Care Center	22	4

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R01	Citywide Evacuation	Shu Ren International School	Preschool/Day Care Center	179	30
		St. John's Child Care Center	Preschool/Day Care Center	45	8
		Step One School	Preschool/Day Care Center	108	18
		Sunshine Preschool (CEID)	Preschool/Day Care Center	45	8
		The Monteverde School	Preschool/Day Care Center	30	5
		The New School of Berkeley	Preschool/Day Care Center	48	8
		The New School Of Berkeley-Schoolage	Preschool/Day Care Center	45	8
		Through the Looking Glass Early Head Start	Preschool/Day Care Center	24	4
		UCB - Clark Kerr Campus Children's Center	Preschool/Day Care Center	29	5
		UCB - Clark Kerr Preschool	Preschool/Day Care Center	29	5
		UCB - Dwight Way Center	Preschool/Day Care Center	42	7
		UCB - Harold E. Jones Child Study Ctr/Childcare	Preschool/Day Care Center	56	10
		UCB - Haste Street Child Development Center	Preschool/Day Care Center	92	16
		VIA Nova Children's School	Preschool/Day Care Center	45	8
		Woolly Mammoth Childcare & Preschool	Preschool/Day Care Center	69	12
		Acupuncture and Integrative Medicine College-Berkeley	School	153	0
		Bayhill High School	School	73	12
		Berkeley Arts Magnet at Whittier School	School	407	69
		Berkeley City College	School	6,519	174
		Berkeley High School	School	3,427	583
		Berkeley Rose Waldorf School	School	97	16
		Berkeley School of Theology	School	65	0
		Berkeley Technology Academy	School	36	6
		Berkwood Hedge School	School	128	22
		Black Pine Circle School	School	347	59
		California Jazz Conservatory	School	88	0
		Church Divinity School of the Pacific	School	122	0
		Cragmont Elementary School	School	331	56
		Dominican School of Philosophy & Theology	School	100	0
		East Bay School for Boys	School	105	18
		Emerson Elementary School	School	323	55
		Escuela Bilingue Internacional School	School	324	55

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R01	Citywide Evacuation	Graduate Theological Union	School	275	0
		Institute of Buddhist Studies	School	53	0
		Jesuit School of Theology	School	112	0
		John Muir Elementary School	School	306	52
		Longfellow Arts and Technology Middle School	School	504	86
		Malcolm X Elementary School	School	552	94
		Martin Luther King Middle School	School	1,007	171
		Maybeck High School	School	121	21
		Oxford Elementary at West Campus	School	256	44
		Pacific Boychoir Academy	School	30	5
		Pacific Lutheran Theological Seminary	School	50	0
		Pacific School of Religion	School	139	0
		Rosa Parks Environmental Science School	School	442	75
		Ruth Acty Elementary School	School	433	74
		School of the Madeleine	School	337	57
		Sylvia Mendez Elementary School	School	409	70
		The Berkeley School	School	236	40
		The Crowden School	School	75	13
		The Elmwood Academy	School	100	17
		The Wright Institute	School	638	0
		Thousand Oaks Elementary School	School	382	65
		University of California - Berkeley	School	44,075	2,289
		VIA Center	School	20	3
		Walden Center & School	School	84	14
		Washington Elementary School	School	416	71
		Willard Middle School	School	669	114
		Zaytuna College	School	43	0
REGION TOTAL:				141,006	30,382

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R02	Fire 1923 Evacuation Order	Various locations throughout the region	Transient Attractions	9,342	2,803
		Various locations throughout the region	Major Employers	15,362	5,484
		Various locations throughout the region	Transit Dependent Residents	525	525
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	108	108
		New Bridge Foundation	Medical Facility	45	45
		Redwood Gardens Apartments	Medical Facility	168	168
		Berkeley Hills Nursery School	Preschool/Day Care Center	40	7
		Berkeley Montessori School	Preschool/Day Care Center	119	20
		Beth El Nursery School	Preschool/Day Care Center	74	13
		BUSD - Hopkins Street	Preschool/Day Care Center	140	24
		Childrens Community Center	Preschool/Day Care Center	52	9
		Hearts Leap North	Preschool/Day Care Center	45	8
		Jewish Community Ctr of The East Bay-Berkeley	Preschool/Day Care Center	75	13
		Mustard Seed Preschool	Preschool/Day Care Center	66	11
		The New School of Berkeley	Preschool/Day Care Center	48	8
		The New School of Berkeley-Schoolage	Preschool/Day Care Center	45	8
		UCB - Clark Kerr Campus Children's Center	Preschool/Day Care Center	29	5
		UCB - Clark Kerr Preschool	Preschool/Day Care Center	29	5
		Bayhill High School	School	73	12
		Berkeley Arts Magnet at Whittier School	School	407	69
		Church Divinity School of the Pacific	School	122	0
		Dominican School of Philosophy & Theology	School	100	0
		Graduate Theological Union	School	275	0
		Jesuit School of Theology	School	112	0
		Martin Luther King Middle School	School	1,007	171
		Pacific Lutheran Theological Seminary	School	50	0
		Pacific School of Religion	School	139	0
		School of the Madeleine	School	337	57
		University of California - Berkeley	School	44,075	2,289
		Zaytuna College	School	43	0

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R02	Fire 1923 Evacuation Warning	Various locations throughout the region	Transient Attractions	4,265	1,280
		Various locations throughout the region	Major Employers	1,156	413
		Various locations throughout the region	Transit Dependent Residents	270	270
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	56	56
		Berkeley Little School	Preschool/Day Care Center	42	7
		Cornerstone Children's Center	Preschool/Day Care Center	112	19
		Dandelion Nursery School, Inc	Preschool/Day Care Center	24	4
		St. John's Child Care Center	Preschool/Day Care Center	45	8
		The Monteverde School	Preschool/Day Care Center	30	5
		UCB - Dwight Way Center	Preschool/Day Care Center	42	7
		UCB - Harold E. Jones Child Study Ctr/Childcare	Preschool/Day Care Center	56	10
		UCB - Haste Street Child Development Center	Preschool/Day Care Center	92	16
		Berkeley City College	School	6,519	174
		Berkeley High School	School	3,427	583
		California Jazz Conservatory	School	88	0
		Cragmont Elementary School	School	331	56
		East Bay School for Boys	School	105	18
		Emerson Elementary School	School	323	55
		Institute of Buddhist Studies	School	53	0
		Maybeck High School	School	121	21
		Pacific Boychoir Academy	School	30	5
		Ruth Acty Elementary School	School	433	74
		The Crowden School	School	75	13
		The Wright Institute	School	638	0
REGION TOTAL:				66,681	6,669

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R03a	Fire 1923 Phase a Evacuation Order	Various locations throughout the region	Transient Attractions	1,423	427
		Various locations throughout the region	Transient Dependent Residents	64	64
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	13	13
		Pacific Lutheran Theological Seminary	School	50	0
R03a	Fire 1923 Phase a Evacuation Warning	Various locations throughout the region	Transient Attractions	2,377	713
		Various locations throughout the region	Transient Dependent Residents	175	175
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	36	36
		Berkeley Hills Nursery School	Preschool/Day Care Center	40	7
REGION TOTAL: 4,178 1,435					
R03b	Fire 1923 Phase b Evacuation Order	Various locations throughout the region	Transient Attractions	3,347	1,004
		Various locations throughout the region	Transient Dependent Residents	207	207
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	43	43
		Berkeley Hills Nursery School	Preschool/Day Care Center	40	7
R03b	Fire 1923 Phase b Evacuation Warning	Pacific Lutheran Theological Seminary	School	50	0
		Various locations throughout the region	Transient Attractions	2,772	832
		Various locations throughout the region	Major Employers	3,028	1,081
		Various locations throughout the region	Transient Dependent Residents	175	175
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	36	36
		Church Divinity School of the Pacific	School	122	0
		Graduate Theological Union	School	275	0
		Jesuit School of Theology	School	112	0
R03c	Fire 1923 Phase c Evacuation Order	Pacific School of Religion	School	139	0
		Zaytuna College	School	43	0
		REGION TOTAL: 10,389 3,385			
		Various locations throughout the region	Transient Attractions	9,342	2,803
R03c	Fire 1923 Phase c Evacuation Order	Various locations throughout the region	Major Employers	15,362	5,484
		Various locations throughout the region	Transient Dependent Residents	525	525
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	108	108

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R03c	Fire 1923 Phase c Evacuation Order	New Bridge Foundation	Medical Facility	45	45
		Redwood Gardens Apartments	Medical Facility	168	168
		Berkeley Hills Nursery School	Preschool/Day Care Center	40	7
		Berkeley Montessori School	Preschool/Day Care Center	119	20
		Beth El Nursery School	Preschool/Day Care Center	74	13
		BUSD - Hopkins Street	Preschool/Day Care Center	140	24
		Childrens Community Center	Preschool/Day Care Center	52	9
		Hearts Leap North	Preschool/Day Care Center	45	8
		Jewish Community Ctr of The East Bay-Berkeley	Preschool/Day Care Center	75	13
		Mustard Seed Preschool	Preschool/Day Care Center	66	11
		The New School of Berkeley	Preschool/Day Care Center	48	8
		The New School of Berkeley-Schoolage	Preschool/Day Care Center	45	8
		UCB - Clark Kerr Campus Children's Center	Preschool/Day Care Center	29	5
		UCB - Clark Kerr Preschool	Preschool/Day Care Center	29	5
		Bayhill High School	School	73	12
		Berkeley Arts Magnet at Whittier School	School	407	69
		Church Divinity School of the Pacific	School	122	0
		Dominican School of Philosophy & Theology	School	100	0
		Graduate Theological Union	School	275	0
		Jesuit School of Theology	School	112	0
		Martin Luther King Middle School	School	1,007	171
		Pacific Lutheran Theological Seminary	School	50	0
		Pacific School of Religion	School	139	0
		School of the Madeleine	School	337	57
		University of California - Berkeley	School	44,075	2,289
		Zaytuna College	School	43	0
R03c	Fire 1923 Phase c Evacuation Warning	Various locations throughout the region	Transient Attractions	4,265	1,280
		Various locations throughout the region	Major Employers	1,156	413
		Various locations throughout the region	Transit Dependent Residents	270	270
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	56	56
		Berkeley Little School	Preschool/Day Care Center	42	7
		Cornerstone Children's Center	Preschool/Day Care Center	112	19

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R03c	Fire 1923 Phase c Evacuation Warning	Dandelion Nursery School, Inc	Preschool/Day Care Center	24	4
		St. John's Child Care Center	Preschool/Day Care Center	45	8
		The Monteverde School	Preschool/Day Care Center	30	5
		UCB - Dwight Way Center	Preschool/Day Care Center	42	7
		UCB - Harold E. Jones Child Study Ctr/Childcare	Preschool/Day Care Center	56	10
		UCB - Haste Street Child Development Center	Preschool/Day Care Center	92	16
		Berkeley City College	School	6,519	174
		Berkeley High School	School	3,427	583
		California Jazz Conservatory	School	88	0
		Cragmont Elementary School	School	331	56
		East Bay School for Boys	School	105	18
		Emerson Elementary School	School	323	55
		Institute of Buddhist Studies	School	53	0
		Maybeck High School	School	121	21
		Pacific Boychoir Academy	School	30	5
		Ruth Acty Elementary School	School	433	74
		The Crowden School	School	75	13
		The Wright Institute	School	638	0
		REGION TOTAL:		91,385	14,956

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R04	Panoramic Hill Fire Evacuation Order	Various locations throughout the region	Transient Attractions	757	227
		Various locations throughout the region	Transient Dependent Residents	80	80
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	16	16
		Redwood Gardens Apartments	Medical Facility	168	168
		UCB - Clark Kerr Campus Children's Center	Preschool/Day Care Center	29	5
		UCB - Clark Kerr Preschool	Preschool/Day Care Center	29	5
		Various locations throughout the region	Transient Attractions	1,090	327
R04	Panoramic Hill Fire Evacuation Warning	Various locations throughout the region	Major Employers	172	61
		Various locations throughout the region	Transient Dependent Residents	127	127
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	26	26
		St. John's Child Care Center	Preschool/Day Care Center	45	8
		The Monteverde School	Preschool/Day Care Center	30	5
		Emerson Elementary School	School	323	55
		Maybeck High School	School	121	21
		The Wright Institute	School	638	0
		REGION TOTAL:			1,131

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population
R05	Fire Zones Fire Zones 2 and 3 Combined	Various locations throughout the region	Transient Attractions	8,851	2,655
		Various locations throughout the region	Major Employers	172	61
		Various locations throughout the region	Transit Dependent Residents	668	668
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	138	138
		New Bridge Foundation	Medical Facility	45	45
		Redwood Gardens Apartments	Medical Facility	168	168
		Arbor Preschool East	Preschool/Day Care Center	22	4
		Berkeley Hills Nursery School	Preschool/Day Care Center	40	7
		Beth El Nursery School	Preschool/Day Care Center	74	13
		Childrens Community Center	Preschool/Day Care Center	52	9
		Dandelion Nursery School, Inc	Preschool/Day Care Center	24	4
		Kids In Motion	Preschool/Day Care Center	70	12
		Step One School	Preschool/Day Care Center	108	18
		UCB - Clark Kerr Campus Children's Center	Preschool/Day Care Center	29	5
		UCB - Clark Kerr Preschool	Preschool/Day Care Center	29	5
		Church Divinity School of the Pacific	School	122	0
		Cragmont Elementary School	School	331	56
		Dominican School of Philosophy & Theology	School	100	0
		Graduate Theological Union	School	275	0
		Jesuit School of Theology	School	112	0
		John Muir Elementary School	School	306	52
		Pacific Lutheran Theological Seminary	School	50	0
		Pacific School of Religion	School	139	0
		The Wright Institute	School	638	0
		Zaytuna College	School	43	0
REGION TOTAL:				12,606	3,920

Region Number	Region Name	Facility Name	Facility Type	Total Population	Transit Dependent Population	
R06	Tsunami Phase 3	Various locations throughout the region	Transient Attractions	1,944	583	
		Various locations throughout the region	Major Employers	126	45	
		Various locations throughout the region	Transit Dependent Residents	32	32	
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	7	7	
			REGION TOTAL:			2,109
R07	Tsunami Max Phase	Various locations throughout the region	Transient Attractions	4,077	1,223	
		Various locations throughout the region	Major Employers	3,547	1,266	
		Various locations throughout the region	Transit Dependent Residents	111	111	
		Various locations throughout the region	People Requiring Specialized Transportation Assistance	23	23	
			Preschool/Day Care Center	77	13	
		Duck's Nest - Berkeley	Preschool/Day Care Center	91	15	
		Golden Gate Learning Center	Preschool/Day Care Center	57	10	
		VIA Center	School	20	3	
		REGION TOTAL:			8,003	2,664

0. City of Berkeley Evacuation StoryMaps: Text-Only Version

July 2025

This document provides a text-only version of analysis from the City of Berkeley's [Evacuation StoryMaps](#).

This document has six parts:

1. **The Evacuation Time Study Project:** Explains why the Study was conducted and highlights key evacuation time estimates for different hazard scenarios.
2. **Household Evacuation Planning:** Offers useful takeaways from the Study to help residents create their own evacuation plans.
3. **Evacuation and Fire Spread:** Compares wildfire spread rates in the Berkeley Hills with evacuation timelines to assess risk to the community.
4. **Improving Evacuation Times:** Evaluates proposed ideas—such as parking restrictions or road design change—to see whether they would meaningfully improve evacuation safety or speed.
5. **Access Impaired Neighborhoods Analysis:** Addresses the requirements of Senate Bill 99, which mandates identification of residential developments in hazard areas that lack at least two emergency evacuation routes.
6. **Evacuation Route Safety, Capacity and Viability Analysis:** Addresses the requirements of Assembly Bill 747, which requires local governments to assess the capacity, safety, and viability of evacuation routes under various emergency conditions.
7. **Learn More:** Contains links to access more information and download referenced reports.

1. The Evacuation Time Study Project

0. About the Study

Berkeley faces risks like wildfire, tsunami, and other emergencies that could require large evacuations. These rare but dangerous events can have very different outcomes depending on the time, season, and how the community responds.

The Evacuation Time Study uses simulations to model a wide array of large-scale evacuations that would be too risky or impractical to conduct in real life. It tests different conditions—like time, location, and evacuee behaviors—and is built on a solid understanding of Berkeley’s hazards, streets, and community. The Study is a useful tool to help responders, residents, and elected leaders better prepare for emergencies.

1. Evacuation Time Study Methodology

Berkeley’s Evacuation Time Study was developed over two years by experts in evacuation, transportation, and emergency planning.

In 2023, the City hired KLD, a firm experienced in evacuation modeling, including for nuclear sites.

KLD drove every street in Berkeley, gathered detailed information, and surveyed the community. They used all of this to build a detailed evacuation model for Berkeley.

Using this model, KLD estimated evacuation times for different parts of the city.

KLD also ran “what-if” scenarios to see how evacuation times might change under different conditions.

2. Evacuation Areas

The Study estimates how long it would take to evacuate different parts of Berkeley. These areas are based on past disasters, known risks, and geography.

Each evacuation area has several evacuation time estimates, depending on the time of day, day of the week, and season.

Evacuations take longer when more people are in Berkeley—this means more people need to leave and there is more traffic on the roadways, both in and outside the evacuating area.

Evacuation times are longer when school is in session, on weekdays, and during daytime hours. They are shorter at night and on weekends.

3.How long will it take to evacuate different areas of Berkeley?

1923 Berkeley Fire Repeat

This evacuation area is based on the 1923 Berkeley Fire, the worst fire in the city's history.

Evacuation orders would stretch from Berkeley's eastern edge and extend as far west as Sacramento Street, involving residents from Marin Avenue stretching as far south as the UC Berkeley campus.

Estimated evacuation times range from 1 hour and 35 minutes to 4 hours and 10 minutes.

Panoramic Hill Fire

This evacuation area is based on a fire affecting Panoramic Hill, an area of Berkeley's Wildland-Urban Interface with only one road in and out.

Estimated evacuation times range from 45 minutes to 1 hour and 45 minutes.

Tsunami Warning

Two evacuation areas were analyzed for a Tsunami Warning.

A Max Phase Tsunami Warning would affect areas of Berkeley extending from the San Francisco Bay to as far east as 7th Street. Evacuating this area would take between 1 hour and 50 minutes and 2 hours and 15 minutes.

A Phase 3 Tsunami Warning would affect only the area west of I-80. Evacuating this area would take between 55 minutes and 1 hour and 45 minutes.

2. Household Evacuation Planning

0. Some Background

The Evacuation Time Study is a high-level model to support emergency planning. It also gives useful insights for community members making their own household evacuation plans.

1. Evacuation Process

Evacuation doesn't start on the road. It happens in three steps:

1. **Notification** – Knowing there's an evacuation order is the first step. Signing up for emergency alerts helps people get this information faster.
2. **Mobilization** – This is the time spent getting ready to leave, like packing, preparing the home, or waiting for family members.
3. **Roadway Time** – This is the time spent driving out of the hazard area.

Each household's total evacuation time will be different, depending on how quickly they get notified, how long they take to get ready, and how fast they can travel to safety.

The evacuation times in this report combine the estimated times for all people within a given evacuating area.

2. Evacuate Faster

Here are key tips from the Study to help you reduce your own evacuation time:

Tip 1: Sign up for emergency alerts.

Knowing you need to evacuate is the first step.

- Download the [Genasys Protect App](#) to be first to know when evacuations are ordered.
- Sign up for [AC Alert](#) to get detailed instructions to your phone and email.

Tip 2: Leave as Early as Possible

The Study shows that people who leave sooner have shorter travel times. They start driving before roadways become heavily congested.

In simulating household evacuation times during a repeat of the 1923 Fire, the Study shows that taking longer to get ready rapidly increases your total evacuation time. For example:

- A household that leaves in 30 minutes may reach safety in 1 hour and 10 minutes.
- A household that leaves in 1 hour may reach safety in 2 hours and 15 minutes.
- A household that leaves in 1.5 hours may reach safety in 3 hours and 10 minutes.
- A household that leaves in 2.5 hours minutes may reach safety in 3 hours and 50 minutes.

In this example, waiting an extra 30 minutes can add over an hour to the total evacuation time.

These delays are caused by growing traffic. In the 1923 Fire Repeat example:

- At the start, roads are mostly clear.
- After 30-45 minutes, they become 50% full.
- After 120 minutes, the roads are completely jammed.

This example shows that if you get on the road earlier, when traffic is light, you'll get out faster.

3. Plan Where You'll Go

Most people will choose to stay with friends, family, or at a hotel.

Make your plan before an emergency. Think about options outside of Berkeley—or even outside the Bay Area.

If there is a fire or tsunami, emergency shelters will also be opened in safe areas. They may be outside of Berkeley.

Know Multiple Ways Out

Being ready to use different roads will help you – and all evacuees— get to safety faster.

This map highlights Berkeley’s highest-capacity roadways that can move the most people. They include:

- University Ave
- Adeline St
- Ashby Ave (SR 13)
- Cedar St
- Interstate 80 (I-80)
- San Pablo Ave (SR 123)
- Sacramento St
- Claremont Ave
- Marin Ave

But during a major evacuation, they won’t be enough on their own. Evacuees will need to use all available streets to get out. Spreading out traffic helps everyone escape more quickly.

“What’s my evacuation route?”

1. Be ready to use any available roadways.
2. Know the roads around your home and plan at least 2 routes out.

4. Evacuees Without Cars

The Evacuation Time Study predicts times for people leaving in vehicles, but many people in Berkeley do not own cars.

Here are key tips from the Study for people without cars:

1. Plan to carpool:

- Carpooling helps reduce the number of vehicles on the road during an evacuation.
- Everyone should plan ahead to carpool with neighbors.
- If you don't own a car, make arrangements with neighbors who do.
- If you have a car, plan to help neighbors who may need a ride.
- Working together makes evacuation faster and safer for everyone.

2. “Should I walk or bike out?”

- Walking or biking during an evacuation can be risky, especially if the hazard is close or traffic is heavy.
- Cars provide some protection against the hazard and in traffic collisions.

3. No matter how you evacuate, your chances of staying safe are much better if you leave as early as possible.

Here are a few key tips from Berkeley public safety officials to help you plan ahead and choose the safest option for your situation:

1. In the case of a tsunami,

- Walking and cycling can be good options for your tsunami evacuation plan.

- Berkeley's tsunami zone is west of 7th Street.
- Walking or biking out of the tsunami zone might be quicker than driving.

2. In the case of a wildfire:

- Berkeley public safety officials do not recommend walking and cycling as your first choice to evacuate from the Berkeley Hills. Fires can spread quickly and unpredictably, and there's no way to know how much time you have.
- On foot or bike, you're directly exposed to heat, smoke, and dangerous gases. In a car, you have some protection.
- Drivers evacuating during wildfires make dangerous choices. If you're walking or biking, you're exposed—not just to the fire, but to the traffic around you.

The safest choice is to leave the Berkeley Hills early on days when the Berkeley Fire Department has declared Extreme Fire Weather. Visit the [Fire Weather and Evacuation page](#) to learn more.

5. Emergency Transportation

Don't count on government transportation as your main evacuation plan.

In a major emergency, Berkeley will ask for help from nearby agencies to send buses, ambulances, and wheelchair vans. They may not get to you in time because:

- There may not be enough vehicles available quickly.
- Roads may be blocked or too crowded.
- Conditions may be too dangerous—buses can't drive through fire, and bus drivers aren't trained like firefighters.

Plan ahead:

- Leave the Berkeley Hills early on Extreme Fire Weather Days.

- Get to know your neighbors. Make a plan to help each other evacuate.
- Plan to carpool.
- For tsunami evacuations, consider walking or biking.

3. Evacuation and Fire Spread

1. Evacuation and Fire Spread: Impacts of the 1923 Berkeley Fire in the Present Day

Evacuation time estimates are an important tool for planning.

To understand their impact on community safety, we need to compare them to how fast a hazard, like a fire, could reach the evacuating area.

This section compares how fast a fire could spread in the Berkeley Hills with how long it might take to evacuate.

- **First**, we use data from the 1923 Berkeley Fire—the city’s worst fire—to model how a fire might spread today.
- **Then**, we use evacuation modeling to show traffic and congestion if that same area had to evacuate now.

By combining fire spread and traffic patterns, we can see the risks the community would face in a modern-day repeat of the 1923 Berkeley Fire.

2. 1923 Berkeley Fire

Archival maps show key details of the 1923 Berkeley Fire.

The archival maps extend as far east as today’s Rose Garden and Glendale La Loma Park, about halfway up the present-day Berkeley Hills.

In 1923, areas east of this point were mostly grasslands.

The fast-moving grass fire entered this point around 2:00 PM.

It was pushed by strong Diablo winds blowing 25 to 40 mph.

The fire spread southwest until around 4:20 PM, when moist westerly winds took over. It reached as far as Shattuck Avenue and Berkeley Way and moved through about 1.3 km of buildings in 2.5 hours.

Shifting to the Present Day

More buildings have been added to the Berkeley hills.

Areas that were grasslands in 1923 are now neighborhoods.

The current border of Berkeley neighborhoods has moved 1.3 km uphill.

To model the spread of the 1923 Fire in today's Berkeley, we also shift the point where it enters built neighborhoods 1.3 km farther uphill.

Today, if the same fire entered Berkeley at the current eastern edge, it would take about 2.5 hours to reach Codornices Park and the Rose Garden.

It would take another 2.5 hours to reach Shattuck Avenue.

In total, the fire would take about 5 hours to move from Berkeley's eastern edge to Shattuck Avenue.

3. Evacuation for a 1923 Berkeley Fire Repeat

Now, let's look at what this fire spread could mean for people trying to evacuate.

If the 1923 Berkeley Fire happened today, evacuation orders (lawful orders to leave now) would stretch from Berkeley's eastern edge and extend as far west as Sacramento Street, involving residents from Marin Avenue stretching as far south as the UC Berkeley campus. Evacuation warnings (instructions to prepare to evacuate or leave immediately if you need extra time), would be issued for areas surrounding the Evacuation Order zones.

Evacuation Time Estimates

This Evacuation Time Study predicts how long it would take to clear the evacuation order area.

The evacuation clock starts when evacuations are ordered.

The times differ depending on time of day, season, and day of week.

In the Spring, Fall, and Winter:

- Midweek daytime evacuation takes 4 hours and 10 minutes.
- Weekend daytime evacuation takes 1 hour and 45 minutes.
- Evening evacuation takes 1 hour and 35 minutes.

In the Summer:

- Midweek daytime evacuation takes 2 hours and 25 minutes.
- Weekend daytime evacuation takes 1 hour and 50 minutes.
- Evening evacuation takes 1 hour and 35 minutes.

Combining Evacuation Traffic and Fire Spread

Now we will combine our 1923 Fire spread model with an associated traffic simulation from the Evacuation Time Study. We will use a midweek daytime evacuation in the fall, because fall is the season that carries the highest risk for a wind-driven wildfire.

The estimated evacuation time is 4 hours and 10 minutes.

How to use this model

This model shows what a repeat of a past fire might look like today. It was built using one set of possibilities – like where a fire starts, how it spreads, and which roads are open. It is meant to show general ideas about fire spread and evacuation, not exact outcomes. **Do not use this model to choose your evacuation routes or make your household evacuation plan.**

What the model shows

Many evacuees will encounter gridlock.

This model doesn't predict how many people get out safely.

It shows that some evacuees will be overtaken by fire on the roads as they try to escape.

1 Hour after Evacuation Order

The fire has reached Berkeley's eastern border.

Severe roadway congestion is extending into the Berkeley flats.

Many streets are gridlocked.

2 Hours after Evacuation Order

Fire is spreading through Berkeley buildings.

Fire is also spreading over roadways in use by evacuees.

Berkeley's highest-capacity roadways nearest to the fire are gridlocked.

3 Hours after Evacuation Order

Fire continues to spread through Berkeley neighborhoods.

Overall, there is less gridlock as more evacuees escape.

Fire is spreading over roadways in use by evacuees.

4 Hours after Evacuation Order

Fire continues to spread through Berkeley neighborhoods.

Some traffic congestion is still present in the evacuation order area.

5 Hours after Evacuation Order

Fire continues to spread through Berkeley neighborhoods.

The evacuation is complete.

6 Hours after Evacuation Order

Fire reaches Shattuck Avenue.

We've experienced this before

The model shows traffic gridlock in areas where fire is spreading.

In a fast-moving, wind-driven fire, flames could outpace evacuation efforts—reaching people before they can escape.

This threat is not unique to Berkeley. Some similar situations have occurred most recently in Los Angeles, Lahaina, and Paradise, and locally in the 1991 Oakland-Berkeley Hills Fire.

This modeling reinforces the urgent need for new approaches to fire evacuation—starting with individual households and reaching through the highest levels of government.

Taking Control

Fires are unpredictable once they ignite.

The model makes clear that Berkeley's road network cannot support a quick, large-scale evacuation.

In Berkeley, both residents and responders have the most control over fire safety before a fire starts.

Our approach to fire evacuation must be built on a foundation of:

- Preventing fire spread through home hardening and defensible space
- Leaving the Berkeley Hills early on Extreme Fire Weather days—before a fire begins.

4. Improving evacuation times

The Evacuation Time Study looked at many ideas from the community and first responders to find ways to improve evacuation times and keep people safer.

1. Will parking restrictions in the Berkeley hills help in evacuations?

Yes and no.

Parking restrictions won't get evacuees out faster.

On typical residential street in the Berkeley Hills, cars park along the sides of the street. At some points, the street is too narrow for two cars to pass each other.

Removing parked cars reduces side-to-side crowding.

Without parked cars, evacuating vehicles can drive faster on the street.

But, there is a bigger problem.

When there are too many cars going the same way, intersections turn into chokepoints.

When parked cars are removed, evacuating vehicles will use the extra roadway width to try to get out faster.

But there are still too many cars going the same way.

Even without parked cars, intersections are still chokepoints.

And there is another problem.

When the road narrows, cars must still go 1 by 1 to get through.

The primary limitation is too many cars trying to leave at once.

Removing parked cars won't address this main problem.

However, selective parking restrictions may help emergency responders get in.

On wider streets, parking restrictions may help fire engines and other emergency responders get through while people are evacuating.

Response apparatus may use wider Berkeley Hills roadways to access emergencies.

Removing parked cars reduces side-to-side crowding.

This added road width could help fire engines get in.

Fire engines may still be slowed down at intersections.

But they will not be caught in the same gridlock as evacuees, because most traffic is headed out.

2. Roadway Design and Infrastructure

The Study found that evacuation traffic is likely made worse by pre-timed traffic signals and roadway designs intended to slow vehicles and restrict their movement.

Traffic Calming

On normal days, traffic calming devices (like diverters, traffic circles, and speed humps) make roads safer by slowing down cars, reducing traffic on residential streets, and limiting how cars move through neighborhoods.

But during evacuations, the safety goal is to move traffic quickly. Traffic calming slows down evacuees and adds to traffic jams.

Traffic Signals

Traffic signals can impact evacuation times.

Pre-timed traffic signals follow a fixed schedule to control which direction of traffic gets to go. During an evacuation, these fixed signals **can slow things down**.

Actuated or adaptive signals adjust their timing based on real-time traffic. These signals can **help traffic move** more smoothly during evacuations and in everyday use.

Existing Infrastructure

Traffic calming devices and traffic signals are positioned throughout Berkeley.

The Study found four parts of Berkeley where traffic backups during evacuations are likely made worse by pre-timed traffic signals, as well as street designs focused on slowing vehicles and limiting how they travel:

- South and West of the UC Berkeley Campus
- South and West of Clark Kerr Campus
- North of Ohlone Park
- Lawrence Berkeley National Lab

5. Access Impaired Neighborhood Analysis

California Senate Bill 99 (SB99) requires cities to identify residential developments in hazard areas that do not have at least two emergency evacuation routes.

The Access Impaired Neighborhood analysis identifies:

- Primary Access Impaired Neighborhoods, which have only one way in and out
- Secondary Access Impaired Neighborhoods, which have only one viable way out

Residents with only one way out are at greater risk during evacuations. If their one route is cut off because of the emergency, or blocked by vehicles evacuating, they will be forced to flee on foot or bicycle.

Primary Access Impaired Neighborhoods (SB99)

This analysis identifies parcels with one way in and out as Berkeley's "Primary Access Impaired Neighborhoods."

In total, there are 139 Primary Access Impaired Neighborhoods with 1,547 residential parcels. These neighborhoods are distributed throughout the Berkeley flats and hills. Only one primary AIN is west of San Pablo Ave.

There are different reasons that each of these neighborhoods has one way in and out. Some have a natural dead end, such as a cul-de-sac. Others have manmade blockages from bollards or islands.

Primary Access Impaired Neighborhoods exist throughout Berkeley. The Panoramic Hill neighborhood contains the most Primary Access Impaired Neighborhood parcels, with only one exit route for the entire neighborhood at a stop-controlled intersection at Panoramic Way and Prospect St/Canyon Rd.

Primary Access Impaired Neighborhoods created by manmade blockages are mostly in the Berkeley flats. Some are on Panoramic Hill, and some are in southeast Berkeley between College Ave and Claremont Ave.

Additional Analysis:

Secondary Access Impaired Neighborhoods (AIN)

The analysis next identifies Berkeley's "Secondary Access Impaired Neighborhoods." These parcels have multiple evacuation routes available but only one viable exit, due to narrow roadways and hairpin turns.

In total, there are 195 Secondary Access Impaired Neighborhoods with 3,715 residential parcels. They primarily sit in the North Berkeley Hills with a few scattered in southeast Berkeley, east of Claremont Ave.

The northern Berkeley Hills contain the majority of secondary Access Impaired Neighborhoods. Residents in these neighborhoods will need more time for safe evacuation compared to those in other parts of the city.

Narrow Roads

There are different reasons for narrow roadways and tight turns. In some cases, topography dictates the challenging roadway. In others, on-street parking narrows the available pavement width.

When responders must use narrow, winding roads to access an emergency, they cannot drive quickly. They are likely to encounter traffic delays as they try to pass outgoing traffic. These ingress challenges will be exacerbated in an evacuation.

Berkeley's narrow roads are classified as constrained, moderately constrained, and severely constrained.

The narrow roadways are almost exclusively in the north Berkeley Hills in the area north of Codornices Park. Narrow roadways are also present on Panoramic Hill.

Tight turns exist throughout the North and South Berkeley Hills.

6. Evacuation Route Safety, Capacity, and Viability Analysis

0. Introduction

California Assembly Bill 747 (AB747) requires cities to identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios.

The analysis discusses the capacity, safety, and viability of Berkeley's roadways for different evacuations.

1. Capacity

The capacity of each roadway segment within the City of Berkeley is based on field observations collected in May 2023, including the number of moving lanes on each roadway.

The analysis identified assigned measured the capacity of each roadway segment and assigned a capacity from one of these four levels:

- red: 225-900 passenger cars per hour,
- yellow: 901-1700 passenger cars per hour,
- light green: 1701-5700 passenger cars per hour,
- dark green: 5701-15750 passenger cars per hour.

In the Berkeley Hills, most roadways are red. In the rest of the city, roadways are a mixture of red, yellow and light green. The only dark green roadway is the I-80 freeway.

I-80 has the highest capacity, followed by multilane major arterials like San Pablo Ave, University Ave, Shattuck Ave/Adeline St, Sacramento St, Telegraph Ave, and Claremont Ave.

The vast majority of roadways within the city are single-lane collectors with a free flow speed of 45mph or less and a capacity of approximately 1,700 passenger cars per hour

or less. In the hills, free flow speeds are 20 mph or less and capacities are 900 passenger cars per hour or less.

2.Max Demand

When under maximum evacuation demand, most of Berkeley's roadways will experience significant congestion.

Major arterials like San Pablo Avenue, Sacramento Street, University Avenue, Adeline Street, Ashby Avenue, and Claremont Avenue can better service the evacuating demand than the smaller, local streets within the heart of the city. Under maximum demand, these roadways show less congestion.

However, to most quickly evacuate an area, traffic should be distributed across all available routes.

3.Safety Risk

Each Berkeley roadway is given a safety rating. Lower scores are safer.

Roadways with the highest scores have the highest exposure to traffic fatalities, narrowest width, tightest turns, steepest slopes, poorest pavement condition and/or are located above or below a bridge or tunnel. Safety ratings do not consider the roadways' exposure to natural hazards. Hazard rating, described below, addresses this risk.

Berkeley's least safe roadways are within the hills and along Panoramic Way. These roadways are extremely narrow, winding, and steep.

Many of the roadways within the flats, including San Pablo Ave, have poor or very poor pavement conditions, giving them a higher unsafe rating.

The safest roadways are Frontage Road, University Avenue, and Adeline Street.

4.Hazard Rating

In addition to the roadway characteristics, roadway safety can be described based on hazard exposure.

Roadways receive hazard ratings based on their exposure to hazards such as landslide and tsunami.

It should be noted that routes with hazard exposure may still need to be used by evacuees. As such, the hazard factors are presented separately from the safety factors and were excluded in the overall safety rating in the Safety Risk section previously discussed.

5. Demographic Vulnerability

Although not specifically a consideration of a roadway's safety, capacity or viability, neighborhood demographics can indicate areas that may face greater challenges when evacuating.

For example, areas with less vehicle availability will face greater challenges when evacuating, as compared to areas where households have more personal vehicles to drive themselves out.

Higher vulnerability ratings indicate greater vulnerabilities of the population living along a roadway segment. Demographic vulnerability factors were considered separately from the safety, capacity or viability factors described above.

The analysis identified four different demographic vulnerability levels:

- blue: 0.5-1.14,
- light green: 1.5-1.9,
- orange: 2.0-2.7,
- red: 2.8-3.8.

The map shows blue level vulnerability in the following areas:

- North Berkeley Hills.
- Claremont neighborhood.
- Area north of University Ave bounded by San Pablo Ave to the west and Sacramento St to the east.

- Panoramic Hill (City of Oakland portion).

The map shows light green level vulnerability in the following areas:

- Area bounded by 6th St to the west, University Ave to the south San Pablo Ave to the east and Camelia St to the north.
- Area bounded by Sacramento St to the west, Martin Luther King Jr Way to the east, Dwight Way to the south and Cedar St to the north.
- Area bounded by Hearst Ave to the south, Spruce St to the west, Cedar St to the north and Lawrence Berkeley National Laboratory (LBNL) to the east.
- Area bounded by Fulton St to the west, College Ave to the east, Derby St to the north and city boundary to the south.
- Area bounded by College Ave to the west, Ashby Ave to the south, city boundary to the east and Dwight Way to the north.

The map shows orange level vulnerability in the following areas:

- Everything west of San Pablo Ave with the exception of the area bounded by 6th St to the west, University Ave to the south, San Pablo Ave to the east and Camelia St to the north.
- Area bounded by Eunice St to the north, Spruce St to the east, University Ave to the south and Martin Luther King Jr Way to the west.
- Area bounded by San Pablo Ave to the west, Fulton St to the east, Dwight Way to the north, and city boundary to the south. The orange area extends north on Shattuck and Milvia St to Bancroft Ave. It extends east to College Ave on Dwight Way, Blake St, Parker St and Carleton St.

The map shows red level vulnerability in the following areas:

- Area bounded by San Pablo Ave to the west, University Ave to the north, Sacramento St to the east and Dwight to the south.
- The UC Berkeley main campus.
- Southside neighborhood extending east to Fulton St and south to Dwight Way.
- Berkeley High extending south to Dwight Way.
- Streets surrounding Downtown Berkeley Bart Station.
- Panoramic Hill (City of Berkeley portion).

6.Results

While the safety, capacity, viability, and vulnerability varies somewhat within individual street segments on a particular roadway, the following roadways have the highest capacity, are relatively safe, and are the most viable across their entire length.

- University Ave
- Adeline St
- Ashby Ave (SR 13)
- Cedar St
- Interstate 80 (I-80)
- San Pablo Ave (SR 123)
- Sacramento St
- Claremont Ave
- Marin Ave

7. Learn More

Berkeley's evacuation instructions use findings from the 2025 Evacuation Time Study. Download the [Evacuation Time Study](#).

Berkeley also performed analysis to comply with State evacuation planning requirements. Download the [Access Impaired Neighborhoods Analysis](#) and the [Evacuation Route Safety, Capacity, and Viability Analysis](#) to learn more.

To learn more about Berkeley's Extreme Fire Weather leave early approach and to make your own household fire weather plan, visit the [Fire Weather and Evacuation page](#).

To learn more about protecting your property and preventing fire spread, visit [FireSafe Berkeley](#).

RESOLUTION NO. 70,712-N.S.

CONTRACT: KLD ENGINEERING, P.C. FOR EVACUATION AND RESPONSE TIME
MODELING

WHEREAS, due to climate and land use changes, wildfires are occurring more frequently along the West Coast. The fuel, topography, transportation network, housing density, and narrow structure separation make a large portion of the City a CalFIRE Very High Fire Danger Severity Zone (VHFDSZ). This means the area presents significant wildfire risk to the people living in, working in and visiting these areas and the adjacent areas of the City; and

WHEREAS, with an estimated population of 30,000 in the VHFDSZ even a partial evacuation will place a substantial number of people and vehicles on the road network. Given the geography of the City with wildland areas to the east, evacuees must predominately travel west to evacuate the VHFDSZ using mostly narrow evacuation routes. Evacuating a large number of people with such a challenging transportation network presents a significant risk. If flames or smoke from a wildfire, or down power lines from an earthquake block one or more of these evacuation routes, the risk is exacerbated; and

WHEREAS, according to the Standards of Coverage analysis provided to City Council on April 19, 2022, the City's response to fire and medical emergencies is 1 minute, 53 seconds slower than the nationally recommended travel time of four-minutes. Today the Department only has only experiential data to quantify the impacts proposed roadway treatments would have to response times; and

WHEREAS, the City requires professional assistance to meet the unfunded state mandates outlined in SB 99, AB 747, and AB 1409, and requires related professional services in the areas of traffic and evacuation modeling and planning; and

WHEREAS, funds are available for this contract in the Fire Department Measure FF (Budget code 164-72-745-000-0000-000-612990) and UC Settlement Funds (Budget code 147-72-743-000-0000-000-612990).

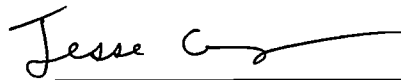
NOW THEREFORE, BE IT RESOLVED by the Council of the City of Berkeley that the City Manager is authorized to piggyback on the County of Santa Barbara contract and execute a contract and any amendments with KLD Engineering, P.C., for Evacuation and Response Time Modeling from April 1, 2023 through June 30, 2024 in the amount not to exceed \$400,000 with an option to extend for an additional two years not to exceed an additional \$100,000 if the piggyback contract is extended.

The foregoing Resolution was adopted by the Berkeley City Council on March 14, 2023 by the following vote:

Ayes: Bartlett, Hahn, Harrison, Humbert, Kesarwani, Robinson, Taplin, Wengraf, and Arreguin.

Noes: None.

Absent: None.



Jesse Arreguin, Mayor

Attest: 

Rose Thomsen, Deputy City Clerk

RESOLUTION NO. 71,368-N.S.

CONTRACT NO. 32300165 AMENDMENT: KLD ENGINEERING, P.C. FOR
EVACUATION AND RESPONSE ANALYSIS

WHEREAS, on May 18, 2023, the City executed Contract No. 32300165 with KLD Engineering, P.E. for traffic evacuation and evacuation modeling services; and

WHEREAS, this contract piggybacked on a County of Santa Barbara contract which expires on June 30, 2024; and

WHEREAS, the County of Santa Barbara is not extending its contract (on which the City of Berkeley piggybacked) with KLD Engineering, P.E.; and

WHEREAS, this work is required by the State of California within SB 99, AB 747, and AB 1409; and

WHEREAS, in July 2023, KLD Engineering, P.C. reached a strategic agreement to transfer its evacuation and emergency planning business line to KLD Associates; and

WHEREAS, Staff from KLD Associates has already developed a detailed traffic model that will underly any evacuation time studies, has collected and begun analysis on voluminous data from response apparatus, and has developed deep familiarity with the Berkeley community, key sites, hazards, and other data that will inform evacuation and response times; and

WHEREAS, due to this and the specific experience with the City of Berkeley listed above, competing for this service is not amenable performed this work for the first year of the contract with KLD Engineering, P.E.; and

WHEREAS, staff determined that ongoing as-needed analysis would be required beyond the contract's original extended expiration date.

NOW THEREFORE, BE IT RESOLVED by the Council of the City of Berkeley that the City Manager is authorized to amend to Contract No. 32300165 with KLD Engineering, P.C. for evacuation and response time modeling to reassign to KLD Associates through June 30, 2026, and to provide an option to extend for an additional five (5) years and add \$200,000, making initial term plus extension NTE \$600,000 through June 30, 2031.

The foregoing Resolution was adopted by the Berkeley City Council on June 4, 2024 by the following vote:

Ayes: Bartlett, Hahn, Humbert, Kesarwani, Lunaparra, Taplin, Wengraf, and Arreguin.

Noes: None.

Absent: None.



Jesse Arreguin, Mayor

Attest: 

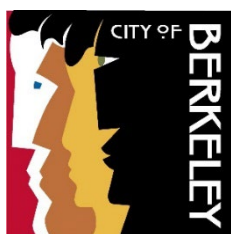
Mark Numainville, City Clerk



Date Completed

Household name

Home Address



HOUSEHOLD FIRE WEATHER PLANNING TOOL

CITY OF BERKELEY FIRE DEPARTMENT



Dear Berkeley community,

This Household Fire Weather Planning Tool will guide you through important decisions to stay safe during “Extreme Fire Weather” and evacuations. By taking time to think through these issues now, ahead of an emergency, you will have more power when the time comes to act.

Our fire challenge

Fire has always been a natural part of our ecosystem, maintaining forest health, controlling invasive species, and providing a rich habitat for wildlife. In Berkeley, densely-built homes and vegetation have been introduced to hillside areas that required burning to maintain ecological balance. For many years people have tried to prevent fire in forests and developed areas, disrupting this balance. As a result, catastrophic fires are now occurring throughout the Bay Area and the world. We must respect that in Berkeley, we built densely on a place that nature wants to periodically burn, and we must be ready to act when this natural process occurs.

History has shown that evacuations out of the Berkeley hills will be challenging. In the 1991 Tunnel Fire, cars backed up on narrow roadways. Many people had to abandon their vehicles and run. Twenty-five people lost their lives. We have seen similar situations play out in wildfires across the West including the Camp Fire in Paradise (85 deaths), the Tubbs Fire in Santa Rosa (29), and the Maui fires in Lahaina (101).

When the Berkeley Fire Department examined wildfire history, it became clear to us that the most catastrophic fires started under extreme fire weather conditions. During extreme fire weather, low humidity and strong winds spread fires with breathtaking speed. Normal firefighting is hampered, and firefighters shift their focus to moving people out of harm’s way. With climate change, fire weather is becoming more frequent. Berkeley’s roadways are still constrained, and do not have capacity to quickly move large populations out of the way of a fast-moving fire. **For these reasons, we recommend that you leave the hills during extreme fire weather, even before a fire starts.**



Make the right decisions for your household

Ultimately, you are responsible for choosing when to leave. In this document we share key decisions you'll need to make about your safety during extreme fire weather or an evacuation. We designed this tool so you can complete it with everyone in your household, giving you a shared plan before you are put into a crisis situation.

Planning together

Especially here in our city, we live in community with one another. Every day we rely on people around us for help. As you make your plans for fire weather and evacuation, think about the friends, family, and caretakers you rely on every day – will you need their help to pack up and leave? If so, create this plan with them.

The people we rely on the most don't always live nearby. Once you have used this planning tool to understand the help you will need, create your second line of defense – say hello to your neighbors. Ask them for the help you will need to safely evacuate. These conversations can feel uncomfortable. Many of us have lost touch with the people living next to us. There is good news: time after time disasters bring communities together. Don't wait for a disaster to make a connection. We hope this document will help facilitate conversations with the people who are closest to you and can help in an emergency. Once your plan is ready, share copies with anyone who will help you, and keep a copy readily accessible so you can review it in the event an emergency occurs.

In service,

David Sprague
Fire Chief
City of Berkeley

DAVID SPRAGUE / FIRE CHIEF

2100 MARTIN LUTHER KING JR. WAY, SECOND FLOOR, BERKELEY, CA 94704 510.981.3473

DSPRAGUE@BERKELEYCA.GOV

Members of our household

☐ Everyone in our household knows their role in our plan.

List Household members (humans and pets):

Our household has decided to leave...

Before a fire

- ☐ Red Flag Warning conditions
☐ Extreme fire weather conditions

After a fire starts

- ☐ Evacuation warning for our zone
☐ Evacuation order for our zone



Definitions and details:

Will you wait to evacuate until after a fire starts, or will you leave during periods of heightened threat?

Fire weather: heightened threat

- Red Flag Warning: Indicates elevated fire risk. Declared by National Weather Service.
- Extreme fire weather: Rare conditions of extremely elevated fire risk. Declared by Berkeley Fire Department.

The Berkeley Fire Department recommends that residents in [Fire Zones 2 and 3](#) (the Berkeley Hills) leave during extreme fire weather, before a fire starts. A fire that starts during extreme fire weather will spread quickly, and you may not have enough time to evacuate. See www.berkeleyca.gov/wildfire to learn about fire weather in Berkeley.

Evacuation warning/order: a fire has ignited

- Evacuation Warning: Prepare to evacuate. Evacuate now if you will need extra time to evacuate (children, pets, elders, people with mobility challenges).

- Evacuation Order: Evacuate now.

Even if you have not received an evacuation warning or order, you should leave immediately if you experience any of the following:

- Fire in a home adjacent to yours, or
- Fire in a home close to yours and the wind is strong, or
- Strong winds are carrying smoke or embers through or over your neighborhood, or
- You feel threatened.

Our household is ready to receive emergency alerts.

Berkeley's emergency alerting systems will be used to share Red Flag Warnings, extreme fire weather, and evacuation instructions.

All members of my household:

- ☐ Have signed up for [AC Alert](#)
- ☐ Have listened to the [fire evacuation alert](#) from the Outdoor Warning System sirens
- ☐ Have visited [Berkeley's Emergency Map](#) and learned our evacuation zone.
- ☐ Have downloaded the Genasys Protect app to our smartphones to get alerts about emergencies in the areas of Berkeley we care about.
 - We have also added addresses we care about (ex: home, work, school) as "My Saved Locations."

Our Household's Evacuation Zone: BER-E_____

- ☐ Know what to do if they hear an emergency siren tone: Find more information!
 1. Check their phones
 2. Check [Berkeley's Emergency Map](#)



Definitions and details:

- **AC Alert** is Berkeley's primary emergency alerting system. [Sign up](#) for AC Alert before a fire to make sure you get messages. Officials will use it to send alerts about fire weather and evacuations.
- During a fire, responders will post real-time evacuation information on **Berkeley's Emergency Map**. You can [bookmark the site](#) on your phones and computers.
- The **Outdoor Warning System** is a network of emergency sirens designed to alert people outdoors to a life-threatening emergency. Check out [our library of](#)

siren messages to get familiar with alerts you could hear from Berkeley's outdoor warning system.

When we leave, we will stay at...

Evacuation Location 1 (friend, family, or hotel): _____

Address: _____

Phone numbers: (____)____-____ / (____)____-____

Evacuation Zone for this location: _____

Evacuation Location 2 (friend, family, or hotel): _____

Address: _____

Phone numbers: (____)____-____ / (____)____-____

Evacuation Zone for this location: _____



Tip: Plan now for places you can stay outside the Berkeley Hills during fire weather and/or fire evacuation. Your options might include friends, family, or a hotel.

If there is a fire evacuation and residents are required to stay away from their homes for a long period, the City will work with the Red Cross to designate shelters for evacuees and their pets who have nowhere else to go. These shelters will be group living situations to meet basic needs. You will sleep on a cot, sharing a large space (ex: a basketball court or community room) with many other evacuees. Your pet will be in a kennel. If you can make your own plans now, you will likely be more comfortable.

Getting help to pack and leave

Think about your household and choose one:

☐

No one in our household will need help to pack and leave, **OR**

☐

One or more people in our household will need help to pack and leave, so:

- Before a fire starts, we will get help from _____ to pack and leave. Phone:(____)____-____
- In an emergency evacuation, I will get help from my neighbor, _____, to pack and leave. Phone:(____)____-____



Tips:

- Answer the following questions:
 - What kinds of help will you need to leave your home?
 - Navigating stairs
 - Lifting heavy items
 - Gathering pets
 - Other: _____
 - Can everyone in your household pack and leave on their own?
 - In an emergency, normal helpers might not be available. Neighbors and people who live close by are the best option. Who is around to help you in emergencies?
- Involve your friends, family, and neighbors in planning now – don't wait for an emergency to ask for help.

How we will get there

Leaving Before a Fire

We will (select all that apply):

- ☐ Drive
- ☐ Take the bus
- ☐ Use Paratransit
- ☐ Take Uber/Lyft/Taxi
- ☐ Ride bike
- ☐ Walk

Leaving After a Fire Starts

We will (select all that apply):

- ☐ Drive*
 - Carpool with: _____ Phone: (____) _____ - _____
 - Carpool with: _____ Phone: (____) _____ - _____
 - Carpool with: _____ Phone: (____) _____ - _____
- ☐ Bike*
- ☐ Walk

*We will always be ready to walk.



Tip: You will have more choices the earlier you leave. If you choose to leave after a fire starts, you must always be ready to walk in case you encounter a traffic jam, get a flat tire, or the roadway is blocked.

Our path of travel

Leaving Before a Fire

Any route we choose to our designated location (family, friend, or hotel)

Leaving After a Fire Starts

If you leave after a fire starts, you should plan multiple routes away from your home in multiple directions. Plan at least 2 routes for driving and another 2 for walking.

- ☐ We have chosen routes out of the hills:
 - 2 or more driving routes
 - 2 or more walking routes
- ☐ We have highlighted routes on a map and placed them in our go-bag (backpack to carry your evacuation needs), see “What we will pack” below



Tips:

- While wind-driven fires generally push from east to west, you may also be able to evacuate to the north or south to get out of harm's way.
- When you choose walking routes, include [Berkeley Path Wanderers paths](#). These paths often offer the most direct path out of the hills.
- Highlight your evacuation routes on a map.
- Practice using the different routes you've chosen to leave your neighborhood. Make it a fun family outing or weekend routine. Habits you create now will help during an emergency.
- During a fire evacuation, if possible, law enforcement personnel will provide fire evacuees with evacuation directions. If you do not receive directions, use main roads to connect to major streets or freeways. Once you are clear of the fire area, go to a friend or family's home or to a hotel. If these are not options for you, drive to a parking lot out of the hazard area and await additional information and instructions.

What we will pack

Leaving Before a Fire

- ☐ Items to be safe and comfortable while we are away
- ☐ Medications, prescriptions, and medical devices
- ☐ Computers, electronics & chargers
- ☐ Irreplaceable items (family treasures, art, photo albums)
- ☐ Other valuables

Leaving After a Fire Starts

Have a go-bag (backpack) packed and ready with basic items:

- ☐ Flashlight/headlamp
- ☐ Area map, marked with driving/ walking evacuation routes
- ☐ Printed list of phone numbers and email addresses for important contacts
- ☐ Map with evacuation routes marked
- ☐ Battery-powered radio and extra batteries
- ☐ Prescriptions or critical medications
- ☐ Extra eyeglasses or contact lenses
- ☐ Extra set of keys
- ☐ Whistle - to signal for help
- ☐ Cell phone charger
- ☐ Copies of important documents (paper copy or jump drive)
- ☐ Cotton face mask or dry bandana for use while evacuating
- ☐ N95, KN95 or surgical mask for use at your evacuation location
- ☐ Toiletries and change of clothing
- ☐ Hand sanitizer
- ☐ **Add last minute:** Wallet, cell phone



Tips:

If you are leaving before a fire starts, focus on:

- Items you need to be safe and comfortable when you arrive at your destination
- Irreplaceable or valuable items that you wouldn't want to lose in a fire.

If you are leaving during a fire evacuation, focus on:

- Items that you need to safely evacuate the fire area
- Items that you need to safely live until you arrive at your personal evacuation location, or until government/Red Cross sheltering and assistance become available
- **Remember:** You are responsible for carrying your go-bag. Make sure you can lift and carry your go-bag for your entire evacuation route.

What we will wear

Leaving Before a Fire

Any clothes we choose

Leaving After a Fire Starts

If there is time to change:

- Closed-toe shoes
- Cotton clothes (no polyester!) - Long sleeved shirts, pants, and a hat with a brim
- Cotton mask or dry bandana (**NOT** N95, KN95 or surgical mask which may melt to skin in high temperatures)



Tip: The best clothes for fire evacuation are made of natural fibers including wool that will not melt, and will protect your skin from flying embers.

Planning for our children

Our children will leave before a fire

- Our children will leave (when): _____
- Our children will go to:
 - Same place as household (see above)
 - Different place:
- Name: _____
- Address: _____
- Phone: (____)____ - _____
- Evacuation Zone for this location: _____

Our children will leave after a fire starts

We are ready to walk with our children:

☐

Our children can walk/run for long periods without help.

☐

We are ready to carry our children out on foot with carriers/baby wearing, backpack.

Planning for our pets

Our pets will leave before a fire

- Our pets will leave (when): _____
- Our pets will go to:
 - ☐ Same place as household (see above)
 - ☐ Different location (pet boarding, etc.) – see below:
- Name: _____
- Address: _____
- Phone: (____) ____ - _____
- Evacuation Zone for this location: _____

Our pets will leave after a fire starts

We are ready to walk with our pets:

- ☐ Our pets can walk/run for long periods without help. We have leashes ready.
- ☐ We are ready to walk our pets out using carriers (consider a pet carrier with wheels).
- ☐ We have made a plan with our neighbors for them to take our pets if there is an evacuation order and we are not at home.

Before we leave, we will take final steps to protect our home.

Leaving Before a Fire

Inside our house

- ☐ Shut all windows and doors
- ☐ Raise shades and remove curtains
- ☐ Move flammable furniture to the center of the room, away from windows and doors
- ☐ Turn on inside lights
- ☐ Turn off air conditioning

Outside our house

- ☐ Move any flammable outdoor items inside, or move them far away from the home (ex: patio furniture, toys, doormats, trash cans)
- ☐ Move propane BBQs away from structures
- ☐ Connect garden hose with a spray nozzle to outside water valves and spigots
- ☐ DO NOT leave sprinklers on or water running
- ☐ Turn on outside lights
- ☐ Leave a ladder visible for firefighters to use

- ☐ If vents to the attic, basement, and crawlspace are not ember-resistant, seal them with pre-cut plywood or commercial seals
- ☐ Make sure vehicles are parked so that they allow easy access for emergency vehicles both on the street, and in the driveway.

Leaving After a Fire Starts

Evacuation Order (“Leave Now”):

- ☐ Close and lock doors.

Evacuation Warning (“Prepare to Evacuate”):

- ☐ If anyone in your household needs extra time to leave (ex: children, elders, people with mobility constraints), pack up and leave.
- ☐ If no one in your household needs extra time, consider taking the “Leaving Before a Fire” steps to prepare your property.

We have taken steps to protect our home.

Defensible space is a buffer around your home that will slow the spread of fire to your home. **Home hardening** steps prepare your home for wildfire.

Together, hardening your home and creating defensible space around it can increase the chances that your home will survive a fire.

Berkeley hills residents (Fire Zone 2 & 3):

- ☐ We reviewed our home's [Defensible Space Report](#) and followed the instructions on defensible space and home hardening.



Tips:

Fire Zones are different from Evacuation Zones. Not sure which Fire Zone you live in? Use this [online fire zone map](#) to find out.

The Fire Department conducts annual defensible space inspections for properties in the Berkeley hills (Fire Zones 2 and 3). You can access your [Defensible Space Report](#) to get specific instructions to make your home safer.

- *Lost your access code?* Use the “Submit a Request” button at the bottom of the page to access your report.

All Berkeley residents:

- ☐ We use the free [Berkeley Chipper Day Program](#) for curbside pickup, chipping, and disposal of vegetation material from our home's yard.



Tip: Even if you live in Fire Zone 1 (the Berkeley flats), you can also take steps to protect your home from fire. Visit [FireSafe Berkeley](#) for more information.

Links

Berkeley's Emergency Map	https://protect.genasys.com
Genasys Protect App	Download on Apple's App Store or on Google Play for Android
Sign up for AC Alert	www.ACAAlert.org
Outdoor Warning System Map	https://bit.ly/berkeleyoutdoorsirens
Outdoor Warning System Message Library	https://soundcloud.com/cityofberkeley
Map: Berkeley Fire Zones 2 and 3	https://bit.ly/BerkeleyFireZones
Learn more about Fire Weather and Evacuation	www.berkeleyca.gov/wildfire
Berkeley Path Wanderers Paths	https://www.berkeleypaths.org/path-list
Defensible Space Report	https://www.defensiblespacereport.org/berkeley
FireSafe Berkeley	www.berkeleyfiresafe.org
Berkeley Chipper Day Program	https://www.chipperday.com/berkeley/

Contact us: oes@berkeleyca.gov



General Plan

DRAFT DISASTER PREPAREDNESS & SAFETY ELEMENT

Appendix B: Groundwater Rise and Contaminated Site Analysis



Please see Appendix A to this Draft Element– Existing Conditions Report:

- Go to Appendix B of the Existing Conditions Report – Groundwater Rise and Contaminated Site Analysis



General Plan

DRAFT DISASTER PREPAREDNESS & SAFETY ELEMENT

Appendix C: Access Impaired Neighborhood Analysis

Please see Appendix A to this Draft Element– Disaster Preparedness & Safety Existing Conditions Report:

- Go to Appendix C of the Disaster Preparedness & Safety Existing Conditions Report – Access Impaired Neighborhood Analysis



General Plan

DRAFT DISASTER PREPAREDNESS & SAFETY ELEMENT

Appendix D: Evacuation Route Safety, Capacity, and Viability
Analysis



Please see Appendix A to this Draft Element– Disaster Preparedness & Safety Existing Conditions Report:

- Go to Appendix D of the Disaster Preparedness & Safety Existing Conditions Report – Evacuation Route Safety, Capacity, and Viability Analysis



General Plan

DRAFT DISASTER PREPAREDNESS & SAFETY ELEMENT

Appendix E: Community Engagement Summary

1 Background

The City of Berkeley Planning and Development Department is updating the City's General Plan Disaster Preparedness and Safety Element and developing a new Environmental Justice (EJ) Element. This project used a two-prong approach to community engagement. In order to ensure fair treatment and meaningful involvement for communities who have been disproportionately harmed by pollution and environmental hazards, the City partnered with a local community-based organization, the Ecology Center, to lead an equitable community engagement process. The Ecology Center's equitable community engagement activities varied depending on the goals of each phase of the larger project, however the central approach was to include community organizations and direct community input through a Community Advisory Committee (CAC). The CAC was facilitated by the Ecology Center and provided a structure for the project team to collaborate with EJ Communities, guiding the development of the EJ and Safety Elements based on the CAC's lived experiences, needs, and priorities.

The CAC was composed of a group of nine local community-based organizations that serve communities most sensitive to harmful systems and natural disasters. Participating organizations included Berkeley Food Network, The Center for Food, Faith, and Justice, The Center for Independent Living, The Gray Panthers of Berkeley/the East Bay, Healthy Black Families, Latinos Unidos de Berkeley, Multicultural Institute, Pacific ADA, and Waterside Workshops. These organizations were compensated for their time and developed memoranda of understanding that were tailored to each organization's needs and capacity.

The second prong of the engagement strategy involved broader community outreach through traditional public events, meetings, and engagement activities, providing opportunities for all Berkeley residents to learn about the process and contribute input.

2 Summary of Engagement Activities

A summary of the community engagement activities conducted for the Safety and EJ Element between October 2024 through September 2026 is listed below.

1. Community Advisory Committee (CAC) assets, challenges and priority mapping (October 2024 – February 2025)
2. Community Advisory Committee Group and Follow-Up Meetings (December 2024– December 2025). Facilitator from Ecology Center also
3. Community Workshop #1: Assets, Challenges and Environmental Justice mapping and small group discussions (February 1, 2025)
4. Community Survey: Identification of issues and priorities related to the Safety Element and Environmental Justice Element (May – June 2025).
5. Community Pop-Up Exhibits: Preliminary Goals and Policies for the Safety Element, Environmental Justice Element and Climate and Resilience Metrics (October 27 – November 7, 2025).

6. Commission Meetings: Planning Commission (June 2024 and September 2026), Disaster & Fire Safety Commission (September 2026), and Environment and Climate Commission (June 2024 and September 2026)
7. Tribal Consultation: The City is also consulting with California Native American Tribes in accordance with Gov. Code, § 65352.3 for this project¹.

A brief summary on each of these activities can be found below. For more information including materials used for these activities, please see the “Summary of Community Engagement (October 2024-November 2025)” on the City’s Prepared, Safe and Healthy Berkeley for All [website](#)².

2.1 Community Advisory Committee (CAC) assets, challenges and priority mapping (October 2024 – February 2025)

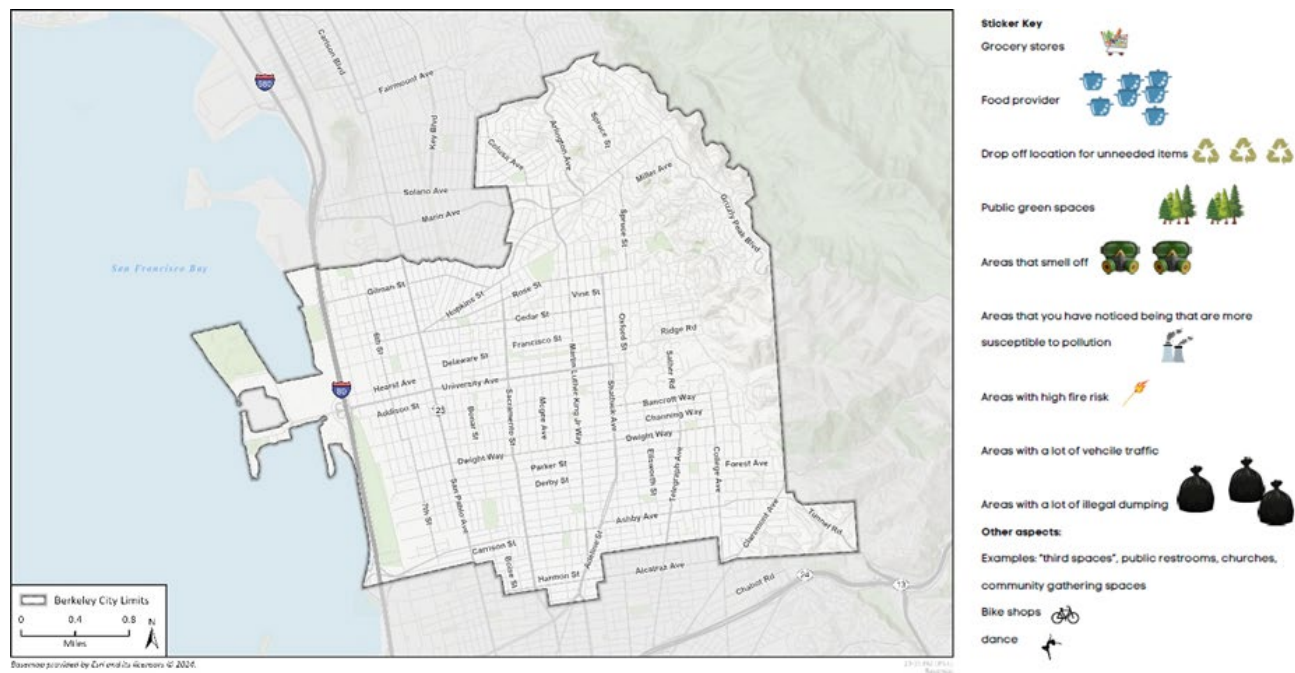
The Ecology Center conducted mapping activities with community members associated with the Community Advisory Committee to identify issues and resiliencies within the City of Berkeley. This resulted in over 30 maps that carried individual experience and expertise of a very diverse selection of community members who live, work or learn in Berkeley. These maps provided real community lived experiences and directly informed the resulting EJ Areas maps for this Element. The Ecology Center met with representatives of different CAC organizations and other members of the community selected by CAC members in one-on-one and small group settings. Participants were provided with blank maps of Berkeley (see Figure 1) and asked to place stickers or markers where they identified issues and resiliencies. A list of issues and resiliencies were provided, but participants were encouraged to add additional ones.

This section provides a summary of the takeaways from this engagement. For more information and maps, please see the “Summary of Community Engagement (October 2024-November 2025)” on the City’s [website](#).

¹ Senate Bill 18 requires consultation with Native American Tribes when a jurisdiction adopts or amends a General Plan Element and Assembly Bill 52 requires consultation with Native American Tribes when a public agency undertakes a discretionary project that is subject to California Environmental Quality Act (CEQA).

² <https://berkeleyca.gov/construction-development/land-use-development/general-plan-and-area-plans/prepared-safe-and-healthy>

Figure 1- Example of map provided at in-person mapping activity



Key Takeaways – Resiliencies

In response to the question “What places in Berkeley do you serve and feel served by? Can you list their characteristics?”, participants identified several key resiliencies in the City of Berkeley, including (1) **community support systems** (organizations and institutions, events and programming) (2) **local businesses**, (3) **neighborhoods**, (4) **local government** (departments, facilities and services), and (5) **green space**.

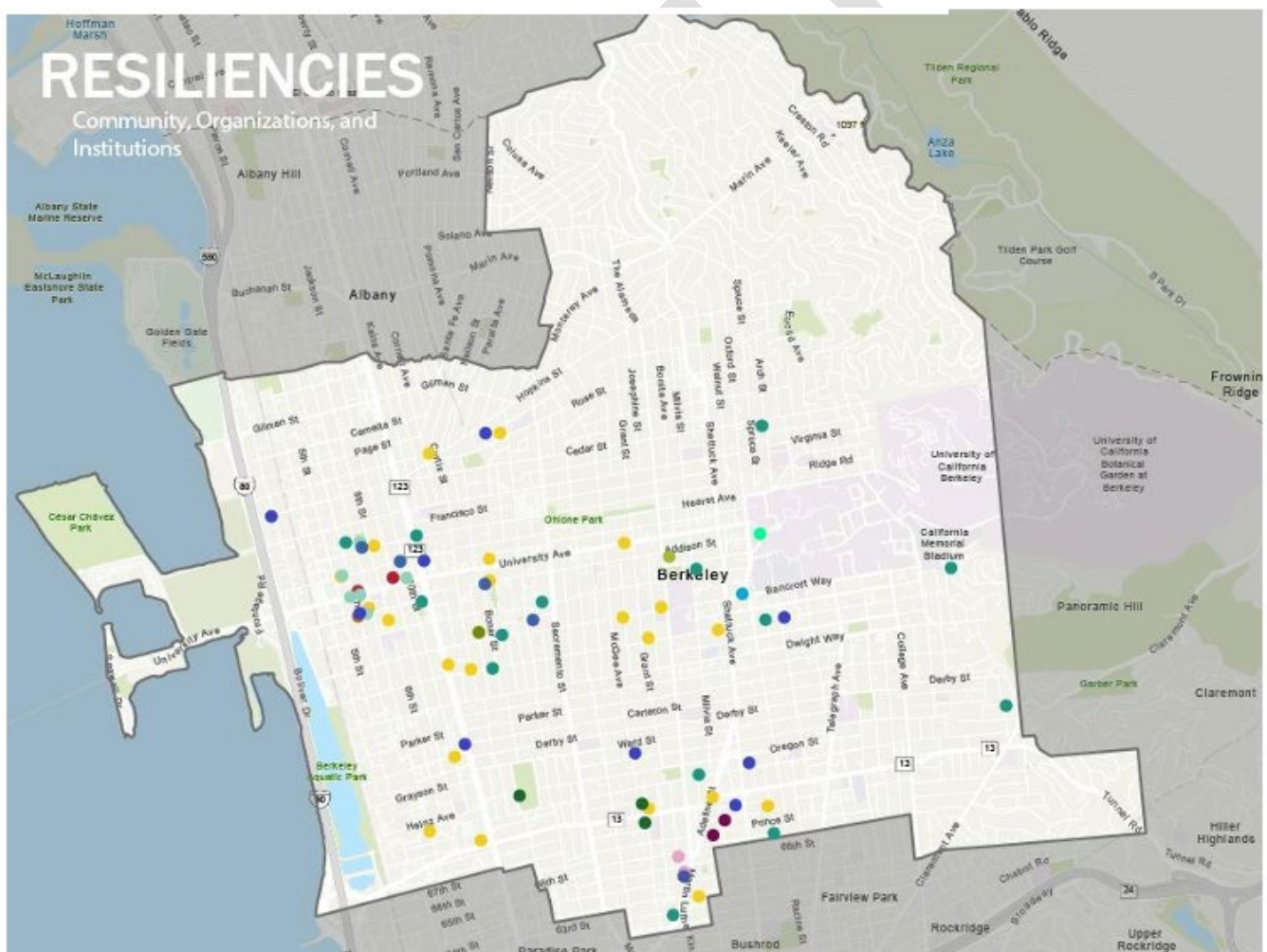
- **Community Support Systems.** Almost every respondent named one or more **community organizations or institutions** as resiliencies. In addition to mentioning the organizations that respondents are associated with, respondents primarily named nonprofit organizations and institutions supporting **homeless services, cultural centers, religious institutions, disability support, and youth support**. Other groups mentioned support on **safe streets, neighborhoods, food access, and education**. The maps showed a concentration of community and local organizations and institutions in West and South Berkeley.
- **Businesses.** In addition to mentioning organizations, almost every respondent mentioned businesses. Responses primarily focused on restaurants and grocery stores/farmer’s markets. Other types of businesses were also mentioned, including community banks, pharmacies, clothing stores, childcare, gyms, dance studios, barber shops, gas stations, privately-owned sports facilities, and pet stores.
- **Neighborhoods.** Some respondents identified which neighborhoods they felt most served by. West Berkeley was the neighborhood highlighted by respondents the most,

followed by Downtown Berkeley. Other neighborhoods mentioned include Northwest Berkeley, Southwest Berkeley, the Berkeley Marina, Upper Hearst and Panoramic Hill.

- **Local Government Departments, Facilities, and Services.** The Public Works Department and ADA Compliance Officer were mentioned, as were the City’s Senior Centers, City Council Chambers, the public libraries, the West Berkeley Family Wellness Center, BUSD and the Office of Family Engagement and Equity, and a few specific schools.
- **Parks and Green Space.** Many respondents provided names of the parks that they felt supported by.

An example map of resiliencies cited related to community, organizations, and institutions can be found below.

Figure 2 - Resiliencies: Community, Organizations, and Institutions



Key Takeaways – Issues

In response to the questions “What are the challenges your community is confronted with?”, “What contributes most to these challenges?”, and “Are there examples of resources

addressing these problems?”, participants focused largely on issues with the **Built Environment** and issues related to **Sensitive Populations**, and often the intersection between the two. Sensitive Populations most frequently raised included: the **unhoused, people with disability, people with limited English-speaking abilities, seniors, and the LGBTQIA+ population**. The issues highlighted most frequently included:

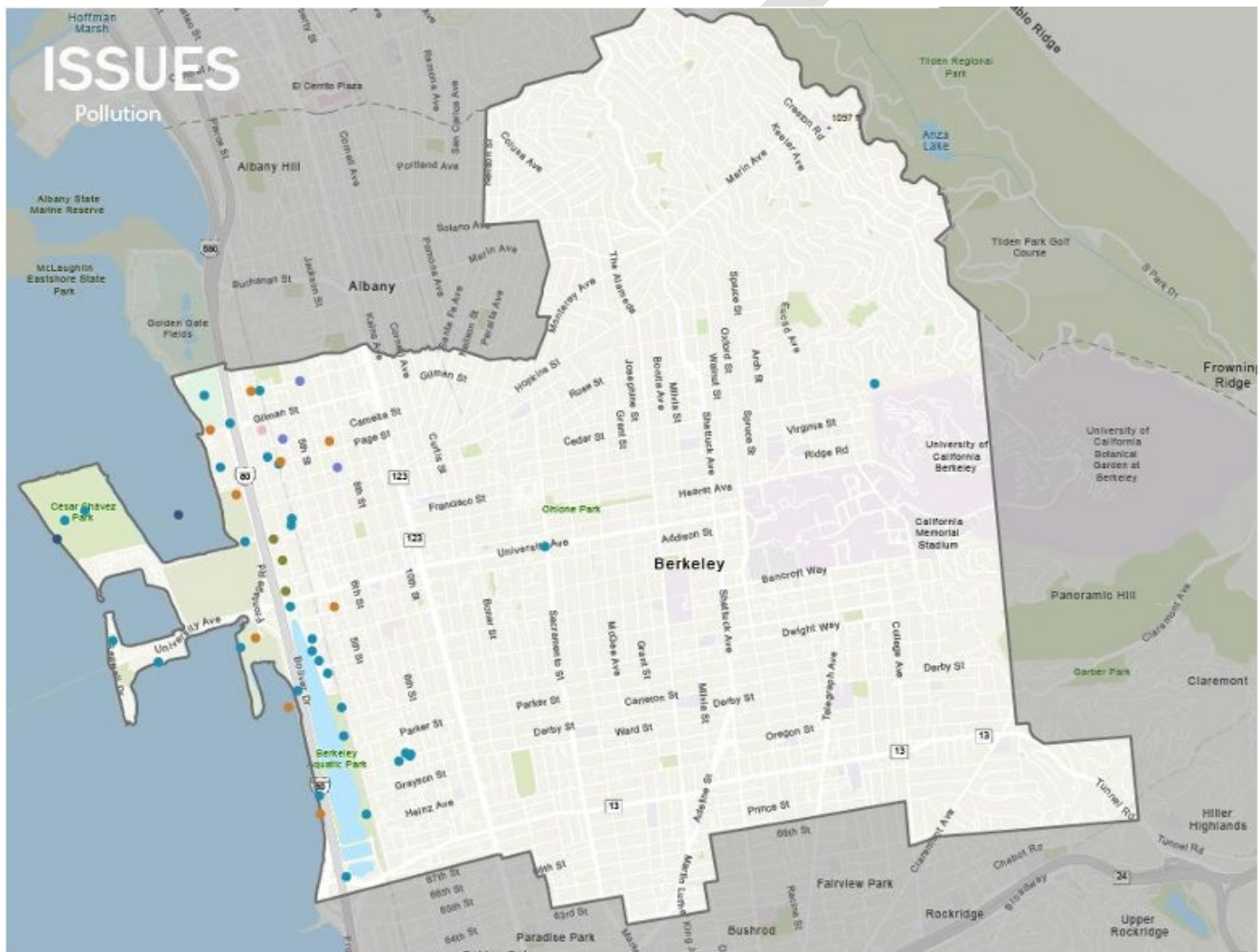
- **Access to Public Bathrooms.** One of the most frequently mentioned issues within the community was the lack of access to public bathrooms, with respondents highlighting this being particularly challenging for people experiencing houselessness, as well as seniors.
- **Access to Food.** A number of respondents highlighted food insecurity, healthy food access and affordability, and food education as challenges the community faces. Respondents also mapped accessibility of food retailers, such as narrow aisles, small parking lots, and crowded stores
- **Access to Housing.** Another frequently mentioned challenge was housing, and the need to make it more available, affordable, and accessible. Respondents also mentioned the unhoused and the lack of shelter and available resources.
- **Bike and Pedestrian Accessibility and Safety.**
- **Public Transportation.** In addition to mentioning bike and pedestrian accessibility and safety, respondents highlighted poor transit options, the high cost associated with transit, safety concerns, sanitation concerns, and limited accessible parking.
- **Aging Infrastructure and Pedestrian Safety.** Respondents listed concerns with aging infrastructure, including roads, sewers, parks, urban trees, and train tracks. Additionally, safety concerns about the breaking down of sidewalks and streets were raised, as were safety concerns as a result of outdated audible street crossing.
- **Sanitation.** While a few individuals noted trash and sanitation issues more broadly, others focused on clean air, as well as bad and unpleasant odors. Trash in the streets, dirty bus and BART stops, and illegal dumping were also mentioned. Respondents also mapped rats and vermin, excrement, and needles.
- **Community Engagement and Education.** Respondents raised challenges around engaging in the community, due to:
 - a. Lack of accessibility for those living with a disability and for those with limited English-speaking ability
 - b. Lack of funding to compensate community members for their time and expertise, reaching
 - c. Lack of community organizations to support the Latino community, individual neighborhoods, and neighborhood disaster planning/preparation

d. Tokenistic inclusion of sensitive populations in planning processes, if any inclusion at all

- Other commonly highlighted challenges included: hire fire risk in the Hills, mental health/lack services in support of mental health; water access; unemployment/lack of employment opportunity; language access (ASL and Spanish), and a broader lack of access to resources/support.

An example mapping of the issues cited related to pollution can be found below.

Figure 3 - Issues: Pollution



2.2 Community Advisory Committee Group Meetings (December 2024–December 2025)

The CAC met at least once a month as a group between December 2024 and December 2025, and often the Ecology Center followed up directly with individual organizations between

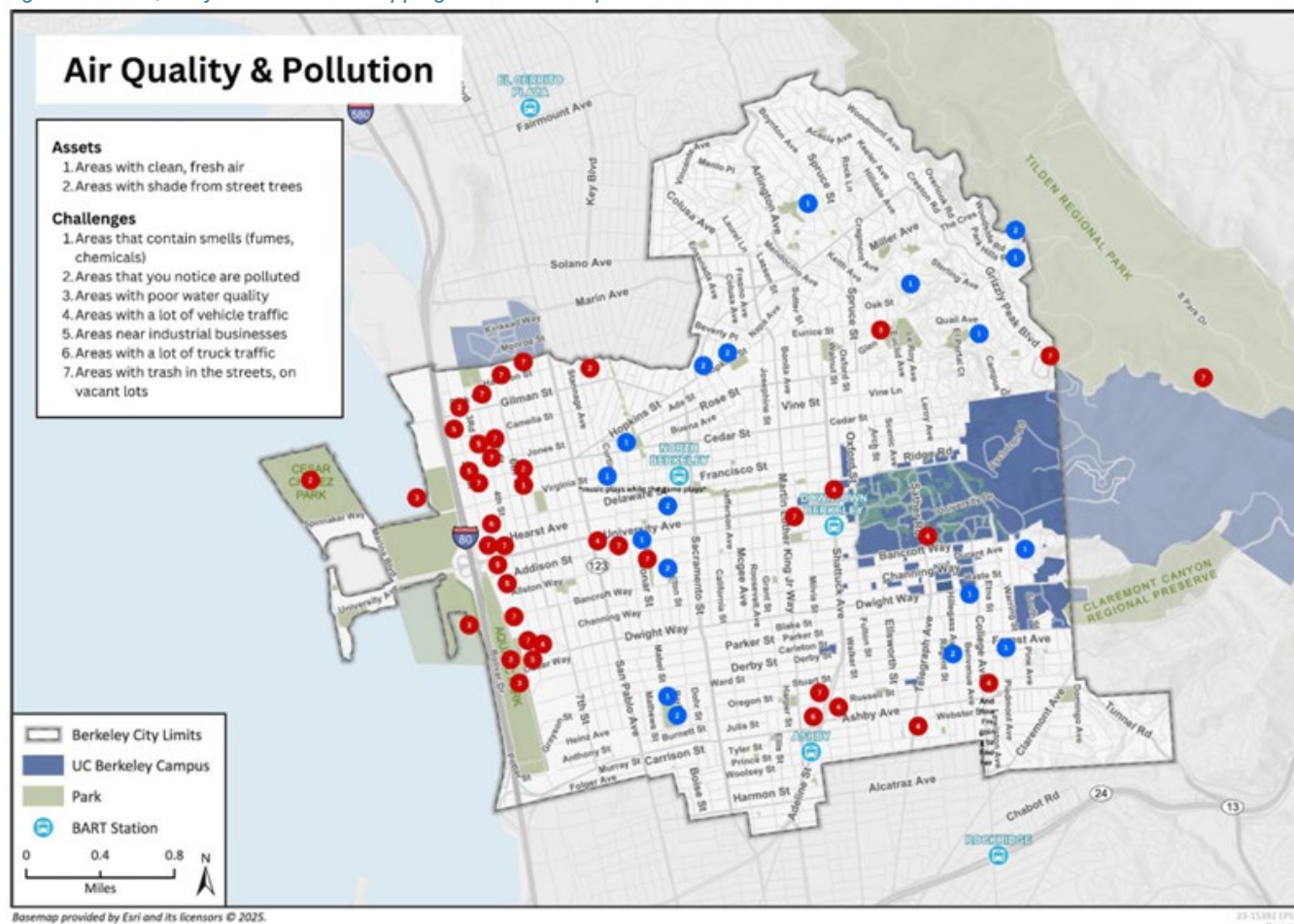
meetings multiple times. The City of Berkeley also continued to engage with CAC members directly through the publication of the Elements.

2.3 Community Workshop #1: Assets, Challenges and Environmental Justice mapping and small group discussions (February 1, 2025)

Community Workshop #1, held on Saturday, February 1, 2025 at the South Berkeley Senior Center, provided an opportunity for community members to learn about the project and share their experience of environmental justice and community environmental health and safety issues through mapping exercises and group discussions. There were nineteen attendees.

Activity #1: Mapping Assets and Challenges - The first activity provided a way for participants to identify areas where they live, work and play where historical systems of injustice still affect health and quality of life, as well as the assets to support resilience. gathered input on environmental justice and safety across Berkeley. Participants explored five stations with large maps focused on air quality, housing, fresh food access, public facilities, and physical activity. Each station included lists of pre-identified assets and challenges. Participants mapped assets with blue dots and challenges with red dots, and also added comments on sticky notes. An example of the feedback and mapping for air quality is below, and for additional information and maps see the City's website.

Figure 4 – Air Quality and Pollution Mapping from Workshop 1



After the mapping activity, City staff from each mapping station summarized the key takeaways from each map. Participants were then invited to sit in small groups to reflect together on what they had learned from their fellow community members about environmental justice, climate vulnerability, and community environmental health.

After the City gave a presentation about the data inputs and process for creating the Draft Environmental Justice Map, and facilitated conversations in small groups to get feedback on if there are areas that felt underrepresented in the maps, overrepresented in the maps, and if the draft maps represent the participants' experience in Berkeley.

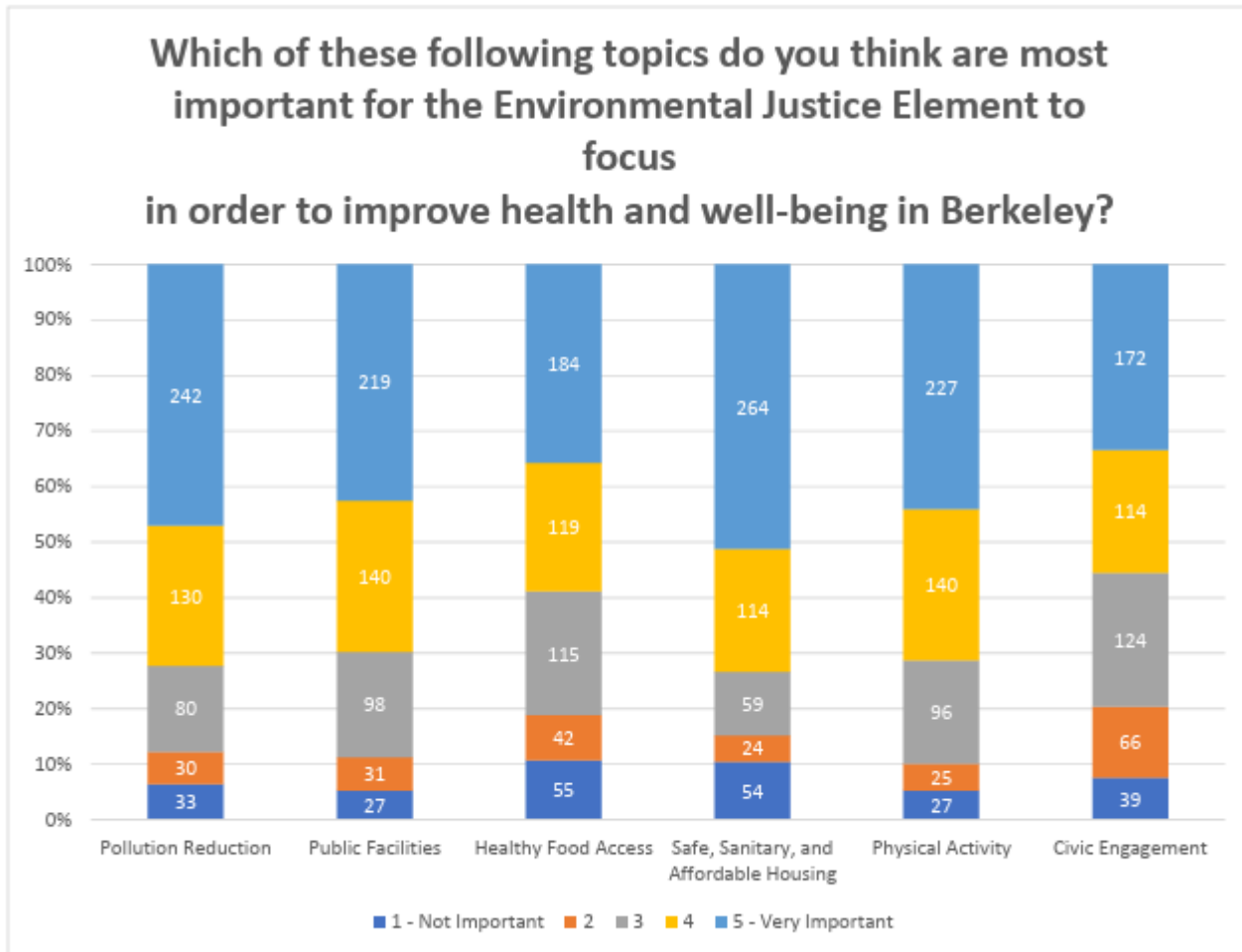
2.4 Community Survey: Identification of issues and priorities related to the Safety Element and Environmental Justice Element (May – June 2025)

The City of Berkeley Planning Department distributed an online survey to help inform the development of two General Plan Elements - an update to the Safety Element and a new Environmental Justice (EJ) Element. The survey asked respondents to prioritize issues related

to the Elements' topic areas – natural and climate change related hazards, disaster preparedness, pollution reduction, affordable housing and civic engagement as well as access to public facilities, healthy food, and physical activity. The survey also asked respondents to identify barriers to progress in those areas. The objective of the survey was to assess community priorities relating to the Safety and Environmental Justice Element topic areas to inform the development of goals and policies for the Elements.

The survey was distributed through the City's online survey platform, Berkeley Considers, in English. It was translated into Spanish and Simplified Chinese through Google forms and support from bi-lingual staff. In addition to the online version, the Spanish translation of the survey was also distributed on paper at the Multicultural Institute where 23 people responded. The survey opened on June 2nd and closed on June 30th, 2025. The Berkeley Considers platform collected 492 responses in English and the Google form got 1 response in Spanish. In total, there were 516 responses. Outreach for the survey was done in partnership with the Ecology Center and the project Community Advisory Committee (CAC). The project team and partners distributed the survey through flyers and QR codes (translated into Spanish and Chinese) and tabling at several events citywide, including walking individuals through the survey with a laptop in person in real-time. The CAC members also shared the survey with their community organizations.

Below is a sample of the responses received. For more detailed information on the survey including all responses, see the Safety and EJ Element Community Engagement Summary on the City's Website.



2.5 Community Pop-Up Exhibits: Preliminary Goals and Policies for the Safety Element, Environmental Justice Element and Climate and Resilience Metrics (October 27 – November 7, 2025)

In partnership with the CAC and the Ecology Center, the City of Berkeley hosted a series of Pop-Up Exhibits to inform the public and gather feedback on our project to update the General Plan Safety Element, create a new Environmental Justice Element and develop Community Climate and Resilience Metrics. From October 27th to November 7th the project team planned 16 Pop-Up Exhibits hosted at venues throughout Berkeley. The venues included libraries, Senior Centers, and CAC partner locations including the Ecology Center Store, Waterside Workshops, McGee Baptist Church, the Berkeley Food Network, Healthy Black Families, the UC Berkeley Latinx Resource Center and the Ed Roberts Campus.

Over the two-week period, over 300 participants engaged with the content of the Pop-Up Exhibits and provided feedback on preliminary goals and policies. The primary goal of this community engagement was to bring information to and get meaningful feedback from as

many Berkeleyans as possible. By hosting 16 events in various locations across Berkeley, the project team intended to meet the community in their spaces or shared spaces and provide flexible timeframes and multiple opportunities for participation. The CAC organizations played a critical role in providing space and gathering their members to engage in this work. Through their efforts to publicize the events, open their spaces and engage with the content, the CAC's role in the success of this engagement was invaluable.

Figure 5 - "Pop-Up" Events at (starting top left, in clockwise order): Center for Food, Faith & Justice; Healthy Black Families; Waterside Workshops, UC Berkeley Latinx Resource Center, Ed Roberts Center, Berkeley Food Network



The content of the exhibits was offered in several languages including Spanish, Chinese, Hindi, Arabic and English. The choice to provide translated materials in these languages was informed by the CAC and the communities they serve. The exhibit materials were also offered online in English and Spanish to allow for virtual participation. Twenty-three people participated online.

Figure 6- Sample Translated Materials



At the Pop-Up Exhibits, City staff presented eight boards with preliminary Safety and EJ policies developed with the CAC. While not exhaustive of all the Safety and EJ topics nor the entirety of the CAC's recommendations, the eight poster boards included 37 policies under the following topic areas:

- **Safety:**
 - Emergency Preparedness & Response
 - Equitable Community Resilience
 - Air Quality
- **Environmental Justice:**
 - Community Connections & Belonging
 - Healthy Food Access
 - Healthy & Accessible Public Spaces
 - Safe & Affordable Housing
 - Effective and Inclusive City Government

Participants were asked to read through the policies and provide feedback in two ways. First, participants were given sticky dots and asked to indicate on a scale from 1 to 5 how well the policies resonated with them. Participants were also invited to add their ideas to the boards in response to two questions: 1) Is anything missing from these draft policy themes?; and 2) How will we know this is successful? Using sticky notes, participants added their ideas to the boards. Staff were available throughout the exhibition to answer questions and provide clarification.

2.6 Berkeley Commission Meetings

The project team presented about this project to three commissions, to share information about the project and process, and hear feedback:

- Planning Commission³ (June 2025 and September 2026),
- Disaster & Fire Safety Commission⁴ (September 2026), and
- Environment and Climate Commission⁵ (June 2025 and September 2026)

³ Planning Commission web page: <https://berkeleyca.gov/your-government/boards-commissions/planning-commission>

⁴ Disaster and Fire Safety Commission web page: <https://berkeleyca.gov/your-government/boards-commissions/disaster-and-fire-safety-commission>

⁵ Environment and Climate Commission web page: <https://berkeleyca.gov/your-government/boards-commissions/environment-and-climate-commission>



General Plan

DRAFT DISASTER PREPAREDNESS & SAFETY ELEMENT

Appendix F: 2024 Local Hazard Mitigation Plan





City of Berkeley

2024 Local Hazard Mitigation Plan

Final

March 18, 2025

A. Planning Process

Note: Meeting minutes, sign-in sheets, and other supporting documents to described activities are provided for State and federal reviewers in Attachment 1: *Documentation*.

A.1 Plan Development Process

Planning Process Overview

The City of Berkeley's Local Hazard Mitigation Plan was originally adopted by the City Council on June 22, 2004, following a process that built on years of disaster mitigation activities. An update to the Plan was adopted on December 16, 2014 and again on December 20, 2019. To create the 2024 LHMP update, Berkeley followed the same multi-phased, broadly-inclusive process used to update the Plan in 2019.

LHMP Kickoff Meeting and Formation of Core Planning Team

On June 20, 2023 the City of Berkeley kicked off the 2024 LHMP Planning Process by convening a Core Planning Team made up of City Staff representing the many departments and divisions most involved in mitigation efforts. The Core Planning Team met monthly throughout the development process. The Core Planning Team included the following City Staff:

- Jamie Albrecht, Emergency Services Coordinator, Office of Emergency Services
- Galadriel Burr, Community Services Specialist, Building and Safety
- Zoe Covello, Assistant Planner, Land Use Division

- Scott Ferris, Director, Parks, Recreation, and Waterfront
- Dan Green, Assistant Fire Chief, Wildland Urban Interface Division
- Ashley James, Senior Planner, Land Use Division
- Ruth Raisner, Health Services Program Special, Public Health Emergency Preparedness
- Meagan Jones, Health Services Program Specialist, Public Health Emergency Preparedness
- Sarah Lana, Emergency Services Manager, Office of Emergency Services
- Sarah Moore, Community Services Specialist, Office of Energy and Sustainable Development
- Steve Riggs, Fire Marshal, Fire Department

Development of First Draft Plan

Throughout 2023 and in early 2024, the Project Manager collaborated with numerous City staff, hazard experts, and community partners to update the plan's hazard analysis, progress on 2019 actions, and to develop the 2024 mitigation strategy. During this time City leaders provided guidance to the Project Manager through participation in the Core Planning Team. As the Project Team developed the First Draft 2024 LHMP, they engaged key partners and community members to update hazard and risk assessments and mitigation initiatives in the Plan, including the new section in the hazard analysis on mitigating individual and household risk for each hazard. The Core Planning Team worked with key partners to identify opportunities for collaboration on new Actions in the 2024 mitigation strategy.

The list of City Staff and hazard expert representatives as well documentation of their

participation is in the Attachment.

Public Review of First Draft Plan

In May 2024, the City posted the First Draft Plan on the City website for review and comment by the Berkeley community. All of the City's commissions were invited to provide feedback on the Plan. The Project Manager presented the First Draft Plan to the Disaster and Fire Safety Commission and Planning Commission, offering an opportunity for feedback from Commissioners and community members. The City also offered to meet with Council Members one-on-one to discuss the Plan and hear their feedback. In response to this offer, Council Members suggested a presentation to the Safety Committee, which staff gave in July 2024.

To support and encourage community members to provide asynchronous feedback, the City posted created videos introducing Risk Assessment content in an accessible and short format. These videos are accompanied by an email address where community members can share their ideas.

The City also held two First Draft Plan Workshops, offering the public an opportunity to engage in person with staff on the Plan's content. The Workshops included a short presentation introducing the Plan and then an opportunity to comment on poster boards describing each hazard in the First Draft Plan.

This public review process is considered a key step in the City Council's adoption of the 2024 Local Hazard Mitigation Plan. See Element F: *Plan Adoption* for details on the public review process.

A.2 Stakeholder Engagement

In August 2023, the Core Planning Team invited Community Partners to help develop the First Draft 2024 LHMP. Community Partners included local and regional agencies, neighboring communities, representatives from business, academia, and other organizations, as well as local non-profit and community groups. Each Community Partner was asked via email to submit their risk assessment information, mitigation strategy approaches, successes, and ideas for collaboration. The City incorporated this feedback into the Plan.

The Project Manager collaborated with these agencies to include detailed information about partners' hazard and risk assessments and mitigation initiatives in the hazard analysis section of the Plan. Additionally, Community Partners were invited to review and provide comment on proposed actions as part of the process to develop the First Draft 2024 LHMP. The list of Community Partner representatives as well documentation of their invitation to participate is in the Attachment.

Community Partners are also invited to provide feedback on the First Draft Plan as part of the public process.

A.3 Public Engagement during Drafting Stage

In order to involve the public early in the mitigation planning process, the City of Berkeley's Office of Emergency Services spoke to people about the Plan at community events, like National Night Out. During National Night Out, staff went to neighborhoods across Berkeley where residents were hosting free block parties. The block parties were out on the streets or green space of the neighborhood, blocked off to traffic, making them open and accessible to anyone who was available to join. Questions focused on top hazards of concern and how community members can take mitigation and preparedness actions to reduce risk.

The Office of Emergency Services also hosted three community workshops focused on offering the public mitigation actions that could easily take as well as collecting input into the Plan. These workshops included one on all Berkeley's Hazards in central Berkeley, one on Tsunamis at the waterfront, and a Winter Weather Workshop held in north Berkeley. These workshops were held at different times to accommodate a variety of schedules: one on a weekday evening, one on a Saturday morning, and one on Saturday morning and afternoon. Locations were all public transit accessible.

For individuals that could not attend in person events, there was always an option to email staff at mitigation@berkeleyca.gov. This email address was advertised as part of outreach materials such as newsletters and at community events for people to share.

This public engagement led to the decision to remove climate change as its own standalone hazard and instead integrate it more thoroughly into each hazard of concern. Many community members expressed that it didn't make sense to have it so separate from the other hazards. Climate change is now more of framing discussion throughout each hazard section.

A.4 Update of Technical Information

The Project Manager worked with City staff, hazard experts, and community partners to update information in the Risk Assessment, accounting for new scientific research on hazards that could affect Berkeley, their areas of exposure and their potential impacts.

The Endnotes Section of the Element B: *Risk Assessment* provides a detailed listing of technical information incorporated into the plan.

B. Risk Assessment

To become disaster resilient, a community must first understand the existing hazards and their potential impacts. Berkeley is exposed to a number of hazards that vary in their intensity and impacts on the city. This mitigation plan addresses hazards: earthquake, wildland-urban interface (WUI) fire, flood, rainfall-triggered landslide, tsunami, extreme heat, hazardous materials release, poor air quality, sea level rise, infectious disease, high wind events, and utility interruption. Each of these hazards can occur independently or in combination, and can also trigger secondary hazards.

Describing Likelihood and Impacts

Using a structure outlined by Saunders, Beban and Kilvington (2013 draft), the table below summarizes these hazards, their relative likelihoods, and the relative severities of their potential consequences.

Relative degrees of likelihood are described as:

- *Likely*: The event may occur several times in your lifetime, up to once every 50 years
- *Possible*: The event might occur once in your life time, once every 51 – 100 years
- *Unlikely*: The event does occur somewhere from time to time, once every 101 – 1,000 years
- *Rare*: Possible but not expected to occur except in exceptional circumstances, once every 1,001 to 2,500 years
- *Very rare*: Conceivable but highly unlikely to occur, once every 2,500+ years

Relative severity of hazard impacts is described using the following terms, which are defined by matrix of factors, including Social/Cultural, Buildings, Critical Buildings, Lifelines, Economic and Health and Safety:

- *Catastrophic*
- *Major*
- *Moderate*
- *Minor*
- *Insignificant*

Table 1. *Summary of Hazard Analysis*

Hazard	Likelihood	Severity of Impact
Earthquake	Likely	Catastrophic
Wildland-Urban Interface Fire	Likely	Catastrophic
Extreme Heat	Likely	Moderate to Catastrophic
Poor Air Quality	Likely	Minor
High Wind	Likely	Minor
Rainfall-Triggered Landslide	Likely	Minor to Catastrophic
Tsunami	Possible	Minor to Catastrophic
Sea Level Rise	Likely	Minor to Major
Floods	Likely	Minor

Utility Interruption	Likely	Minor to Major
Hazardous Materials Release	Likely	Minor to Catastrophic
Infectious Disease	Likely	Minor to Catastrophic

B.1.a Description of Hazards

Sections B1-B13 describe hazards and how they occur in Berkley. They also describe how related hazards can trigger or be triggered by the hazard in question.

Natural Hazards

Originally, the natural hazards included in this plan were first identified through a community-based process during the revision of the Disaster Preparedness and Safety Element of the City's General Plan, adopted in 2002. The General Plan is the result of four drafts, approximately 100 hours of public workshops, meetings, and hearings, almost 1,000 pages of policy suggestions submitted by Berkeley citizens, and the hard work and dedication of the Berkeley community and Berkeley Planning Commission¹. Specialists from the California Geological Survey, US Geological Survey, UC Berkeley, the Earthquake Engineering Research Institute (EERI), the Association of Bay Area Governments (ABAG) and many others worked with the city on programs and research that were incorporated in the Disaster Preparedness and Safety Element.

Since then, the natural hazards in the plan included in the Plan have been updated with each cycle. Updates are based on new science, recent hazard occurrences, and community feedback during the drafting stage.

- In 2014, the LHMP added Climate Change as a hazard of concern.
- In 2019, the LHMP added extreme heat as a specific hazard.
- In 2024, the LHMP added poor air quality, infectious disease, high wind, sea level rise, and utility disruption as specific hazards. The LHMP removed Climate Change as its own hazard and integrated into each specific hazard, inspired by community feedback during the drafting stage.

Hazards Not Considered in the Plan

Other natural hazards that are extremely rare in Berkeley are not included in this plan; these include prolonged low temperatures, hail, and small tornados and waterspouts. This plan does not focus on these hazards because they are not as likely to occur or to create damage that is as serious as the hazards addressed in detail. California is not generally exposed to the large tornado events experienced in the Midwest. Berkeley's geographic location and moderate climate typically shelters it from prolonged cold. Ocean temperatures moderate the power of tropical storms, lessening the effects of low barometric pressure and storm surge. However, these hazards may become more prevalent in Berkeley with the changing climate.

B.1.b Hazard Location

Sections B.1.b – B.13.b maps the locations in Berkeley that are particularly prone to specific hazards.

B.1.c Hazard Extent and Anticipated Intensities

Sections B.1.c – B.13.c describe the range of anticipated intensities of the hazard, usually

shown with a chart or scale.

B.1.d Previous Hazard Events

Sections B.1.d – B.13.d detail the previous hazard events, including state and federal major disaster declarations since the last update, of all hazards addressed in this hazard analysis.

B.1.e Probability of Future Hazard Events

Sections B.1.e – B.13.e detail the probability of future hazard events for all hazards addressed in this hazard analysis.

B.1.f Vulnerabilities

Vulnerability to Current and Future Assets

Sections B.1.f – B.13.f describe risk to assets including people, structures, systems, natural, historic, and cultural resources, and activities of value to the Berkeley community.

Access and Functional Needs

This plan also recognizes that there are many individuals that are still disproportionately impacted during disasters. People with access and functional needs are defined as community members who may have additional needs before, during and after an incident in functional areas, including but not limited to: maintaining independence, communication, transportation, supervision, and medical care. Individuals in need of additional response assistance may include those who have disabilities, live in institutionalized settings, are elderly, are children, are from diverse cultures, have limited English proficiency, or are non-English speaking, or are transportation disadvantaged. An

individual with a disability is defined by the ADA as a person who had a physical or mental impairment that substantially limits one or more major life activities, a person who has a history or record of such an impairment, or a person who is perceived by others as having such an impairment. The ADA does not specifically name all of the impairments that are covered.

Underserved Communities and Marginalized Populations

Disasters also disproportionately impact underserved communities and marginalized populations. For example, people of color and people with low incomes have been historically denied access to housing and resources, increasing their vulnerability to these shocks. In the 2024 LHMP, actions are considered for how they prioritize underserved communities and marginalized populations. Further, the 2024 LHMP includes a list of mitigation actions for individuals and households that are designed to be approachable and accessible to a variety of circumstances.

B.1.g Risk and Loss Estimates

Sections B.1.g – B.13.g describe the consequences or effects of the hazard on the assets. Impacts are estimated quantitatively, when possible. Economic losses are described when possible.

GFOA Analysis

Some hazard sections Risk and Loss Estimates include analysis from the GFOA. In 2023, the City of Berkeley has been considering the implication that extreme events, like natural disasters, could have on the City government's financial condition, particularly its reserve

levels for the general fund. The City engaged the GFOA to produce a recommendation to help it decide the appropriate reserve level for the general fund, given the risks from extreme events. GFOA is a non-profit association of more than 23,000 state and local government finance professionals and elected officials from across North America. A key part of GFOA's mission is to promote best practices in public finance, including reserve policies. The analysis by GFOA also shed light on the potential broader economic losses to the community from the risks posed by extreme events.

Any “risk” can be thought of as the downside to an uncertain event. The next section describes GFOA's approach to uncertainty.

B.1.h The Approach to Uncertainty

The accomplished forecasting scientist, Spyros Makridakis, suggests a “Triple-A” approach for dealing with highly uncertain phenomena.

Accept. First, we must accept that we are subject to uncertainty. For example, the severity and timing of an earthquake is unpredictable. Berkeley could go years without experiencing a serious earthquake or one could occur next month!

Assess. Next, we must assess the potential impact of the uncertainty, with history providing a useful reference point. The experiences of other local governments are also a good reference point. For example, we used the historical experiences of Berkeley and other relevant municipalities to estimate the potential impact of future extreme events. However, historical experiences are not perfectly predictive of the future.

Augment. The range of uncertainty we face will almost always be greater than what we

initially assess it to be. Therefore, we must augment our understanding of risk beyond what our historical experiences show us. For example, very few people saw the 2008 Great Recession coming or thought it could be as bad as it was. They were unprepared for this historically unprecedented recession. We can augment our understanding of risk using a technique called “Probability Management.”² Probability Management is an application of modern information processing technology that allows us to simulate thousands of potential events (e.g., floods, recessions, etc.) so that we can observe the probability of events of various magnitudes coming to pass. The statistical technique that Probability Management is based on is called “Monte Carlo analysis.” This technique was established in the late 1940s, but until very recently required special computers and software to use. Modern information technology has made Monte Carlo analysis accessible to anyone with a personal computer.

In order to use Probability Management, we express any given type of extreme event as a range of possibilities that the City might experience. This range is called a “distribution.” A distribution is a shape that signifies how frequently the City might expect to experience a certain type of event and/or how severe the event might be.

The most common type of distribution is called the “normal distribution,” more popularly known as the “bell curve.” Many phenomena fit a bell curve. To help us understand how to read a distribution, we can start with an example that is related to everyday life: the height of American men.

Exhibit 3.1 shows a bell curve for the height of American men. The horizontal axis of Exhibit 3.1 represents height. The vertical axis represents frequency. The most common

height is 5'9", so it is shown at the top of the curve. Much taller men, like NBA centers, would be found on the right-hand side of the curve. Very short men would be found on the left.

Exhibit 1. Bell curve for the height of American men.

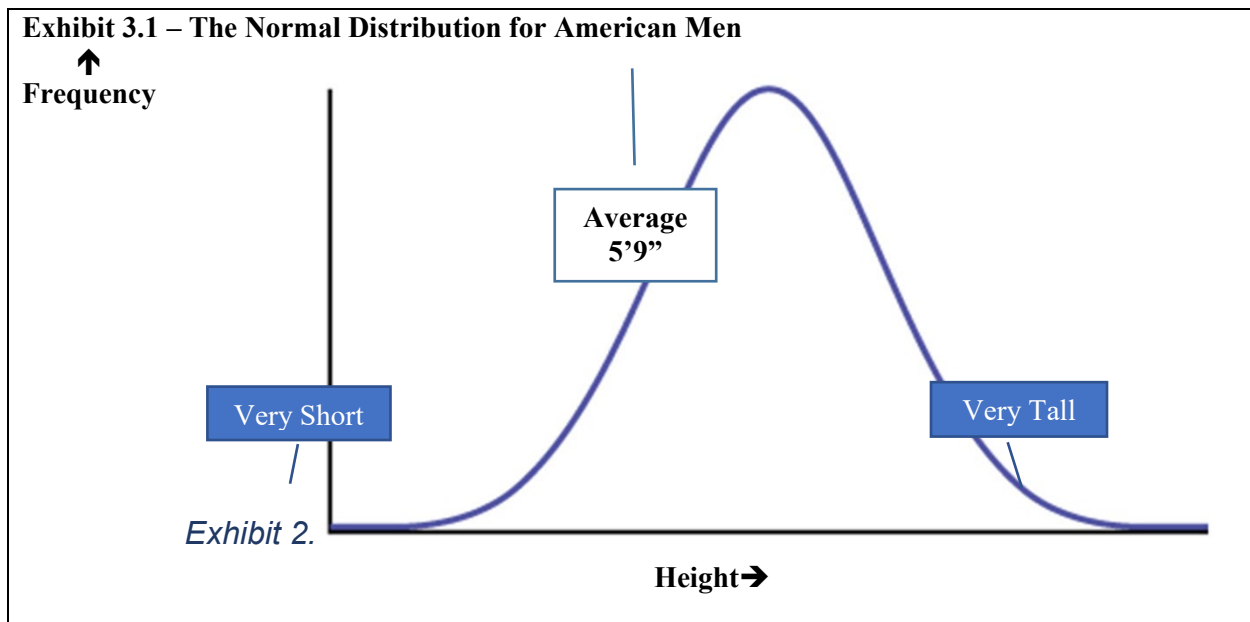
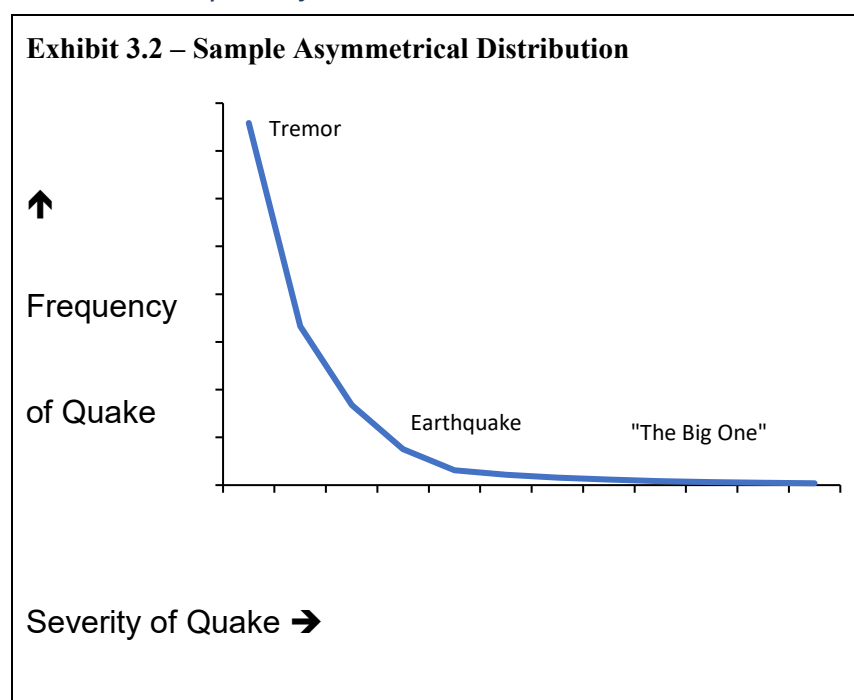


Exhibit 3. Sample Asymmetrical Distribution



The normal distribution can help analyze risk. To illustrate, the severity of an economic downturn is roughly normally distributed. A few downturns are slight, few are severe, but most are closer to average.

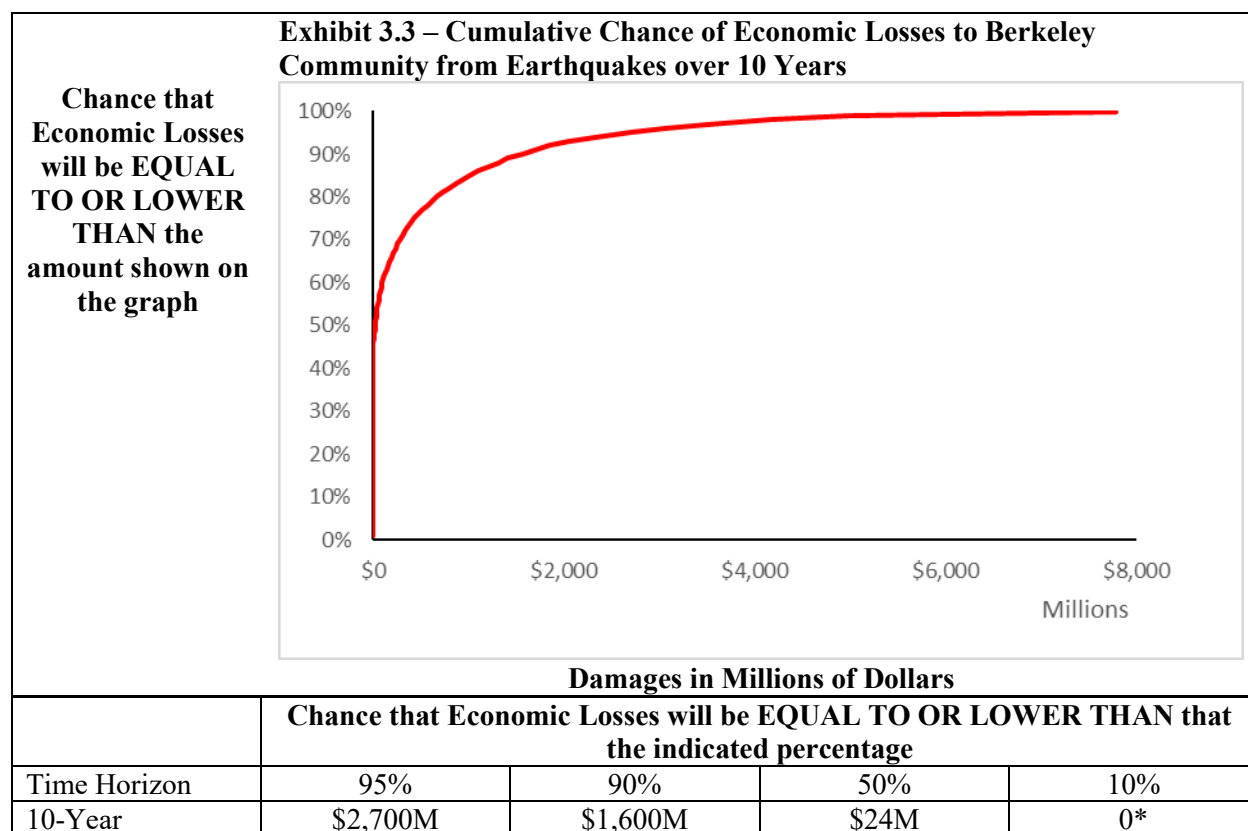
Another type of distribution we use in our analysis is an asymmetrical distribution, shown in Exhibit 3.2. Earthquakes fit an asymmetrical distribution. Exhibit 3.2 shows that tremors are the most common. Full-fledged earthquakes are relatively rare. The distribution is “asymmetrical” because the frequency with which we will experience these events are not evenly distributed around the middle of the distribution. Put another way, there are far more tremors that are smaller than the “average” earthquake. Yet, there are far fewer earthquakes (“the big one”) that are larger than the average earthquake.

Expressing Berkeley’s vulnerability as distributions allows us to calculate the probability that an event of a given magnitude will come to pass. When we associate a dollar amount with that event, we can estimate the probability or chance that Berkeley will need to have a given amount of money on-hand to respond.

Exhibit 3.3 is not a distribution but is a type of graphic we use in our work. It is called a

“cumulative probability chart.” The example in Exhibit 3.3 shows the economic losses to the entire Berkeley community from earthquakes over the course of 10 years. Earthquakes are rare events, so over a ten-year period there is a chance that there are no earthquakes at all. Hence, the red line intersects the vertical axis at about 50% (there is about a 50% chance of no earthquake). We then see the red line go up and to the right from the vertical axis. This means that the chance of larger and larger losses become increasingly remote. To illustrate, the red line intersects 70% at about \$300 million. This means there is a 70% chance that total economic losses are \$300 million or less (or a 30% chance that losses will be more). The red line intersects 80% at \$670 million, which means there is an 80% chance that losses will be less than that (or a 20% chance that losses will be more).

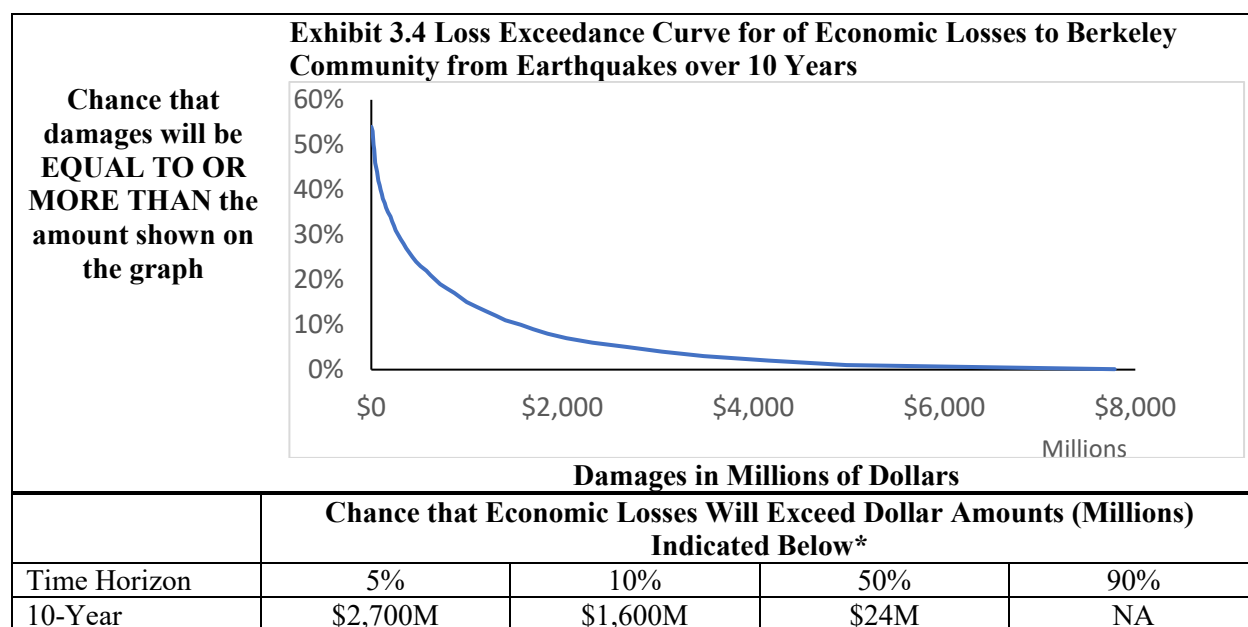
Exhibit 4.– Cumulative Chance of Economic Losses to Berkeley Community from Earthquakes over 10 Years



*Consult the graph for the precise chance that losses are equal to or lower than zero

Another of chart and one we will use to show community-wide losses in this report is a loss exceedance curve. A loss exceedance curve is another way of looking at the same concept as we saw in Exhibit 3.3. Exhibit 3.4 shows the loss exceedance curve for the same earthquake data. It just presents it in an inverse way. So, the 20% point on the vertical axis is \$670 million because there is a 20% chance that damages will be more than that. Exhibit 3.4 showed there was an 80% of damages being less.

Exhibit 5. Loss Exceedance Curve for of Economic Losses to Berkeley Community from Earthquakes over 10 Years



*Not Applicable (NA) means that the loss exceedance curve intersects zero before this point. See the graph to see where the curve meets the vertical axis for the chance of losses exceeding zero.

Both cumulative probability charts and loss exceedance curves are commonly used when quantifying risk. In our work with the City we will use loss exceedance curves to show economic losses to the entire Berkeley community and cumulative probability charts to show losses to just City government. In this particular report, we will be focusing on economic losses to the entire community, so we will show loss exceedance curves. GFOA is working with the City of Berkley on a separate report about financial losses to City government. Our intent is to make it easier to distinguish between charts that depict community versus city government losses by giving each type of loss a distinctive chart (and a different color line), for those readers that will use both reports.

B.1.i NFIP-Insured Structures

The City of Berkeley does not have NFIP-insured structures that have been repetitively damaged by floods.

B.2 Earthquakes

B.2.a Description of Earthquakes and Related Hazards

An earthquake is the ground shaking caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that we feel during an earthquake.

Shaking and Ground Failure

The most significant physical characteristic of a major earthquake is the ground shaking. During an earthquake, the ground can shake for a few seconds or up to a minute or more. The strength and duration of ground shaking is affected by many factors, including the types of soils underneath, and the distance, size, depth, and direction of the fault rupture that caused the quake.

The strongest shaking is typically close to the fault where the earthquake occurs. Horizontal shaking in particular causes most earthquake damage, because structures often have inadequate resistance to this type of motion.

Earthquakes can cause the ground to fail in several ways, resulting in additional hazards: surface fault rupture, liquefaction, and seismically-triggered landslides.

Surface fault rupture: Surface fault rupture occurs when movement on a fault deep within the earth breaks through to the surface. This can severely damage structures that cross the fault, including buildings, roads, pipelines, and train tracks.

Liquefaction: Liquefaction is a phenomenon that occurs in wet, sandy, or silty soils. When shaken, the soil grains consolidate, pushing water towards the surface and causing a loss of strength in the soil. The ground surface may sink or spread laterally.

Seismically-Triggered Landslides: Ground shaking from an earthquake can trigger landslides. This landslide movement can range from a few inches to tens of feet. Ground surface displacements as small as a few inches are enough to break typical foundations.

Fire Following Earthquake³

Fires break out following all major earthquakes. Fire following earthquake presents a significant problem in dense urban environments, where many simultaneous ignitions lead to a firestorm. In these cases, fire damage is even more severe than damage from earthquake shaking.

Earthquake shaking can start fires in numerous ways, such as:

- Tipping over appliances with pilot lights
- Damaging electrical equipment leading to sparks
- Exposing materials to open flames from stoves, candles, fireplaces and grills

Post-earthquake fires can also spread quickly when flammable chemicals spill.

Ground failure due to liquefaction, surface fault rupture and landslide can rupture gas lines (both underground and at the private gas meter). These ruptures can start and fuel fires, which also spread more quickly after major earthquakes because earthquakes damage the infrastructure needed to mitigate or respond to fires:

- Within a building, earthquake shaking and ground failure can damage a building's active fire protection systems (e.g., fire alarms and sprinkler systems), as well as its passive fire protection systems (construction features designed to slow/stop fire, e.g. fire walls, fire-rated floor-ceiling assemblies, and fire doors).
- Within a community, fires also spread more quickly after major earthquakes because earthquakes damage the infrastructure needed to fight them. Earthquake shaking and ground failure due to liquefaction, surface fault rupture and landslide can simultaneously break water mains, damage electrical systems necessary to provide energy to pump water, damage communication infrastructure, impede emergency transportation routes with debris or landslides, and jam firehouse doors, preventing apparatus from responding. Fires can occur in the days or months following an earthquake due to the to electrical systems, fire protection systems, and gas lines.

Connection to sea level rise

The United States Geological Survey predicts that sea level rise will lead to rising water tables. Higher water tables in turn increases the risk of liquefaction during earthquakes, as more soils become wet, sandy, or silty. This means as climate change continues and sea level rise increases, liquefaction will be a concern for more areas in Berkeley.

Connection to utility disruption

All utilities are vulnerable to disruption from earthquake shaking and ground failure. See the Vulnerabilities and Risk and Loss sections of this Earthquake section for more details.

B.2.b Locations of Earthquakes and Related Hazards

Map 1 shows the City of Berkeley and its proximity to known active geologic faults in the San Francisco Bay Region. This map shows most the San Francisco Bay Area, with the City of Berkeley shaded in dark gray. Many green lines move across the map in a northwest to southeast direction:

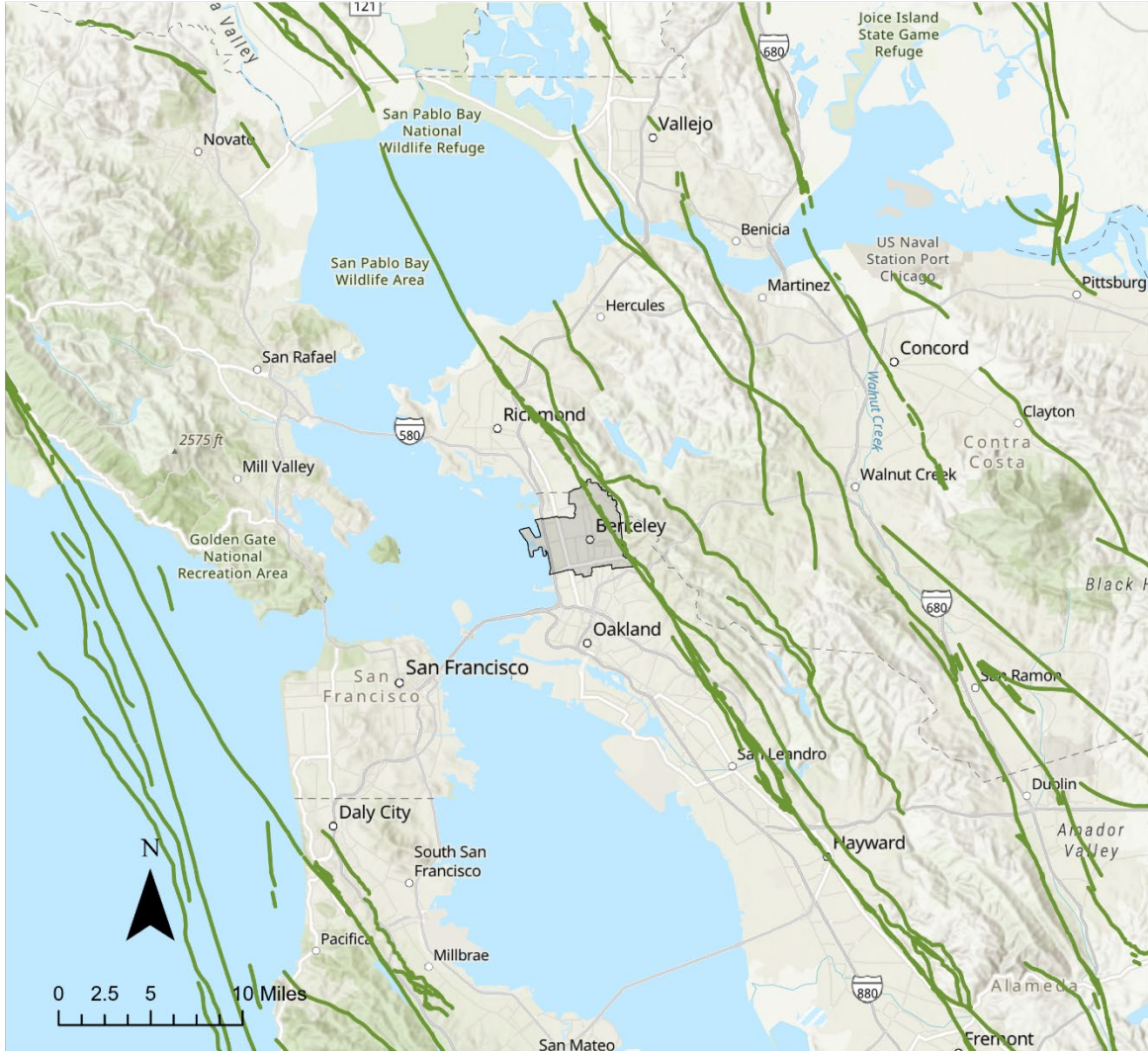
- On the western side of the picture, in the Pacific Ocean, multiple green lines move

along the coast, starting and stopping. One of these lines begins in Marin, stretches through the ocean, and then continues through Daly City and down the peninsula, off the picture. This is the San Andreas Fault.

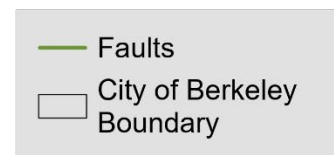
- On the right side of the frame, another set of green lines starts and stops, showing earthquake faults in the East Bay. One of these lines stretches from the middle of San Pablo Bay, crosses directly through the eastern section of Berkeley, and continues down the East Bay past Union City. This is the Hayward fault, which stretches to Milpitas, and is of particular concern in Berkeley.

A large earthquake on any of the illustrated faults could impact Berkeley. For example, the 1989 M 6.9 Loma Prieta earthquake was a rupture of the San Andreas fault, and the 2014 M 6.0 South Napa earthquakes occurred along the West Napa fault.

Map 1. Regional faults and their locations with respect to Berkeley, 2024



Fault Locations Map



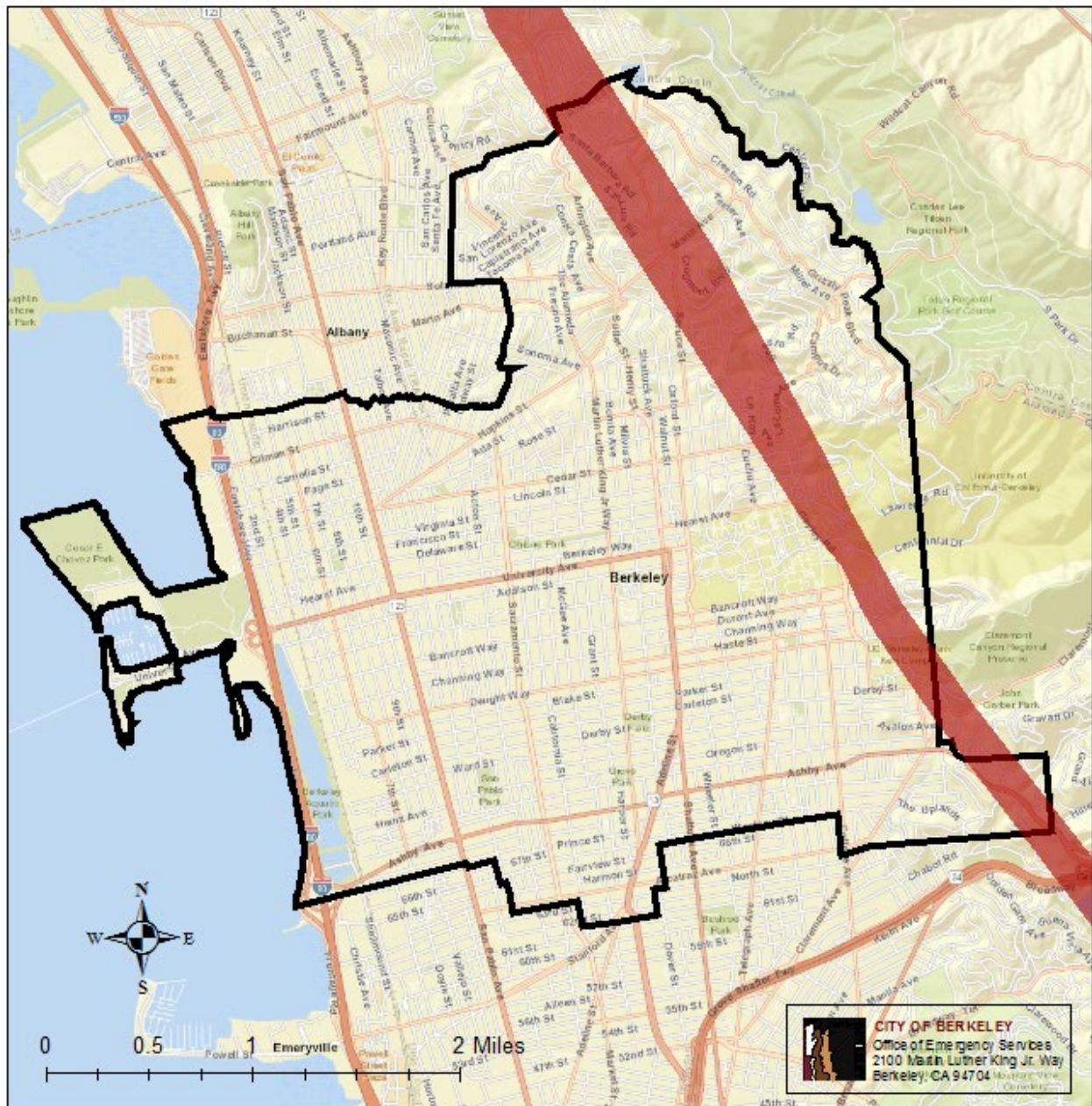
Esri, CGIAR, USGS, California State Parks, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USFWS, USGS Quaternary Faults 2022, City of Berkeley OES 10/22/2024

Location of Surface Fault Rupture:

Map 2 shows the location of the Earthquake Fault Planning Zone, which illustrates the location of the Hayward Fault and the area in Berkeley exposed to surface fault rupture.

Map 2 presents Berkeley, with borders outlined in a thick black line. The Surface Fault Rupture Zone is presented as a thick red line running along the base of the Berkeley hills in a northwest to southeast direction. The line is approximately ¼-mile wide.

Map 2. California Geological Survey Earthquake Fault Planning Zone, 2019



Source: California Geological Survey, Earthquake Fault Planning Zone.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

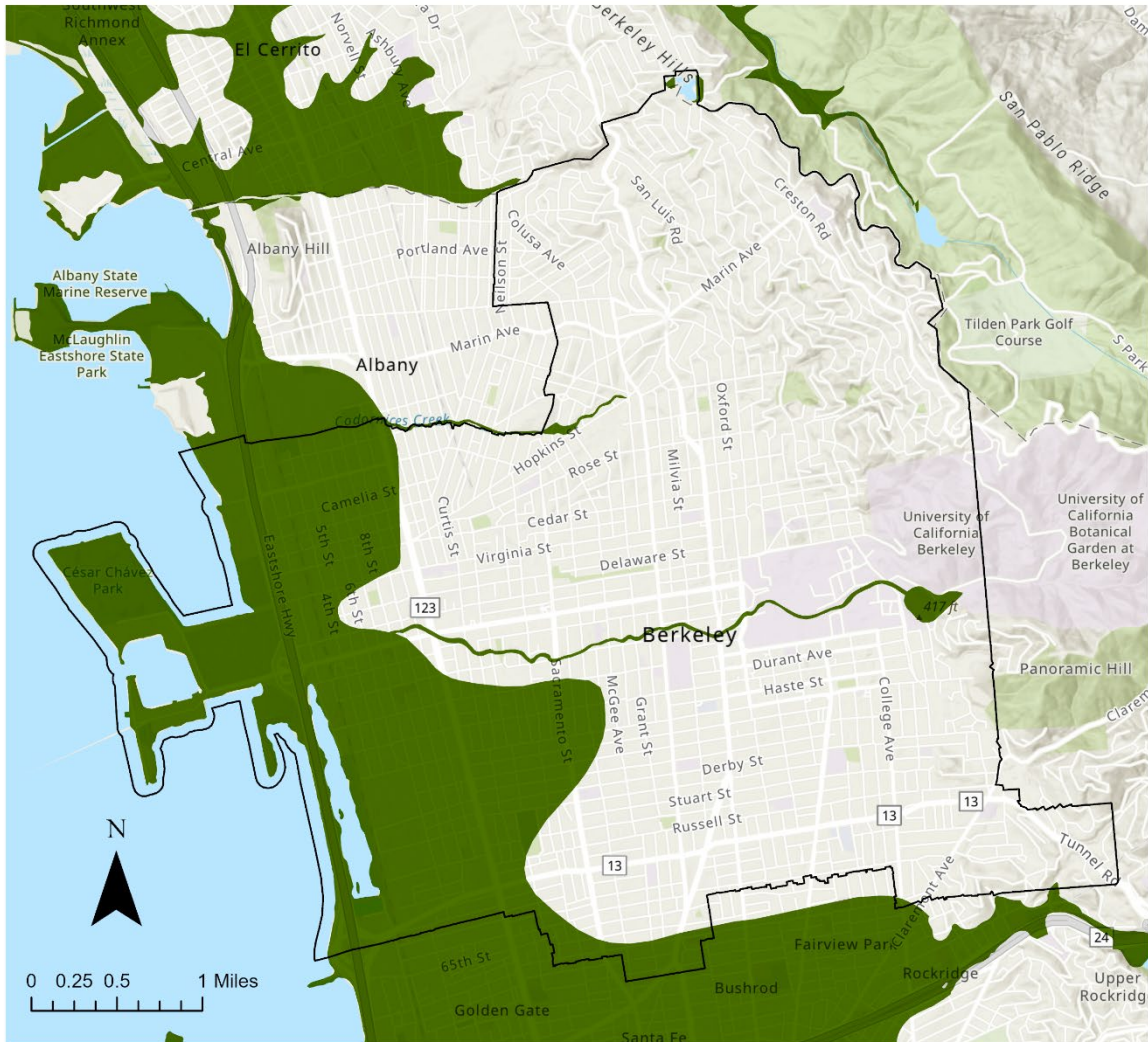
Location of Liquefaction

The USGS classified sediments in the Bay Area based on their susceptibility to liquefaction. Map 3 depicts the areas in Berkeley where soil types and groundwater conditions are more susceptible to liquefaction.

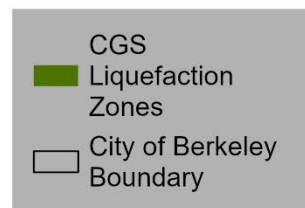
The following areas are shown in deep green, meaning they are in the liquefaction zone and experience liquefaction risk:

- The entire Berkeley Marina and Eastshore State Park
- Interstate 80
- Aquatic Park
- Codornices Creek and Strawberry Creek.
- In Northwest Berkeley the zone begins at the shoreline and ends at San Pablo Ave
- In Southwest Berkeley the zone begins at the shoreline and ends at McGee Ave

Map 3. Liquefaction Zones in Berkeley, 2024



Liquefaction Zones Map

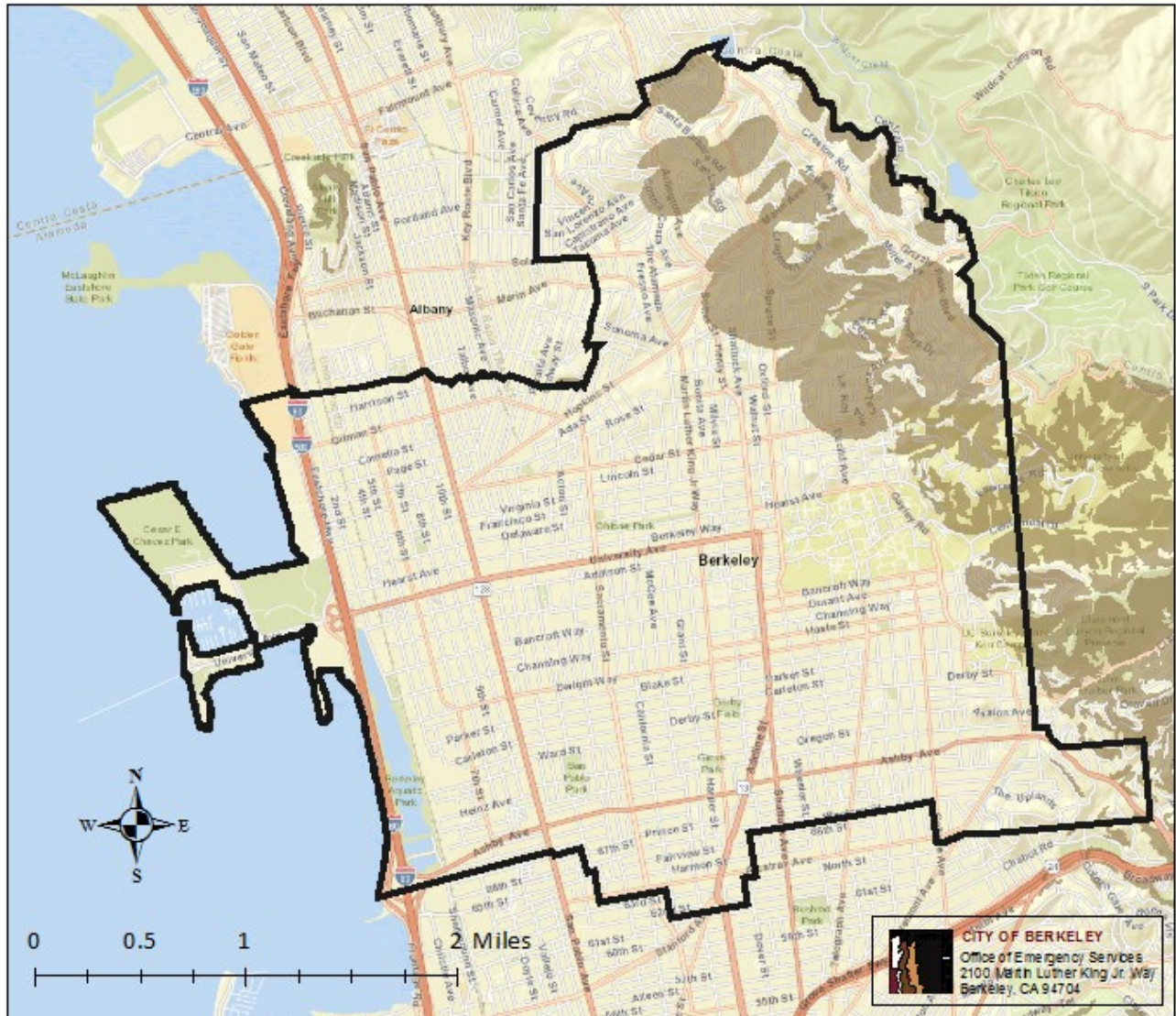


California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA, CGS Liquefaction Zones 2024, City of Berkeley OES 10/22/2024

Location of Seismically-Triggered Landslides

The California Geological Survey has identified the areas of Berkeley with potential to experience earthquake-induced landslide. All areas underlain by known active or dormant landslides are included in the zone. These areas are identified by combining information on rock or soil strength, slope gradient (steepness), and anticipated future shaking levels. In Berkeley, the potential for landslide from seismic activity is high in the hill areas and along creek banks. Map 4 indicates that significant portions of the Berkeley hills have the potential to experience earthquake-induced landslide. These areas are shown in light brown on Map 4 throughout the Berkeley hills.

Map 4. California Geological Survey Earthquake-Induced Landslide Planning Zone, 2019



Source: California Geological Society, Earthquake-Induced Landslide Planning Zone.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

- City of Berkeley
- Earthquake-Induced Landslide Planning Zone

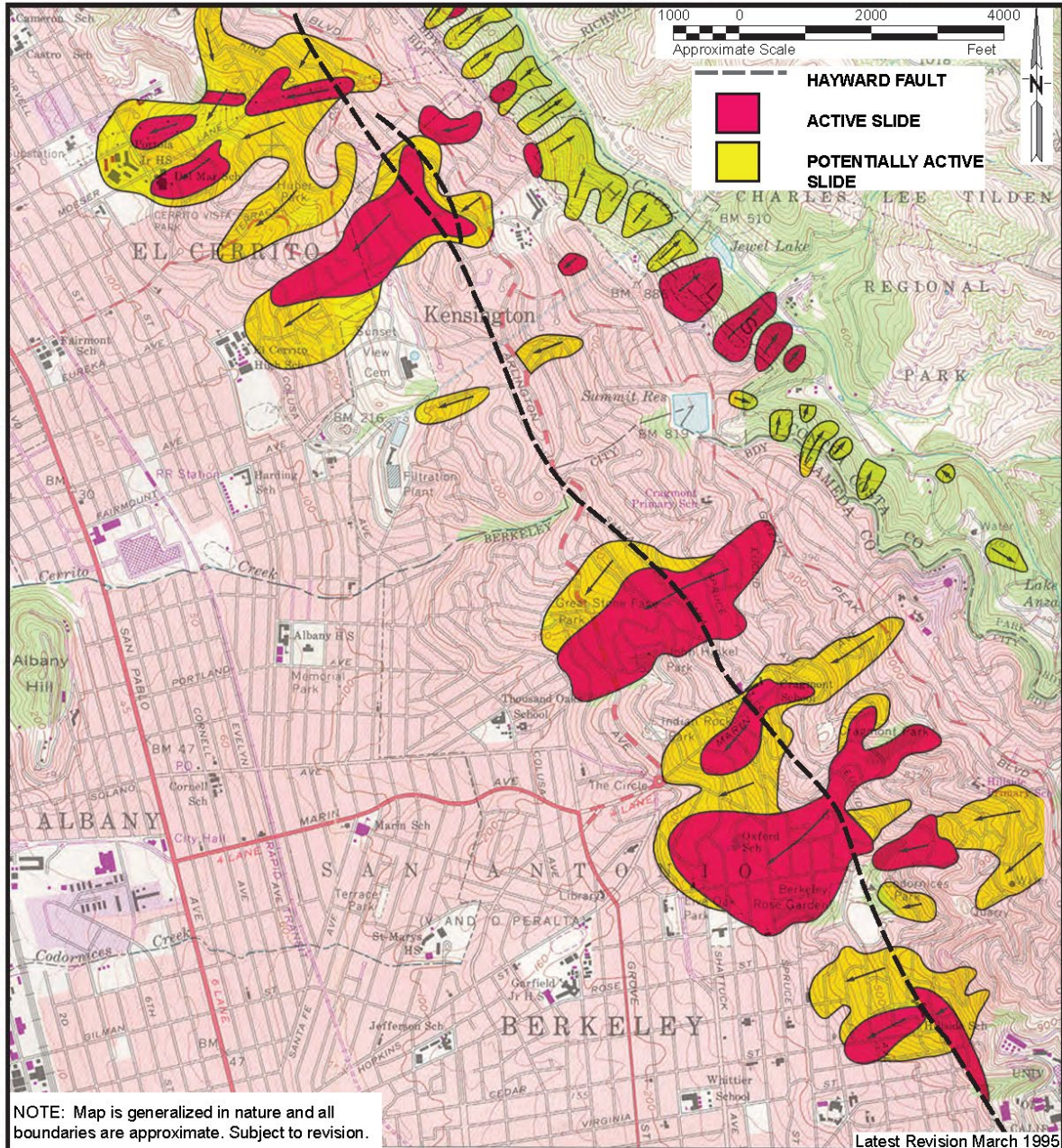
Map 5, created by Alan Kropp and Associates, focuses on a specific area in the northern part of the Berkeley hills, bordered by Virginia Street to the south and Summit Reservoir to the north. On the map, red and yellow blobs run approximately northeast to southwest, with arrows pointing in a southwestern direction.

This map illustrates this area in particular it has active landslides, indicated in red on the map. Potentially-active slides are indicated in yellow. In a Hayward fault earthquake, significant movement is likely in active landslide areas. Earthquake shaking and active slides together could activate other potentially-active slides.

While this map is outdated, it is included in the LHMP because it's the only map of its kind that exists. Alan Kropp and Associates studied this specific area in Berkeley, whereas most other maps available publicly today are not based on this in depth of a local analysis. Unfortunately, there are not currently resources available to recreate this map.

Map 5. Active and potentially-active landslides in Berkeley hills (developed by Alan Kropp Associates 1995 and used with permission)

LANDSLIDES OF THE BERKELEY HILLS



ALAN KROPP & ASSOCIATES, INC.

Geotechnical Consultants

2140 Shattuck Avenue, Berkeley, CA 94704
(510) 841-5095



Location of Fire Following Earthquake

Fire following earthquake is a threat throughout Berkeley making it impossible to map the potential locations. We do know that seismically vulnerable buildings also likely to be a key source of earthquake-caused fires when gas or electricity lines break or rupture. Additionally, Berkeley has many older multi-unit apartment buildings without fire sprinkler systems. These buildings could both cause and feed fires following an earthquake. Ultimately, densely-populated neighborhoods with wooden homes, such as most of the residential areas in Berkeley, are at high risk of fire spread following a major earthquake.

However, even buildings that survive earthquake shaking can succumb to fire, including those buildings that have been seismically retrofitted.

B.2.c Extent of Earthquakes and Anticipated Intensities

Magnitude and intensity are the two commonly-used scales to represent different earthquake characteristics.⁴

Magnitude: An earthquake has a single magnitude, which indicates the overall size and energy released by the earthquake. Magnitude is measured using moment magnitude (M).

Intensity: In the same earthquake, different locations will experience different amounts of shaking. The shaking experienced at different locations varies based on:

- The earthquake's overall magnitude
- The distance from the fault that ruptured in the earthquake
- The ground type: thick valley deposits shake longer and harder than rock.

Intensity measures the strength of earthquake shaking at a particular location. Intensity is measured using the Modified Mercalli Intensity (MMI) scale. Intensity is based on observed effects. The MMI value assigned to a specific site after an earthquake provides a more meaningful measure of the earthquake's severity at that location than the magnitude, which applies one value to the entire earthquake.

MMI descriptions⁵

The MMI scale is composed of twelve increasing levels of intensity that range from imperceptible shaking to catastrophic destruction. Lower numbers on the intensity scale generally deal with the manner in which the earthquake is felt by people. Higher numbers on the scale are based on observed structural damage. Levels are as follows:

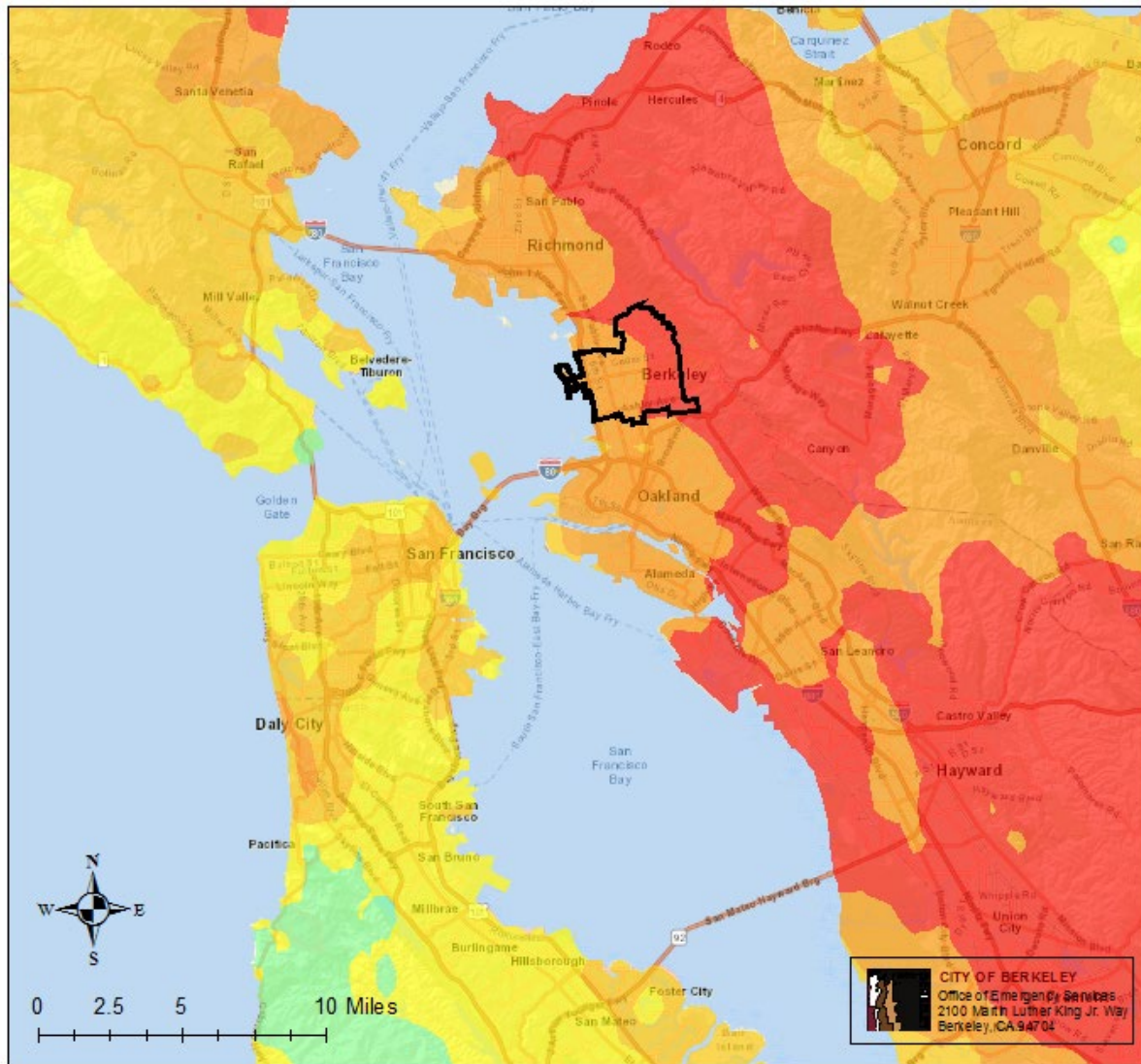
- MMI Level I (White): Shaking Not Felt: Not felt except by a very few under especially favorable conditions.
- MMI Level II (Lavender): Weak Shaking: Felt only by a few persons at rest, especially on upper floors of buildings.
- MMI Level III (Aqua): Weak Shaking: Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
- MMI Level IV (Blue): Light Shaking: Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
- MMI Level V (Gray): Moderate Shaking: Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
- MMI Level VI (Light Yellow): Strong Shaking: Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

- MMI Level VII (Medium Yellow): Very Strong Shaking: Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
- MMI Level VIII (Orange): Severe Shaking: Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
- MMI Level IX (Red): Violent Shaking: Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shift off foundations.
- MMI Level X+ (Dark Red): Extreme Shaking: Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Berkeley could experience earthquakes that span the range of the MMI scale. However, the most concerning is when the shaking is strong, very strong, violent, or extreme. To understand what this means for Berkeley, Map 6 shows most of the San Francisco Bay Area and the different levels of shaking intensity anticipated with a hypothetical magnitude 7.0 earthquake on the Hayward fault. Shaded in colors of yellow, orange, and red, the map shows that very strong, severe, and violent shaking will be felt all along the East Bay, stretching from Pinole to south of Hayward.

Berkeley is outlined with a thick black line and is shaded in colors of orange and red, indicating that in this scenario, the Berkeley flats will experience MMI Level VII (severe shaking), and eastern Berkeley will experience MMI Level IX (violent shaking).

Map 6. **Modified Mercalli Intensity for HayWired Earthquake Scenario, 2017**



Source: USGS, HayWired Scenario, August 2017.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community



B.2.d Previous Earthquakes

The strongest, most recent earthquakes occurred in the Bay Area in 2022. A magnitude 5.1 earthquake struck near San Jose in October and a magnitude 3.6 struck near El Cerrito in December. Both of these earthquakes had minimal reported damages. There have been no federally-declared earthquake disasters in Berkeley since the last update.

Destructive earthquakes struck the Bay Area in 1838, 1868, 1898, 1906, 1911, 1989, and 2014. Impacts of the earlier earthquakes in Berkeley are not well documented, but the damage of the 2014 magnitude 6.0 South Napa Earthquake is fresh in the memory of many Berkeley residents. It killed two people, injured 300 others, and caused moderate to severe damage to more than 2,000 structures.⁶ Electricity and water services sustained disruptions and there was minor damage to roads, water and natural gas lines, and wastewater treatment facilities.

The 1989 Loma Prieta earthquake also informs the Bay Area's understanding of earthquakes. Sixty-two people died in the Bay Area as a direct result of this earthquake. Most of the fatalities, 42, were caused by the collapse of a two-level elevated highway in Oakland only a few miles from the Berkeley city limits. Damage in the City of Berkeley was minor in comparison to many of its neighbors. Many residential structures experienced collapse of unreinforced masonry chimneys, and new cracks were found in the Martin Luther King, Jr. Civic Center Building. The earthquake epicenter was far from Berkeley, but region-wide impacts and disruption increased the Berkeley community's awareness of the high-risk Berkeley faces from much closer earthquakes.

The 1906 San Francisco Earthquake caused structural damage in Berkeley, including

chimney cracking and collapse, and considerable damage to some public buildings including Berkeley High School structures.⁷ Other “small” earthquakes in Berkeley over the years have caused slight damage to and in some buildings.

B.2.e Probability of Future Events

Earthquakes, especially smaller ones, are a part of life in the San Francisco Bay Area. Smaller earthquakes happen regularly and sometimes cause damage, especially inside of homes when furniture or other items move. Although small earthquakes can cause some damage, they are not as concerning as a catastrophic earthquake with a magnitude of 6.0 or more.

According to the US Geological Survey, there is a 72% probability of one or more M 6.7 or greater earthquakes from 2014 to 2043 in the San Francisco Bay Region.⁸ There is a 33% chance that a 6.7 or greater will occur on the Hayward fault system between 2014 and 2043.⁹ This means that it is likely that many Berkeley residents will experience a severe earthquake in their lifetimes.

Researchers are still trying to understand how climate change is impacting the probability of future earthquakes. According to the United States Geological Survey, there is currently no pattern of earthquakes occurring more frequently during periods of heavy precipitation or drought.¹⁰

B.2.f Vulnerabilities

People

People with disabilities and people with access and functional needs, students, and low-

income individuals may live in older housing units that are more vulnerable to collapse or damage from earthquakes. These groups may also have less socioeconomic means to prepare for and recover from an earthquake that damages their home. Earthquakes cause power outages, and people who are dependent on medical or other assistive devices that use electricity are especially vulnerable. Significant damage to streets, curbs, and transportation systems may prevent people with disabilities and people with access and functional needs from navigating to their destinations. Earthquake damage to and reduced functionality of communication systems may create additional challenges for people to get assistance from their families, friends, and caregivers.

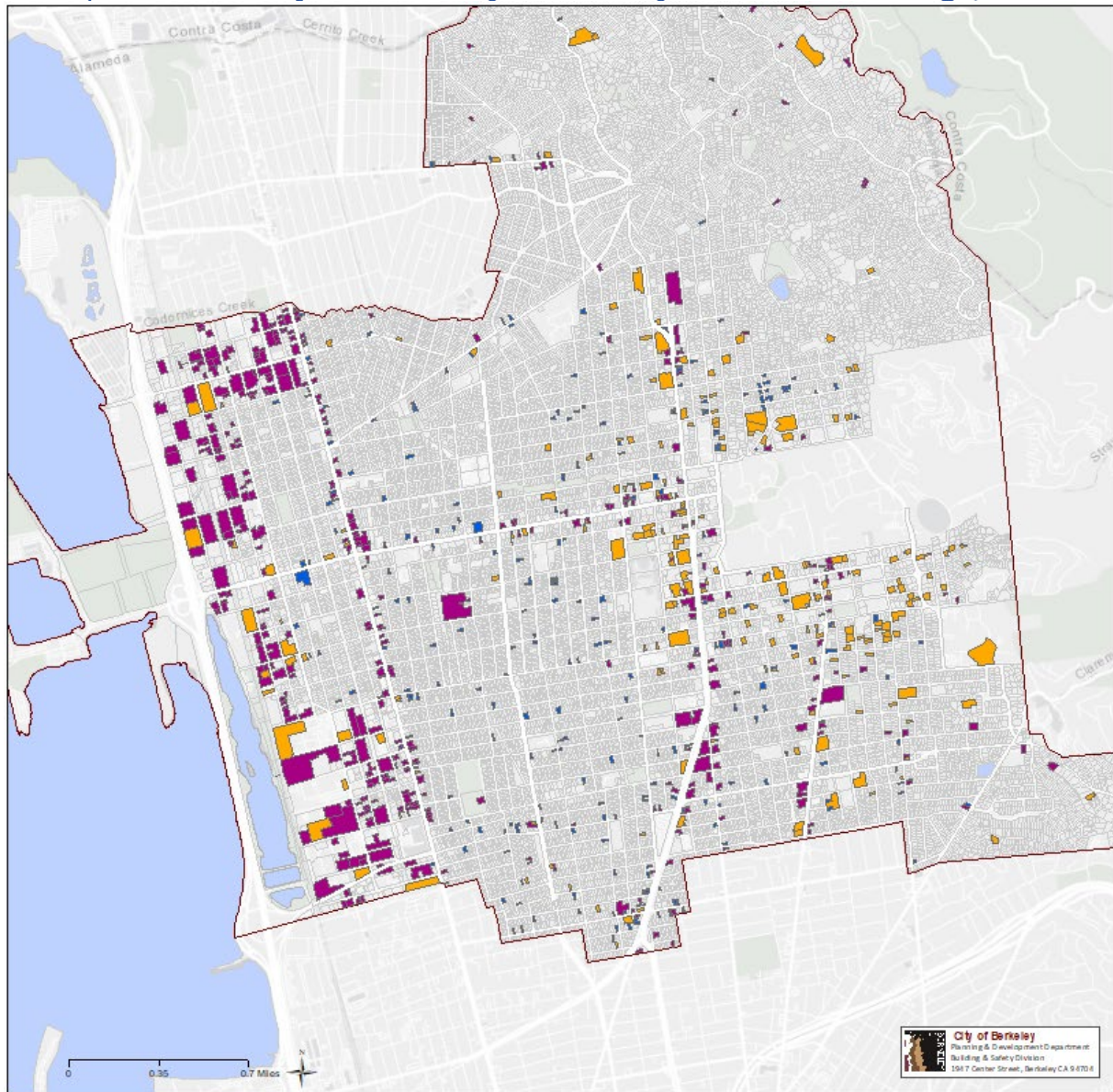
Structures

Several types of seismically vulnerable buildings are located throughout Berkeley, including wood-framed buildings with soft, weak or open front conditions (SWOF), unreinforced masonry (URM) buildings, tilt-up and other rigid wall-flexible diaphragm (RWFD) buildings, and non-ductile concrete buildings. Other wood-framed buildings with seismic deficiencies include those with inadequate anchorage to foundation and/or inadequate cripple wall bracing, multi-family “weak story” buildings, one-story open-front buildings, and buildings with unique configurations.

Map 7 shows Berkeley’s Inventory of Potentially Seismically Vulnerable buildings, developed in 2023. Potentially soft, weak or open front (SWOF) buildings are somewhat evenly spread throughout the City. Potentially non-ductile concrete buildings and rigid wall-flexible diaphragm buildings are more heavily concentrated along commercial corridors and west of San Pablo Avenue. Non-ductile concrete buildings are also

clustered in central Berkeley, and near the UC Berkeley Campus. Soft story buildings are depicted in blue, non-ductile concrete buildings in orange, rigid wall-flexible diaphragm buildings in purple, and unreinforced masonry buildings in red.

Map 7. Inventory of Potentially Seismically Vulnerable Buildings, 2023



- Parcel with Potentially Non-Ductile Concrete Building
- Parcel with Potentially Rigid Wall-Flexible Diaphragm Building (Including Tilt-up)
- Parcel with Potentially Soft Weak or Open Front Wood-Framed Building

Soft, Weak or Open Front (SWOF) Buildings

Soft story buildings are characterized as multi-story wood-frame buildings with extensive ground story openings such as windows, storefronts, garage openings, or open-air spaces such as parking. These buildings may have few perimeter or interior walls at the ground level, leading to a relatively soft or weak lateral load resisting system in this lower story.

Exhibit 6. Example soft story construction



Unreinforced Masonry (URM) Buildings

Unreinforced masonry (URM) buildings are generally constructed of brick, block, tile, stone, or other types of masonry, and were built prior to modern earthquake-resistant design. During an earthquake, unreinforced masonry walls that were originally built without adequate reinforcement (from embedded steel bars) are susceptible to collapse. In addition, URM buildings often include unreinforced masonry parapets, chimneys, and high brick veneers that tend to disconnect from the building and fall outward, creating a hazard for people below, and in some instances causing the building to collapse. Weak or nonexistent connections between the masonry walls and the floors and roofs place

occupants, pedestrians, and adjacent buildings in harm's way.

Exhibit 7. Example of unreinforced masonry construction



Rigid Wall-Flexible Diaphragm (RWFD) Buildings, Including Tilt-Up Buildings

Tilt-up or other rigid wall-flexible diaphragm building types are typically one- or two-story commercial buildings with reinforced concrete or reinforced masonry (brick or concrete block) walls. A “tilt-up” building is distinguished by its method of construction, using precast concrete walls. RWFD have “flexible” roof diaphragms that consist of wood or steel beams, trusses, or rafters with wood sheathing or metal decking above. They may also have flexible diaphragms at intermediate floor levels. These buildings commonly include warehouses, manufacturing facilities, large retail stores, and other similar structures. The most common deficiency is an inadequate connection between the rigid walls and the roof (and floors), leading walls to pull away and collapse during ground shaking.

Exhibit 8. Example of Rigid Wall-Flexible Diaphragm Construction



Non-Ductile Concrete Buildings

Non-ductile concrete buildings built prior to the mid-1970's and modern seismic code standards have performed very poorly in recent earthquakes, and have resulted in catastrophic collapses. In older concrete buildings, the detailing and construction of the reinforcing steel may be inadequate to safely resist large seismic forces caused by ground motions on these heavy structures. The most vulnerable buildings contain elements like columns, wall piers, and joints of beams and slabs that can fail in an earthquake. These buildings are considered “non-ductile” (i.e. brittle) concrete buildings and pose a high risk during a major earthquake. Retrofits of these buildings can vary widely in terms of scope and level of difficulty, and are often expensive to retrofit or rebuild.

Other Wood-Framed Buildings with Seismic Deficiencies

Throughout Berkeley, the most prevalent group of wood-framed buildings vulnerable to significant damage from an earthquake are those constructed prior to 1960 with inadequate cripple wall bracing and/or anchorage to the foundation, which can result in buildings sliding off supporting foundations and cripple wall collapses. These include hillside houses with increased risks of failure to cripple walls and poorly braced extra-tall

walls along the sloping sides.

Multi-family Weak-Story Buildings

In Multifamily Weak-Story buildings (3+ stories), the lowest story of the building may be vulnerable to significant damage due to high demand to-capacity ratios. Multi-family Weak Story buildings are primarily found among the areas of multi-family residential buildings to the south of UC Berkeley (Southside) and extending along College Avenue and nearby streets.

One-Story Open-Front Buildings

One-story open-front buildings, while having less mass to drive seismic response than multi-story buildings, are still anticipated to have very significant torsional response and to have potential concerns of partial or complete collapse. Single-story Open Front buildings can be found along the major commercial corridors, such as Telegraph Avenue, University Avenue, College Avenue, and similar locations.

Buildings with Unique Configurations

Buildings with unique configurations are also potentially vulnerable to an earthquake and are anticipated to be of an age that engineering for seismic loading would not have been provided at the time of construction. These buildings have been observed throughout the City's building stock.

Homes

Berkeley has about 50,046 housing units¹¹, serving the city's population of 124,321¹². Most were built before 1980, meaning that few of Berkeley's homes were constructed to modern building code standards, which require earthquake-resistant structural measures,

fire-resistant materials, and landslide-resistant siting and landscaping. As described above, many people throughout Berkeley live in buildings with seismic vulnerabilities.

City-Owned Buildings

The City of Berkeley owns or leases approximately 221 buildings and structures. These facilities have multiple uses, including running City government, providing emergency services, low-income housing, and recreation. In recent years, the City has been seriously examining the risk to its buildings from disasters, particularly earthquakes. Many important City buildings have been assessed for seismic safety and, when possible, strengthened or replaced. However, additional assessments of City buildings are needed to further determine their level of vulnerability to seismic events. Some buildings' earthquake vulnerabilities may pose risks to life and/or emergency operations, including Old City Hall (2134 Martin Luther King, Jr Way) and Veterans' Memorial Building (1931 Center Street).

City-Owned Critical Response Facilities

Most of the City's critical response facilities have been strengthened or retrofitted because of their importance to continuing emergency services, as well as day-to-day operations.

The Civic Center Building's isolation system and retrofit elements were designed to provide life safety and limited repairable damage in a Design Basis Earthquake (DBE), and life safety and repairable damage in the Maximum Considered Earthquake (MCE). Although the building's base isolation system would meet the essential services standard of the 2010 California Administrative Code, the building was not built to essential services standards. The nonstructural systems and equipment in the Civic Center Building would

need to be evaluated to ensure that their support and bracing systems also meet essential services requirements. Nonstructural elements along the access path to the essential services area should also be evaluated to ensure unobstructed access to these areas in the aftermath of an earthquake.

Hospitals

There is one acute care hospital in Berkeley, Alta Bates Summit Medical Center, owned and operated by the Sutter East Bay Hospitals. The hospital has two campuses in Berkeley: Alta Bates and Herrick.

The Alta Bates campus is a full-service acute care hospital, while the Herrick campus provides acute care limited to mental health and cancer care services. Alta Bates is comprised of eight buildings used to provide acute patient care, five of which were built to pre-1973 seismic standards. These buildings are not considered a threat to life safety, but may not be functional or repairable after an earthquake.¹³ The Hospital Seismic Safety Act requires these buildings to be retrofitted or replaced by 2030 to meet standards to be repairable or functional following an earthquake. Three additional buildings at Alta Bates and three at Herrick have already met this standard.¹⁴ Four buildings at the Herrick Campus are considered to be a significant risk to life safety.¹⁵ Acute care functions formerly housed in these buildings have been relocated into seismically compliant portion of the Herrick campus and/or to the Summit Campus.

Businesses

Businesses are vital to the economy of the city and provide jobs to city residents. Damage to commercial buildings could adversely impact business operations, increase economic

losses, disrupt supply distribution, disproportionately harm small businesses, reduce affordable commercial spaces, and slow recovery after a major earthquake. Ensuring that businesses and employers can return to normal function quickly will in turn ensure that the city recovers quickly from a disaster.

As described above, many Berkeley businesses operate from buildings with seismic vulnerabilities. Buildings of potentially non-ductile concrete construction or rigid wall-flexible diaphragm buildings have been observed along numerous commercial corridors within the city.

Systems

Berkeley's electrical, natural gas, aviation fuel, telecommunications, and potable water supply systems are not under the City's control, and are owned and managed by other quasi-governmental, private, or special district entities. Berkeley's transportation systems are managed by the City and other public entities.

All of these systems have earthquake exposure and vulnerabilities:

Electricity

Electricity is managed by Pacific Gas and Electric (PG&E). Berkeley's electricity system is almost entirely aboveground. Earthquakes can topple or break utility poles, and falling trees or collapsing structures can damage utility lines. Earthquakes can damage electrical switches and transformers in the distribution system, along with equipment at substations and transmission lines, possibly leading to systemwide loss of these utilities.

Because electrical system infrastructure exists throughout Berkeley, earthquake shaking,

liquefaction, fault rupture and earthquake-induced landslides can all damage this infrastructure both above and below the ground. This means that a major earthquake will cause significant power loss to Berkeley.

Natural gas

Natural gas is managed by PG&E. A natural gas transmission line runs the length of Berkeley (north-south direction) under Seventh Street, the area of Berkeley that is more susceptible to liquefaction. In an earthquake, if soils are shaken hard and long enough, liquefaction can occur, causing pipelines in liquefiable soils to tear apart. Underground systems are particularly prone to damage from ground failure in earthquakes and landslides. Underground damage is harder to detect and repair, and the length of service losses may be greater than for aboveground systems. Additionally, rupture compromises this lifeline unless redundant connections unaffected by the earthquake are available.

Natural gas line rupture is one of the chief causes of post-earthquake fires. Additionally, natural gas line rupture has climate implications. The main component of natural gas is methane, which is a potent greenhouse gas that is 25 times more harmful to the atmosphere over a 100-year period than carbon dioxide.¹⁶

Potable water

Potable water is managed by East Bay Municipal Utility District (EBMUD). EBMUD provides drinking water to approximately 1.4 million people and sewer services to 640,000 in the East Bay. EBMUD was created in 1923, and the age and extent of its system makes it particularly vulnerable to damage in earthquakes. Because the potable water system exists throughout Berkeley, its infrastructure will be subject to shaking and ground failure,

including liquefaction, surface-fault rupture, and landslide, leading to many pipeline breaks.

Sanitary sewer system

The City of Berkeley's sanitary sewer system is made up of pipelines with large diameter (six inches to 120 inches). Of the 260 miles of pipelines in the sanitary sewer system:

- 50 miles or 19% is in the Earthquake-Induced Landslide Planning Zone
- 29 miles or 11% is in the Fault Rupture Planning Zone.
- 101 miles or 39% is in the Very High, High or Moderate Liquefaction Zone.

Because the sanitary sewer system exists throughout Berkeley, its infrastructure will be subject to shaking and ground failure, including liquefaction, surface-fault rupture, and landslide.

Storm Drainage System

Areas of the city's storm drainage system are known to be extremely weak and at risk of collapse. Ground shaking, liquefaction, fault rupture and landslides as a result of an earthquake would cause significant damage to this system. If the next earthquake occurs during or shortly before a rainstorm, the city could experience significant flooding in areas that have not seen floodwaters previously.

Of the 94 miles of the storm drain system:

- 13 miles or 14% is in the Earthquake-Induced Landslide Planning Zone.
- 8 miles or 9% is in the Fault Rupture Planning Zone.

- 48 miles or 48% is in the Very High, High, or Moderate Liquefaction Zone.

Transportation systems

Transportation systems are managed by the City and other public entities, including Caltrans, Amtrak, Bay Area Rapid Transit, and Union Pacific.

- Nearly half of all City streets are have a moderate or greater exposure to liquefaction, meaning that vehicle movement throughout the city is likely to be impacted. This movement will also affect aboveground infrastructure (streets, curbs and sidewalks.)
- To Berkeley's east, 17 percent of City streets are situated in the earthquake-induced landslide planning zone. Landslides in this area could distort major and minor roads. This would make access difficult or impossible for firefighters and other emergency responders. It would also complicate evacuation for residents in the Berkeley hills.
- Fault rupture, if it occurs, could damage important east-west streets along the fault, making travel between the hills and flatland areas difficult where displacements are large. Interstate 80 is highly susceptible to earthquake-induced liquefaction and is main thoroughfare for Berkeley and the Bay Area.

Bay Area Rapid Transit District (BART) provides an important public transportation link between Berkeley, San Francisco, and other Bay Area locations to 172,000 riders daily, as of September 2023. In the 1960s, Berkeley taxpayers issued a separate tax to have the BART facilities in Berkeley (three stations and over four miles of tunnel) put underground. These tunnels are generally considered low risk by BART engineers. While the BART system is not exposed to landslide or surface-fault rupture from earthquakes, BART infrastructure in Berkeley will be subject to severe shaking and possibly to liquefaction in a catastrophic earthquake.

Telecommunications

Telecommunications are managed by a variety of private partners, including Verizon, AT&T, and Comcast, among others. Communications infrastructure is spread throughout Berkeley, and thus is exposed to all earthquake ground failure hazards.

Hazardous Materials

Hazardous materials are managed by private and public entities. The shaking and ground failure that can accompany earthquakes could cause hazardous materials release.

Following an earthquake, building structural failures, dislodging of asbestos or encapsulated asbestos, laboratory spills, transportation accidents, pipeline breaks, storage tank failures, and industrial equipment problems will be the major sources of hazardous materials release.

The City carefully tracks and regulates hazardous materials in both public and private structures through its Toxics Management Division. See the section on Hazardous Materials Release for details.

Aviation fuel

Aviation fuel is managed by Kinder Morgan, Inc. Two aviation and multipurpose pipelines run along the railroad tracks from Richmond to the Oakland Airport, through western Berkeley. These pipelines run along the Union Pacific railroad right-of-way in the western part of the city. Soils in this area are potentially susceptible to liquefaction. Rupture of these aviation fuel lines during an earthquake could spark and feed a dangerous fire.

Natural, historic, and cultural resources

Natural Resources

Parks and natural spaces are situated throughout Berkeley and may be damaged from shaking and ground failure based on their locations. Berkeley watersheds (see Floods section) and the San Francisco Bay Shoreline are vulnerable to hazardous materials release. All natural resources are vulnerable to and post-quake fire.

Historic Resources

Because historic structures were not built to meet current building and fire codes, they are especially vulnerable in earthquakes. Historic structures throughout Berkeley are vulnerable to earthquake shaking and ground failure based on their locations. All locations could be subject to hazardous materials release and post-quake fire.

Cultural Resources

Berkeley's culture comes from the people who make up the Berkeley community. Residents, businesses, and the UC Berkeley community are critical parts of Berkeley's culture and will all be impacted in a catastrophic earthquake. The Risk and Loss section below also describes impacts to natural and historical resources.

- **Berkeley Resident Community:** Based on experiences in large urban areas being rebuilt following disaster, planners expect that rebuilding activities will begin quickly, but will prove expensive as construction professionals around the Bay Area are overloaded with work. Owners of damaged multi-unit rental housing may not be able to rebuild affordable housing, and may choose to build condominiums or other higher-profit housing to replace the damaged structures. Many residents will discover they are underinsured for earthquake and fire damage, making it difficult or impossible for them to rebuild. Rebuilt homes, meeting modern codes and style considerations, will change the look of the city.
- Although much harder to predict, demographic shifts may also follow an upended housing market. Older homeowners may be unable or unwilling to rebuild, for

example, and young families may need to relocate, at least temporarily, to ensure the continuity of their children's education. The likely loss of older, more affordable housing stock will also change Berkeley's economic profile, creating displacement of thousands of households.

- Businesses may rebuild or may move to new, cheaper locations. Many local, independent businesses will need to make the tough decision to rebuild or close shop. Retail businesses will be affected by demographic changes after an earthquake. Businesses located in neighborhoods with significant damage will suffer as customer demand changes, even if the businesses themselves are undamaged by the earthquake.
- After a catastrophic earthquake, enrollment at UC Berkeley may slow for a few years, depending on the level of damage experienced on campus. In the unlikely but possible event of a catastrophic incident, such as significant loss of life in a residence hall or classroom building, declines in enrollment will be significant. Remaining students, currently about 30 percent of the city's population, may struggle to find affordable housing.

B.2.g Risk and Loss Estimates

No one knows what the characteristics of the next damaging quake to strike Berkeley will be. A quake could occur on any of the regional faults, be deep or shallow under the ground, and shake for a few seconds or up to nearly a minute. The degree of shaking and resulting damages will vary greatly depending on these characteristics.

Currently, there is not sufficient data or understanding of how climate change is impacting earthquakes. However, the cascading impacts from an earthquake might be more severe due to climate change. For example, areas in Berkeley might be even more susceptible to liquefaction due to sea level rise and shallow ground water rise.

Berkeley's population is expected to keep growing steadily. With more people in Berkeley, the more people are exposed to the catastrophic earthquake risk and the greater potential for impacts and losses. With population and housing demands, Berkeley has regular new development. Current building standards are high, resulting in safer structures that will

suffer minimal damage. High housing costs and insufficient supply of low-income housing today means that after a catastrophic earthquake, there will be even greater levels of homelessness and displacement.

FEMA developed the Hazards US (HAZUS) software to help estimate the consequences of different earthquake scenarios. HAZUS runs a computer model of a hypothetical earthquake, defining the earthquake's magnitude, epicenter location, rupture mechanism and time of day. Using this information, HAZUS estimates losses for that particular earthquake. **These theoretical losses will not exactly predict the actual damage of the scenario earthquake.** Instead, they provide reasonable data to help guide earthquake readiness activities.

Scenario Predictions

This section references three different HAZUS analyses:

- For the 2004 version of this plan, a magnitude 6.9 scenario earthquake on the Hayward fault underneath Berkeley was simulated using HAZUS.¹⁷ In 2014, these loss estimates were combined with impact descriptions from newer HAZUS scenarios for a larger earthquake.¹⁸ Because Berkeley's increased population and density since 2004, it is likely that these predictions underestimate the impacts and associated costs of such an event.
- For the HayWired Earthquake Scenario, a magnitude 7.0 scenario earthquake on the Hayward fault epicenter in Oakland was simulated using HAZUS. Predictions from this scenario consider all losses across the Bay Area, not just those in Berkeley specifically.
- Together, these HAZUS analyses create a broad picture of the impact to Berkeley and the Bay Area overall from a catastrophic earthquake:

People

- One hundred people in Berkeley could be killed by this earthquake. Fifty more will

be in critical condition requiring urgent medical care. Three hundred additional people will need hospitalization and 1,000 people will require first aid.

- From 3,000 to 12,000 households will be displaced from their homes after the quake. 200 more households will be forced to leave their homes due to fire damage. These numbers combined represent up to one quarter of households in Berkeley. One thousand to 4,000 of those households will seek temporary shelter provided by the City and the Red Cross. The remainder may stay with friends, relatives or in hotels.

Structures

- Over \$2 billion¹⁹ of building damage could occur in Berkeley. Commercial corridors will see damage to URM buildings. Damage to tilt-up buildings will impact businesses in the western area of the city. Soft-story buildings, which are situated throughout Berkeley, will be damaged. 620 buildings will be completely destroyed. 21,000 more will have slight to moderate damage, primarily residential structures.
- Low-income and student populations disproportionately live in soft-story multi-unit apartment buildings, older buildings with weak foundations, and other vulnerable types of structures. Much of the damage to residential structures will occur in housing for these populations.
- Following the earthquake, the city will need to remove and dispose of up to 570 tons of debris, consisting of building materials, personal property, and sediment will be generated by the earthquake.
- In the first day following the earthquake²⁰, fires could ignite in six to twelve²¹ different locations around the city. Outside fire departments may not be able to provide mutual aid. Emergency personnel will be stretched thin fighting these fires and may need to use a temporary, aboveground water supply system to pump water from the Bay. Fire could burn for hours or days in a worst-case scenario. Post-earthquake fires could add \$40 to \$80 million²² of damage to structures in Berkeley.

Systems

- Electricity: Immediately following the earthquake, 29,000 homes, more than 60% of Berkeley households, will be without electricity. Power will be down for days to a week.
- Natural Gas: The HayWired Scenario provides estimates for restoration of natural gas in the City of Oakland, to Berkeley's south. HayWired estimates that fifty percent of Oakland buildings will have service restored within 10 days of the quake,

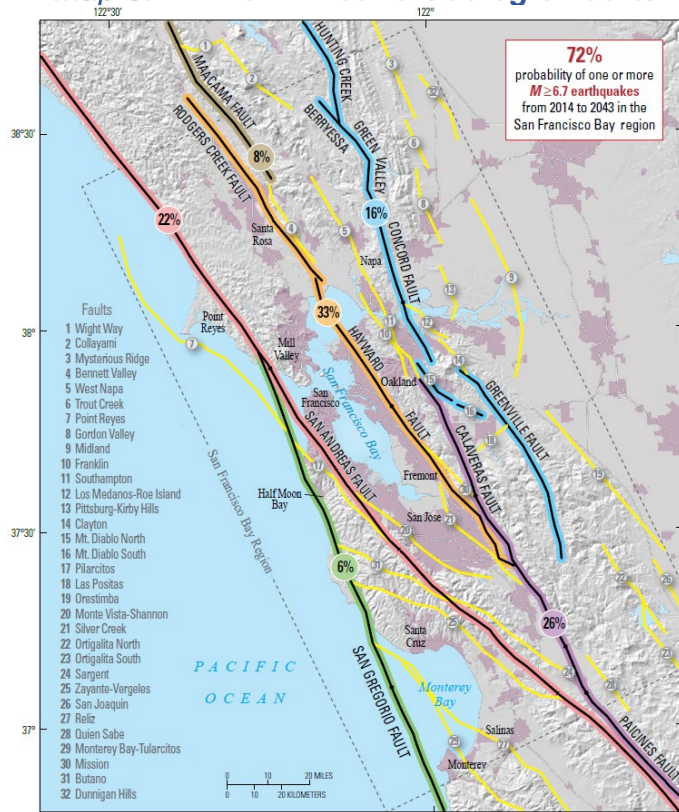
and 90 percent will have service restored after 36 days.

- Water: EBMUD's 4,162 miles of pipe suffer about 1,800 breaks and 3,900 leaks during the earthquake sequence. The average EBMUD customer would be without water for 6 weeks, some for as many as 6 months.²³
- Sewer: Interceptors (large sewer pipes) will suffer major damage following an earthquake. Loss of electrical power will render pumping plants unusable, causing sewage backups and spills through the street access holes, posing potential public health concerns. Open trenches may be necessary to carry sewage for short distances. Sewer pipeline breaks may cause "sinkholes" that undermine roads and buildings.
- Highways: In Oakland, Highways 580, 880, 980, and 24, where they form the MacArthur Maze, a complex of elevated interchange structures, are built on liquefiable soils. Closure of sections of the Maze due to inspection or damage will restrict access into and throughout areas of need in the East Bay.
- BART: BART could be damaged in neighboring cities on all sides, shutting off a major mode of public transit to San Francisco, Oakland and other destinations. The BART Berkeley Hills Tunnel which crosses the Hayward fault would be damaged in a major earthquake on that fault, cutting a key commuting link. Additional ferries and bus lines could be established within a week to provide substitutes for BART.
- Communications: Communications systems, particularly telephone networks, will sustain damage that reduces capacity. Power outages will reduce functionality in situations when the outages last longer than the performance of battery backup and maybe even generator refueling. Congestion will also reduce functionality to a great degree, for several hours or more.²⁴
- Business closures: Additional losses to income will likely occur due to Berkeley business closures, estimated at \$357 million.²⁵

GFOA Analysis

Berkeley is susceptible to earthquake risk. Map 8 provides a map of major fault lines in the region.

Map 8. Known Active Geologic Faults



To address earthquakes, we obtained a data set of simulated earthquakes from Aon for the Contra Costa and Alameda County area. The simulation includes projected economic losses for earthquakes. We then scaled these losses to Berkeley by comparing Berkeley's share of total property value to the rest of the two-county area. Berkeley comprises about 4% of the total property value, so we assumed Berkeley would experience about 4% of the economic losses from a given quake. We also set a limiter in our model to only address quakes above a 6.0 in magnitude. In the USGS report that Exhibit 3 came from describes the potential damage of a 6.0 quake as "light" so earthquakes below that might not cause a material amount of economic loss. That said, our model does provide the ability to manually adjust the threshold downward to include other quakes.

Exhibit 9. Provides a loss exceedance curve for ten years and 1 year, showing total economic losses for Berkeley.

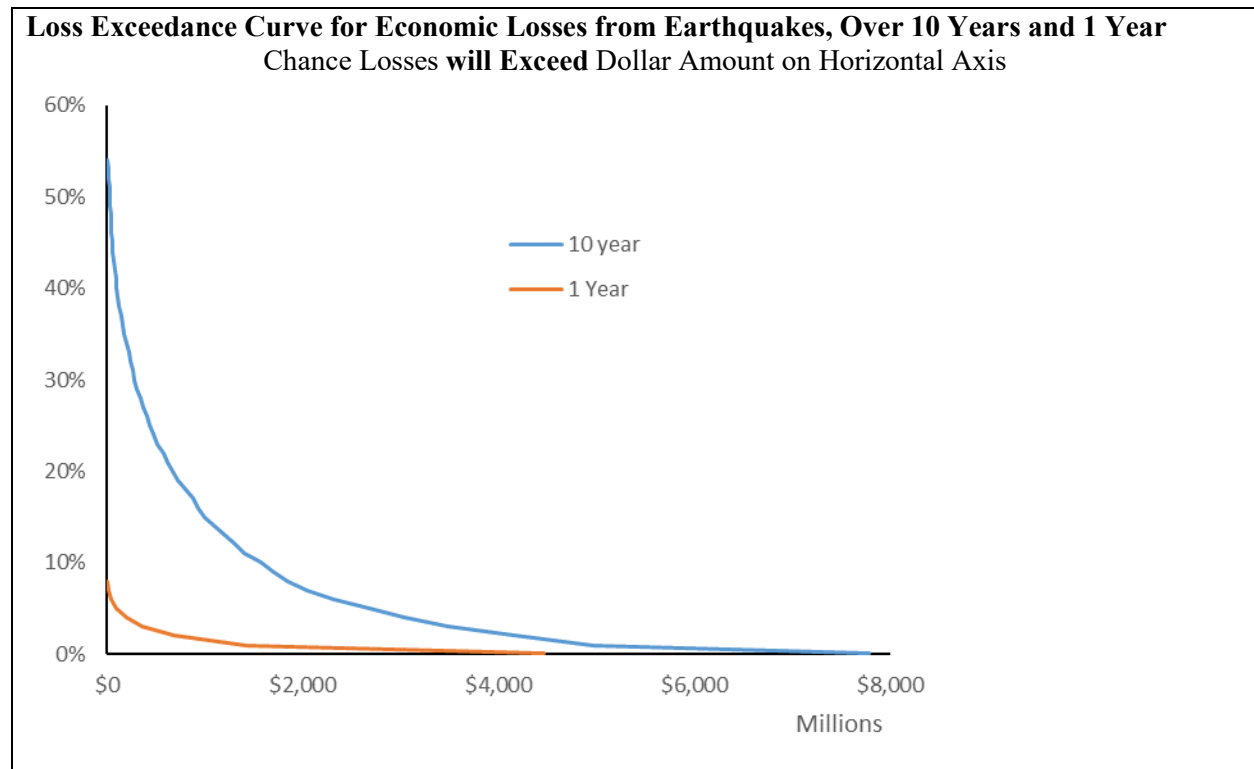


Table 2. Chance that Economic Losses Will Exceed Dollar Amounts (Millions)*

Time Horizon	5%	10%	50%	90%
1-Year	\$89M	NA	NA	NA
10-Year	\$2,700M	\$1,600M	\$24M	NA

*Not Applicable (NA) means that the loss exceedance curve intersects zero before this point. See the graph to see where the curve meets the vertical axis for the chance of losses exceeding zero.

B.3 **Wildland Urban Interface Fire**

B.3.a Description of Wildland Urban Interface Fire and Related Hazards

Fire has always been a natural part of the California and East Bay wildland ecosystem. Fire has historically been a way to maintain forest health, control invasive species, and to provide a rich habitat for wildlife. In Berkeley, densely-built homes and vegetation have been introduced to hillside areas that otherwise required burning to maintain ecological balance. For many years people have tried to prevent fire in forests and developed areas, disrupting this balance. As a result, catastrophic fires are now occurring throughout the Bay Area and the world.

There are two primary types of wildfire: “wildland” fire and “wildland-urban interface” (WUI) fire. WUI fires, the primary concern in Berkeley, occur where the natural landscape and urban-built environment meet or intermix. It is especially difficult to control a fire in the wildland-urban interface, where homes and other infrastructure are close to and within wildland areas.

Ignition

WUI fires can be sparked by both human activity and natural causes. Human activity examples include power lines, sparks from campfires, fireworks, cigarettes, and arson. The only natural cause of wildfire is lightning strikes. In a study of wildfires of the United States from 1992 to 2015, human-caused wildfires accounted for 97% of the residential homes threatened (within 1 km of a wildfire) and nearly a third of suppression costs.²⁶ This study also shows that the WUI, which accounts for only a small portion of U.S. land

area (10%), hosts a major portion of fires, as these fires are almost exclusively human-started.

Spread

Low humidity and high sustained winds create the most dangerous conditions for wildfire spread. While WUI fires can occur at any time of the year, they are especially dangerous in fall when the landscape and vegetation are dry, and strong, hot, dry offshore winds further desiccate vegetation and can push a fire down or up a slope with amazing speed. Under these conditions, traditional firefighting becomes far more difficult.

Connection to climate change

Climate change is resulting in longer and drier summer conditions leading to wildfires of greater frequency and duration. Increased drought conditions cause fuels to become extremely dry and more fire prone. Additionally, climate change causes more frequent bouts of extreme weather, including low humidity and high winds associated with fire weather.

Connection to earthquakes

Earthquakes often spark fires, fueled by damaged gas or power lines. Damage to water pipes from earthquake shaking or ground failure can limit fire suppression. This sequence of events could grow into a firestorm, threatening neighboring jurisdictions. For information on Fire Following Earthquakes, see the Earthquake Section.

Connection to poor air quality

Air pollution from fires both in Berkeley and throughout the region can cause eye and

respiratory illnesses, and can exacerbate asthma, allergies, chronic obstructive pulmonary disease, and other cardiovascular diseases. For more information see the Poor Air Quality Section.

Connection to landslides and flooding

WUI fires can increase an area's risk of landslide. When all supporting vegetation is burned away, hillsides become destabilized and prone to erosion. The charred surface of the earth is hard and absorbs less water. Winter rains in burned areas lead to increased runoff, erosion and landslides in hilly areas. Erosion and land slippage subsequent to fires can lead to temporary or permanent displacement and property damage or loss,^{27 28} making erosion a secondary hazard that must be mitigated immediately after a fire.

Connection to power outage

Fire is related to power outage in two ways: preemptive power shutoff by utilities, or event-caused outages when fires damage power infrastructure.

Pacific Gas & Electric, Berkeley's electric utility, uses two approaches to preemptively cut power to reduce the likelihood of fire ignition. The first, Public Safety Power Shutoffs, involves preemptive cuts to power on specific power lines during times of high fire threat. See the Utility Outage section to learn more. Another PG&E approach is Enhanced Powerline Safety Settings (EPSS), which allow power lines to automatically turn off power within one-tenth of a second when there is a hazard, such as a tree branch falling into a power line. Some PG&E equipment in the Berkeley Hills areas have EPSS protection. According to PG&E, in 2022 there was a 68% reduction in ignitions on EPSS-enabled powerlines.

Loss of power can lead to many cascading and significant consequences, such as impacts to vulnerable infrastructure, inability to operate fuel and water systems that require electricity, communication and service disruptions, loss of heating or cooling, and loss of critical functions for people who rely on power for survival. Locations of Wildland Urban Interface Fire

Berkeley is most vulnerable to a wind-driven fire incident originating in an area adjacent to the City's eastern border, in land owned by UC Berkeley, the Lawrence Berkeley National Lab, the East Bay Regional Park District, the City of Oakland, or Contra Costa County.

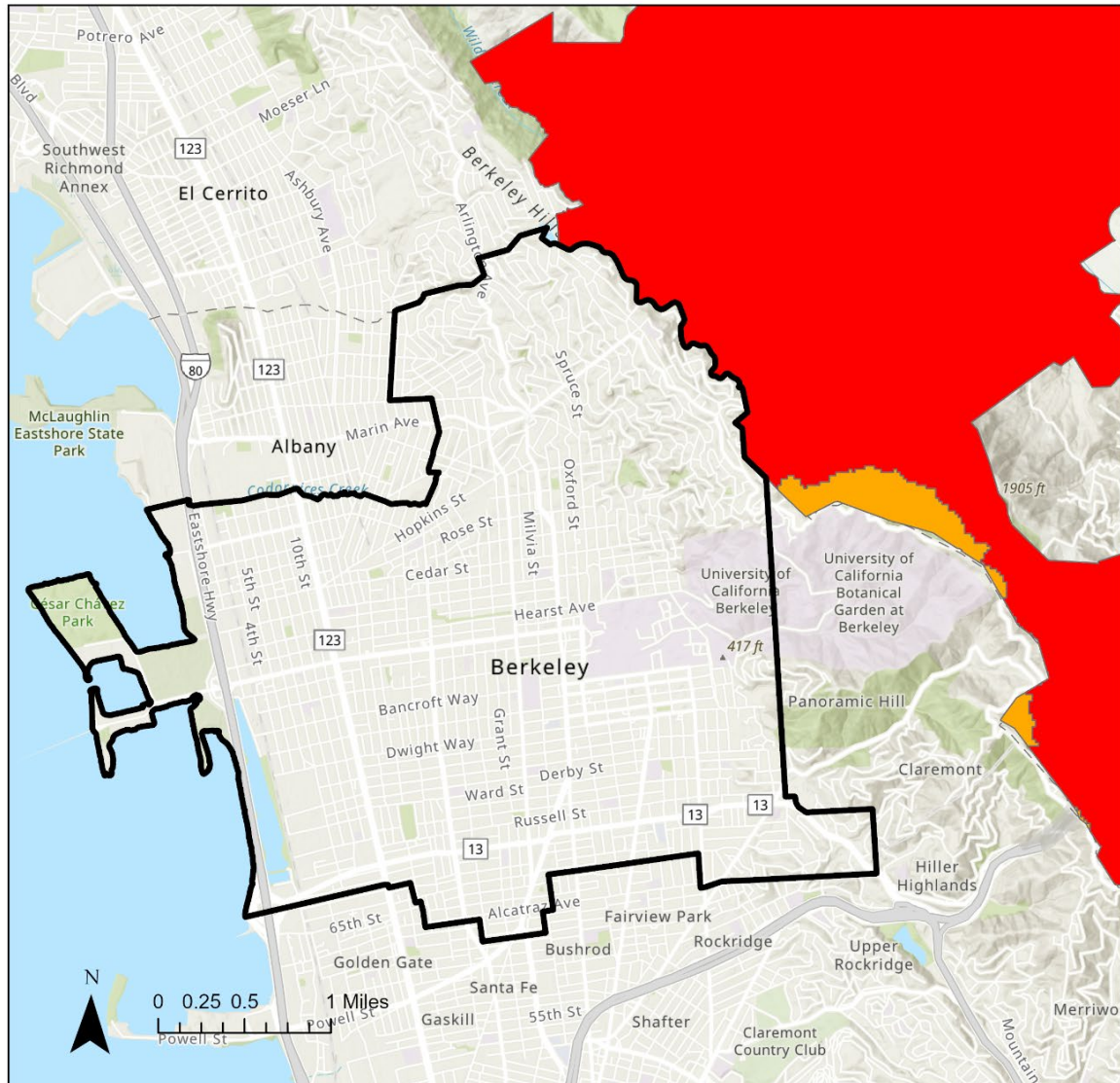
B.3.b Locations of WUI Fires and Related Hazards

Fire Hazard Severity Zones

Map 9 presents the State's Very High and High Fire Hazard Severity Zones. The State Fire Marshal is mandated to classify lands within State Responsibility Areas into Fire Hazard Severity Zones (FHSZ). Fire Hazard Severity Zones fall into one of the following classifications: Moderate, High, and Very High.

As shown in Map 9, the lands to Berkeley's east are almost uniformly the highest hazard classification, shown in in red and orange to the east of Berkley's border.

Map 9. Fire Hazard Severity Zones in State Responsibility Area, 2024



Sources: California Department of Forestry and Fire Protection (CAL FIRE) Fire Hazard Severity Zones Maps. September 29, 2023, effective April 1, 2024.

Esri, NASA, NGA, USGS, California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

**Fire Hazard Severity Zones
in State Responsibility Area**

- Moderate
- High
- Very High

The WUI fire risk facing Berkeley's wildland-urban interface area is compounded by the area's mountainous topography, dense fuel loads, constrained access and egress routes, and its location, overlaid upon the Hayward Fault.

Since before the 1920s, the City of Berkeley has established and adjusted fire zones in Berkeley. While the zones were initially established to address urban fire issues, they have evolved to designate the City's WUI fire hazard. These maps are now linked to the State Fire Marshal's work to classify fire hazards. In addition to the fire hazard map of State lands, shown in Map 9, the State Fire Marshal is also mandated to recommend maps of Very High Fire Hazard Severity Zones in Local Responsibility Areas, including the City of Berkeley.

Following receipt of the State recommendation of very high fire hazard severity zones, the City of Berkeley further interprets the hazard and has divided the city into Fire Zones 1, 2, and 3, designated in order of ascending fire risk. These zone boundaries are adopted by the City Council, along with the Fire Code. These zones are shown in Map 10.

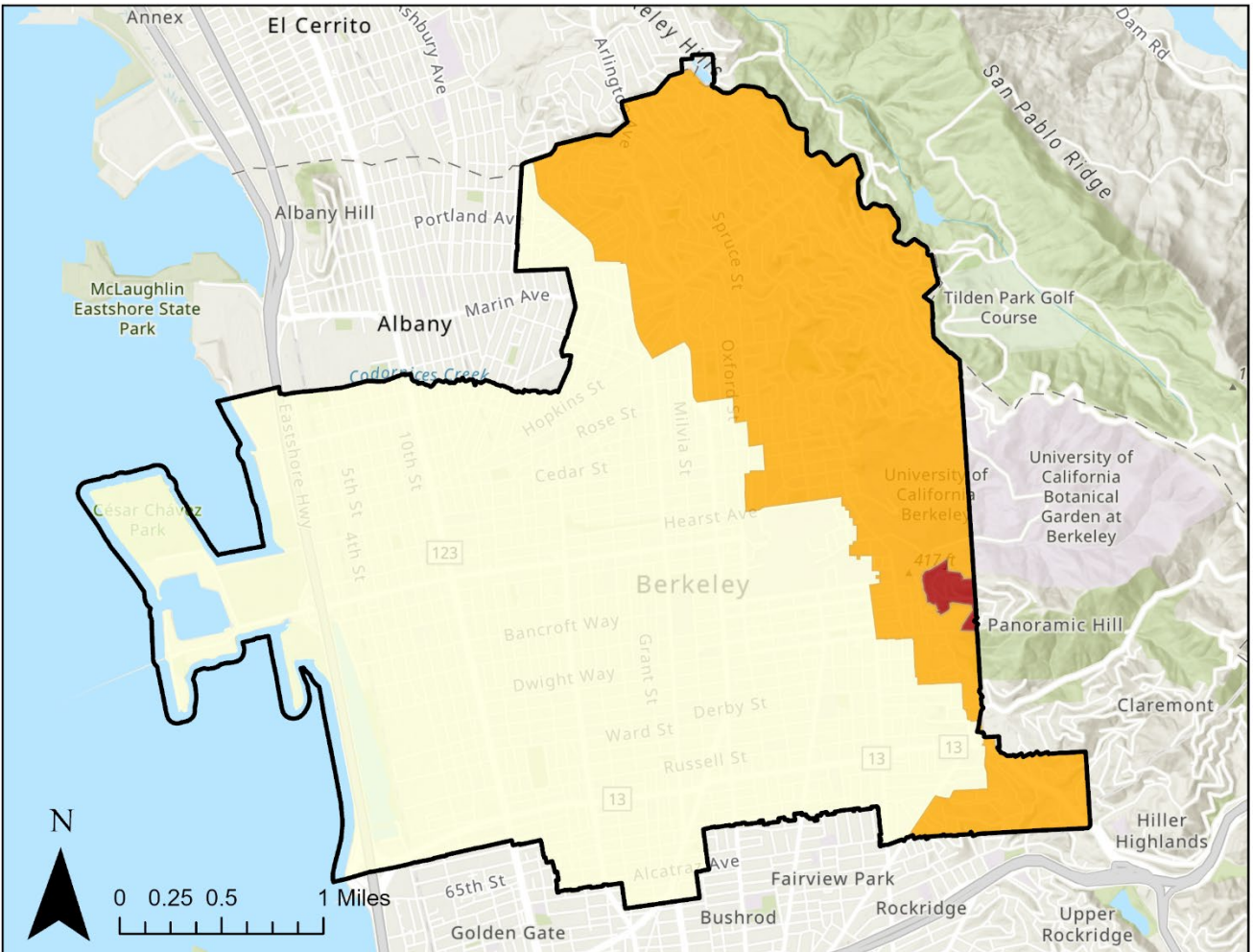
Map 10 shows Fire Zone 3, the Panoramic Hill area, colored in dark red. Fire Zone 2, colored in bright red, covers the remainder of the city's eastern hills up to the northern border. Fire Zone 1, with yellow coloring, covers the rest of Berkeley west of the hills.

Fire Zones 2 and 3 currently include 8,603 parcels with 32,109 residents. These zones have the strictest fire prevention standards in the City for issues such as building materials for new structures. The City also enforces vegetation management measures in these areas to create defensible space around homes.

Fire Zone 3, known as Panoramic Hill, has the greatest WUI fire vulnerability. Panoramic Hill includes areas in both Berkeley and Oakland. In the Berkeley part, there are about 277 parcels, with 989 units in 261 buildings and 2,591 residents. The Hill's minimal access and egress routes, and its exposure to fault rupture further exacerbate the area's WUI fire risk above that of Fire Zone 2.

While much of the concern for fire is placed on the Berkeley hills (Fire Zone 2 and 3), Berkeley's flatlands (Fire Zone 1) are at risk as well. The flatlands are densely covered with old wooden buildings, most not built to modern fire-resistant code. They also have a high risk of damage in an earthquake, which could spark multiple fire ignitions, for example, by damaging gas or electric lines.

Map 10. *City of Berkeley Fire Zones, 2024*



Source: Fire Zones 1, 2, and 3 per City of Berkeley Ordinance NO. 7.157-NS.

Esri, NASA, NGA, USGS, California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

Legend

-  City of Berkeley Boundary
-  Berkeley Fire Zone 1
-  Berkeley Fire Zone 2
-  Berkeley Fire Zone 3

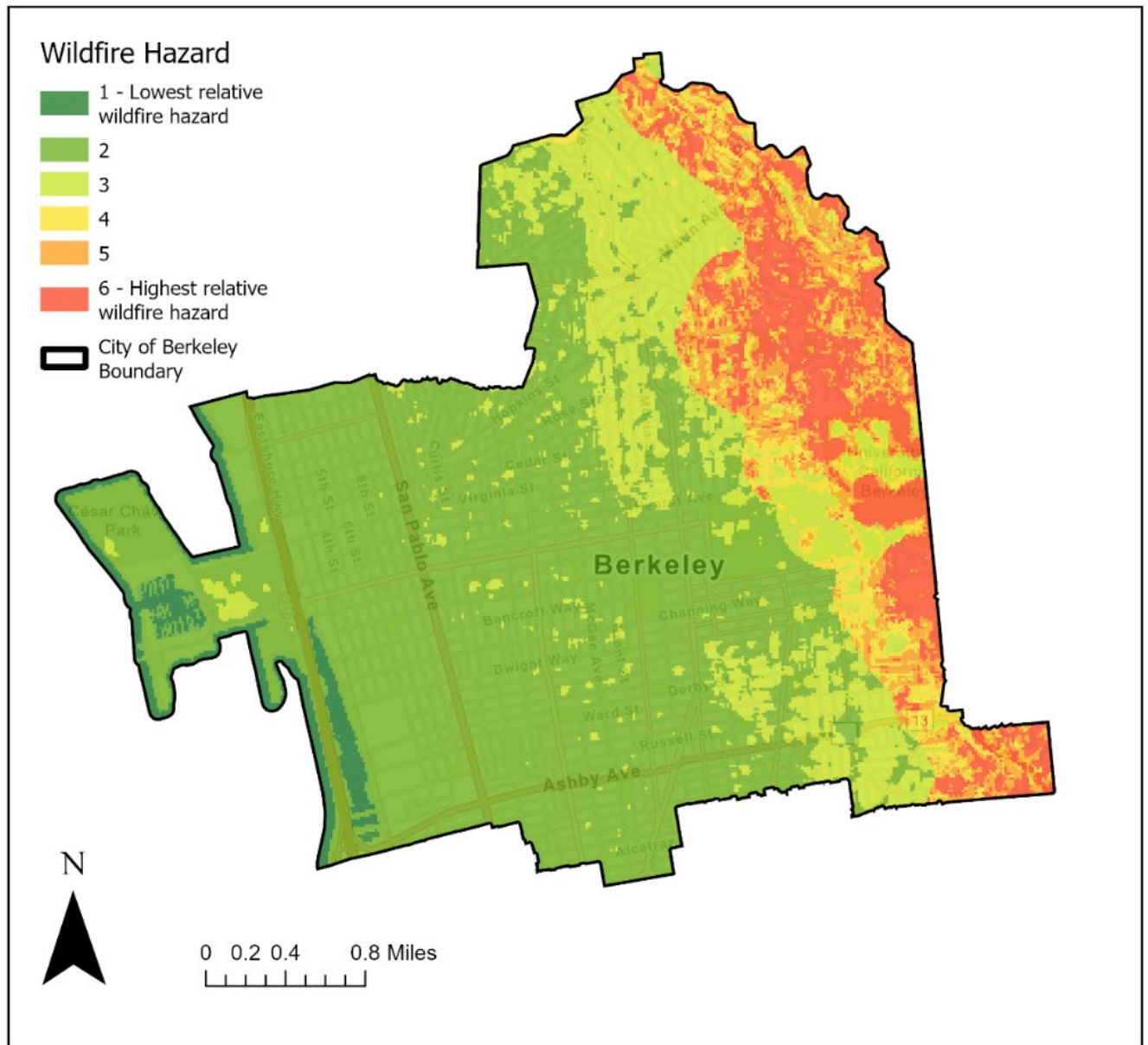
Wildfire Hazard Ratings

New data and modeling from Tukman Geospatial prepared for East Bay Regional Parks have characterized the relative wildfire hazard for Alameda and Contra Costa counties,²⁹ considering estimates from 2017-2022 for conditions including extreme fire weather potential, ember load, suppression difficulty, vegetation (or lack thereof), past fire ignitions, and proximity to human development and power lines.

Map 11 shows this data for Berkeley: the highest relative wildfire hazard (classes 4, 5, and 6) is in the eastern part of the city in yellow, orange, and red. Lower relative wildfire hazard is shown in light and darker greens (classes 1, 2, and 3) in the flatlands and along the Bay.

Although the Berkeley flatlands are presented as having the lowest wildfire hazard, researchers were careful to classify this hazard levels as “relative.” An area with lower relative wildfire hazard does not have no risk, it simply means that it has less risk than other areas. Researchers also noted that this data does not account for home-to-home ignitions common in dense urban areas. This means the analysis likely underrepresents the wildfire hazard in Berkeley.

Map 11. *Wildfire Hazard Map for Fire Prevention Planning, 2020*



Sources: 2020 Alameda and Contra Costa County Wildfire Risk to Structures and Wildfire Hazard Maps for Fire Prevention Planning, East Bay Regional Parks, et al.
California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

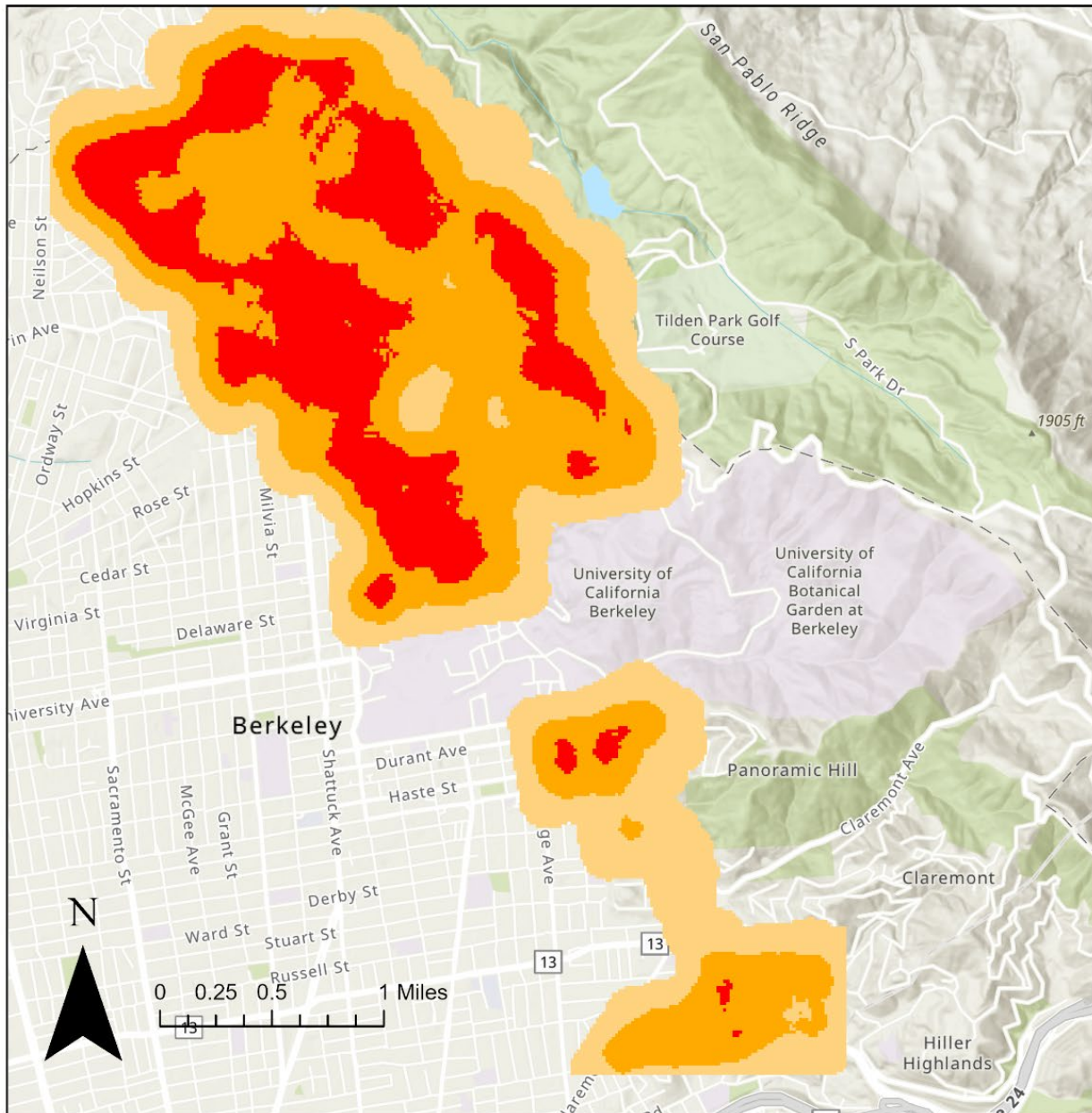
Structure Density

Increased structure density exacerbates wildland-urban interface fire risk. The rate of structure-to-structure ignitions increases when there are more structures per acre.

The National Institute of Standards and Technology (NIST) characterizes high structural density of wildland urban interface areas as more than 2 structures per acre.³⁰ Map 12 shows that most areas of the Berkeley hills have at least 2 structures per acre, considered high density and shown in dark orange. Further, areas in red, concentrated in the north Berkeley hills and a bit around Panoramic Hill, are the highest housing density in Berkeley with more than four structures per acre. Areas in orange have high housing density in the Berkeley hills with greater than two structures per acre. Areas in light orange have medium housing density with one or fewer structures per acre.

Map 12 demonstrates that the density of Berkeley's hills areas will be a critical factor in fire spread.

Map 12. Density of Structures in Berkeley Fire Zones 2 and 3, 2024



California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA

Structure density per acre

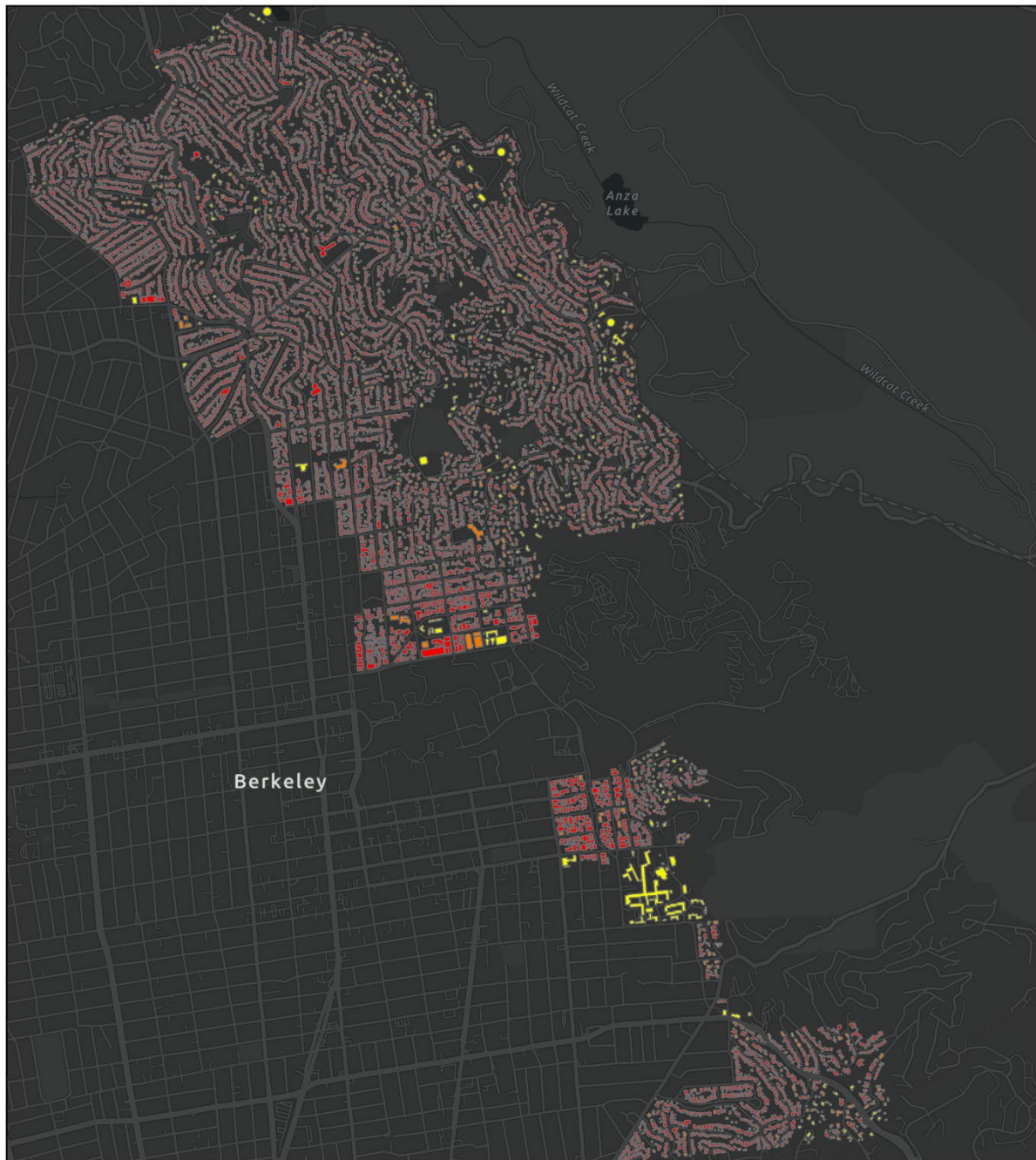


Structure Separation

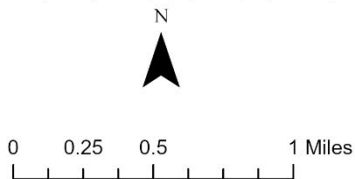
Another critical element that helps characterize wildland-urban interface fire risk in Berkeley is the minimal separation between structures. Structures that are less than 25 feet apart are at extreme risk of directly spreading fire to one another, in a process called “structure-to-structure ignition.” Fires in denser areas will have high rates of structure-to-structure ignition and high risk of losses.

Map 13 shows the distances between structures in Fire Zones 2 and 3. Structures with a separation distance of less than 25 feet are in red. Structures with a separation distance of 25 to 50 feet are in orange. Structures with a separation distance of greater than 50 feet are in yellow. In Berkeley many structures are less than 25 feet apart, which places the community in the highest risk category.³¹ Map 13 demonstrates this risk with the predominantly red coloring in Fire Zones 2 and 3. There are some orange and yellow structures sprinkled throughout Fire Zones 2 and 3, most often on the edges of the boundaries. The greatest patch of yellow structures is near the Claremont Canyon Regional Preserve on the Clark Kerr Campus of the University of California – Berkeley.

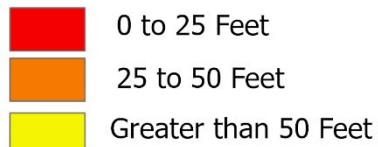
Map 13. *Distance Between Structures in Berkeley Fire Zones 2 and 3, 2024*



California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS



Distance Between Structures



Hazardous Vegetation

Certain plant species, including native and non-native species, have characteristics that make them ignite readily and burn intensely contributing to wildfire risk. Characteristics may include being biologically prone to burn due to chemical composition, being difficult to maintain in a fire-resistant state, presenting challenges to routine maintenance, having high surface area to volume ratio, or being prone to rapid changes in moisture content in response to environmental conditions. While these characteristics make some plants more fire-hazardous, all plants can burn if they are dead, poorly maintained, or drought stressed.³²

Historically, the East Bay Hills ecosystem burned regularly. Researchers have proposed that under indigenous land management, fires due to both natural and anthropogenic ignitions occurred every 5-15 years.³³ Fire is this ecosystem's natural way of clearing dead vegetation and maintaining forest health. Many California native plant species present in the East Bay Hills also need fire in order to reproduce.

Living in a fire-prone area means taking steps to mitigate risks while also recognizing that it's infeasible to remove all of our vegetation. The mere presence of a certain fire hazardous species does not always mean it must be removed. Other factors, such as maintenance and placement, are more important than the plant itself. For property owners thinking about their own landscaping, it's great to focus on California native or other pollinator friendly plants that require little water and are easy to maintain. However, "There are no published fire-wise or fire-resistant plant lists that are science based or peer reviewed. Design and maintenance are more important than plant selection."³⁴

To protect life and property, the Berkeley Fire Department inspects all properties in the Very High Fire Danger Severity Zone for Defensible Space, which is the buffer created between a structure on your property and the grass, trees, shrubs, or other vegetation that surrounds it. This may include the removal of certain vegetation within 100 feet from any structure. These mitigation measures, along with home hardening, are the scientifically validated actions that have the most impact on reducing the ignition potential of homes. Failure to comply with recommendations results in citations and fines.

The City, often in collaboration with regional partners, works to remove and or clean up the understory of hazardous trees that are likely to burn and potentially impact people and infrastructure. For more information on these programs, review Element C: Mitigation Strategy.

Berkeley Overnight Camps

Since the 1920s, the City of Berkeley has operated three resident camps outside of the city limits: Echo Lake Camp, Berkeley Tuolumne Camp, and Cazadero Camp. The City owns the property at Cazadero and holds 30-year lease agreements with the United States Forest Service at Echo Lake Camp and Berkeley Tuolumne Camp. All three camps face significant wildfire risk because of their locations, topography, and dense fuel loads. Two of the three camps have experienced federally-declared fires in the last 12 years. See the section “Fires at Berkeley’s offsite overnight camps” for details.

Echo Lake Camp

The City of Berkeley has operated Echo Lake Camp since 1923. It is located on a ridge

in the El Dorado National Forest a 15-minute walk from Echo Lake. The Camp provides a comfortable experience for family and youth campers boasting a view of Lake Tahoe, a swimming pool, delicious meals, archery, arts and crafts and easy access to miles of hiking trails.

Berkeley Tuolumne Camp

Berkeley Tuolumne Camp, located in Tuolumne County just outside of Yosemite National Park, has been operated by the City of Berkeley since 1922. Primarily operated as a family camp, it has also offered programs for teen leadership, special needs populations, seniors and private group rental opportunities.

Cazadero Camp

The City of Berkeley has owned Cazadero Camp in Sonoma County since 1927. The 33-acre Cazadero Camp has been operated as a music camp for the past 60 years. In 2021, the City extended the Cazadero Performing Arts Camp's lease for another 25 years. The Camp provides a dynamic music education program for young musicians ages 10-18 including both summer camp music programs and JumpStart in Music, a low-cost weekend camp for school music programs.

B.3.c Extent of Wildland Urban Interface Fire and Anticipated Intensities

The extent and intensity of a WUI fire is closely tied to weather conditions and fuel moisture. Fires that ignite under periodic conditions of "Red Flag Warning" or "Extreme Fire Weather" may result in uncontrollable firestorms.

Red Flag Warning

The National Weather Service declares a "Red Flag Warning" when low humidity and high winds combine to elevate fire risk. In Berkeley, "Red Flag" weather generally presents as strong, hot, dry offshore winds (technically called "foehn" winds). These winds are known locally as "Diablo Winds" since they come from the north or northeast in the direction of Mount Diablo. "Diablo Winds" carry extremely dry air at high velocity, so they can quickly desiccate vegetation and other flammable materials and can push a fire down or up a slope with impressive speed.

Extreme Fire Weather

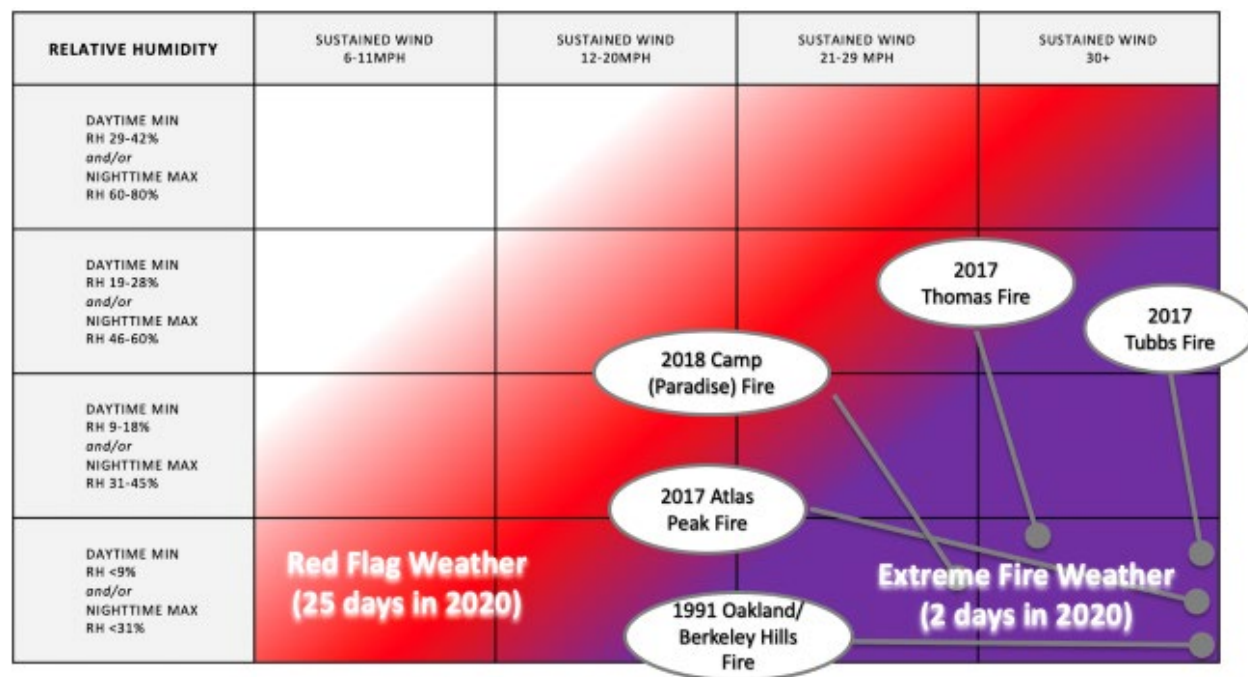
The Berkeley Fire Department has introduced the "Extreme Fire Weather" designation for

extremely windy and dry conditions, under which many catastrophic California wildfires have occurred. Under Extreme Fire Weather, fires spread at extraordinary speeds and ember storms can ignite spot fires far ahead of the main flame front. These ember storms are also the primary cause of home ignitions.

Extreme Fire Weather forecasts are far more rare than Red Flag Warnings. Berkeley's last forecasted Extreme Fire Weather was for two days in 2020. In the same year, Berkeley was forecast to have 25 days under Red Flag Warning.

Although Extreme Fire Weather is still relatively rare, these weather conditions are associated with catastrophic fires. Exhibit 1 shows Red Flag conditions and Extreme Fire Weather conditions. Relative humidity is on the Y axis. Sustained winds are on the X axis. As wind speeds increase and humidity decreases, conditions change first to Red Flag Weather and next to Extreme Fire Weather. The chart identifies five catastrophic fires that ignited under extreme fire weather conditions (all with very low relative humidity and most with sustained winds of 30+ mph). These fires are: the 2017 Atlas Peak Fire, the 2018 Camp (Paradise) Fire, the 2017 Thomas Fire, the 2017 Tubbs Fire, and the 1991 Tunnel Fire, which impacted Oakland and Berkeley. Based on reported conditions it is likely that the 2023 Maui Wildfire also started under Extreme Fire Weather conditions.

Exhibit 10. Graphic X: Red Flag Weather, Extreme Fire Weather, and Catastrophic Fires



Fires that ignite during Red Flag Weather or Extreme Fire Weather can be difficult to contain. A WUI fire can move with devastating speed. In the 2018 North Bay Fires, the fire burned the equivalent of a football field every second.³⁵

During Extreme Fire Weather, when a fire builds to this magnitude and travels with such extreme speed and force, firefighters' primary focus often shifts from firefighting to supporting evacuations. This is because during this type of weather, some normally-available firefighting tools can be ineffective or even unusable – like planes and helicopters, which need to be grounded during high winds.

The Berkeley Hills have narrow, windy roads that make evacuation difficult, which is why the Berkeley Fire Department recommends that people leave the hills during Extreme Fire Weather.

While the ignition risk is highest in the Berkeley Hills, a wind-driven fire under Extreme Fire Weather can blow through the Berkeley flats, all the way to the Bay.

B.3.d Previous Wildland Urban Interface Fire Events

Catastrophic fires have occurred in the greater Bay Area in 2017, 2018, 2019, 2020, 2021, and 2022. Berkeley itself has significant WUI fire history, including the 2017 Grizzly Fire, the 1991 Tunnel Fire, and the 1923 Berkeley Fire. However, there have been no federally-declared wildfire disasters in Berkeley since the last update.

2017 Grizzly Fire

On August 5, 2017 a fire burned approximately 20 acres in the Berkeley and Oakland hills along Grizzly Peak Boulevard just north of South Park Drive. Nine agencies responded to the fire, with 150-200 firefighters working many hours to extinguish it. The suspected cause of this fire was arson.³⁶

1991 Tunnel Fire

This fire in the Oakland/Berkeley hills started the day before as a vegetation fire in the drought-dried hills east of Oakland. It reignited and was whipped into firestorm proportions by 20-30 mph winds, gusting to 60 mph. In minutes, the fire spread to residential structures. While the fire burned a greater area in Oakland, it raged across city boundaries between Oakland and Berkeley, destroying entire neighborhoods in both cities and remaining out of control for more than 48 hours. 25 people died in this fire, most of them while trying to evacuate. This fire received a federal Major Disaster Declaration on October 22, 1991.

1923 Berkeley Fire

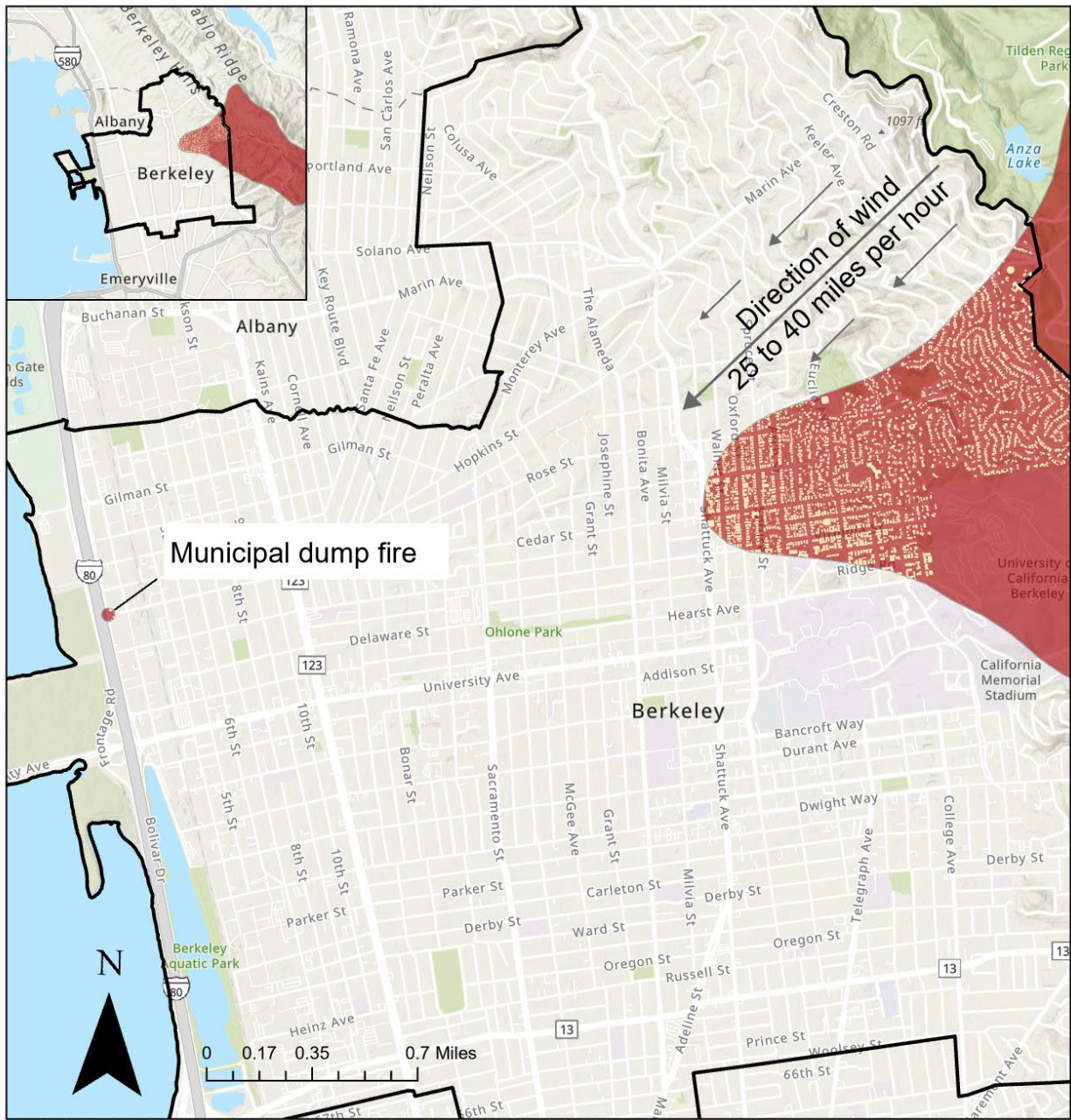
The Berkeley Fire of 1923 began in the open lands of Wildcat Canyon to the northeast and, swept by hot September Diablo winds, penetrated residential north Berkeley. The fire burned downhill all the way to Shattuck Avenue in central Berkeley. A total of 130 built-up acres were burned, and about 4,000 people were made homeless. After this devastating fire, officials stated that the only reason that the fire stopped spreading was because the northeast wind stopped and the damp western wind took over. Fire officials at the time were certain that if the northeast wind had not stopped, the buildings would have burned all the way to the bay in Berkeley, and the fire would have devastated Emeryville and moved south and west into Oakland.³⁷

The fire destroyed 584 structures, including homes, apartments, fraternities and sororities, a church, a fire station and a library. Wood shake roofs are cited as a large contributing factor in the spread of this fire.

Map 14 depicts in red the area burned by the 1923 fire, which stretches from East Bay Regional Parks to Shattuck Avenue. It also overlays the Diablo wind pattern indicated by black arrows to demonstrate how the fire could have spread into the Berkeley flatlands even more, if the wind direction had not changed. According to San Francisco Fire Department records, San Francisco sent engine companies to respond, reporting that one of the San Francisco engine companies “helped control a fire at the municipal dumps at the foot of Cedar Street.”³⁸ This indicates that there was a fire on the western edge of the City, where Cedar meets the waterfront (shown with a dot on Map 14). It is possible that this dump fire was a concurrent but entirely unrelated event. However, there is a considerable likelihood that the fire at the Berkeley dump was ignited by embercast

traveling from the main fire front, which was approximately 2 miles away. This phenomenon has precedent in more recent fires, such as the 2017 Tubbs Fire, during which embers traveled over a mile from the main front. Although wildfire is generally thought of as a problem limited to the Berkeley hills, this historical anecdote, alongside these more recent experiences, indicate the wildfire vulnerability of Berkeley's flats.

Map 14. *Fire Spread in 1923 Berkeley Fire, 2024*



California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA, California State Parks, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, East Bay Parks Fire History Map, City of Berkeley OES

City of Berkeley 1923 Fire Map

- 1923 Fire
- Current Buildings in 1923 Fire Area

Fires at Berkeley's offsite overnight camps

- Berkeley Tuolumne Camp, located in Tuolumne County just outside of Yosemite National Park, was destroyed by the Rim Fire in August 2013. Since that time, the City has reconstructed the Camp. The Berkeley Fire Department WUI Division visited the Camp in 2023, mapping the area in order to plan future mitigation projects. Efforts like this will help to make the Camp more protected and defensible in the event of another wildfire.
- The Caldor Fire in August 2021 started 32 miles away from Echo Lake Camp, in El Dorado County in the El Dorado National Forest. On August 30, the front lines of the Caldor Fire reached Camp. The Berkeley Fire Department deployed its firefighters to defend the camp. For several days they engaged in active firefighting, at one point being forced to retreat from Camp due to the intensity of the fire approaching the property. Thankfully, firefighters were able to return to defend Camp and continued to engage in active firefighting until the threat had passed. While no Camp structures were significantly damaged, several neighboring private cabins less than 100 yards away were destroyed, and areas of the surrounding forest were burned. The fire burned on all sides of Camp, up to within feet of the Ridge Cabins, Recreation Lodge, and Camp Office, but when standing in the center of Camp, one might not know that a fire had threatened the property. Since the fire, City staff have assessed the status of trees and structures on the 15-acre property.

B.3.e Probability of Future Events

Fire is a natural part of the California and East Bay wildland ecosystem, and they will continue to occur in the future. Calculating the probability of a future needs to consider both the likelihood of ignition and the likelihood of spread.

Likelihood of ignition

Historically and more recently, most fire ignitions have been due to human activity and electrical equipment. According to Cal Fire, of the top 20 most destructive California wildfires, three had “human related” causes, five were caused by powerlines, and three had electrical causes.³⁹

Likelihood of spread

A significant WUI fire is one that will spread out of control. The likelihood of fire spread primarily relates to three factors: weather, fuel moisture, and the built environment.

Weather

A significant WUI fire is most likely to occur in Berkeley under Extreme Fire Weather conditions. In 2020, Berkeley was forecast to have 25 days under Red Flag Warning, with the Berkeley Fire Department declaring two of those forecasted days to qualify as Extreme Fire Weather. 2021, 2022, and 2023 were uncharacteristically mild, with one or zero Red Flag Warning days. Despite these mild years, we know that Berkeley will experience more fire weather in the years to come.

Climate change also creates more volatile weather patterns, extending fire season and with it the number of days Berkeley is in Red Flag Warning or Extreme Fire Weather status.

Vegetative Fuel Moisture

The moisture content of live and dead vegetation is not in itself a weather element. It is a product, however, of the cumulative effects of past and present weather events and must be considered in evaluating the effects of current or future weather on fire potential. Fuel moisture content limits fire propagation. When moisture content is high, fires are difficult to ignite, and burn poorly if at all. With little moisture in the fuel, fires start easily, and wind and other driving forces may cause rapid and intense fire spread.

Climate change, which is ongoing, increases drought, reducing the moisture of vegetation and increasing its flammability.

Built Environment

Fire spreads through manmade structures as well as vegetation. According to NIST, “structures represent a significant density of fuels that impact fire spread and, in many cases, directly contribute to the ignition of additional structures, propagating fire throughout the community.” The two primary fuel loads in the Berkeley hills are vegetation and the homes themselves. The “Locations of Wildland Urban Interface Fire” section above outlines how the density and close proximity of structures in the WUI area increase the likelihood of fire spread.

Most Berkeley homes were constructed prior to modern home hardening (fire resistive) codes were put in place, leaving homes in this area vulnerable to ignition from embers, direct flame impingement, or radiant or convective heat. Additionally, the structures’ density and minimal separation distance, and proximity to dense vegetation and wooden fences will increase the rate of fire spread through the area. See “Location of Wildland Urban Interface Fire” for details.

B.3.f Vulnerabilities

The entire City is vulnerable to WUI fires, as described in the historical outline of the 1923 fire. This section focuses on Berkeley’s areas of highest fire risk: Fire Zones 2 and 3, the hills areas.

People

32,109 number of people live in Berkeley Fire Zones 2 and 3. Wind driven, fast-moving fires are particularly dangerous for people, resulting in injuries and deaths from burns and smoke inhalation.

Fires also contribute to poor air quality, which can impact people locally and far away, especially sensitive groups, including infants, young children, people with respiratory illnesses, and people who live or work outside.

Evacuation

All of the Berkeley Hills are marked by windy, narrow roads, which makes evacuation difficult. History demonstrates that residents in the path of a major fire will attempt to leave the area via private vehicles crammed with personal belongings. When there is a catastrophic fire or earthquake, emergency access and egress on overwhelmed residential roadways will be highly constrained. People trying to leave a dangerous condition will hinder emergency personnel trying to address it or trying to reach others who need help to leave.

Because of these challenges, the Berkeley Fire Department recommends that people leave the hills ahead of Extreme Fire Weather. Evacuation is particularly challenging for people with disabilities, people with access and functional needs, and seniors.

Of particular concern is Panoramic Hill. Panoramic Way is the only paved road into and out of this neighborhood. It forms a single loop, 12-18' wide, that begins and ends just south of Memorial Stadium. The street's narrow width and hairpin turns make it barely accessible to fire apparatus, which are required to perform three-point-turns to ascend the Hill. Panoramic Way's narrow width also means that at many points the road is not wide enough to allow vehicles to pass one another. Under normal conditions, vehicles responding to medical emergencies have been impeded by commercial vehicles, trash collection trucks, and illegally-parked personal vehicles. Further, an earthquake-induced

landslide impacting Panoramic Way could also block any vehicles from entering or leaving the area. Panoramic Way could also block any vehicles from entering or leaving the area.

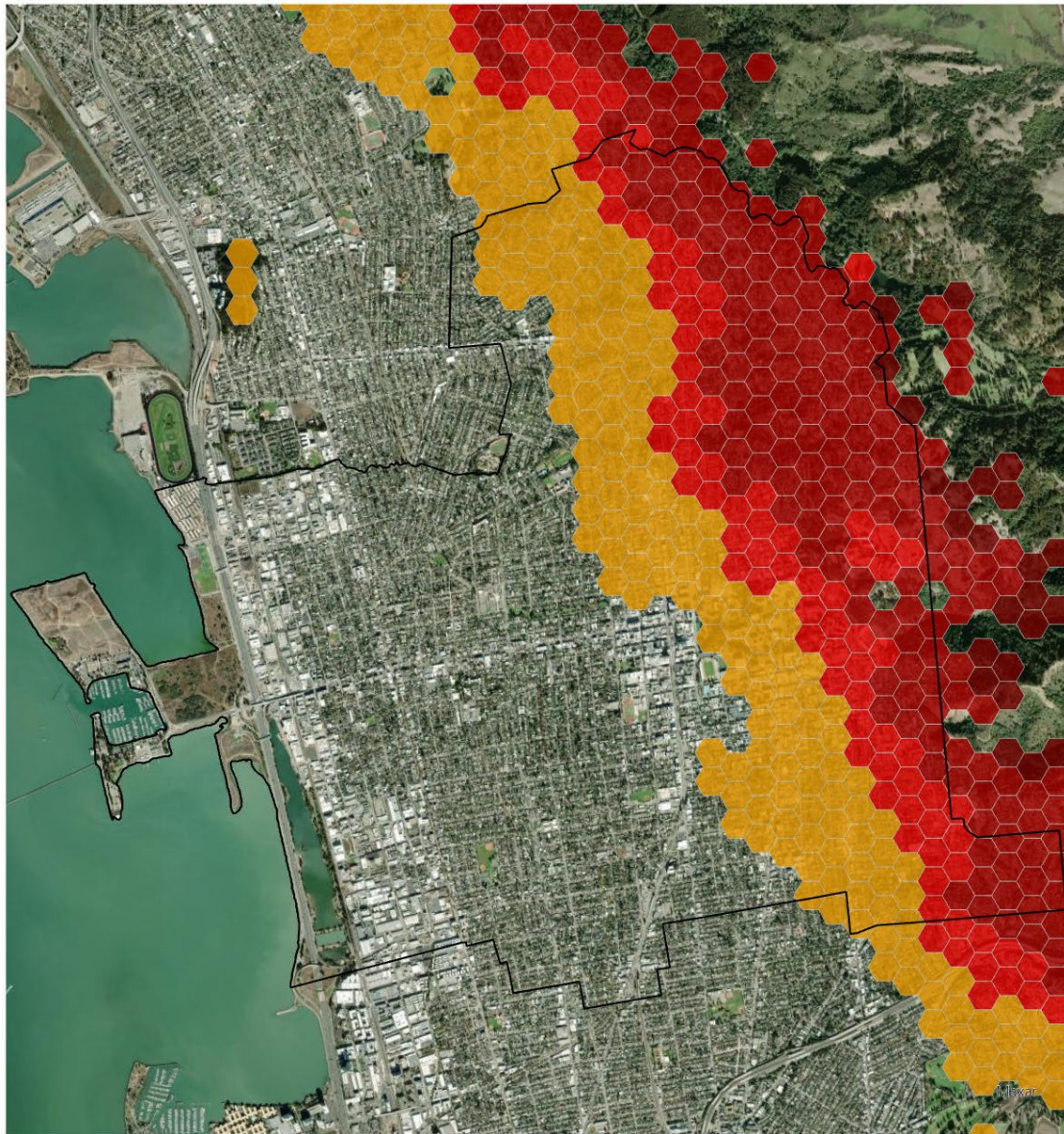
Structures

There are 8,603 parcels in Berkeley Fire Zones 2 and 3. A wildfire will quickly threaten homes and burn infrastructure. The intense heat associated with a firestorm can also deteriorate concrete and asphalt pavement, curbs, sidewalks, and drainage structures.

The “Locations of Wildland Urban Interface Fire” section above outlines how the density and close proximity of structures in the WUI area increase the vulnerability of structures in the area.

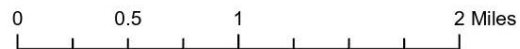
Map 15 presents the wildfire risk to structures in the Berkeley hills. It divides the area into 10-acre hexagon shapes, and ranks the risk to structures for each shape. Areas with high housing density and high wildfire hazard have the highest hazard rating. Map 5 shows that these areas are located on the Eastern border of the city, with most of them bordering Tilden Park. The very high hazard and high hazard hexagons are located in the Claremont Neighborhood, Southside, La Loma Park, and Berkeley Hills. The moderate hazard areas are in the same neighborhoods, and also approach Central Berkeley.⁴⁰

Map 15. *Wildfire Risk to Structures Map, 2024*



Wildfire Risk to Structures

- Moderate Hazard
- High Hazard
- Very High Hazard
- Highest Hazard



Systems

Many of the systems that Berkeley residents, visitors, businesses, institutions, and other partners rely on for day-to-day life are vulnerable to fire. The heat associated with fire can destroy or damage infrastructure that our utility, transportation, and communication systems rely on to operate. This includes aboveground wiring for electricity, telephone and cable lines that allow for communications, and poles for lights and street signals.

Fire can also damage and contaminate water systems, threatening public health and drinking water supplies.

Natural, historical, and culture assets

The City of Berkeley has a variety of natural, historical, and cultural assets spread throughout all Fire Zones. Fire Zone 1 has restaurants, arts and culture and organizations, community organizations, and other businesses that serve the Berkeley community. Fire Zone 3, the Panoramic Hill area, includes one of Berkeley's most architecturally-significant residential districts, which is listed in the National Register of Historic Places because of its association with the Arts and Crafts movement.

Fire Zone 3 includes a number of City parks, playgrounds and recreational facilities. The East Bay Regional Parks immediately to Berkeley's east provide a variety of recreational activities for residents and visitors to enjoy.

Situated outside the City of Berkeley boundaries, the City's overnight camps also provide the Berkeley community with a wide breadth of outdoor opportunities in some of California's most beautiful natural settings.

B.3.g Potential Impacts and Losses

Climate change is expected to increase the potential impacts and losses associated with wildland-urban interface fire. Expected changes in population patterns potentially increase impacts and losses associated with wildland-urban interface fire. As the population steadily increases, more people are exposed to the wildfire risk and the demands on the evacuation infrastructure. Changes in land use and development may potentially increase impacts and losses. New state laws are mandating increased density throughout the city, including in the eastern hills, which are more exposed to wildland-urban interface fire.

Previous wildfires in Berkeley provide some lessons on what the potential impacts and losses might be from a future event.

Impacts to human life

Twenty-five people died in the 1991 Tunnel Fire. Fortunately, there were no deaths in the 1923 Fire, Grizzly Fire, or at the Berkeley overnight camps during the Caldor Fire and Rim Fire. However, a catastrophic WUI fire occurring in Berkeley in the present day, considering Berkeley's density of structures and considerable evacuation challenges, is more likely to see death tolls comparable to catastrophic fires like the 2018 Camp Fire, with 85 civilian deaths, and the 2023 Maui Fire, during which 101 people died.

Fires also have other devastating human impacts. For example, the 1923 Berkeley Fire made over 4,000 people homeless. Berkeley's population has more than doubled since 1923, and the Bay Area is now in a housing crisis. This means that a repeat of the 1923 fire in the present day would destroy the homes of many more people, and also leave

them without alternate local housing options.

Impacts to infrastructure

The 1923 fire was the most extensive WUI fire to impact Berkeley in recent history. This plan calculates losses that would occur if that fire were to recur today. A repeat of this fire would cause significantly more damage in Berkeley than the 1991 Tunnel fire.

The 1923 Berkeley Fire started in Wildcat Canyon to the northeast of the city and burned south and west down to Shattuck Avenue, stopping at the edge of UC Berkeley. Map 15 shows the area burned by this fire. The California Railroad Commission documented the burned area in 1923, three months after the fire. By superimposing this historical map onto the current day building data in Berkeley using the City's Geographic Information System, we find that, today, there are 1,858 buildings located in the footprint of the 1923 fire. These structures include single-family homes, multi-family residences (many of which house UC Berkeley students), stores, restaurants, and offices central to downtown Berkeley.

If a fire occurred today that burned the same area, the loss to structures would be in the billions of dollars.⁴¹ Efforts to stabilize hillsides after the fire to prevent massive landslides would also add costs.

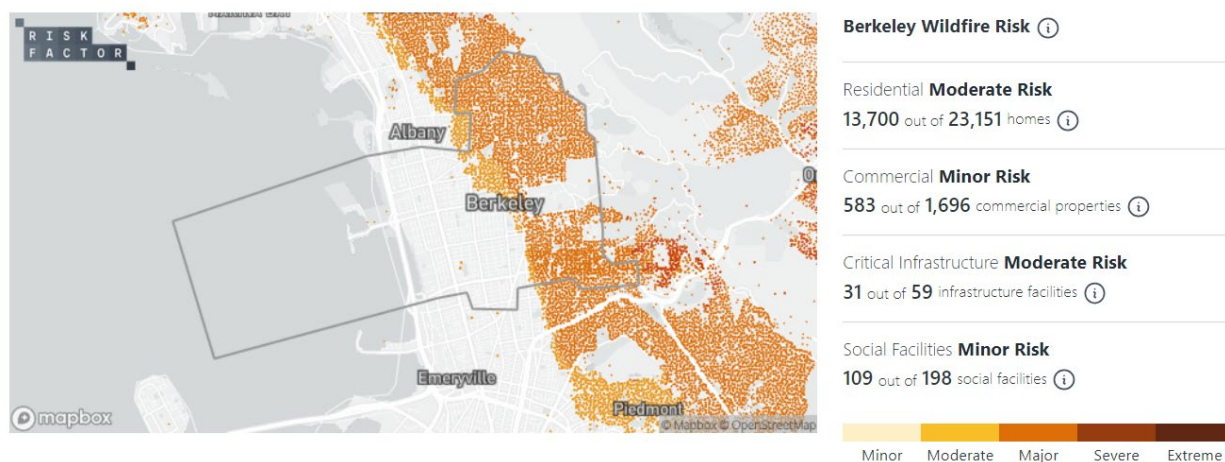
While the financial losses from this scenario are staggering, the social impacts of such a fire would be devastating as well. Thousands of families would be homeless following such an event, losing all of their possessions. Many more would need short-term shelter while the fire was burning, and in the immediate aftermath. Residents and firefighters

could be killed, especially in difficult-to-access areas. Local, independent businesses might disappear forever. A large portion of the city would need to be entirely rebuilt. In short, the entire face of Berkeley would be completely changed.

B.3.h GFOA Analysis

According to the First Street Foundation, “there are 15,085 properties in Berkeley that have some risk of being affected by wildfire over the next 30 years. This represents 57% of all properties in Berkeley.” Exhibit 5 shows a wildfire risk map from First Street.

Exhibit 11. Wildfire Risk in Berkeley (according to the First Street Foundation)



Though the First Street data does help illuminate the potential of actual fires in the City of Berkeley, it does not address consequences of nearby fires, like smoke heavy enough severely impede daily life in Berkeley. Therefore, regional losses might be a more accurate indicator of the consequences of fires.

Even aside from smoke, fire risk in Berkeley is a function of more than fires that happen inside city boundaries. Fires in the region could still be relevant. Therefore, GFOA used data from Aon which provided the annual chance of a fire along with the size of a fire in both Contra Costa and Alameda Counties. This provides total economic loss potential in

the region. Examining the two-county region provides a broader sense of total wildfire exposure. Having access to this “big picture” could be useful because, for example, the economic losses from smoke would impact Berkeley, even if the fire is not in or immediately adjacent to Berkeley. Unfortunately, wildfire loss data is not detailed enough, as of this writing, to accurately apportion economic losses to Berkeley versus other locales in the two-county area.

Exhibit 12. Loss exceedance curve for total economic losses in the two-county region, for both a 1 year and 10-year time horizon.

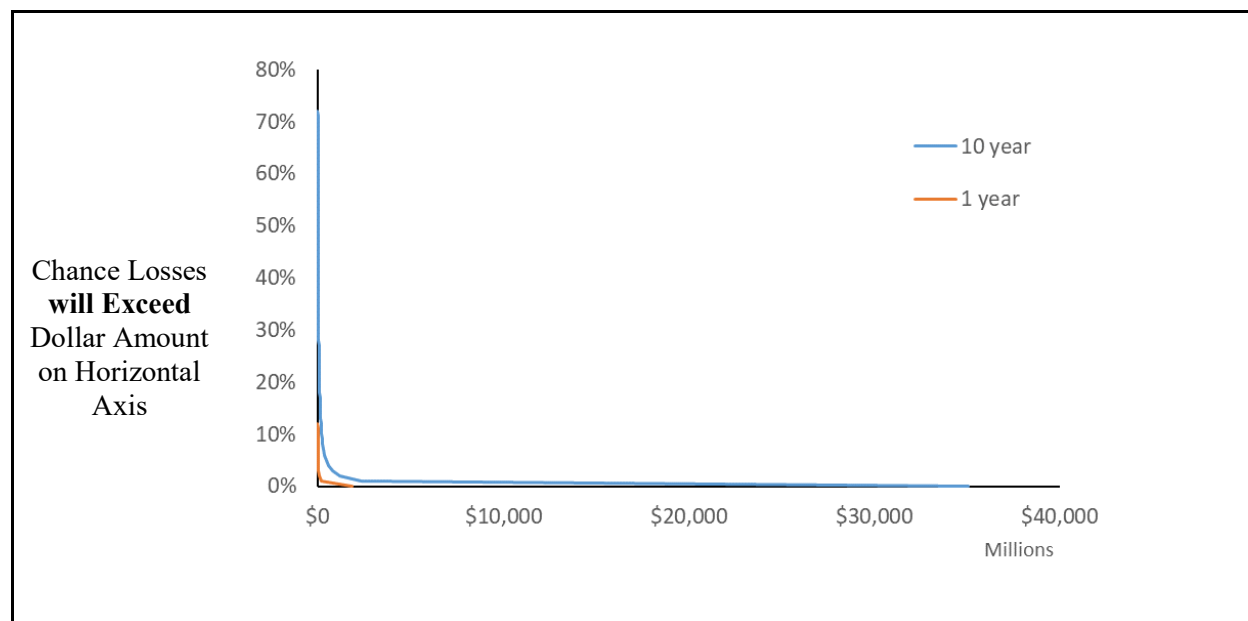


Table 3. Chance that Losses Will Exceed Dollar Amounts (Millions) over 1 and 10-year time horizons

Time Horizon	5%	10%	50%	90%
1-Year	\$22M	\$6.5M	NA*	NA*
10-Year	\$462M	\$211M	\$18M	NA*

*Not Applicable (NA) means that the loss exceedance curve intersects zero before this point. See the graph to see where the curve meets the vertical axis for the chance of

losses exceeding zero.

This data does not factor in the impact of climate change, so the 10-year losses may be understated. Finally, the 1-year curve is far less visible than in some of the other loss exceedance curves for other risks. This is not because the 1-year risk is low; rather it is because the further we look out in the future, the better chance we have of experiencing the most extreme outcomes – outcomes that can be quite different from what is experienced in a single year.

B.4 Extreme Heat

B.4.a Description of Extreme Heat and Connection to Other Hazards

According to Cal-Adapt, California's database of climate information, multiple factors contribute to the extreme heat hazard:

Extreme heat days: An extreme heat day is when temperatures reach the 98th percentile of historic maximum temperature. In Berkeley, an extreme heat day is a day above 88.3 degrees Fahrenheit (F).

Warm nights: A warm night in Berkeley is considered to be one that does not cool below 61.7 degrees F. Warm nights can increase health risks significantly, as people do not have the ability to cool down and recover.

Heat wave: When there are five or more days of extreme heat.

Duration of heat wave: Longer heat waves have proportionally more negative impacts

than shorter heat waves.

Extreme heat during unexpected times of year: When extreme heat occurs outside of historically hotter months.

Urban heat island effect

Extreme heat events can be further exacerbated by the urban heat island (UHI) effect, through which densely-built cities like Berkeley experience higher temperatures in comparison to surrounding more rural areas.

Factors contributing to the UHI effect include:

- A relative lack of vegetation;
- Reduced air flow;
- An abundance of hard, dark surfaces—such as buildings, streets, cars and sidewalks— which absorb heat rather than reflect it. These surfaces also slowly release that absorbed heat throughout the night, contributing to warmer nighttime temperatures.

The UHI effect can also worsen air quality (particularly ground-level ozone) in urban environments.⁴² The UHI effect increases heat-related illnesses and fatalities, particularly after two to three days of extreme heat.⁴³

Vegetation helps mitigate the UHI effect through evaporative cooling. This makes urban tree cover, parks, and green roofs essential tools to combatting the UHI effect. Green roofs, cool roofs, and cool pavements (light-colored materials that reflect, rather than absorb, solar energy) reduce the UHI effect, and can also lower cooling loads in buildings. Urban vegetation and increased urban tree cover reduce temperatures and provide

benefits such as improved air quality and needed shade (for buildings and people) during heat events.

Connection to climate change

Due to climate change, projections indicate that the number of extreme heat days, warm nights, and heat waves will increase exponentially in the next few decades. In addition to this increased frequency and duration, heat waves are also expected to occur in months not typically associated with extreme heat.

Connection to wildland-urban interface fire

While hot temperatures do not specifically start fires, they are associated with decreased moisture in vegetation, increasing its flammability and the length and severity of fire season.⁴⁴ Warming temperatures combined with increased development in the wildland-urban interface are projected to increase fire risk in most of the Bay Area.

Connection to poor air quality

While naturally-occurring ozone that exists higher in the Earth's atmosphere is beneficial to the climate, ground-level ozone can be extremely harmful to human health. Extreme heat can lead to the formation of ground-level ozone when emissions from industrial facilities, power utilities, cars, trucks and other sources chemically react in the presence of heat and sunlight. Ground-level ozone contributes to smog and other secondary air pollutants.

Extreme heat can also cause stagnant air conditions, causing the smog to stay low longer, and increase community exposure.⁴⁵ Community reactions to extreme heat – including

use of cars for transport and use of cooling systems in buildings – can compound the already heightened creation of ozone. For this reason, the availability of non-polluting modes of transportation and ultra-efficient building systems can mitigate both the direct impacts of the heat on the community and the worsened air quality.

Exposure to increased ozone concentrations is associated with pneumonia, asthma, allergic rhinitis, and other respiratory diseases, as well as premature death. Elderly people, infants, and children are particularly susceptible.⁴⁶

Connection to utility disruption

Increased power demand during hot weather and extreme heat events can overload electrical equipment, causing power outages. The local utility company, PG&E may also initiate a public safety power shutoff during these high heat events in areas that have high fire risk to prevent wildfires. Outages can also occur when circuit breakers or other protective equipment shuts off the flow of power in order to prevent damage to the electrical system.

B.4.b Location of extreme heat

Two important factors influence how hot it is in certain parts of Berkeley: the urban heat island effect and thermal belting.

Urban heat island effect

The urban heat island effect often makes temperatures hotter in the urban, more dense parts of a city. To visualize what parts of Berkeley might more likely suffer from the urban heat island effect, Map 16 shows the tree coverage throughout Berkeley. Urban tree

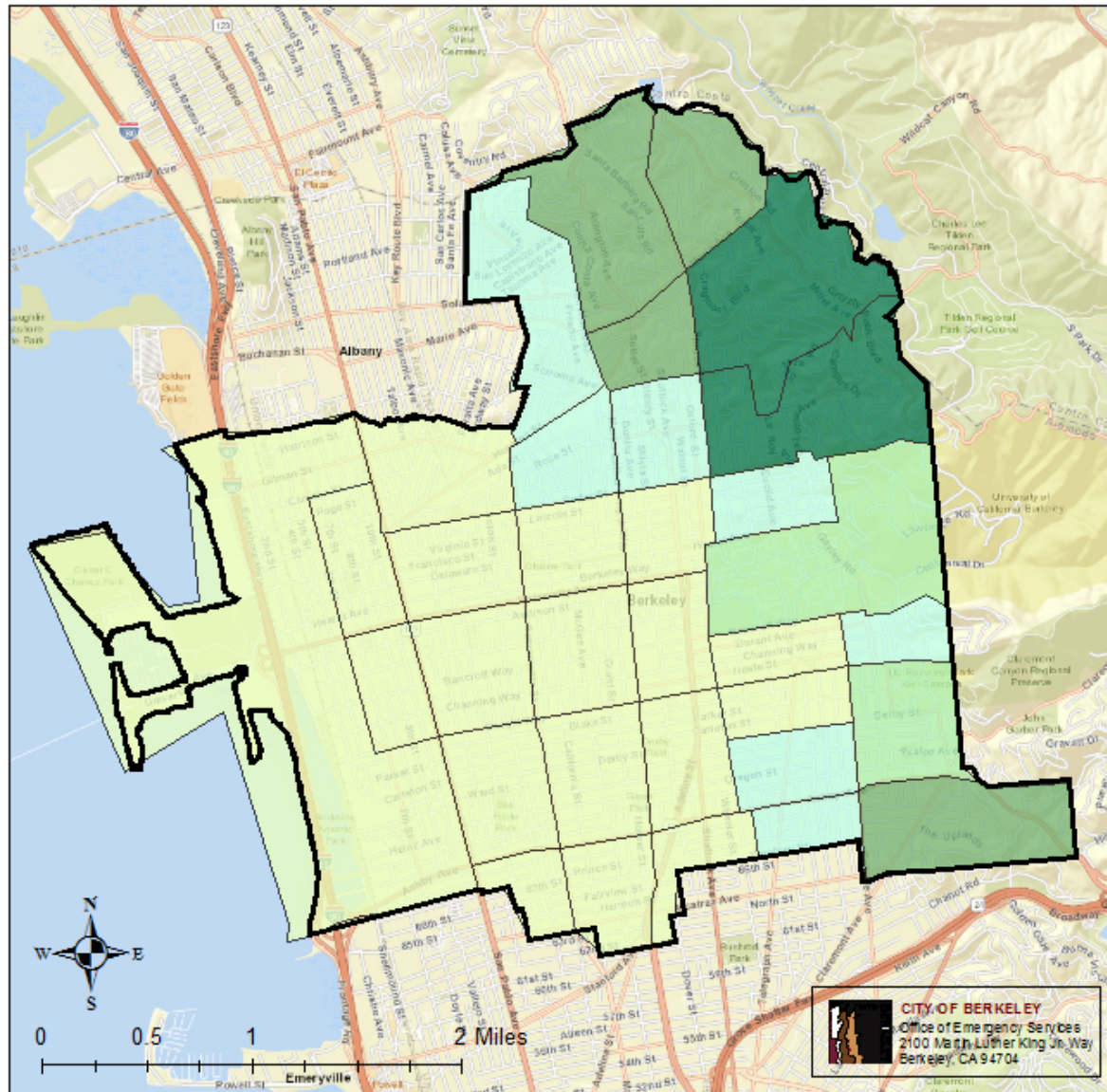
canopy directly reduces surface and air temperatures through shading and absorption, combating the urban heat island effect. In addition, this shading can reduce cooling loads in buildings and provide shade for individuals as well. Trees also improve air quality that often worsens during extreme heat. A dense tree canopy can result in fewer heat-related emergencies.⁴⁷

In Berkeley, census tracts have between 4% and 48% tree coverage. Map 16 shows the current percentage of tree coverage for each census tract in Berkeley. Table 3 below describes the information on Map 16.

Table 4. Percentage of Tree Coverage in Different Areas of Berkeley

Area	Percentage Tree Cover
The Berkeley flats and areas to the south of the UC Berkeley campus	Less than 10%
Western part of Hopkins street north to the Berkeley border	11% to 20%
area immediately north of the UC Berkeley campus	11% to 20%
Panoramic Hill	11% to 20%
Elmwood	11% to 20%
UC Berkeley campus	21% to 30%
Areas to the north/south of the western part of Derby street	21% to 30%
Claremont	31% to 40%
Berkeley Hills north of Marin Avenue	31% to 40%
Berkeley Hills south of Marin Avenue	41% to 50%
Berkeley Hills north of Cedar	41% to 50%

Map 16. *Percentage of tree coverage in City of Berkeley, 2019*



Source: Cal Adapt <https://cal-adapt.org/>

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

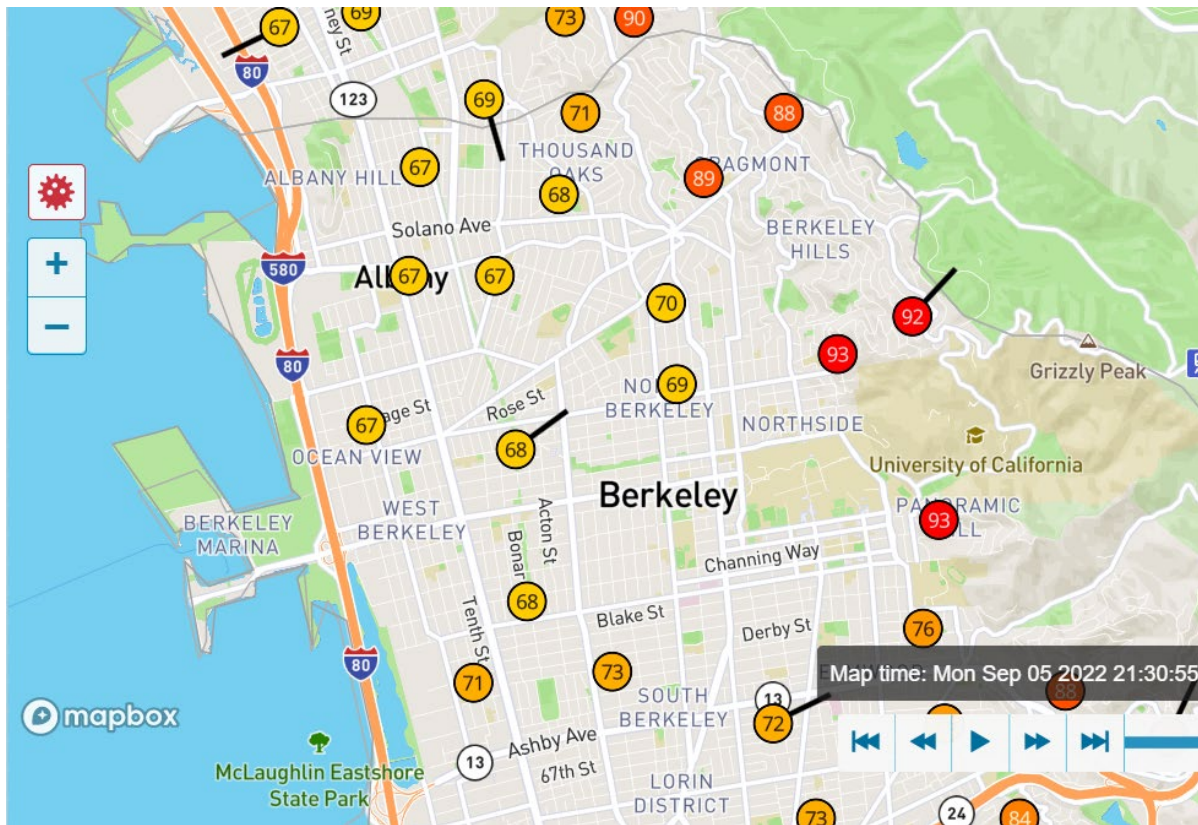
Thermal belting

Although the Berkeley hills have a greater tree canopy, temperatures are often higher there than in the rest of the city, due to a phenomenon known as thermal belting. Thermal belting occurs in areas where there is a hillside and a valley below. Heat is absorbed by the ground during the day, and the heat energy radiates up from the soil at night. As the warm air rises, the radiation of the heat causes the air closest to the ground to cool. Since cold air is heavier than warm air, cooler air sinks down the hillside into the valley. As the cooler air fills the valley, the warm air heads upwards. This warm air becomes trapped on the hilltop and is referred to as a thermal belt. For Berkeley, this means that during extreme heat events, the Berkeley hills are likely to be hotter at night than the rest of the city.

Map 17 illustrates the thermal belting phenomenon in Berkeley during a heat wave in September 2022. The graphic is taken from Weather Underground website's Wundermap, which displays temperatures and wind directions at citizen weather monitoring stations throughout Berkeley.

Map 17 shows temperature differentials between the Berkeley hills, flats, and coast at 11:30 pm at night on Monday, September 5, 2022. The Berkeley hills have temperature readings in the upper 80s and 90s while the flats and waterfront have temperatures in the 60s and 70s F. In some cases, temperature differentials are more than 20 degrees F in a distance of ten city blocks.

Map 17. Thermal belting during September 2022 heat wave



B.4.c Extent of Extreme Heat and Anticipated Intensities

The National Weather Service uses different tools to describe and forecast the extent and intensity of extreme heat events.

Heat Index

The National Weather Service Heat Index considers relative humidity alongside air temperature to establish how hot it feels to a human body. Exhibit 12 is the Heat Index chart. The chart demonstrates the interaction between temperature and relative humidity, and how increasing temperatures and increasing relative humidity creates the increased likelihood of heat disorders with prolonged exposure or strenuous activity.

Along the X axis, the chart displays temperatures ranging from 80 degrees F to 100

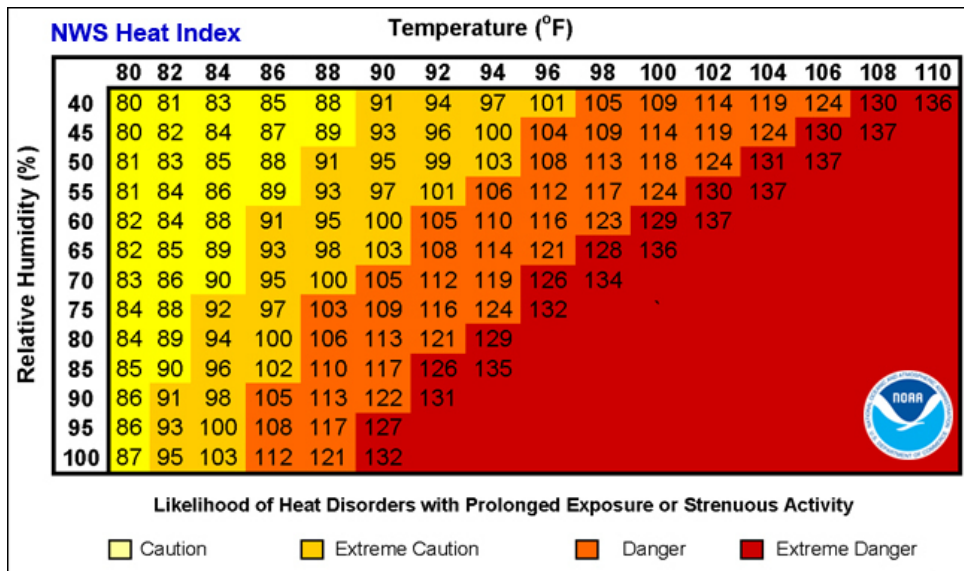
degrees F. Along the Y axis, relative humidity is displayed from 40% to 100%. The chart shows how perceived temperatures (Heat Index temperatures) increase as the humidity increases. Examples from the chart:

- 80 degrees F with 40 percent humidity creates a Heat Index temperature of 80 degrees
- 80 degrees F with 100 percent humidity creates a Heat Index temperature of 87 degrees
- 90 degrees F with 65 percent humidity creates a Heat Index temperature of 103 degrees
- 90 degrees F with 95 percent humidity creates a Heat Index temperature of 127 degrees
- 100 degrees F with 40 percent humidity creates a Heat Index temperature of 109 degrees
- 100 degrees F with 65 percent humidity creates a Heat Index temperature of 136 degrees

The chart also shows the likelihood of heat disorders at each perceived temperature, using colors and descriptions ranging from:

- **Light yellow (“caution”)** – Heat Index 80-90 degrees F
- Medium yellow (“extreme caution”) – Heat Index 91-103 degrees F
- **Orange (“danger”)** – Heat Index 104-124 degrees F
- **Red (“extreme danger”)** – Heat Index 126-137 degrees F

Exhibit 13. National Weather Service Heat Index



Forecasting Heat Risk

The National Weather Service HeatRisk Prototype is a new tool that forecasts risk of heat-related impacts in a given day for a given area. In forecasting risk, the HeatRisk tool considers temperature, how unusual the heat is for the time of year, and the duration of the heat, including daytime and nighttime temperatures. The index supplements official National Weather Service heat information to provide risk guidance for decision-makers and heat sensitive populations who needs to take actions at lower levels.

HeatRisk defines the risk of heat-related impacts using the following categories.

Table 5. *Heat Risk Categories*

Number	Color	Description
0	Light Green	Little to no risk from expected heat.
1	Yellow	Minor - This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.
2	Orange	Moderate - This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.
3	Red	Major - This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat-sensitive industries and infrastructure.
4	Magenta	Extreme - This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat-sensitive industries and infrastructure.

B.4.d Previous Extreme Heat Events

Berkeley has experienced extreme heat events regularly, and has experienced extreme heat each year from 2019 through 2023. However, there have been no federally-declared extreme heat disasters in Berkeley since the last update. The National Oceanic Atmospheric Administration Storm Database describes some of the most notable events:

- In July 2006, there were five consecutive days with temperatures above 110 F in the Bay Area, and approximately 75 heat-related deaths during this period. The last comparable extreme heat event prior to this 2006 event occurred for two days in 1972.⁴⁸
- In August 2017, the Bay Area experienced record-setting high temperatures.⁴⁹ A Berkeley weather station on the University of California, Berkeley campus near Hearst and Euclid Avenues reported a temperature of 108.5 F.⁵⁰ The National Weather Service issued an excessive heat warning that lasted five days for the Bay Area. During this time there were six heat-related deaths in nearby San Francisco and San Mateo Counties.

- In June 2019, a combination of high pressure and strong offshore flow resulted in an early season heat wave across the Bay Area. Multiple daily records were broken across the region and multiple power outages were reported due to the heat. Approximately 26,000 people across the region lost power, followed by an additional 30,000 on the following day. Three fatalities were reported in the region.
- From August 14-19, 2020, a prolonged and oppressive heat wave swept the Central Coast and Bay Area for almost a week, with widespread record-breaking temperatures observed across the region. Multiple days of triple-digit afternoon highs were recorded inland with some coastal locations even reaching the mid-90s. Several days of hot and dry weather further dried vegetation in the area, increasing fire danger. During this event, a surge of monsoonal and tropical moisture from a former Tropical Storm moved northward with sufficient instability to generate multiple high-based and dry thunderstorms that produced several thousand lightning strikes over the Greater Bay Area. Many locations saw wind gusts of 40-50 miles per hour (mph) with isolated areas seeing gusts of 60-75 mph. This prompted the San Francisco Bay Area forecast office to issue a rare severe thunderstorm warning. At the same time, all of the wildfires burning simultaneously across the state gave the Bay Area the worst air quality in the world.
- In September 2020, a large area of high pressure over the west brought excessive heat and dry conditions to the region. Numerous record high temperatures were broken, including 13 broken records on Sunday September 6th alone. Temperatures reached 110 degrees F across the interior, with 90s along the coast to start the weekend, and even reaching 100 degrees in San Francisco on Sunday. Once the ridge began to break down towards the end of the weekend, offshore winds increased flaring up some of the wildfires that were ignited during August's lightning storm. These winds also enabled smoke from various wildfires across the state to blanket much of the Bay Area. The skies were tinted orange and red with ash accumulating for many locations.
- In July 2021, strong high pressure building over the region in early to mid-July brought warm to hot temperatures across the interior. Daytime highs rose into the 100s with locations across the East Bay up to 110 degrees between July 9-11. Overnight lows remained warm, particularly across higher elevations where temperatures were still in the 70s and 80s in the early mornings. Additionally, prolonged dry conditions resulted in near record dry fuels for July. This along with breezy afternoon winds prompted the Diablo Fire in Contra Costa County.

B.4.e Probability of Future Events

Climate models from the Cal-Adapt tool⁵¹ from the California Energy Commission predict the average number of extreme heat days (above 88.3 degrees F) in Berkeley to

continually increase by the end of the century. The specific number of extreme heat days expected in Berkeley depends on the level of greenhouse gases (GHGs) emitted from human activities into the atmosphere:

Medium Emissions Scenario (GHG emissions peak in 2040 and then decline)

- 2035-2064: 7 extreme heat days in Berkeley
- 2070-2099: 9 extreme heat days in Berkeley

High Emissions Scenario (GHG emissions continue to rise throughout the 21st century)

- 2035-2064: 9 extreme heat days in Berkeley
- 2070-2099: 16 extreme heat days in Berkeley

B.4.f Vulnerabilities

People

Across California, the highest risk of heat-related illness occurs in the typically cooler regions found in coastal areas like Berkeley. Vulnerability is increased for these communities as they are relatively unaccustomed to extreme heat. As a result, they are less acclimatized or potentially less aware of preventative behavior and are less likely to have air conditioning or cooling in their homes.⁵²

Public health impacts associated with extreme heat events include premature death, cardiovascular stress and failure, and heat-related illnesses such as heat stroke, heat exhaustion, and kidney stones.⁵³ Studies have also found links between rising temperatures and a range of mental health issues including mental fatigue, aggression,

and even higher rates of suicide.⁵⁴

People with disabilities, people with access and functional needs, people with chronic diseases, the elderly, and children under five years old are the most at risk to heat-related illnesses.⁵⁵ People working outdoors and unhoused populations are also more exposed and at risk. Research also indicates that communities of color, and the poor suffer more during extreme heat events because of lack of access to common heat adaptation strategies, such as tree canopy for shading, air conditioning and insulation in buildings, or car ownership to travel to public cooling centers that allow them to escape the heat.⁵⁶

These increased vulnerabilities to heat events among lower-income communities are illustrated using the University of California, Los Angeles Heat Maps Tool⁵⁷. The tool examines excess emergency room visits during heat events based on location.

The data in the Table 5 below, tracked from 2009-2018, shows impacts in various parts of Berkeley:

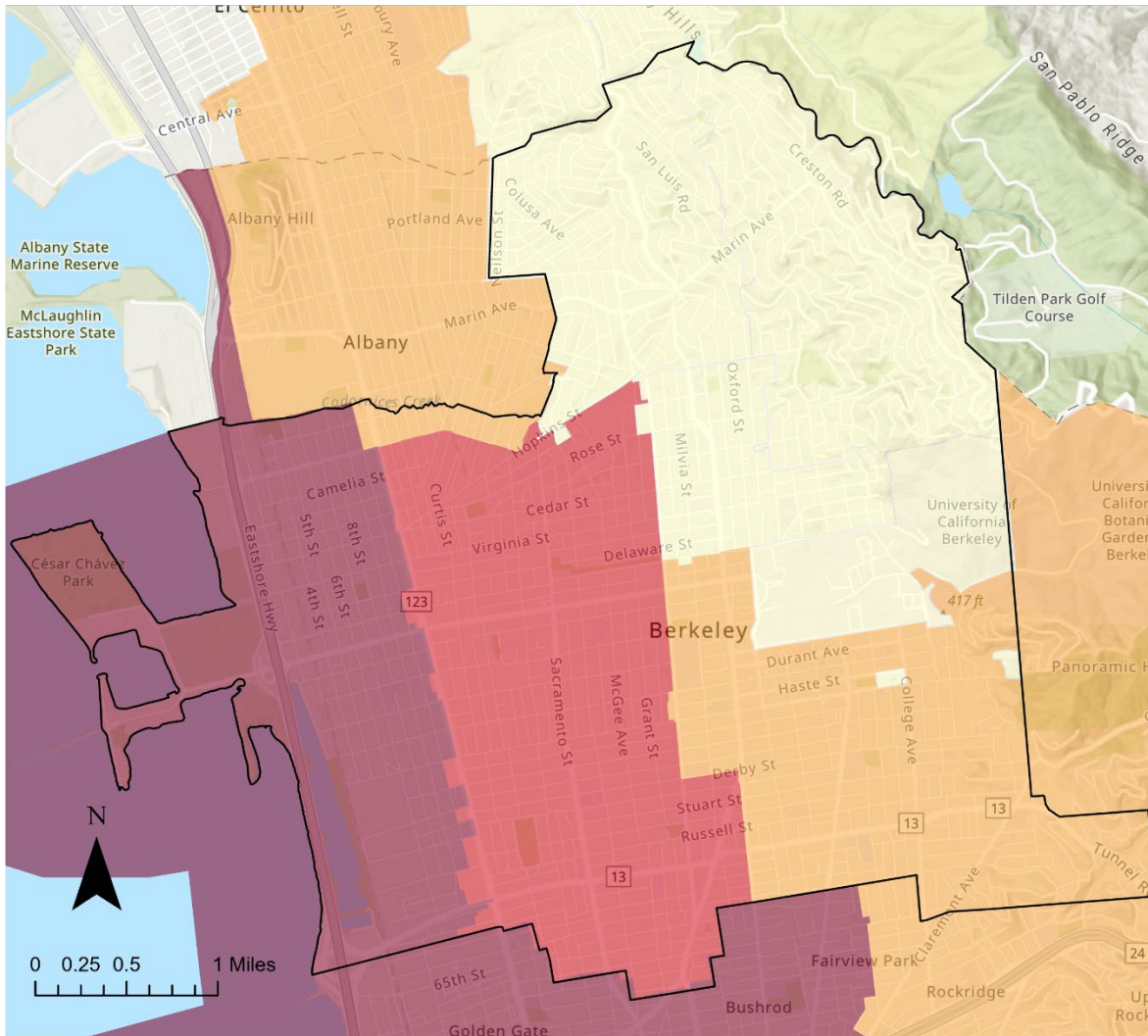
Table 6. Excess Emergency Room Visits by Zip code

Zip Code	Rate of Excess ER visits per Extreme Heat Day	Total Excess ER visits (2009-2018)
94710	6	617
94702	8	1,446
94703	4	1,413
94704	2	660
94705	3	701
94707	2	545
94708	2	487
94709	2	333

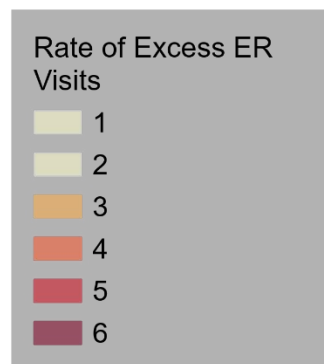
Map 18 visualizes the data above, demonstrating higher rates of excess hospital visits on

hot days for people in central, south, and west Berkeley. Although the thermal belting phenomenon described above creates hotter temperatures in the Berkeley hills, heat waves appear to have outsized impacts on the health of people living in the Berkeley flats. This likely relates to historic patterns of disinvestment on people with low incomes and people of color.

Map 18. Rate of Excess Emergency Room Visits Per Extreme Heat Day Per 10,000 people, 2024



Rate of Excess ER Visits Map



California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA, UCLA Heat Maps 2018, City of Berkeley OES 2024

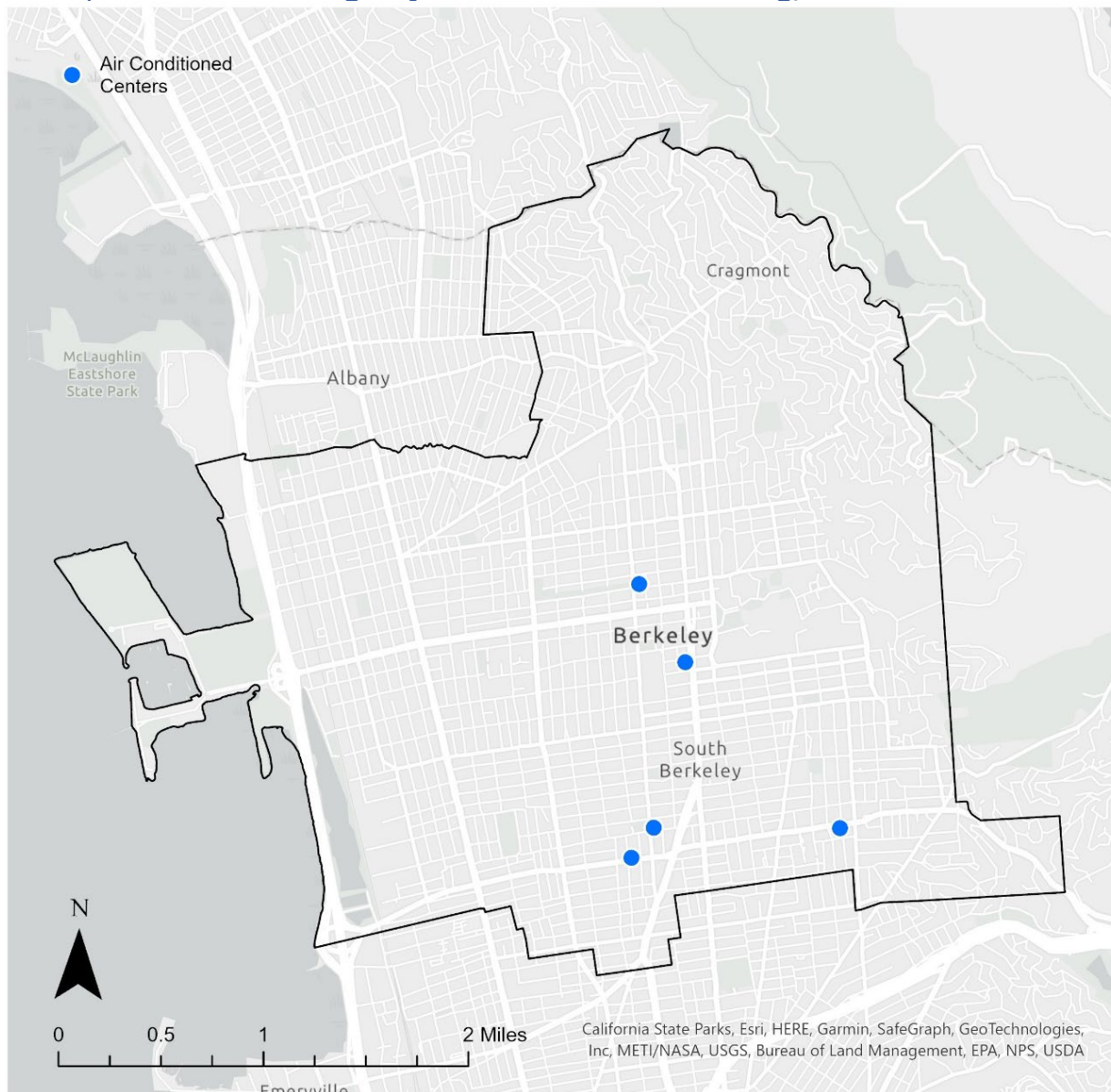
Structures

Well insulated buildings and those with access to air conditioning, or buildings with ventilation, can make a huge difference to individuals during periods of extreme heat. Berkeley has some public buildings with air conditioning that can serve as cooling centers during extreme heat events:

- [North Berkeley Senior Center](#), 1901 Hearst Ave, Berkeley, CA 94709
- [South Berkeley Senior Center](#), 2939 Ellis St, Berkeley, CA 94703
- [Central Library](#), 2090 Kittredge St, Berkeley, CA 94704
- [Claremont Branch Library](#), 2940 Benvenue Ave., Berkeley, CA 94705
- [Tarea Hall Pittman South Branch Library](#), 1901 Russell St., Berkeley, CA 94703

Map 19 shows the location of these sites on a map of Berkeley using blue dots.

Map 19. Public-facing City sites with air conditioning, 2024



As extreme heat becomes more frequent and severe, Berkeley buildings, including City facilities, will need to add cooling capacity. This effort will need to be done strategically over the coming decades to find building upgrade solutions that are clean, efficient, and functional during electrical grid outages. For existing buildings and new construction, consideration will be given to heat pump technology, a highly-efficient electric HVAC system (up to 400% efficient⁵⁸ in energy efficient buildings) with both heating and cooling

capabilities. Cooling approaches will also include natural ventilation and passive cooling techniques whenever possible, such as shading, orientation, and building envelope.

Strategic planning is also needed to ensure the readiness of critical City facilities during grid failure. The ability for these facilities to island off of the grid and rely on clean backup energy during a power outage would improve the City's energy assurance during extreme heat events. The City is currently partnering with Ava Community Energy (its local community choice aggregator and electricity provider) to design and install solar panels and backup batteries at some critical municipal facilities to advance this energy assurance goal.

Systems

High temperatures can damage critical infrastructure, including transportation systems. During a Fall 2017 extreme heat event, BART and Caltrain operated trains at reduced speeds in order to avoid damage to the tracks.⁵⁹ Unreliable public transit during extreme heat could cause more people to drive, adding to the heat and worsening air quality. Extreme heat events also create needs for additional infrastructure maintenance, particularly for roadways where heat can contribute to deformation or premature failure.⁶⁰

Extreme heat can also lead to power outages. Due to Berkeley's historically mild climate, many buildings are not equipped with efficient cooling systems, and therefore rely on inefficient and sometimes ineffective methods of indoor cooling, such as window air conditioning units. This increases electricity demands which in turn can overwhelm the power grid, causing power outages when people need their cooling devices the most. Power outages can lead to many cascading and significant consequences including

impacts to electrically powered fuel and water systems as well as communication infrastructure. The loss of power can also be devastating for people with disabilities who rely on electricity to power medical devices.” The Utility Disruption section of this plan has more information about the impacts of power outages.

Natural, historic, and cultural resources

Berkeley’s tree canopy provides some measure of protection during extreme heat events but also is vulnerable to extreme heat. Sudden limb failure is a commonly-noted phenomenon in trees during extreme heat events. The precise mechanism leading to limb failure is not well understood, but poses hazards to trees, as well as people trying to escape the heat by sitting in their shade.

Berkeley and its immediate surrounding cities have bodies of water that are usually places to cool down and seek relief from the heat. Locations such as Lake Anza or the Bay are prime examples. However, extreme heat can cause harmful algae to bloom when water temperature is warmer than usual. When this kind of algae is present, community members cannot enjoy or seek relief in the water.

Activities that have value

As noted earlier, studies have shown that extreme heat causes mental fatigue and aggression. These feelings and behaviors can impact family and social dynamics, work productivity, and participation in community events and outdoor activities. Researchers have also linked high heat to decreased academic performance, with lower-income, older, and other marginalized populations being disproportionately impacted.⁶¹

B.4.g Potential Impacts and Losses

According to California Climate Change Center, by mid-century with climate change, extreme heat in urban centers could cause two to three times more heat-related deaths than occur today.⁶² Population patterns in Berkeley could also increase the potential impacts. The senior population has grown steadily in Berkeley as well as the population experiencing homelessness. These groups suffer greater impacts of extreme heat. Development has the potential to decrease the impacts of extreme heat, as new buildings are designed to mitigate heat and energy use.

A study of the 2006 heat wave in California estimated excess statewide healthcare costs of \$120 - \$175 million, lost productivity costs nearing \$10 million, and the societal cost of over 650 premature deaths, which exceeded \$5 billion.⁶³ Unfortunately, little useful research exists on economic impacts of high heat at the local level – research focuses on aggregated losses at the national or international level.

GFOA's Extreme Heat Analysis

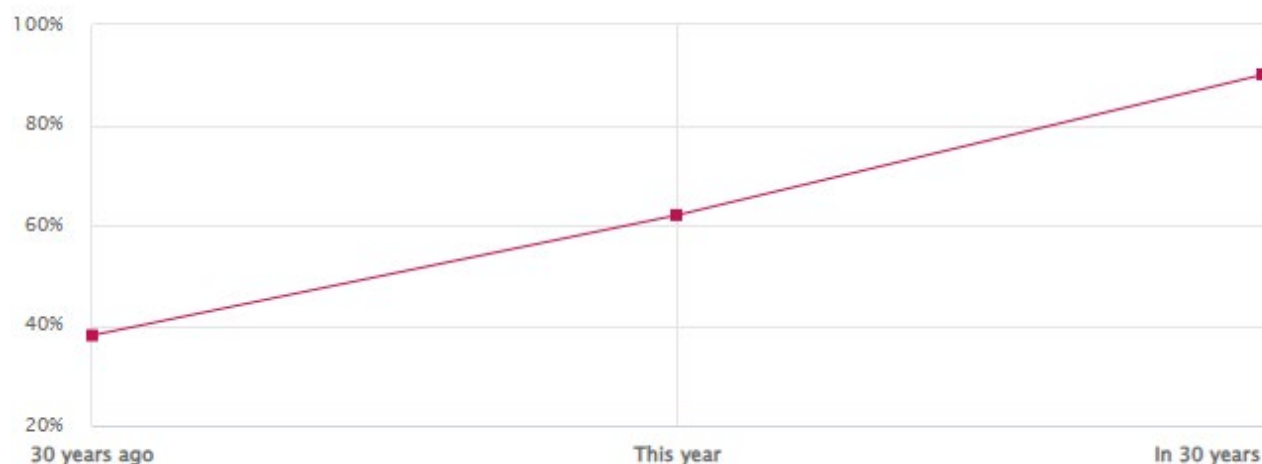
According to the First Street Foundation's Risk Factor tool, Berkeley has a "moderate" risk for heat. This analysis defines a hot day as temperatures above 83 degrees F, and the likelihood of this kind of hot day is increasing. "Feels like" temperatures have also been rising, but First Street also posits that homes in Berkeley have moderate vulnerabilities to heat based on factors like shade and proximity to bodies of water.

Exhibit 8 shows First Street's rising expectations for heat waves in the future. It shows:

- 30 years ago, there was a 40% likelihood of a 3+ day heat wave

- This year, there is a 62% likelihood of a 3+ day heat wave
- In 30 years, there will be a 90% likelihood of a 3+ day heat wave

Exhibit 14. Likelihood of 3+ days above 83 degrees Fahrenheit



Data was used from First Street to simulate the number of heat days along the following thresholds, where the indicated temperature is the “feels like” temperature, so includes humidity (which increases the perceived temperature). First Street provided an estimate of the average number of days between 80 and 90 degrees F and above 90 degrees F for the next 30 years. Table 6 focuses on the next ten years. The difference between what First Street’s algorithm would have predicted for past years was compared to what actually happened, to estimate the potential variation between what First Street’s algorithm predicts for the future and what actually happens.

Table 7. Summary of Simulation Results for Number of High Heat Days

“Feels Like” Temperature	Annual Average Now	Annual Average in 10 Years	Annual 90th Percentile Now	Annual 90th Percentile in 10 Years
80-85 Degree Days	17	18	25	26
85-90 Degree Days	8	10	13	16
90-100 Degree Days	6	7	11	12
100+ Degree Days	0	1	2	2

Unfortunately, not much useful research exists on economic impacts of high heat at the local level – research seems to focus on aggregated losses at the national or international

level. Because the available data was so broad, it was not used as the basis for a local estimate.

B.5 Poor Air Quality

B.5.a Description of Poor Air Quality and Related Hazards

Poor air quality is a growing concern in Berkeley and in California. According to the California Air Resources Board, 90% of Californians breathe unhealthy levels of outdoor air during some parts of the year. The Bay Area Air Quality Management District (BAAQMD) offers continuous monitoring for 11 pollutants, set by state and federal standards to protect the health and climate. More information about those 11 pollutants and how they compare to federal or state standards is available on the BAAQMD website.

In the Bay Area, the air pollutants of greatest concern include ozone, particulate matter, and toxic air contaminants.

- **Ozone** is formed in the atmosphere through chemical reactions between pollutants emitted from vehicles, factories and other industrial sources, fossil fuels, combustion, consumer products, evaporation of paints, and many other sources. Ozone is the main ingredient in summertime smog.
- **Particulate matter** is composed of an assortment of tiny airborne particles that vary in size and mass (ultrafine, fine, and coarse), physical state (solid or liquid), chemical composition, toxicity, and how they behave in the atmosphere. These particles originate from a variety of manmade and natural sources, including fossil fuel combustion, refining crude oil, residential wood burning and cooking, wildfires, volcanoes, sea salt, and dust. Residential wood burning is the largest source of particulate matter in the Bay Area during the winter.
- **Toxic Air Contaminants** are generally present in very small amounts in the air, but are extremely hazardous to human health. In the Bay Area, the toxic air contaminant of greatest overall concern is exhaust from diesel engines.

Poor air quality is a major public health concern. Poor air quality can irritate the eyes, nose, and throat, cause shortness of breath, aggravate asthma and other respiratory conditions, and affect the heart and cardiovascular system. Poor air quality can last for a few hours or a few weeks, depending on its source. It can also be a chronic issue, for example in places near industry or highways. The air quality can also change quickly due to weather conditions, such as rain or wind.

Connection to climate change

According to the National Climate Assessment, the global warming observed over the industrial era is unequivocally caused by greenhouse gas emissions from human activities—primarily burning fossil fuels. Climate change will affect human health by increasing air pollution, affecting ozone and/or particulate matter. Scientists are also predicting that climate change will contribute to longer, hotter, and drier fire seasons, which will increase the risk of severe wildfires and exposures to wildfire smoke. While climate change can harm everyone's health, its impacts exacerbate long-standing disparities that result in inequitable health outcomes for historically marginalized people, including people of color, Indigenous Peoples, low-income communities, and sexual and gender minorities, as well as older adults, people with disabilities or chronic diseases, outdoor workers, and children.

Connection to extreme heat

As the world's climate has shifted toward warmer conditions, the frequency and intensity of extreme cold events have declined over much of the US, while the frequency, intensity, and duration of extreme heat have increased. Extreme heat can lead to negative health

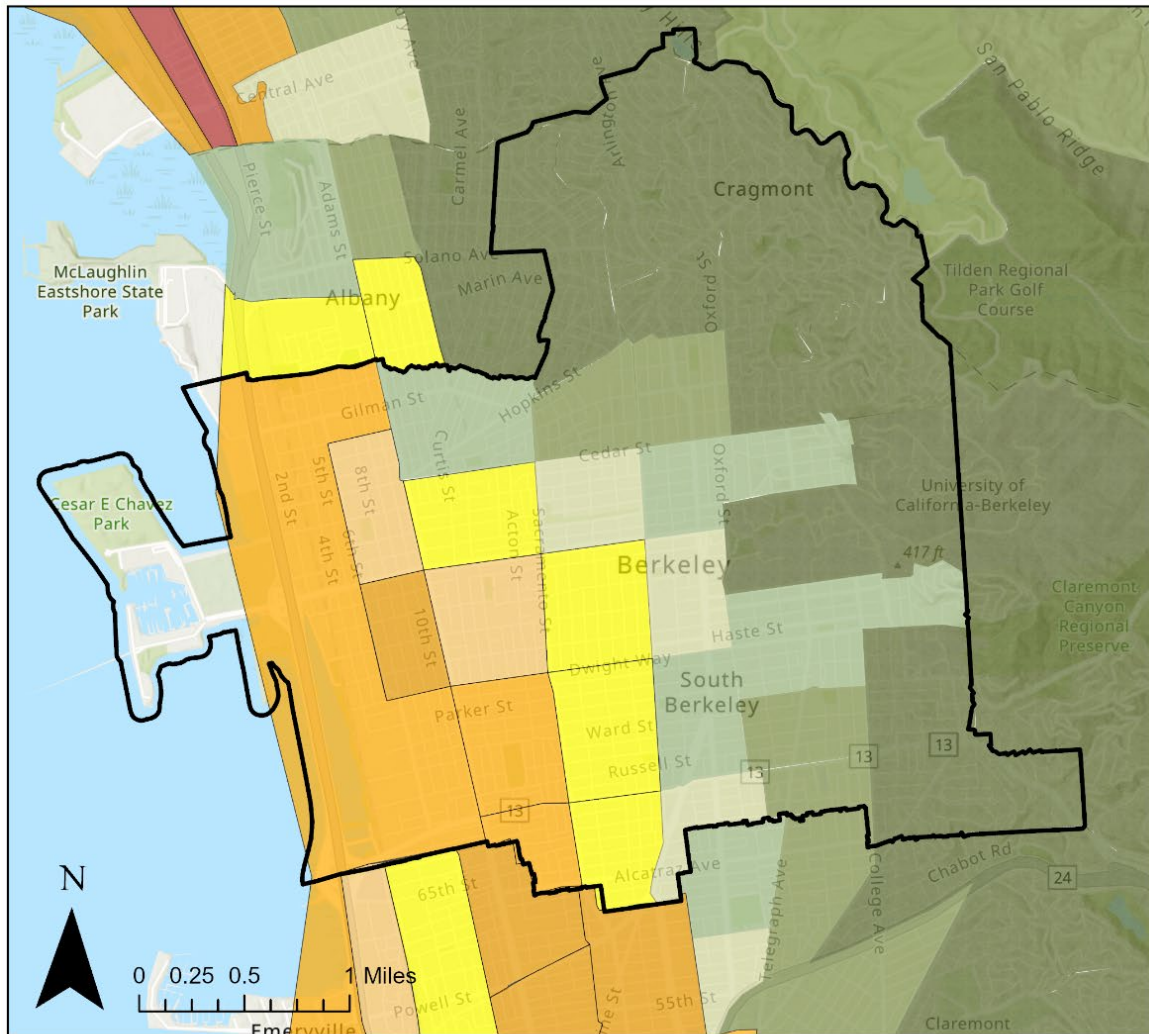
risks including heat-related illness and death. People who regularly struggle to afford energy bills—such as low-income, and older fixed-income households and communities of color—are especially vulnerable to more intense extreme heat events and associated health risks, particularly if they live in homes with poor insulation and inefficient cooling systems.

B.5.b Location of Poor Air Quality

Poor air quality can impact all of Berkeley, for those both indoors and outdoors. South and west Berkeley are generally more exposed to everyday poor air quality from outdoor pollutants due to the areas' proximity to the train, highways, and industrial facilities.

The California Communities Environmental Health Screening Tool CalEnviroScreen is a screening methodology that can be used to help identify California communities that are disproportionately burdened by multiple sources of pollution. Map 20 shows the CalEnviroScreen percentile for Berkeley. Higher percentiles indicate that an area experiences more pollution burden. Generally, the everyday pollution is higher in west Berkeley and lower in the eastern areas of the city. Areas in west and south Berkeley carry higher pollution burdens with percentiles in the 50s, 60s, and 70s, shown in the shades of orange color. The Berkeley hills show percentiles of 10s, 20s, and 30s. The eastern portion of the Berkeley flats shows percentiles in the 40s.

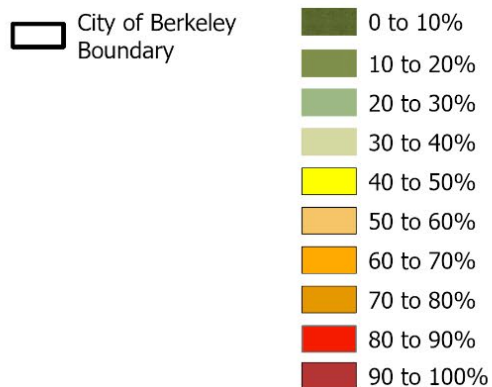
Map 20. Pollution Experienced in Berkeley, 2021



Credits: CalEnviroScreen 4.0, October 2021

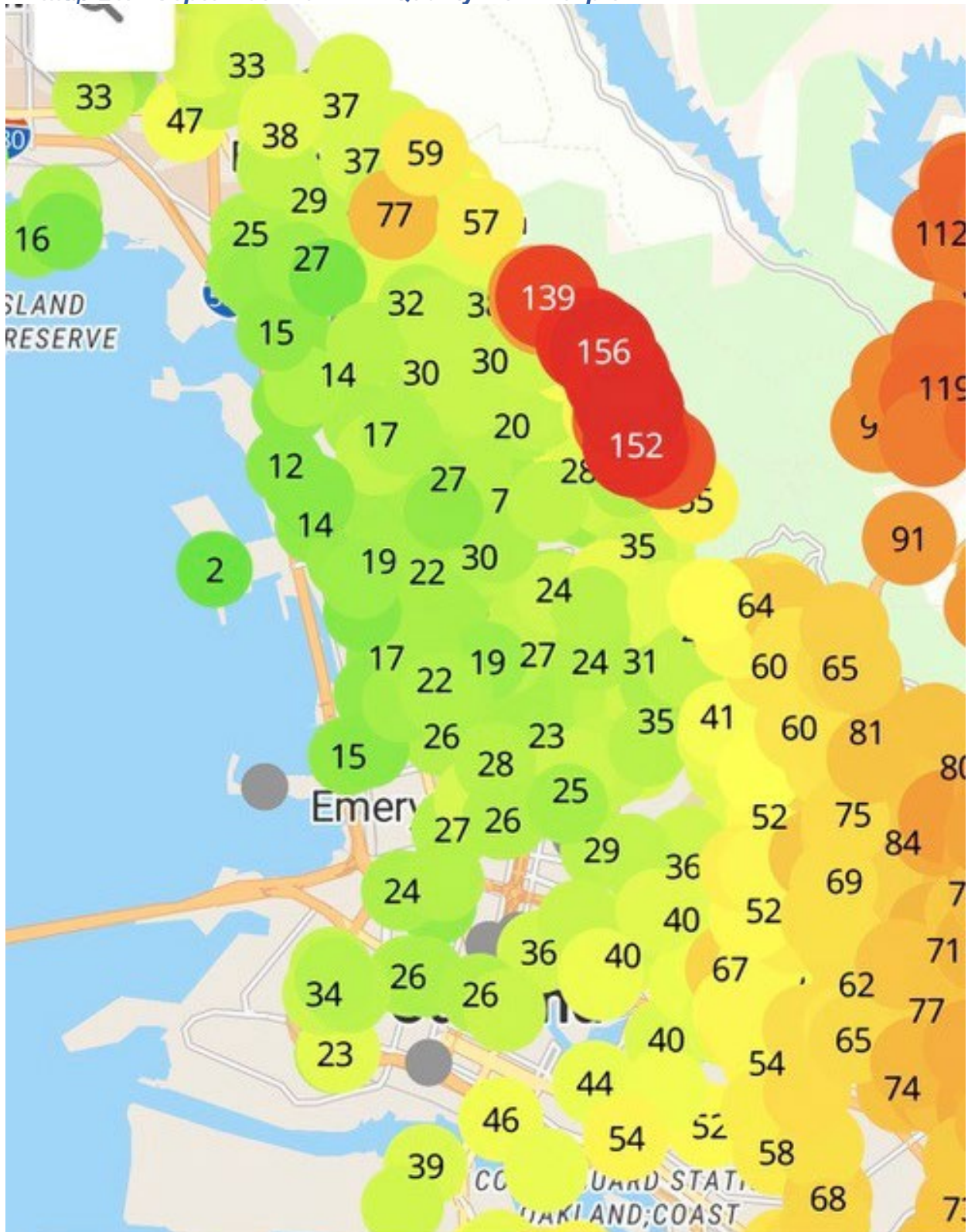
Esri, NASA, NGA, USGS, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

CalEnviroScreen Percentile



While day-to-day pollution is more common in Berkeley's western neighborhoods, smoke from wildfires often concentrates in the Berkeley Hills, due to the marine layer inversion effect that prevents air higher in the air from mixing with lower air near the ground, effectively trapping smoke above it.⁶⁴ The map below from September 2021 provides an example of the differences in air quality in Berkeley, with air quality numbers above 150 clustered in the hills. Air quality over 150 means that the air is unhealthy for the entire population.

Map 21. September 2021 Air Quality from PurpleAir



Older housing stock, which accounts for much of the homes throughout Berkeley, is more likely to have leaky windows and doors, letting in poor air from outside. In addition to outdoor pollution and smoke, our indoor environments are often filled with chemicals from consumer products, gas appliances, building materials, smoking, furniture, and other household materials. Given that most people spend more time indoors than outside, the quality of indoor air is important. Indoor air quality monitors and air filtration systems are on the market, but are expensive.

B.5.c **Extent of Poor Air Quality and Anticipated Intensities**

The Air Quality Index (AQI) issued by the Environmental Protection Agency is used for reporting daily air quality. Metro areas with a population of more than 350,000 are required to report the daily AQI. The AQI reports how clean or polluted the air in a given area is, and any associated health effects. The AQI focuses on health effects that may be experienced within a few hours or days after breathing the polluted air.

Table 8. AQI Basics for Ozone and Particle Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
<i>Green</i>	<i>Good</i>	<i>0 to 50</i>	<i>Air quality is satisfactory, and air pollution poses little or no risk.</i>
<i>Yellow</i>	<i>Moderate</i>	<i>51 to 100</i>	<i>Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.</i>
<i>Orange</i>	<i>Unhealthy for Sensitive Groups</i>	<i>101 to 150</i>	<i>Members of sensitive groups may experience health effects. The general public is less likely to be affected.</i>
<i>Red</i>	<i>Unhealthy</i>	<i>151 to 200</i>	<i>Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.</i>
<i>Purple</i>	<i>Very Unhealthy</i>	<i>201 to 300</i>	<i>Health alert: The risk of health effects is increased for everyone.</i>
<i>Maroon</i>	<i>Hazardous</i>	<i>301 and higher</i>	<i>Health warning of emergency conditions: everyone is more likely to be affected.</i>

B.5.d Previous Poor Air Quality Events

Everyone in Berkeley can be impacted by poor air quality – some neighborhoods experience moderate or unhealthy air quality on a regular basis due to proximity to various sources of pollutants like highways and industry, and there have also been several extreme examples of poor air quality that impacted the entire City due to nearby wildfires.

In September and October of 2017, the wildfires in North Bay sent smoke to Berkeley, causing unhealthy air for sensitive groups. In November 2018, smoke from the Camp Fire brought very unhealthy air quality. Schools were cancelled, and there were calls for the entire population to avoid outdoor activities for multiple days. In October 2019, smoke from the Kincade Fire brought unhealthy air to Berkeley for a few days. In September and

October of 2020, multiple northern California wildfires brought very unhealthy air to the Bay Area for over twenty consecutive days. In August and September 2021, smoke from northern California wildfires created moderate air quality in the Bay Area for a few days. In December 2022, the Bay Area had unhealthy air mostly due to local residential wood burning and active wildfires in the state.

There have been no federally-declared poor air quality disasters in Berkeley since the last update.

B.5.e Probability of Future Events

Spare the Air was created in 1991 by BAAQMD to alert residents when air quality is forecasted to be unhealthy and to share information on ways to reduce air pollution. Since 1991, there has been at least one Spare the Air issued for the Bay Area per year.

Table 9. *Number of Spare the Air days since 2017*

Year	Number of Spare the Air Days
2023	3
2022	17
2021	16
2020	52
2019	26
2018	13
2017	18

According to a new report from the Federal Reserve Bank of San Francisco⁶⁵, frequency of heavy smoke events has increased the San Francisco-Oakland metro area from about one day every four years to about 12 days each year. In the last decade, the average person in the San Francisco-Oakland metro area went from experiencing about three days per year of medium smoke to an average of 13 days per year.

With climate change and the increasing number of extreme heat days, the number of poor air quality days is likely to increase the number of days with Spare the Air notices.

B.5.f Vulnerabilities

People

Poor air quality creates negative health impacts for everyone, including irritation of the eyes, nose, and throat, coughing, chest tightness, shortness of breath, fatigue, and headaches. Poor air quality can also exacerbate other respiratory problems like asthma. According to the United States Environmental Protection Agency (EPA), some studies have shown a link between poor air quality and severe cardiovascular issues. Groups most at risk during poor air quality events include the elderly, children, infants, pregnant women, people with preexisting conditions, people who work or live outdoors, and people who live in neighborhoods that have been historically overburdened by pollution and other environmental contaminants, such as west and south Berkeley.

Structures

The effect of air pollution on physical structures may be seen in terms of discoloration, material loss, structural failing and soiling. The smell and residue of smoke can also permeate homes, which may cause a financial burden to clean or replace items.

Natural, historic, and cultural resources

According to the EPA, there is a robust body of research that links the negative impacts that air pollution can have on natural ecosystems. Pollutants can put excess levels of acids into bodies of water, damage soils, and harm plants, trees, and other wildlife.

Berkeley is lucky to be in an area of rich environmental diversity, including close proximity to regional parks. All of these natural resources can suffer due to poor air quality.

Activities that have value to the community

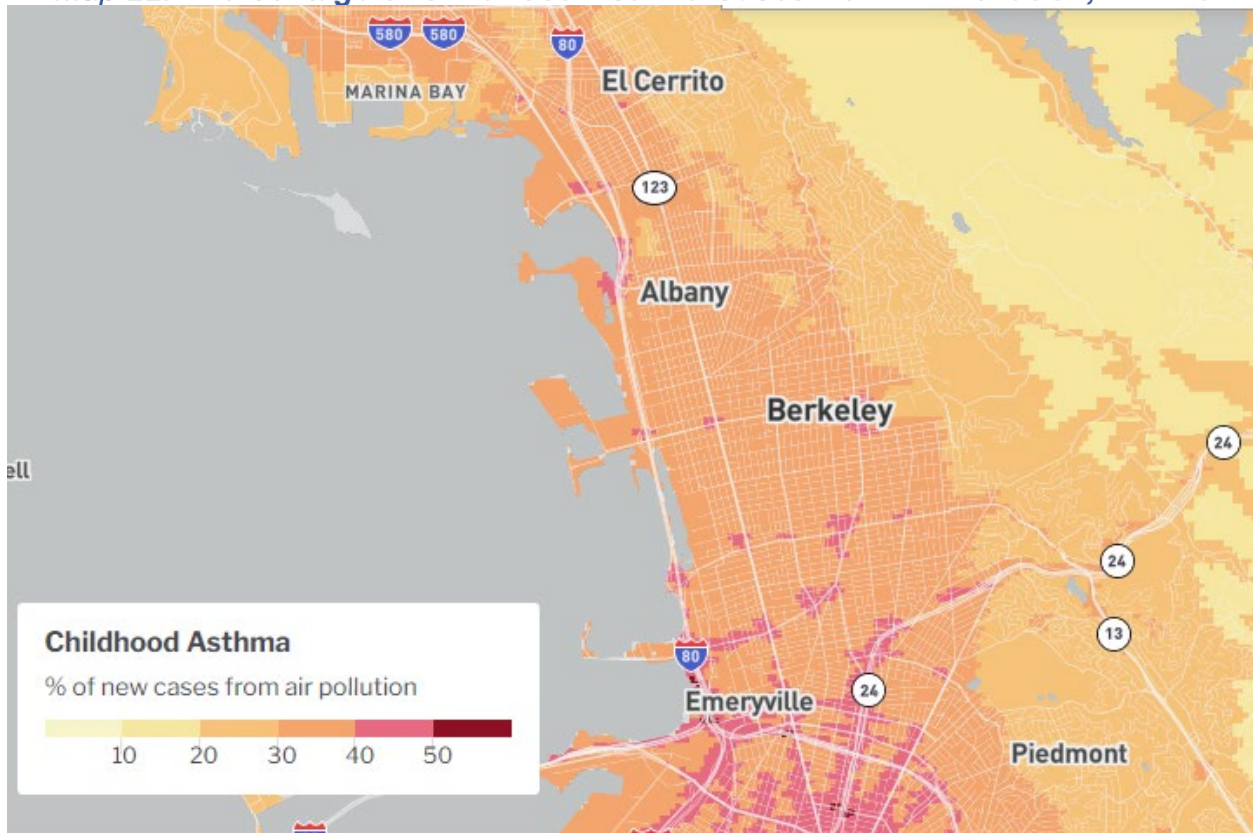
Berkeley provides great access to a wide variety of outdoor activities, including parks, recreation facilities, commerce, outdoor dining, and other unique experiences. These activities can be unsafe during poor air quality events, causing residents and visitors to miss out on the opportunity to visit and enjoy these special parts of Berkeley. The Parks, Recreation, and Waterfront Department hosts a number of activities for children and families throughout the year. During the COVID-19 emergency, when there were poor air quality days, activities had to be cancelled as it was unsafe to have children indoors or outdoors. Additionally, businesses that rely on outdoor activities experience financial losses during these events.

B.5.g Potential Impacts and Losses

The biggest impacts related to poor air quality are those on human health. Southerland et al., published a study in 2021⁶⁶ on the harmful impacts of pollution in the Bay Area. According to these estimates, more than 2,500 people die and 5,200 children develop asthma every year due to traffic-related air pollution exposure in the Bay Area.

Map 22 from the Environmental Defense Fund shows the percentage of new childhood asthma caused by air pollution in the East Bay. Most of Berkeley is in dark orange category, meaning over 40 percent of new asthma cases in Berkeley are attributable to air pollution. Some pockets of the Berkeley flats near major intersections rise to fifty percent. The eastern edges of Berkeley in the peaks of the hills drop to thirty percent.

Map 22. *Percentage of Childhood Asthma Cases from Air Pollution, EDF 2021*



Until recently, most of the research on the health impacts of air pollution were not wildfire-specific. Increased fire activity has led to an uptick in published research on health outcomes. A growing body of scientific evidence links wildfire smoke exposure to various adverse health effects. It is often assumed that while most healthy people will recover from short-term exposure to wildfire smoke, others might experience more severe symptoms, especially people with preexisting medical conditions or other factors, like inadequate housing or lack of access to health care.⁶⁷

B.6 High Wind

B.6.a Description of High Wind

According to the National Oceanic and Atmospheric Administration (NOAA), wind is air in motion, traveling between areas of high pressure to areas of low pressure. Bigger differences in air pressure create strong winds. High- and low-pressure systems are created by ascending and descending air, caused most often by differences in temperature. Wind is described using its horizontal speed and the direction it is coming from.

National Weather Service Definitions

The National Weather Service (NWS) defines “high winds” as:

- Sustained wind speeds of 40 miles per hour (mph) or greater lasting for one hour or longer, or
- Wind gusts of 58 mph or greater for any duration.

Sustained wind speed is different than a wind gust. A wind gust is a brief increase in the wind speed typically around 20-30 seconds.

The NWS issues a wind advisory when there are sustained winds of 31 to 39 mph, or gusts of 46 to 57 mph.

Seasonality of High Wind

In Berkeley, high wind events are typically associated with the seasons.

- In the winter, high winds come with weather systems and cold fronts, generally between November through March.
- In the summer, temperature and pressure differences between the Pacific Ocean and the interior valleys to Berkeley's east create stronger afternoon and evening winds coming from the west.
- Primarily in the fall, dry offshore foehn winds, known as the "Diablo Winds," occur. Diablo Winds are associated with fire weather.

Connection to climate change

Climate change creates more intense and variable weather conditions (both wet and dry), including high wind.

Connection to wildland urban interface fire

Diablo winds can create significant fire danger. Diablo winds are dry and fast. Fires that ignites when Diablo winds are blowing will spread more quickly. See the Wildland Urban Interface Fire Section of this plan for details.

Connection to utility disruption

High wind events can lead to downed trees and/or power lines, causing power disruption. Sometimes when high wind events coincide with extreme heat and dry conditions, in some cases the local utility PG&E may initiate a public safety power shutoff (PSPS) event, temporarily shutting of power in areas of high fire risk to prevent wildfires. Similarly, Enhanced Powerline Safety Settings (EPSS) allow PG&E power lines to automatically turn off power within one-tenth of a second. This can happen when there's a hazard, like a tree branch falling into a power line, which can cause a fire. These settings are in high-fire risk and surrounding areas.

B.6.b Location of High Wind

The location and elevation allow high winds to be felt throughout Berkeley. The westerly wind carries oceanic moisture toward the city, and as the wind flow hits the Berkeley Hills, it splits, producing northward and southward winds. The hot and dry Diablo Winds, particularly common in the spring and fall, affects the Berkeley Hills area more, while the cold storms, more common in the winter, increase wind speeds in the flats.

B.6.c Extent of High Wind and Anticipated Intensities

Beaufort Wind Scale

The Beaufort Wind Scale measures wind severity according to visible environmental impacts, without the use of instruments:

- 0 is calm, meaning calm wind. Smoke rises vertically with little if any drift.
- 1 is light air, with speeds of 1 to 3 mph. The direction of wind is shown by smoke drift, not by wind vanes. Little if any movement with flags. Wind barely moves tree leaves.
- 2 is light breeze, with speeds of 4 to 7 mph. Wind felt on face. Leaves rustle and small twigs move. Ordinary wind vanes move.
- 3 is gentle breeze, with speeds of 8 to 12 mph. Leaves and small twigs in constant motion. Wind blows up dry leaves from the ground. Flags are extended out.
- 4 is moderate breeze, with speeds of 13 to 18 mph. Wind moves small branches. Wind raises dust and loose paper from the ground and drives them along.
- 5 is fresh breeze with speeds of 19 to 24 mph. Large branches and small trees in leaf begin to sway. Crested wavelets form on inland lakes and large rivers.

- 6 is strong breeze with speeds of 25 to 31 mph. Large branches in continuous motion. Whistling sounds heard in overhead or nearby power and telephone lines. Umbrellas used with difficulty.
- 7 is near gale, with speeds of 32 to 38 mph. Whole trees in motion. Inconvenience felt when walking against the wind.
- 8 is gale, with speeds of 39 to 46 mph. Wind breaks twigs and small branches. Wind generally impedes walking.
- 9 is strong gale, with speeds of 47 to 54 mph. Structural damage occurs, such as chimney covers, roofing tiles blown off, and television antennas damaged. Ground is littered with many small twigs and broken branches.
- 10 is whole gale, with speeds of 55 to 63 mph. Considerable structural damage occurs, especially on roofs. Small trees may be blown over and uprooted.
- 11 is storm force, with speeds of 64 to 75 mph. Widespread damage occurs. Larger trees blown over and uprooted.
- 12 is hurricane force, with speeds of over 75 mph. Severe and extensive damage. Roofs can be peeled off. Windows broken. Trees uprooted. RVs and small mobile homes overturned. Moving automobiles can be pushed off the roadways.

Damage to Trees and Vegetation

The extent of damage caused by a high wind event is related to what meteorologists call antecedent conditions. Essentially, if previous weather conditions have been wet, the impacts of high winds on trees, for example, could be higher since the ground is weak with saturation. Timing can also play a role. If it's the first high wind event of the season, there might be more foliage, limbs, or branches that fall as the wind blows for the first time in a while.⁶⁸

B.6.d Previous High Wind Events

The strong wind can create dangerous conditions, especially when combined with low humidity and dry fuels. This combination could escalate fires if ignition occurs or damage

infrastructure and human health. Therefore, wind speed is constantly monitored. Using data collected by observational instruments placed at the Lawrence Berkeley National Lab, we identified several days with sustained winds exceeding 25 miles per hour (Category 6, considered a strong breeze with speeds of 25 to 31 mph). The highest wind speed recorded was 31 mph on March 21, 2023, and 29 mph on January 26, 2021. Additionally, there are numerous days with wind gusts surpassing 31 miles per hour, the highest being 63 mph on March 14, 2013, and 61 mph on March 21, 2023. The winter months (December, January, February, and March) statistically experience prevailing strong winds of 20 mph or higher.

The winter months of 2023 had several severe storms that included flooding, high winds, and landslides. During January to April 2023, there were three federally declared disasters in Alameda County, including DR-4699, DR-4683, and EM-3591.

B.6.e Probability of Future Events

As temperatures increase worldwide due to climate change, changes in rising sea levels, humidity, and storminess are unavoidable as the physical processes are all interlinked. Given the prevalence of previous high-wind events, it is expected that each year will bring more. By analyzing past and present weather patterns, scientists predict an increase in wind speed and wave height in coastal areas, including the Bay Area and Berkeley.

B.6.f Vulnerabilities

People

High winds can pose significant safety risks to people. Large branches can break off or

topple trees, putting people outside or inside adjacent buildings at significant risk. Winds may dislodge other heavy objects, and dust and debris can cause injuries to the eyes, throat, and mouth.

High winds can be particularly dangerous for people experiencing homelessness, people who work outside, and people who live in mobile or unanchored homes.

Structures

Downed trees or blowing objects can damage infrastructure, including homes, public and private buildings, and vehicles.

Systems

High winds can topple trees, which in turn can take down power lines and/or cause other objects to do the same. Downed power lines pose an immediate risk to people in the area, and can also have widespread impacts via power outages.

Natural, historic, and cultural resources

High winds can severely damage or kill trees, such as when major limbs fail or the trunk topples to the ground. For example, in 2022 a redwood tree fell at Willard Park after a windstorm. In the 2023 storms, the City lost an 80-foot Guadalupe Cypress in Caesar Chavez Park and UC Berkeley lost a redwood tree in the UC Botanical Garden.

According to the University of California Statewide Integrated Pest Management Program⁶⁹, wind can harm gardens, landscapes, and other parts of the natural environment. Wind can damage bark, flowers, foliage, fruit, and limbs of most trees or

shrubs.

B.6.g Potential Impacts and Loss Estimates

Climate change is expected to increase the potential impacts and losses associated with high wind, as it brings more varied and extreme weather. Changes in population patterns and in development are not expected to drastically change the potential impacts of high winds.

Because high wind events are generally associated with either winter storms or fire weather, the impacts from high winds alone are not tracked specifically.

However, winter storms in 2023 illustrate potential impacts. Berkeley's Parks, Recreation, and Waterfront Department estimates that these storms toppled 85 trees on City property, many of them falling around the Berkeley waterfront. This count does not include trees that fell on private property. There is not a comprehensive list of damages or estimates of total damage, but reported damage includes one tree falling onto a house and another on a pickup truck.⁷⁰ From December 2022 to April 2023, there were more than 300 calls to 311 about broken branches and trees, more than any winter since 2015-2016.

Damage from these storms resulted in three federally-declared disasters in Alameda County and created a backlog of tree removal work that limited staff capacity and time for tree planting and maintenance.

GFOA's High Wind Analysis

High winds can cause damage in the community. High winds can occur relatively frequently. For example, data from the National Weather Service indicates that there have

been 118 wind events in the entire San Francisco Bay Shoreline zone since 2011, with an average speed of 43 miles per hour.

Of course, not every wind event in this zone will impact Berkeley. An examination of wind data from a local weather station for the last 24 months showed that the average windspeed of the 10 sustained wind events was about 30 mph. For comparison, FEMA regards 67 mph as a very strong wind event that would be likely to cause significant damages. During the same 24-month period, the San Francisco Bay Shoreline Zone experienced three events over 40 mph. The biggest was on April 11, 2002. On that day in Berkeley, the maximum sustained wind period was around 40 mph. It should be noted that sustained winds (customarily measured over ten minutes) are not as strong as short wind gusts that can happen during the wind event. For example, during a recent two-year period the top speed of a wind gust was an average of 4.7 mph greater than the speed measured for the associated sustained wind event.

To estimate the number of wind events per year on average Berkeley can expect to experience, 24 months of local weather station data was compared to the same period from the National Weather Service data. The wind events for the San Francisco Bay Shoreline zone were fully felt in Berkeley in four out of eleven cases (36%). That same portion was then applied to the entire 12-year period of history to arrive at an assumption that there will be an average of 3.5 wind events per year, on average.

An assumption was made that there is a 3% chance of a wind event with sustained winds of 67 mph or greater, which is equivalent to assumptions from FEMA's estimates of losses for Berkeley. 50% of wind events were assumed to be 45 mph or less, which is consistent

with historical data. To estimate damage, estimates were taken from FEMA for damages from a very strong wind event (67 mph), based on total exposed value and expected rates of loss, which was \$43,200 per event. That loss was then scaled down to expected damage from a 45mph event. According to the Beaufort Wind Scale, winds at 45 mph result in damages such as twigs and small branches broken from trees. It was therefore assumed that damage was minimal at winds of this speed. These assumptions resulted in the loss exceedance curve shown in Exhibit 14.

Exhibit 15. Loss Exceedance Curve for High Wind, 10 Year and 1 Year Risks (millions of dollars)

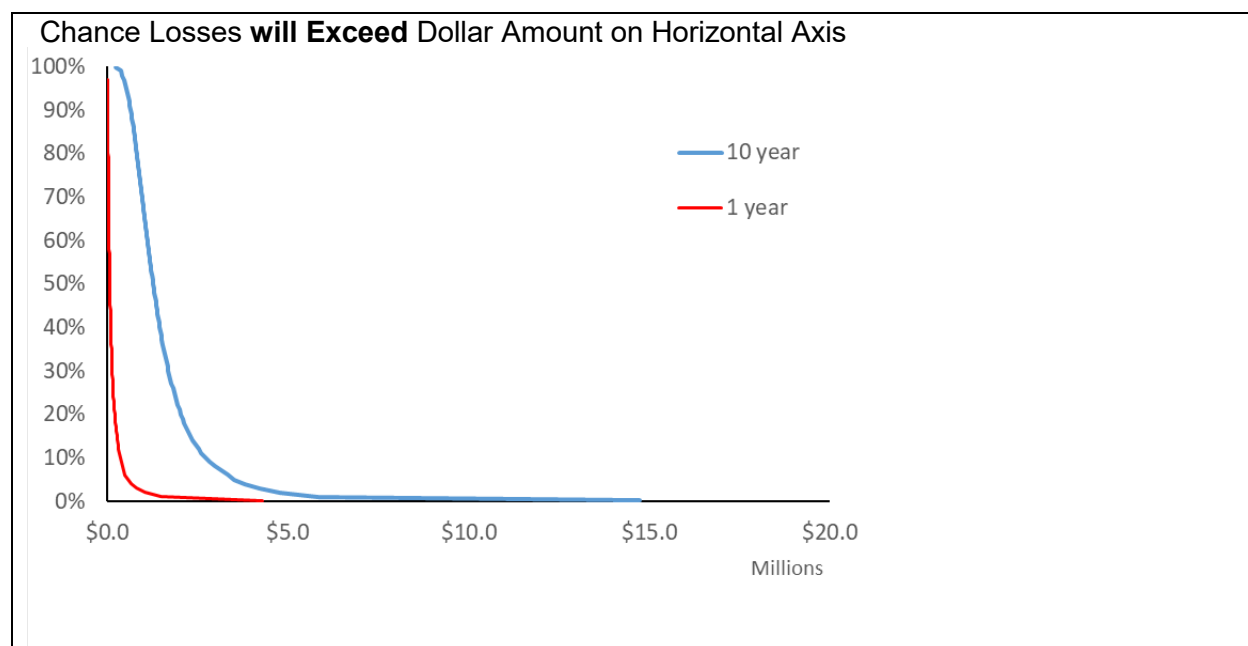


Table 10 pinpoints key ideas from Exhibit 14 above. For example, over a one-year period, there is a 5 percent chance that there will be a wind event causing \$600,000 of damage, but there is a 90 percent chance of zero damage. However, over a ten-year period, the risk increases. There is a 5 percent chance that there will be a high wind event causing \$3.5 million in damage, and a 90 percent chance that there will be at least \$600,000 in damage due to high winds.

Table 10. *Chance that Economic Losses Will Exceed Dollar Amounts (Millions)*

Time Horizon	5%	10%	50%	90%
1-Year	\$0.6M	\$0.3M	\$0.1M	\$0**
10-Year	\$3.5M	\$2.7M	\$1.3M	\$0.6M

- 1 *Not Applicable (NA) means that the loss exceedance curve intersects zero before this point. See the graph to see where the curve meets the vertical axis for the chance of losses exceeding zero.
- 2 **Potential damages are so low that we round to zero

B.7 Rainfall-Triggered Landslide

B.7.a Description of Rainfall-Triggered Landslide

According to the United States Geologic Survey, a landslide is a movement of a mass of rock, debris, or earth down a slope. The term “landslide” includes five modes of slope movement, including falls, topples, slides, spreads, and flows. They are further subdivided by the type of geologic material (bedrock, debris, or earth).

In the United States, the most frequent and widespread damaging landslides are started by prolonged or heavy rainfall. The majority of rainfall-triggered landslides are shallow (less than a few meters deep), small, and move rapidly. Rainfall-triggered landslides often turn into debris flows (fast moving slurries of water, soil, and rock) as they travel down steep slopes.

Rainfall, snowfall, changes in water level, erosion, ground water, and human activity can contribute to landslides. Examples of human activity include grading for roads, home construction, and landscaping, all of which can decrease hillside stability by adding weight to the top of a slope, destabilizing the bottom of a slope, and/or increasing water content of the underlying materials.

Connection to climate change

Climate change is creating more intense and varied weather conditions, including intense rainfall, which can contribute to landslides.

Connection to wildland-urban interface fire

Tree roots and vegetation can be important to providing support and preventing erosion. Fires can burn trees and vegetation, removing that hillside support. Post-fire landslide hazards include fast-moving, highly destructive debris flows that can occur in the years immediately after wildfires in response to high intensity rainfall events.

B.7.b Location of Rainfall-Triggered Landslide

The California Geological Survey has produced two maps that together provide helpful data on where landslides are most likely to be triggered by winter storms.

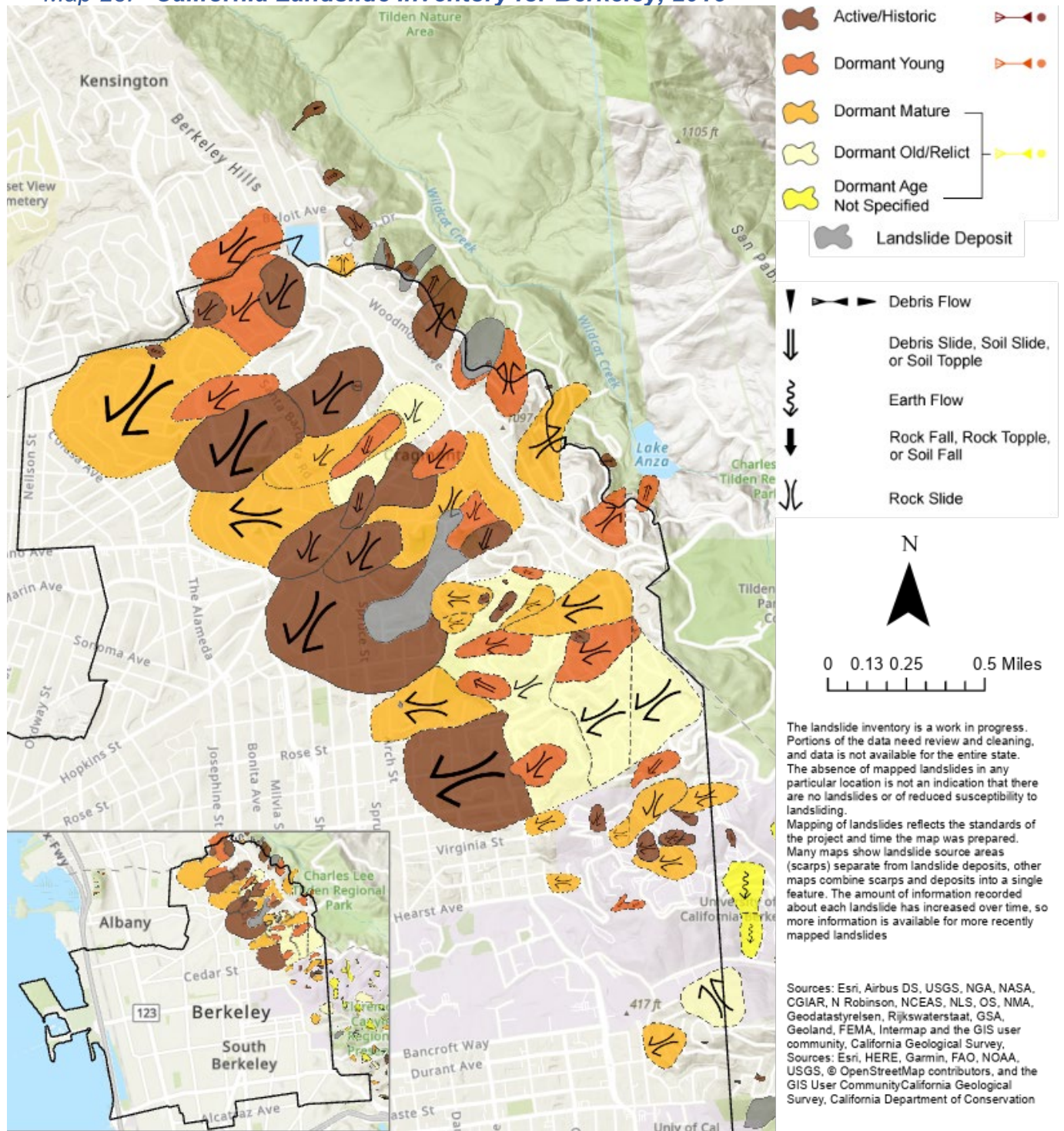
The Landslide Inventory is an ongoing project to collect and display current and historical landslide data for the State of California. Map 23 shows the Landslide Inventory for Berkeley, focused on the Berkeley hills. Landslide movement could range from a few inches to tens of feet in any given year, but ground surface displacements as small as a few inches are enough to break typical foundations.

On Map 23:

- Active landslides are shown in brown.
- Dormant landslides are shown in orange, yellow, or light yellow. These are deep-seated or dormant landslides that are not currently moving, but that may have moved in historic time or in recent geologic time. These dormant landslides could be reactivated by changing surface or subsurface conditions.

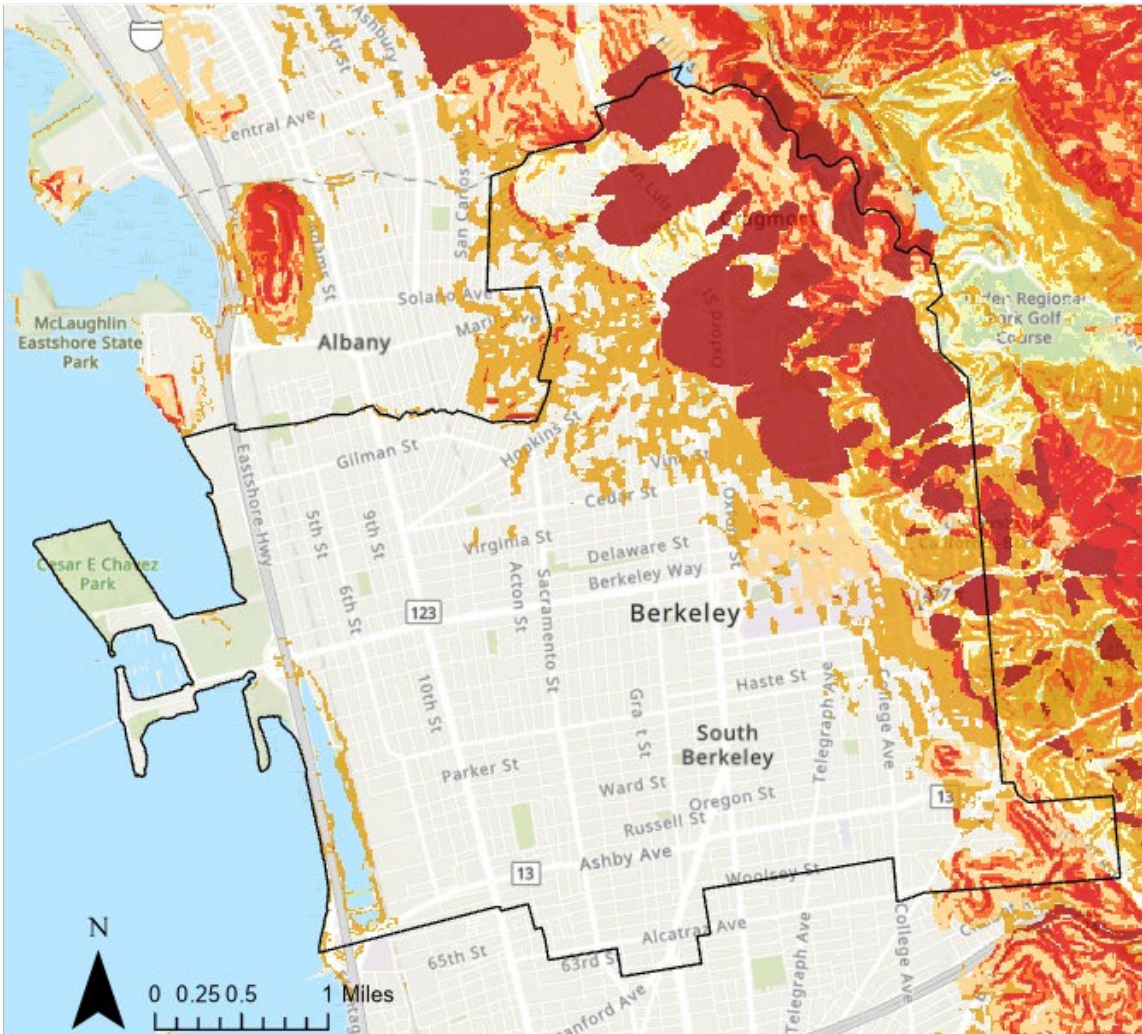
Generally speaking, in Berkeley, there are active and dormant landslides spread throughout locations in the Berkeley hills.

Map 23. **California Landslide Inventory for Berkeley, 2015**



Map 24 shows the overall susceptibility to deep seated landslides in areas throughout Berkeley. Rock strength and slope are combined to create classes of landslide susceptibility. These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility, classes VIII, IX, and X, includes very steep slopes in hard rocks, and moderate to very steep slopes in weak rocks. Generally speaking, these classes in Berkeley are concentrated in northeast Berkeley and in the Berkeley hills. The further east in the Berkeley hills have greater susceptibility with steeper slopes and weaker rocks (shown with darker red colors).

Map 24. Landslide Susceptibility in Berkeley, 2015



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community. Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, DOC/CGS California Geological Survey, California Department of Conservation

Landslide Susceptibility Classes

- 0
- III
- V
- VI
- VII
- VIII
- IX
- X

ROCK STRENGTH

High ← → Low		
0	0	0
0	V	VII
0	V	VII
III	VIII	IX
VI	IX	X
VII	IX	X
VIII	IX	X
VIII	IX	X

LANDSLIDE SUSCEPTIBILITY CLASSES

(0 III V VI VII VIII IX X)
increasing susceptibility

B.7.c Extent of Rainfall-Triggered Landslides and Anticipated Intensities

The most dangerous landslides in terms of life safety are fast-moving, generally shallow debris flows. These are triggered when intense rainfall follows storms that have already saturated hillsides. Debris flows initiate in concave slope areas where subsurface water is concentrated, elevating pore pressure above the natural strength of the soil. Once initiated, debris flows can travel great distances at relatively high velocities, flowing down drainages and onto alluvial fans and damaging any structures lying in their paths. Preexisting and recently-active, larger landslides (such as those shown in Map 23) are more often triggered by exceptionally long periods of seasonal rainfall, and sometimes do not start moving until long after the rain has stopped. These types of slides may not move as rapidly as debris flows, but can damage large areas and many structures, resulting in extensive landslide losses.

B.7.d Previous Rainfall-Triggered Landslide Events

The most recent landslide in Berkeley occurred in January 2023 and it was federally declared disaster DR-4683. In December 2022 and January 2023, six atmospheric river events brought over 15 inches of rain to Berkeley, along with wind gusts over 55 miles per hour. A large chunk of hillside located on the eastern edge of Zaytuna College's Upper Campus broke loose. The landslide traveled onto the private property immediately downslope, destroying an outbuilding and damaging the home. In total, residents were evacuated from one impacted property, along with seven more threatened properties further downslope). There were no injuries but homes remained evacuated for multiple weeks while the slide was remediated.

Another landslide occurred in Berkeley in January 2017. At the time, the overall rainfall in

California was on pace to be the wettest season in over 100 years on record. Rain saturated the soil in Berkeley and throughout the State. The slide occurred on an undeveloped lot in the North Berkeley hills and threatened to close the street situated in the path of the slide. Repairs to the hillside were completed in late 2018. There were no injuries.

During the winter of 1997-1998, another landslide occurred in North Berkeley, when soils became oversaturated from heavy rains brought by the El Nino weather system. One home was significantly damaged and had to be demolished. Residents had to evacuate two additional homes but were able to reoccupy these homes after the hillside was stabilized. No one was hurt.

In 1996, a minor slide collapsed the Euclid Avenue retaining wall, blocking the roadway.

At other times over the 20th century, landslides from rainfall-saturated ground in the Berkeley Hills damaged and sometimes destroyed homes and public infrastructure, including streets, sewers, and other utilities. Most of the areas damaged were later rebuilt or built over.⁷¹

B.7.e Probability of Future Events

Berkeley has a number of active landslides (shown in Map 23), which means they are currently moving or movements have been recorded in the past. There are a number of deep-seated landslides that continuously move, with the rate of movement affected by rainfall and groundwater conditions.

There have been 4 damaging landslides,¹ triggered by rain, in Berkeley since 1982. Using this rate of three landslides in 41 years, there is a 7% annual chance of a landslide.

However, climate change will likely increase this risk. Climate change results in more intense rainfall events, creating favorable conditions for more devastating landslides. There is not currently a way to quantify how climate change increases the probability of a damaging landslide.

B.7.f Vulnerabilities

People

People may be hurt or killed during a landslide. Damage to roads and sidewalks may prevent people from evacuating, and will challenge responders to access the area.

Structures

Landslides are most likely to damage residential or privately-owned structures because the landslide risk predominately affects residential areas. According to a USGS report approximately 6,000 structures are located in areas at moderate to high risk of landslides.⁷²

Property owners are responsible for mitigating landslide risks to their own properties. Homeowner's insurance often excludes landslides, forcing property owners to manage damage and costs without coverage.

The hazard is greater in steeply-sloped areas, although slides may occur on slopes of 15

¹ By "major and damaging" we simply mean that the damage was large enough to require intervention by City government and cause City government a significant cost.

percent or less if the conditions are right. Slope steepness and underlying soils are the most important factors affecting the landslide hazard. However, surface and subsurface drainage patterns also affect the landslide hazard, and vegetation removal can increase the likelihood of a landslide.

The hazard can be reduced through grading, strengthening, geotechnical engineering, drainage, and other landscape methods. The City does regulate and inspect new development activities, but most of the Berkeley hillside development predates current best practices and codes. Further, mitigation efforts can be costly and out of reach for many residents on a fixed budget.

Systems

Roads and sidewalks may be damaged as a result of a landslide.

Underground utilities (water, sewer lines, storm drains, natural gas lines, and conduits) and aboveground utilities (electricity, telecommunications, cable) may be damaged in a landslide. Damage to underground utilities may pose serious health and environmental risks. Interruptions in electrical power may require with disabilities and people who depend on electrical equipment for medical needs to evacuate or to have emergency power supplies, even if they are not directly impacted by a landslide.

In Berkeley, several collector streets that are critical for emergency access and evacuation are located in areas susceptible to landslides.

Natural, historic, and cultural resources

The Berkeley hills, where landslide risk is most present, include homes of architectural

significance. There are also several parks, recreational areas, as well as institutions that may be impacted by a landslide.

According to Map 24, significant portions of the University of California - Berkeley campus, as well as the Lawrence Berkeley National Lab, are susceptible to landslide.

B.7.g Potential Impacts and Losses

Landslides can cause serious injury or death. Fortunately, recent landslides have not caused any deaths or injuries. There is currently no data on how many deaths or injuries to expect with a given landslide, but Berkeley's landslide-exposed areas are densely populated, meaning that there is significant risk to people.

Climate change is expected to increase the potential impacts and losses associated with rainfall-triggered landslides. Expected changes in population patterns potentially increase impacts and losses associated with rainfall-triggered landslides. As the population steadily increases, if there is additional development in the eastern hills, more people could be exposed to landslide risk. Changes in land use and development may potentially increase impacts and losses. New state laws are mandating increased density throughout the city, including in the eastern hills, which are more exposed to wildland-urban interface fire and landslides.

GFOA's Rainfall-Triggered Landslide Analysis

A search of historical records indicates that there have been 4 damaging landslides, triggered by rain, in Berkeley since 1982. We used this as the basis for the potential frequency of landslides in the future: 3 landslides in 41 years implies a 7% annual chance

of a landslide.

For potential damages landslides might cause we looked at two sources:

1. FEMA estimates of total exposure to landslides in each census tract in Berkeley and estimated loss ratios. This provided a starting point for what losses might be from a landslide.
2. Historical records of losses from landslides in the region. This provided a sense of the variation that can take place.

We put all these pieces of data together to develop a range of possible landslide outcomes. This resulted in the potential community economic losses shown in Exhibit 10.

Exhibit 16. Loss Exceedance Curve for Landslides, 10 Year and 1 Year Risks (thousands of dollars)

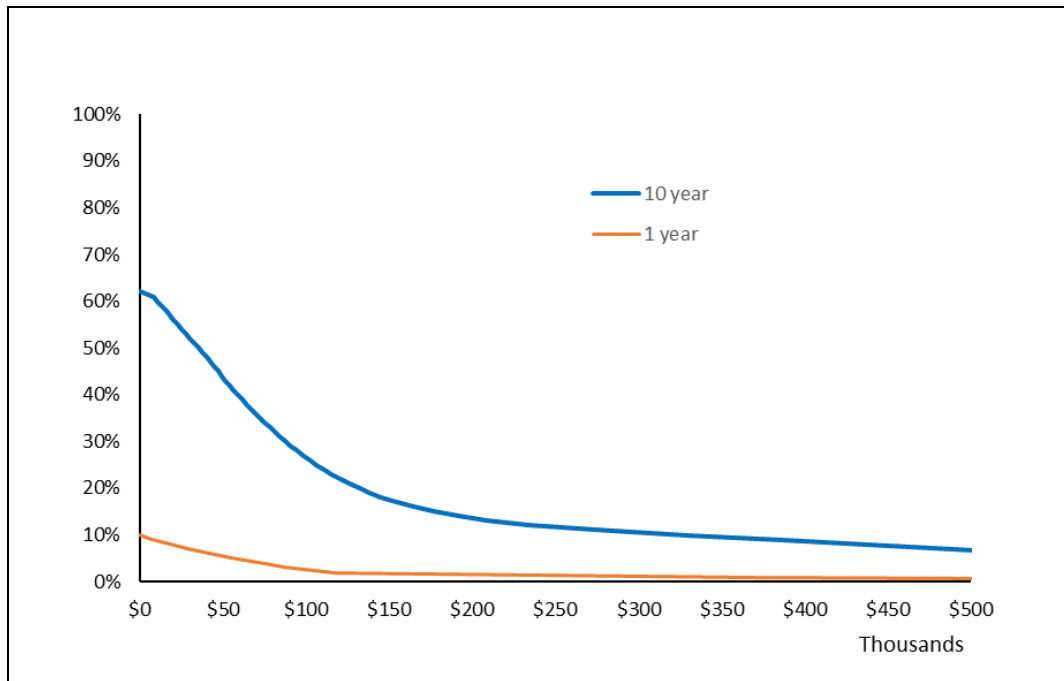


Table 10 pinpoints key ideas from Exhibit 10 above. For example, over a one-year period,

there is a 5 percent chance that there will be a landslide causing \$55,000 of damage. Over a ten-year period, the risk increases, and there is a 5 percent chance that there will be a landslide causing \$600,000 in damage.

Table 11. Chance that Economic Losses Will Exceed Dollar Amounts

Time Horizon	5%	10%	50%	90%
1-Year	\$55K	NA*	NA*	NA*
10-Year	\$600K	\$330K	\$35K	NA*

*Not Applicable (NA) means that the loss exceedance curve intersects zero before this point. See the graph to see where the curve meets the vertical axis for the chance of losses exceeding zero.

B.8 Tsunami

B.8.a Description of Tsunami

A tsunami occurs in a body of water when a rapid disturbance vertically displaces the water, causing a series of surges. These changes can be caused by an underwater fault rupture (that generates an earthquake) or underwater landslides (typically triggered by earthquakes).

Tsunamis affecting the Bay Area can result from offshore earthquakes within the Bay Area, or from very distant events. While it is most common for tsunamis impacting the Bay Area to be generated by faults in Washington and Alaska, local tsunamis can be generated from local faults running underwater (such as the small tsunami that was triggered by the 1906 earthquake). The San Andreas Fault runs along the coast off the Peninsula and the Hayward fault runs partially through San Pablo Bay.

Connection to climate change

As sea levels and temperatures rise, so does the potential impacts of tsunamis. Increases in sea levels and higher tides may be contributing factors to more frequent and intense coastal flooding.

B.8.b Locations of Tsunami

In 2021, the California Geological Survey (CGS) and the California Governor's Office of Emergency Services (Cal OES) updated the existing tsunami inundation maps for Alameda County, shown in Map 25. In this update, the tsunami boundaries have changed to reflect the best available science as well as local geographic features that impact evacuation safety.

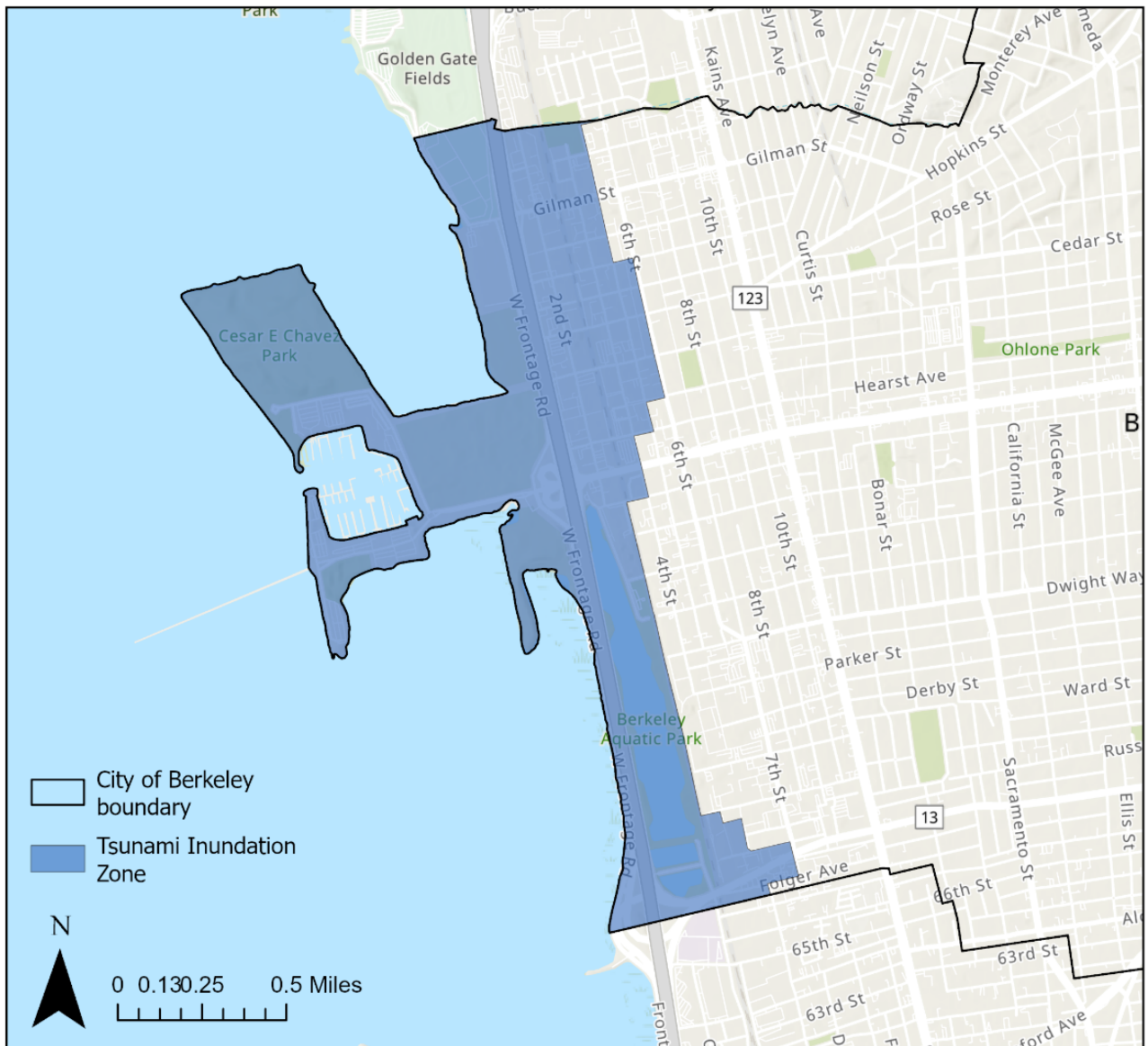
Map 25 shows in blue shading the area of potential tsunami inundation in Berkeley. It does not reflect the inundation area from any singular tsunami, but represents what is possible from large, realistic scenarios primarily from the Alaska and Cascadia subduction zones. This map is intended to be used to evacuation planning purposes only.

Given Berkeley's sloping terrain and the Bay's waters at their current levels, tsunami inundation will not extend far inland from the shoreline, but the zone has increased slightly since the last update to reflect new science and local features. According to Map 25 and shaded in blue, the tsunami inundation zone extends along the entire shoreline of the Bay. Starting at the city's northern border, the zone stretches east from the Bay until it meets Fifth Street. At Page Street, the edge of the zone stretches as far east as Sixth Street until Delaware Street. At Hearst Street, the edge of the zone runs east to Fifth Street. At University Avenue, the edge of the zone runs east to Fourth Street. From

Addison to Heinz Avenue the eastern edge runs to Third Street or to where Union Pacific Railroad is located. At the far south end of the city after Heinz Avenue, the eastern edge of the zone runs to Fifth Street for one block and to Seventh Street at Potter and Folger Avenue.

According to Map 25, the zone captures Golden Gate Fields, the Tom Bates Regional Sports Complex, Eastshore State Park, the Berkeley Marina, the Dona Spring Animal Shelter, portions of Interstate 80 and the frontage roads beside it, the San Francisco Bay Trail, the Amtrak Station, and Aquatic Park. It also captures the Fourth Street Business District.

Map 25. **Berkeley Tsunami Inundation, 2021**



Credits: Tsunami Hazard Area Map, Alameda County; produced by the California Geological Survey and the California Governor's Office of Emergency Services; 2021, mapped at multiple scales.
California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, Esri, NASA, NGA, USGS, FEMA

B.8.c Extent of Tsunamis and Anticipated Intensities

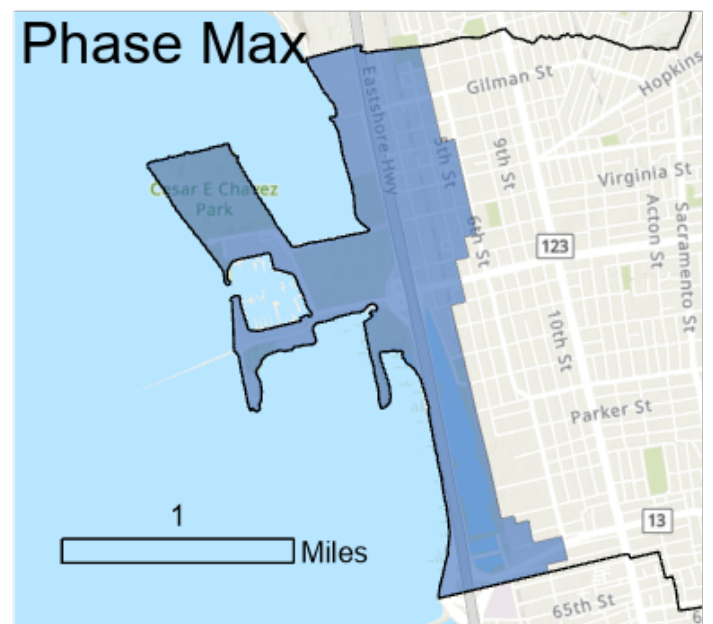
In 2023, the California Geological Survey, the California Governor's Office of Emergency Services, and the National Ocean and Atmospheric Administration (NOAA) released an updated California Tsunami Evacuation Playbook for Alameda County.

Tsunami Evacuation Playbooks reflect more refined and detailed planning, in which forecasted tsunami amplitudes, storm surge, and tidal information can help guide which areas might be inundated in different scenarios, depending on the extent of the event. This analysis uses helps NOAA to better predict inundation areas during actual tsunami events. Local emergency managers can use this information to better target evacuation areas during actual tsunami events.

Map 26 below present these Playbook zones for evacuation as "Evacuation Phases." The areas covered under each phase expand as follows:

- Phase 1 includes beaches, harbor docks and boats, and piers.
- Phase 2 adds small areas of land south of University Avenue and west of the West Frontage Road.
- Phase 3 adds Golden Gate Fields, the Tom Bates Regional Sports Complex, Eastshore State Park, the Berkeley Marina, and portions of the San Francisco Bay Trail.
- The Maximum Phase is presented blue and reflects the full tsunami inundation zone presented on Map 25. The Maximum Phase includes Golden Gate Fields, the Tom Bates Regional Sports Complex, Eastshore State Park, the Berkeley Marina, the Dona Spring Animal Shelter, portions of Interstate 80 and the frontage roads beside it, the San Francisco Bay Trail, the Amtrak Station, and Aquatic Park. It also captures the Fourth Street Business District.

Map 26. *Berkeley Tsunami Evacuation Phases, 2021*



■ Evacuation Area

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community,
 Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

B.8.d Previous Tsunami Events

There have been no federally-declared tsunami disasters in Berkeley since the last update. But in January 2023, an underwater volcano erupted near Tonga, resulting in a tsunami advisory for Berkeley. Residents evacuated from boats, docks, and near the shoreline. While there were some noticeable swells and strong current leading to entrance of the Berkeley Marina, there wasn't any reported damage.⁷³

The most recent tsunami to cause damage in Berkeley was associated with the March 2011 earthquake off the coast of Japan. As a result of the tsunami, a half-meter-tall surge was observed nearby in Oakland with 4-6 knot current. The tsunami surge entered the Berkeley Marina, causing \$158,000 of damage to docks and boats.⁷⁴

Tsunamis generally impact the Pacific Coast of California, and reports of tsunamis entering the San Francisco Bay are rare. Tsunamis, or seiches as they are called when they occur within an enclosed body of water, can also be generated within the Bay by the Hayward fault, which passes under San Pablo Bay. The 1868 Earthquake on the Hayward fault is reported to have created a seiche within the Bay. It is unknown whether the seiche impacted the City of Berkeley. The 1964 Alaska earthquake caused extensive tsunami damage that flooded and heavily damaged coastal northern California near Crescent City; data is not available regarding impacts to Berkeley.

B.8.e Probability of Future Events

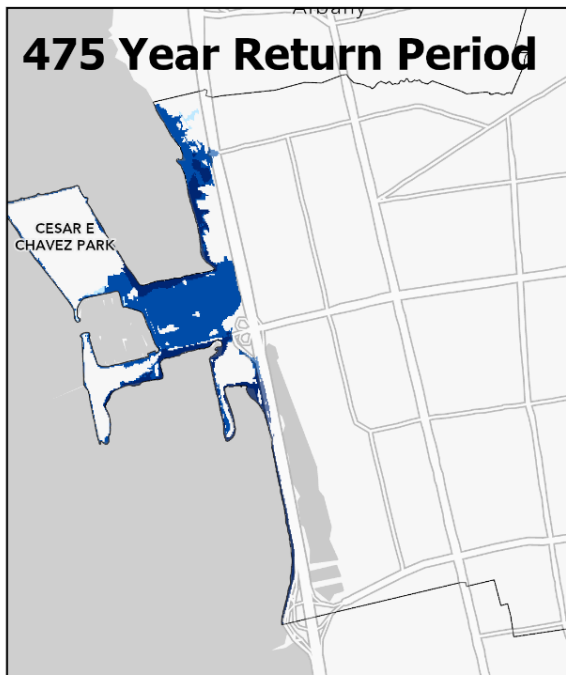
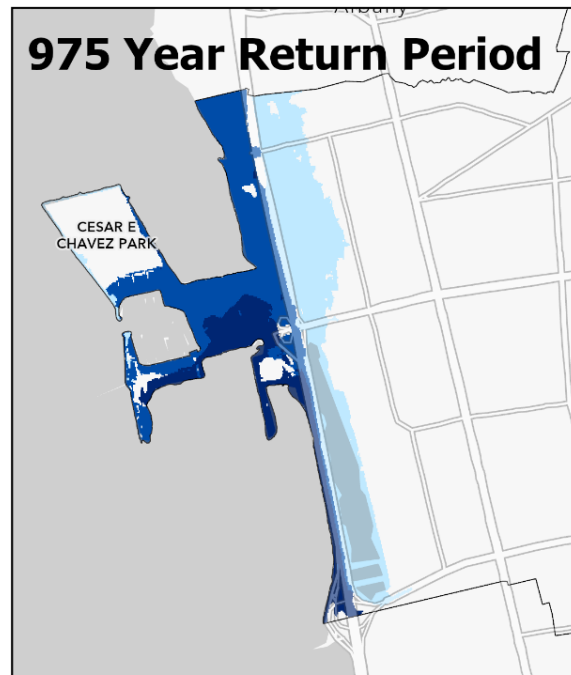
The probability of a tsunami occurring is typically described in return periods, or the estimated average amount of time between events. Map 27 shows the extent of inundation in Berkeley associated with a 100-year, 200-year, 475-year, and 975-year

events.

- A 100-year event has a 1% chance of occurring in a given year.
- A 200-year event has a .5% chance of occurring in a given year.
- A 475-year event has a .2% chance of occurring in a given year.
- A 975-year event has a .1% chance of occurring in a given year. In other words, a 975-year event has a 5% chance of occurring once in the next 50 years.

The areas of impact for these events are fairly similar to the tsunami evacuation phases presented earlier.

Map 27. Inundation associated with 100-year, 200-year, 475-year, and 975-year return periods, 2023



Amplitude in Meters

≤ 3.4

≤ 3.73

≤ 4.05



0.1 0.25 0.5 Miles

State of California, 2023. Probabilistic Tsunami Hazard Analysis Raster Data – Version 1, California Geological Survey and AECOM Technical Services; dated 2023.

California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

B.8.f Vulnerabilities

People

The people most at risk in any kind of tsunami are those that live on boats at the Berkeley Marina. This includes 100 liveaboard households, as well as 13 houseboats, for a total of 113 households. The Berkeley Marina has 1,000 boat slips. Approximately 200 residents live onboard boats in these slips. An additional estimated 13 live onboard houseboats, and regulations permit all slip holders to spend 12 nights per month on their boats.

Everyone who lives in or visits Berkeley's tsunami inundation area (Map 25) is exposed to tsunami. According to ESRI Demographic Data, 1,416 people in 502 households live in Berkeley's tsunami inundation zone. Of that population, 58 households include a member with a disability, 213 include a member who is over 65 years old, and 23 households are below the poverty line. Berkeley's tsunami inundation area has an estimated daytime population of 6,840, including employees, visitors, and people recreating. This data likely undercounts individuals who are unhoused and those that live at the Berkeley Marina as mentioned above.

According to ESRI Demographic Data, there are 448 businesses with 4,821 employees in the tsunami inundation zone. These businesses are estimated to have a high visitor potential, which may make evacuation more challenging, if customers are unfamiliar with tsunamis and or the geography of the area.

Warning systems typically allow for enough notice for at-risk individuals to evacuate. In the event of a distant-source tsunami, where the underlying earthquake does not impact Berkeley, warnings can be issued before the tsunami arrives onshore in Berkeley.

However, the limited number of egress routes will slow evacuations. Evacuations will also be slowed by the pinch point created on the stretch of University Avenue between Marina Boulevard to the west and West Frontage Road to the east. This stretch of roadway is the only eastward driving option out of the Marina.

Evacuation

The numbers of people and assets exposed to a tsunami are relatively low as compared with other hazards presented in this Plan. However, evacuation routes for Marina residents and visitors are limited. Interstate 80 runs north-south along the eastern edge of the Marina, bisecting the area from the rest of the city. There are six access/egress routes from the Marina into Berkeley:

1. Via the University Avenue Bridge
2. Via the frontage road north to Gilman Street
3. Via the frontage road south to Ashby Avenue/CA-13
4. Via Interstate 80
5. Via the I-80 Bicycle/Pedestrian overcrossing⁷⁵

An earthquake occurring in the waters close to Berkeley could cause a near-source tsunami, which would allow for little to no time to provide warning to people in the inundation area. A near-source tsunami could severely compound evacuation challenges

for individuals in the Marina. These evacuation challenges will disproportionately impact people with disabilities and people with access and functional needs. They may not have immediate transportation options to evacuate quickly. Additionally, in the event of a tsunami, they may be separated from their caregivers and may need assistance to evacuate.

Tsunamis can cause the release of pollutants, toxic substances, and other hazardous materials, threatening public health, water, and the environment. Debris and hazardous materials may also impede evacuations and or emergency response.

Structures

Of primary concern to the City is the Berkeley waterfront, which is primarily used for recreational purposes, educational and environmental programming, industrial, non-profit, and commercial operations.

At the Berkeley Marina, existing docks are a range of ages, with an average age of around 40 years old. Many docks are in significantly deteriorated condition. Broken finger docks, utilities, and pilings pose a safety risk to Marina customers and their vessels. This deteriorating infrastructure exacerbates the area's vulnerability to tsunami. D & E docks were damaged badly in the Tsunami of 2011 (and are scheduled to be replaced in 2024), and many finger docks and pilings are still unusable and have not been repaired or replaced. This results in lost revenue to the Marina, lost capacity, and a reduction in the recreational resources available to the public.

Recent tsunami inundation models⁷⁶ provided in the 2018 Harbor Improvement Plan from

the California Geologic Survey have identified a moderate tsunami vulnerability in the Gas Dock, Docks B-K, and Dock O. Docks D and E are considered the area's most vulnerable to modeled tsunami events, with a moderate level of vulnerability to all events. The next most vulnerable are Docks B and C, which have a moderate vulnerability to particular scenario events. In this study, moderate vulnerability was defined as damage to 10% - 90% of cleats and pile guides.

The most significant financial losses to the City of Berkeley in the event of a tsunami would be inundation of the following structures:

- Dona Spring Animal Shelter⁷⁷
- Marina Boat Docks
- Berkeley Yacht Club
- Shorebird Nature Center
- Marina Corporation Yard
- Marina Administration Building
- Skates on the Bay restaurant
- 199 Seawall Drive
- 125-127 University Avenue (office buildings, Berkeley Police Department's Traffic Division are based there)
- Hana Japan Restaurant
- Cal Sailing and Cal Adventures
- Berkeley Marine Center

Other City- and privately-owned facilities of significant value also sit in the tsunami inundation zone. These facilities host a number of businesses and community recreation assets. Tsunami damage could also lead to a drop in revenue to the City from the buildings it leases to others, as well as a drop in tax revenue from businesses operating in the area.

The Tsunami Inundation area includes the DoubleTree Hotel with 378-rooms, many of which are on the ground floor. The DoubleTree regularly hosts events with 500-600 attendees, potentially making it the City's most densely-populated location with tsunami exposure.

The waterfront also includes three restaurants, several offices, commercial boating operations, sailing clubs and businesses, nonprofit offices, two small-scale commuter ferry operations, the Adventure Playground, Shorebird Park Nature Center, Shorebird Park, and an industrial boat yard. A number of waterfront restaurants, such as Skates on the Bay, often have large numbers of customers.

Systems

Tsunamis can damage critical utility infrastructure. This may cause a loss to basis services such as power, sewer, and water. The DoubleTree Hotel is the only business in the area with a generator. See the Utility Disruption Section for details on potential impacts from utility disruption.

Inundation maps show tsunami inundation affecting parking areas and buildings in the Marina. The University Avenue access road is also within the inundation zone. The

University Avenue overpass over Interstate 80 is also shown to be within the inundation zone. While the overpass itself is unlikely to be inundated due to its height, if inundation extends to Second Street, the access ramps on either end of the overpass would be covered, making the overpass impassable.

Natural, historical, and cultural Resources

The Berkeley Waterfront is a public asset and community resource within the City of Berkeley and San Francisco Bay area. The Waterfront is well-loved by the local community, who enjoy the diverse recreational opportunities and the exceptional coastal landscape and biodiversity.

B.8.g Potential Impacts and Losses

Climate change is anticipated to increase the potential impacts and losses associated with tsunamis. With a steadily increasing population, more people will be exposed in the tsunami inundation area. New state laws are mandating increased density throughout the city, which may increase development in the tsunami inundation zone. However, any new development would be required to comply with the applicable regulations to ensure avoidance of and/or adequate mitigation of hazard-induced risk.

Estimating losses from tsunami inundation is difficult given that the inundation maps do not represent inundation from a single scenario event. Inundation from any single event will almost certainly be less severe than depicted in Map 25, which is intended to display worst-case scenario run-up heights from all potential tsunami sources across the Pacific Rim.

SAFRR Analysis

The 2013 SAFRR tsunami scenario⁷⁸ depicts a hypothetical but plausible tsunami, created by an earthquake offshore from the Alaska Peninsula. The study projected impacts on the California coast, which included:

- Pilings in the Berkeley Marina will not be overtopped by tsunami waters, but over half of the docks in California coastal marinas will be damaged or destroyed
- One-third of boats in California coastal marinas will be damaged or sunk
- In Alameda County, tsunami inundation will create \$20 million in building damage and \$164.4 million in damage to building contents
- Wastewater treatment plants in Alameda County will be inundated and could release raw or partially-treated sewage and wastewater-treatment chemicals.

GFOA Analysis

Berkeley is at some risk from tsunami. The worst tsunami that researchers have commonly contemplated is the 1-in-900-year tsunami. This represents a tsunami so large that we would expect to see one that large only once in 900 years. Map 25 shows the area of the City we could expect to be impacted by such a tsunami. A tsunami of this size is expected to impact about 1,400 residents, a daytime population of 6,800, and 448 buildings.

The damage of less intensive tsunamis is substantially less. A tsunami of sufficient intensity to occur only once every 475 years is only estimated to impact 125 residents, 1,100 daytime population, and 14 businesses.

Unfortunately, researchers have not produced usable estimates of projected economic losses from a major tsunami. Further research is needed to fully assess Berkeley's

tsunami hazard, including structural assessment of buildings and infrastructure in the inundation zone, to determine if they are designed and constructed with the strength and resilience needed to resist the effects of tsunami surges.

The City will leverage ongoing research and coordinate with regional, State and federal partners to help answer these questions.

B.9 **Sea Level Rise and Shallow Groundwater Rise**

B.9.a Description of Sea Level Rise and Shallow Groundwater

Sea Level Rise

Sea level rise is an increase in the level of the world's oceans. Warmer temperatures associated with climate change are causing global sea levels to rise through two processes:

- Warmer temperatures are increasing the amount of ice melt from the world's glaciers, ice caps and ice sheets. This melted ice increases the volume of water in the ocean.
- In a process termed “thermal expansion,” warmer temperatures cause ocean water to expand, further increasing the ocean's volume.

Shallow Groundwater Rise

Recent scientific studies have begun to evaluate the impact of the shallow groundwater rising in low-lying coastal areas (like Berkeley) combined with sea level rise. According to the San Francisco Estuary Institute and the Pathways Climate Institute⁷⁹, as sea levels

rise in San Francisco Bay, shallow groundwater underneath low-lying coastal communities will also rise. For this reason, low-lying inland areas could flood from below by emergent groundwater long before coastal floodwaters overtop the shoreline. As groundwater rises, it will increasingly infiltrate sewer systems, flood basements, and damage underground infrastructure. Rising groundwater will also interact with contaminated lands around the Bay, creating a potential exposure pathway that could impact the environment and public health. And rising groundwater will increase liquefaction hazards in response to earthquakes, particularly in former open water, mudflat, marsh, and floodplain areas that have been filled for development. Liquefaction occurs when loosely-packed, water-logged sediments at or near the ground surface lose their strength in response to strong ground shaking.

Connection to climate change

Burning fossil fuels releases carbon dioxide and other heat-trapping gases into the atmosphere; oceans then absorb the majority of this heat. As water becomes warmer, it expands. This results in ocean levels rising worldwide.

The Intergovernmental Panel on Climate Change (IPCC) has identified four potential scenarios that reflect different future scenarios for greenhouse gas concentrations of the atmosphere. The scenarios are known as Representative Concentration Pathways (RCPs). They range from:

- RCP 2.6: Represents stopping all current greenhouse gas emissions, as well as significant carbon sequestration (a negative carbon output), to
- RCP 8.5: Represents continuing and increasing carbon emissions.

Each scenario presents estimates for expected increase in sea level rise as the planet warms and melting rates increase. Table 11 provides analyses of sea level rise projections for the State and the Bay Area under these different climate scenarios in the year 2100.⁸⁰

Table 12. Sea Level Rise Projections in year 2100 for Different Carbon Emissions Scenarios

Source	Carbon Sequestration & Eliminate Carbon Emissions (RCP 2.6)	Significant Carbon Emissions Reductions (RCP 4 .5)	Carbon Emissions Increase (RCP 8.5)
State Projections (Fourth CA Climate Assessment) ⁸¹	N/A	2.4 ft	4.5 ft
Bay Area Projections (Ocean Protection Council) ⁸²	1.6 ft	N/A	2.5 ft

Connection to flooding

Sea level rise increases flooding frequency in the following ways:

- Groundwater table and stream water levels rise, increasing areas subject to flooding.
- Storm surges rise, exposing new areas previously not at risk of flooding.
- Coastal erosion increases, expanding areas exposed to flooding and inundation⁸³.
- Levees and storm walls have to endure increasing loads and may be susceptible to overtopping, making these traditional measures to address sea level rise no longer adequate or financially feasible.

Connection to hazardous materials release

Rising groundwater could push toxic materials stored underground upward, which could

create major impacts on public health and the environment. The City is planning to expand on the new science around groundwater rise combining with sea level rise to better understand specific impacts on hazardous materials in Berkeley.

B.9.b Location of Sea Level Rise and Shallow Groundwater

Sea level rise and shallow groundwater are most prevalent in the western edge of Berkeley along the shoreline. For further details, read the Extent and Anticipated Intensities analysis below.

B.9.c Extent of and Anticipated Intensities of Sea Level Rise and Shallow Groundwater

Sea Level Rise Analysis

An interactive, Bay Area-specific map called the Bay Shoreline Flood Explorer⁸⁴ was produced by the Adapting to Rising Tides (ART) program of the San Francisco Bay Conservation and Development Commission (BCDC), a State agency working to increase the resilience of San Francisco Bay Area communities to sea level rise and storms.

Three maps below depict the permanent inundation that may occur based on sea level rise of 2 feet, 4 feet, and 5.5 feet. These maps indicate that sea level rise is expected to mainly affect the shoreline areas of Berkeley. The Berkeley Waterfront is the most vulnerable.

These maps were purely based on topography and do not account for riverline flooding, wave hazards, groundwater, erosion and subsidence, marsh vegetation, and salt ponds and wetlands.

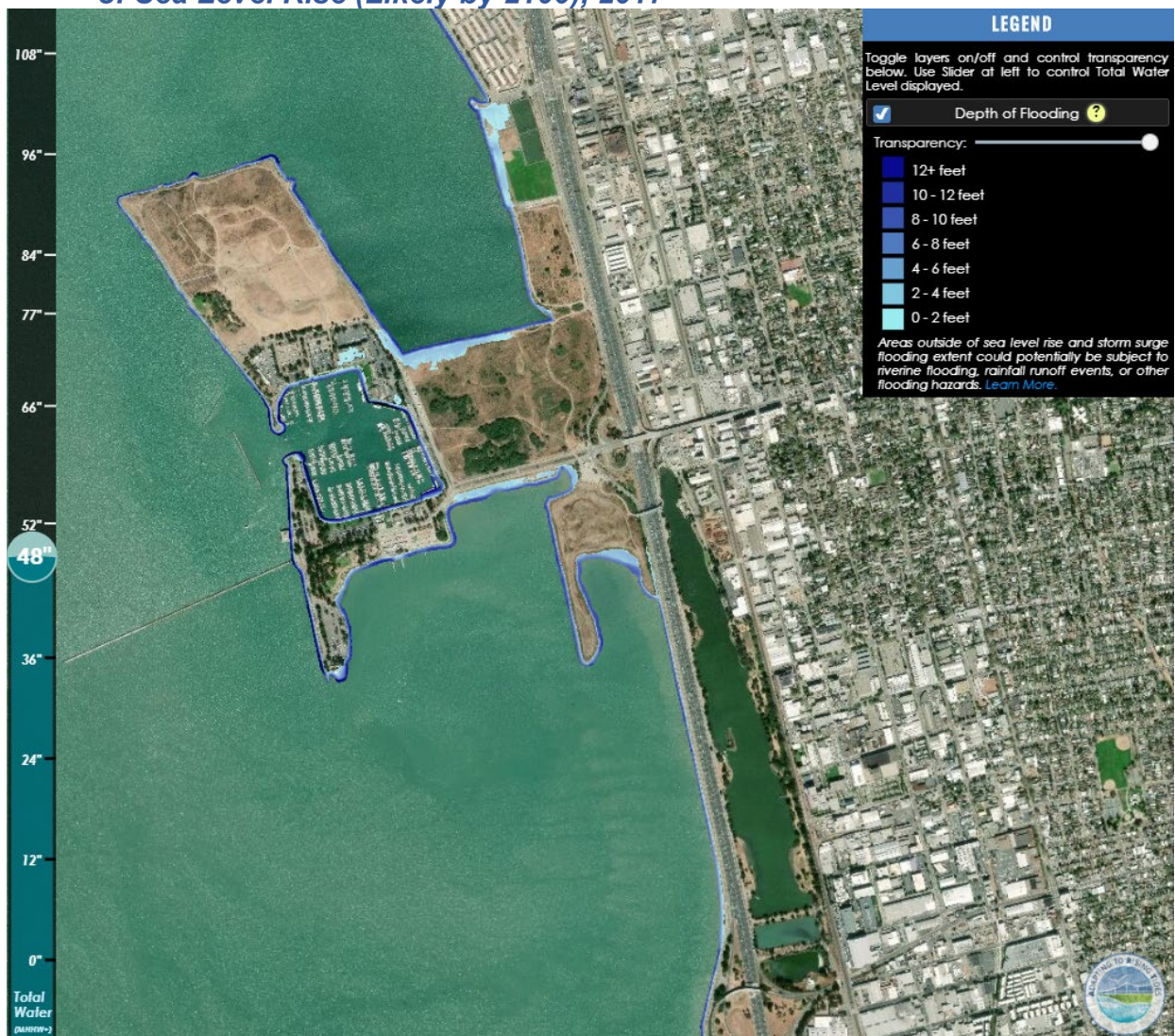
Map 28 shows that with two feet of sea level rise, which is considered very likely by 2100, the Berkeley shoreline will experience shallow inundation, with small sections of the northern and southern edges of McLaughlin Eastshore State Shoreline experiencing inundation further in.

Map 28. Berkeley Shoreline Areas Prone to Permanent Inundation due to 2-ft of Sea Level Rise (Very likely by 2100), 2017



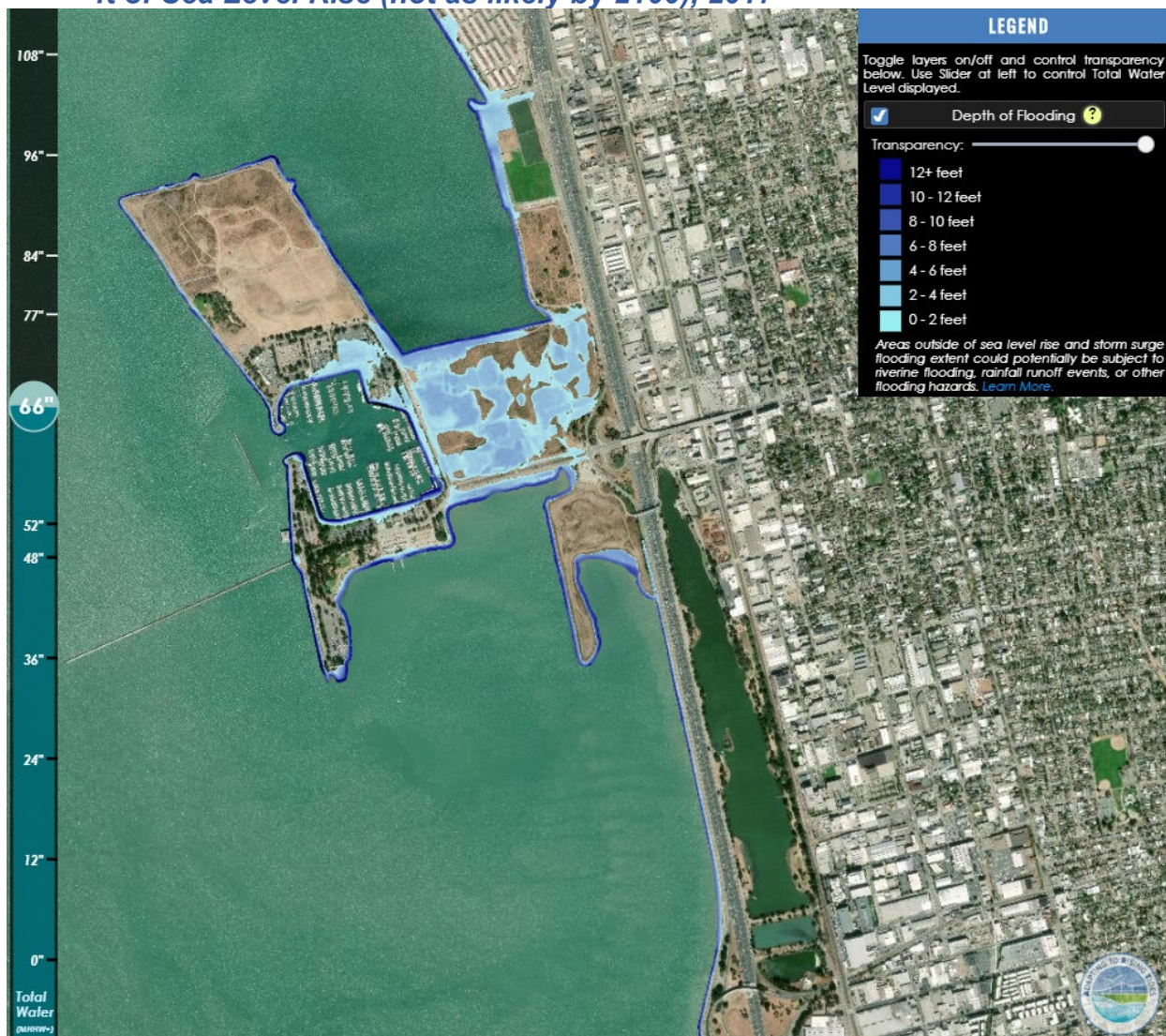
Map 29 shows that with four feet of sea level rise, which is considered likely by 2100, all of Berkeley's coastline will experience at least some inundation. Areas along the northeastern corner of the Marina, where the Doubletree hotel is situated, are expected to receive some inundation. Further inundation is expected along the edges of the McLaughlin Eastshore State Shoreline. Additionally, shallow inundation is expected in the northwestern corner and western edge of the Tom Bates Regional Sports Complex.

Map 29. Berkeley Shoreline Areas Prone to Permanent Inundation due to 4-ft of Sea Level Rise (Likely by 2100), 2017



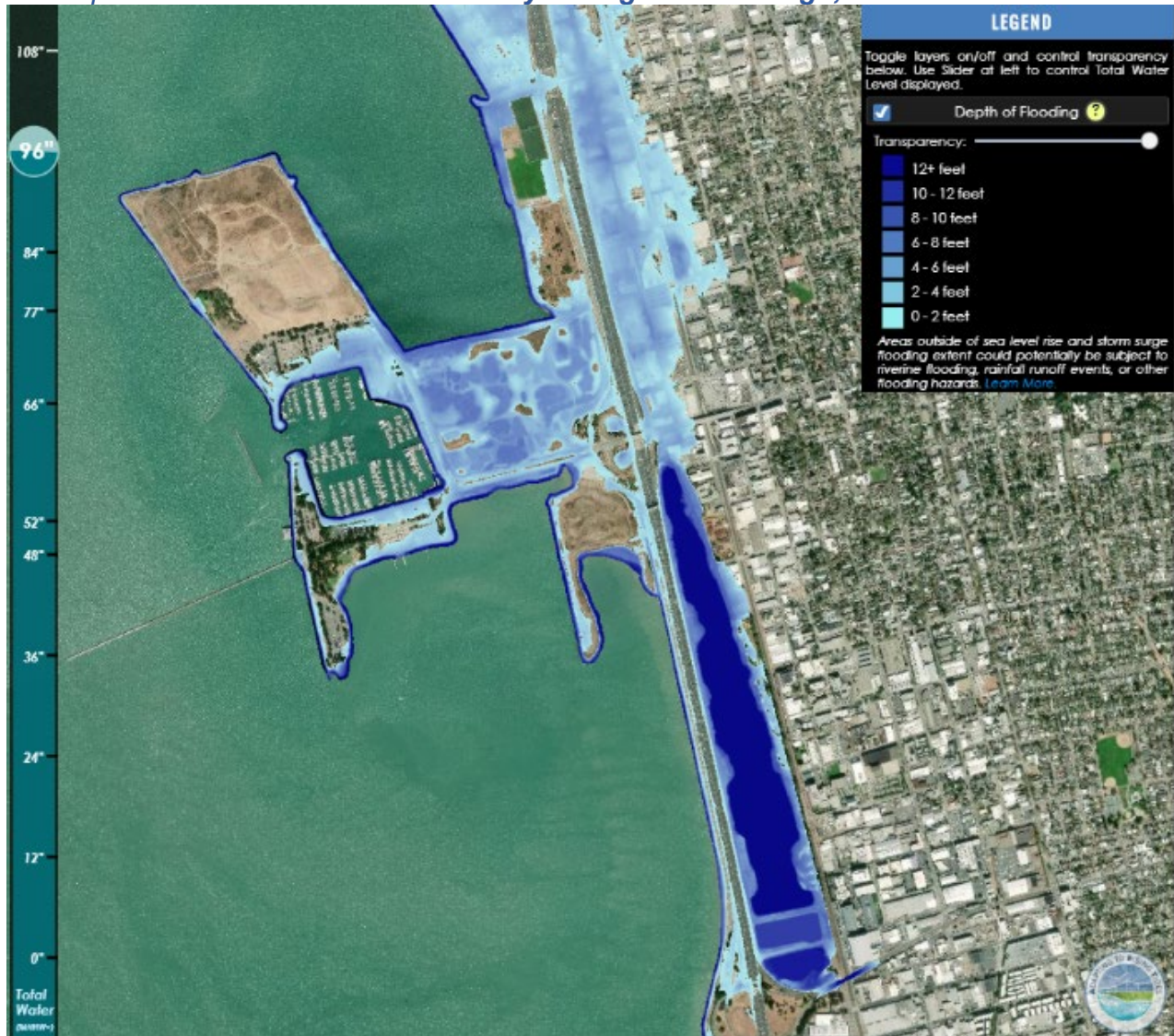
Map 30 shows inundation from 5.5 feet of sea level rise, which is not as likely by 2100 but still possible. In addition to inundated areas in the other scenarios, 5.5 feet of sea level rise will inundate the majority of the McLaughlin Eastshore State Seashore with varying depths of water. Areas along the northeastern corner of the Marina, where the Doubletree hotel is situated, will be further inundated. Inundation also increases along the western side of the Tom Bates Regional Sports Complex.

Map 30. Berkeley Shoreline Areas Prone to Permanent Inundation due to 5.5-ft of Sea Level Rise (not as likely by 2100), 2017



Map 31 below layers another hazard – a 25-year design storm – atop the 5.5-foot sea level rise scenario presented in Map 3. With these combined hazards, water could inundate Interstate 80 and potentially as far east as Fifth Street in Berkeley.

Map 31. 5.5 ft Sea level rise + 25-yr design storm surge, 2017



Groundwater Rise Analysis

New data and maps from the Pathways Climate Institute LLC and the San Francisco Estuary Institute provide insight into how rising groundwater can impact coastal communities and interact with sea level rise.

Map 32 shows that Berkeley already faces high groundwater (within six feet of the ground surface) in multiple areas, posing risks to underground infrastructure that is mostly built within 6 feet of the surface. However, emergent groundwater is limited to a small area in the northeast corner of McLaughlin Eastshore State Seashore.

Map 33 presents future groundwater level projections associated with the sea level rise scenarios presented in Maps 28-31, as well as another worse sea level rise scenario.

Map 32. *Current Conditions Map of Depth to Groundwater in Feet, 2024*



Current Conditions Map



SFEI Update: 12/16/22

California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS, SFEI, City of Berkeley OES 10/29/24

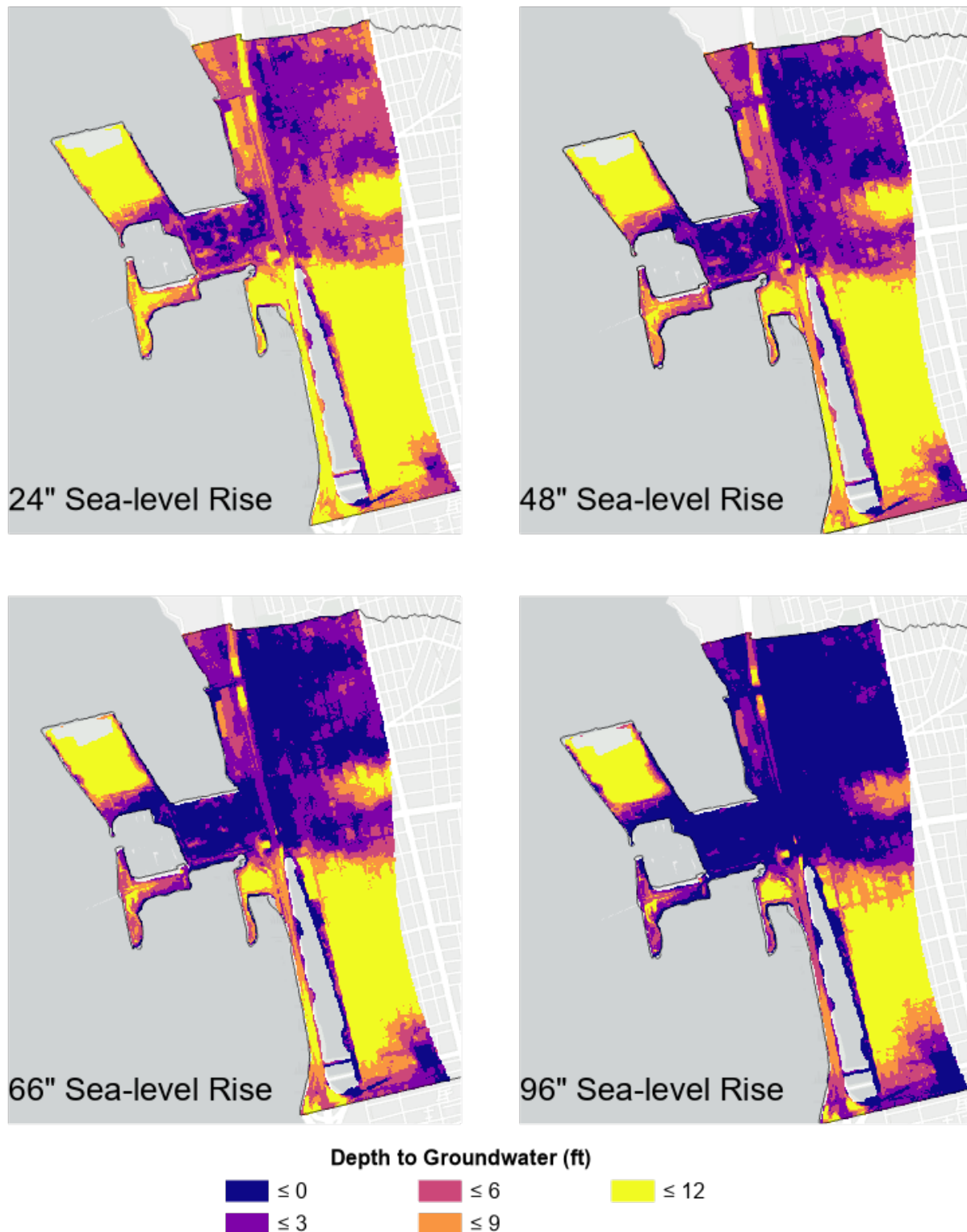
Combined Effects of Sea Level Rise and Groundwater Rise

Sea level rise analysis shown in Maps 28-31 is purely based on topography and does not account for groundwater rise. Groundwater levels presented in Map 32 reflect current conditions but do not consider future sea level rise scenarios.

In these scenarios, emergent groundwater begins to appear in dark blue. Emergent groundwater is when the groundwater surfaces, making the depth of the groundwater zero. Emergent groundwater can damage surface infrastructure like roadways and add to surface flooding, especially during rain events. As sea level rises, more emergent groundwater is projected.

- At 24" sea level rise (very likely by 2100), we begin to see "emergent" groundwater.
- At 48" sea level rise (likely by 2100), emergent groundwater increases, particularly in West Berkeley north of University Avenue.
- At 66" sea level rise (not as likely by 2100), emergent groundwater is apparent in about half of the Berkeley area north of University Avenue.
- At 96" sea-level rise (probability currently unknown) a large portion of West Berkeley north of University Avenue is covered by emergent groundwater.

Map 33. Comparison Maps of Depth to Groundwater at 24", 48", 66", and 96" Sea Level Rise, 2024



Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Pathways Climate Institute, San Francisco Estuary Institute

B.9.d Previous Sea Level Rise Events

It is estimated that the San Francisco Bay has already risen approximately eight inches since 1900.⁸⁵

There have been no federally-declared sea level rise disasters in Berkeley since the last update.

B.9.e Probability of Sea Level Rise

Sea level rise in the Bay Area will continuously rise in the next few decades, but most considerably in the latter half of the 21st century. The probability of sea level rise relates to future greenhouse gas emissions, as is described in Table 12.

Recent studies have suggested that the Antarctic ice sheets are melting at rates much faster than previously reported.⁸⁶

B.9.f Vulnerabilities

People

Sea level rise will have disproportionate impacts on disadvantaged communities in Berkeley. For example, the areas most likely to experience flooding with increased sea level rise are in West Berkeley, which has a higher percentage of communities of color and low-income communities. These are the same neighborhoods that were historically redlined, have poorer air quality, and experience higher incidents of hospitalization due to asthma. West Berkeley also has a history of industrial buildings and usage, resulting in more hazardous materials stored underground. As the groundwater table rises along with the sea level, these materials can also rise and move, causing environmental and

public health hazards.

Structures

Consideration of storm surge and other compounding flooding risks on structures is increasingly important, particularly when designing infrastructure with finite effectiveness, such as sea walls or barriers. Both permanent inundation from sea level rise as well as more frequent and more extensive flooding events will need to be considered in long-term planning along Berkeley's coast.

The 2019 Draft Berkeley Marina Area Sea Level Rise Assessment is a site-specific analysis for compliance with State requirements in AB 691. The document identifies three locations in the Berkeley Waterfront that are most susceptible to intermittent inundation in the future due to sea level rise:

1. Virginia Street Extension (north shore of McLaughlin Eastshore State Seashore) intersection with Marina Boulevard
2. South Shore of University Avenue
3. North-East side of the Berkeley Inner Harbor.

The 2019 Draft Berkeley Marina Area Sea Level Rise Assessment is a living document and will be used to inform future City of Berkeley projects and development at the Marina.

Systems

As sea levels rise, storms could cause key underpasses and roads accessing Highway 80, including Ashby Avenue (State Highway 13), to flood more often or be permanently inundated, impacting transportation on this major regional artery.

Berkeley's stormwater and sanitary sewer pipes are vulnerable to inundation. In addition, flooding resulting from sea level rise in combination with severe storms may threaten natural gas pipelines regionally. Prolonged and more frequent inundation from sea level rise can accelerate structural failures and threaten the functionality of California's natural gas distribution system.⁸⁷ This infrastructure vulnerability can lead to disrupted service and the leakage of methane gas from the system. Methane is both a health and safety hazard as well as a highly potent greenhouse gas, further contributing to climate change.

Cultural and Natural Resources

According to the 2019 Draft Berkeley Marina Area Sea Level Rise Assessment, in Berkeley the major risk of sea level rise to the shoreline is the loss and/or degradation of the revetment, which is a structure intended protect the bank from erosion. This could jeopardize the landfill of César E. Chávez Park, causing erosion and loss of landmass. There is a potential of erosion and loss of the integrity of both the San Francisco Bay Trail Spur and University Avenue.

Several trails and access to the Marina viewing points and coastal access will be impacted by projected sea level rise. Degradation of the trails will make walking and running less accessible and will also cut off potential for small boat recreation.

Damage to natural resources includes potential damage to the protected natural area within César E. Chávez Park and the Western Burrowing Owl habitat, both located in the northeast corner of the park. Because there is significant inundation within the McLaughlin Eastshore State Seashore, any habitat within the grassland will be significantly impacted starting in 2030.

Sea level rise will inundate beaches and shoreline habitats. These changes are expected to substantially alter the Bay ecosystem, reducing wetlands, and adversely affecting water quality and wildlife.⁸⁸

Landfilled areas and areas experiencing drought—both common in the Bay Area—are particularly susceptible to land subsidence, which is the gradual settling or sudden sinking of land.⁸⁹ In the Bay Area, this includes developed areas that sit on top soft compressible bay mud.⁹⁰ Land subsidence can expand areas susceptible to sea level rise as these areas sink while sea levels are rising to meet them.⁹¹

Scientists predict that climate change will have many effects on freshwater and marine environments. These effects, along with nutrient pollution, could increase the frequency, intensity, and exposure to harmful algal blooms. Algal blooms endanger human health, the environment, and the economy. Sea level rise would create more shallow and stable coastal water, conditions that are perfect for algae growth.⁹²

Activities that have value

The Berkeley Waterfront is a critical community asset for recreation, education, and local businesses. Recreation activities occur both on land and surrounding waters. Nonprofit sailing clubs operate out of the Berkeley Waterfront and many boaters and fishers use the area. Recreation areas on land include César E. Chávez Park, Shorebird Park and the Shorebird Nature Center, Horseshoe Park, and Adventure Playground. César E. Chávez Park features a bird habitat, and an off-leash dog area.

Many businesses operate out of the area, including restaurants, the DoubleTree hotel,

boat repair/storage facilities, and stores. In the Berkeley Marina, there are about 1,100 boat slips including about 100 liveaboard slips. Additionally, two small-scale commuter ferries operate out of the Berkeley Marina along with fishing charter boats.

B.9.g Potential Impacts and Losses

Potential financial impacts to the Berkeley Marina caused by projected sea level rise include damage to commercial and public buildings and infrastructure, loss of public resources, loss of habitat and natural resources, and loss of berth rental revenue to the City.

All current and upcoming capital projects in the Berkeley Marina near the shoreline band will be designed to be resilient to mid-century sea-level rise and be adaptable to end of century. These projects' sea level rise mitigation measures will be reviewed and approved by Bay Conservation Development Commission's permit review process, ensuring the latest sea level rise requirements are being met by the design.

Table 13. *Estimated costs from sea level rise at Berkeley Waterfront*

Cost Type	Current	2030	2050	2100
Repair, Replacement, Maintenance ^[ii]	\$0	\$0	\$3,019,000	\$17,0940,000
Losses in nonmarket value ^[iii]	\$0	\$0	\$0	\$12,000,000
Adaptation costs ^[iv]	\$0	\$1,050,000	\$11,050,000	\$15,592,600

According to BayAdapt, a regional Bay Area sea level rise organizing effort coordinated by the Bay Conservation Development Commission, the following are at risk of flooding in 48" of sea level rise throughout the Bay Area:

- 28,000 socially vulnerable residents
- 1,900 residents living near contaminated sites
- 13,000 existing housing units
- 70,000 new housing units
- 104,000 existing jobs
- 85,000 new jobs
- 20,000 acres of wetlands, lagoon, and tidal marsh habitat
- 5 million daily highway vehicle trips
- 60,000 daily rail commuters

B.10 **Floods**

B.10.a Description of Floods

Floods occur when there is an overflow of water in areas that are normally dry. In Berkeley, three types of flooding typically occur: coastal flooding, creek flooding, and storm drain overflow.

Coastal Flooding

Coastal flooding occurs when water inundates or covers normally dry coastal land as a result of high or rising tides or storm surges. Higher tides and sea level rise reduce creek and storm drainage flow capacity in the western portions of the City. See the Sea Level Rise section of this Plan for more information.

Creek Flooding

Like in many urban areas, creeks in Berkeley have been affected by urban development. Stretches of creeks in Berkeley are completely contained by culverts, and open channel segments of the creeks are often segmented by shorter culverts that enable streets and development.⁹³ Creeks in west Berkeley flow year-round. The upper reaches of creeks only flow for a short time after rainfall. When the level of runoff exceeds the capacity of a creek, the flood waters overtop the banks and flood into properties and streets. Creek flooding in Berkeley generally originates on private property. Blockages can happen in creeks, thus the City increases cleaning efforts on the right of way ahead of and during significant rainfall events. Residents are responsible for maintaining creeks and related infrastructure within their property.

Storm Drain Overflow

The City's storm drainage infrastructure collects urban runoff and carries it either directly to the Bay or to nearby watercourses that discharge to the Bay. Causes for storm drain overflow are generally rainfall events that exceed the capacity of the storm drainage facilities, blockages in the storm drainage facilities, or damage to storm drainage infrastructure that reduces its capacity.

When storm water runoff exceeds the capacity of the storm drain infrastructure, the excess water flows into city streets. Most of Berkeley's storm drain infrastructure is engineered to accommodate a 10-year design storm.⁹⁴ Using this 10-year design storm standard is considered the most cost-effective design practice, and provides guidance for computing flows and for sizing storm drainage infrastructure.⁹⁵ Maintenance helps preserve the flow capacity of the infrastructure, reducing the frequency of flooding, however many components of Berkeley's storm drain infrastructure are over 90 years old and are past their useful life expectancy. Concrete pipes have eroded or separated and metal pipes have corroded over the years. In some locations sink holes have formed as soil enters the storm drain through cracks and other defects.

Connection to Climate Change

Climate change increases the intensity and severity of rainfall events, which leads to more frequent flooding. Climate change also creates sea level rise, which in turn will lead to rising groundwater, increasing flood risk. For more information, review the Sea Level Rise section of this Plan.

Connection to Infectious Diseases

According to the National Institutes of Health, the risk of viral infection increases after a flood.⁹⁶ Floods can increase the transmission of viral diseases, especially waterborne infections, vector-borne diseases, and respiratory infections.

Connection to Utility Disruption

An unknown number of property owners rely on electric sump pumps to keep their homes and buildings free from water during the rainy season. A power outage that disables sump pumps during a storm can lead to flooding inside structures.

Connection to Sea Level and Shallow Groundwater Rise

New studies have linked sea level rise and groundwater rise to increased flood risk in the San Francisco Bay Area.⁹⁷ For more information, review the Sea Level Rise section of this Plan.

B.10.b Location of Floods

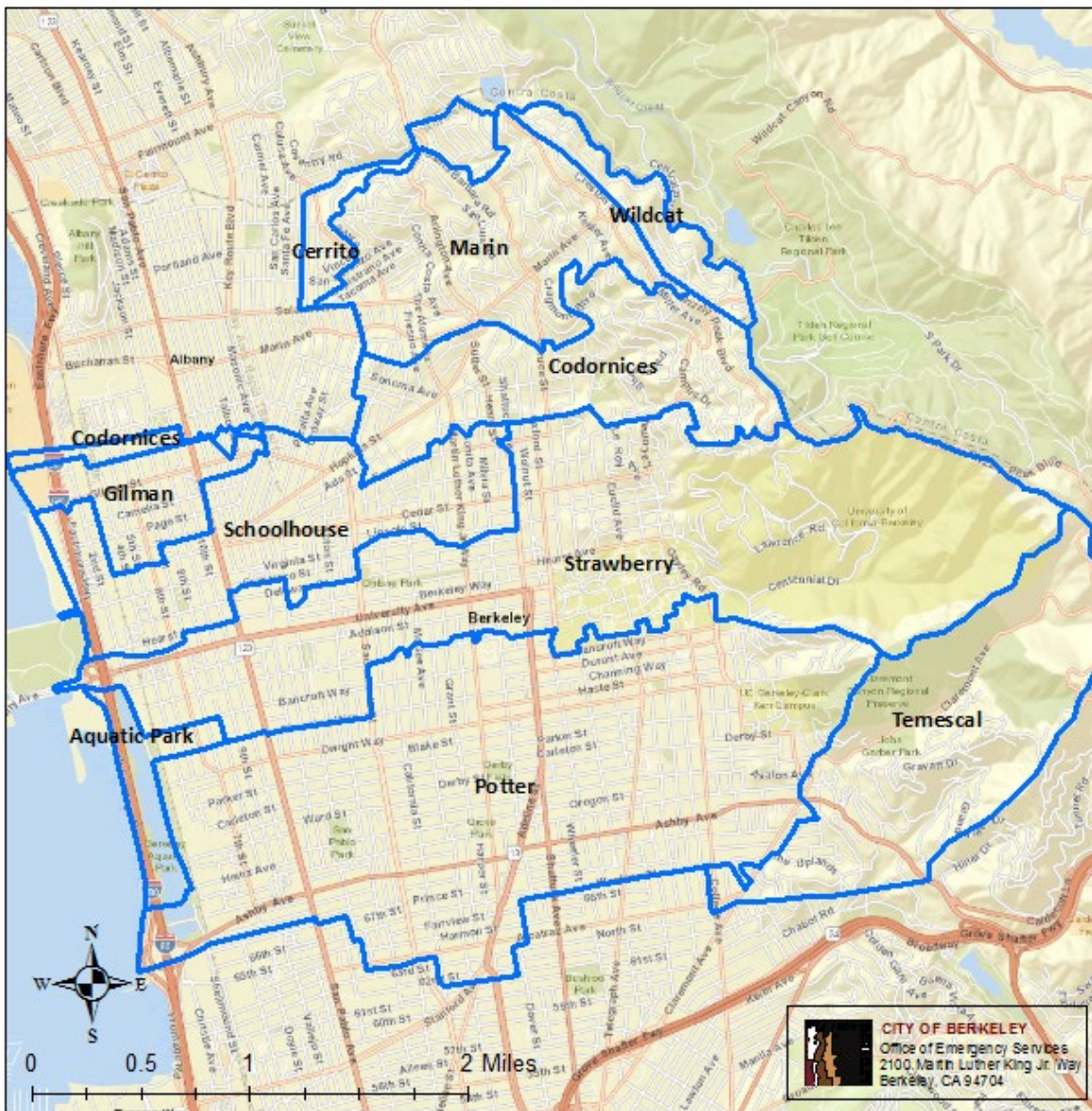
The City maintains approximately 93 miles of storm drain pipelines and appurtenant structures in the public right-of-way and in easements. The City is responsible for the maintenance of approximately 0.5 miles of open creeks and nearly 4 miles of creek culverts running in the right of way or in City owned properties. A majority of the City's stormwater assets are nearing or past their expected useful life and others require an evaluation of hydraulic capacity.

Map 34: *Berkeley Area Watersheds* shows Berkeley's watersheds:

- Codornices

- Marin
- Cerrito
- Wildcat
- Strawberry
- Schoolhouse
- Aquatic Park
- Potter
- Temescal
- Gilman

Map 34. *Berkeley Area Watersheds, 2019*



Source: Stormwater Plan (1984) identified 10 major drainage systems in Berkeley. Last updated 2004.
 Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community



Storm Drain Overflow

In 2011 the City's Public Works Department developed the Watershed Management Plan (WMP), which examined two of the watersheds in the City, represented in Map 34: *Berkeley Area Watersheds*. The Potter and Codornices Watersheds were selected because they represent the full range of the urban drainage spectrum in Berkeley.⁹⁸

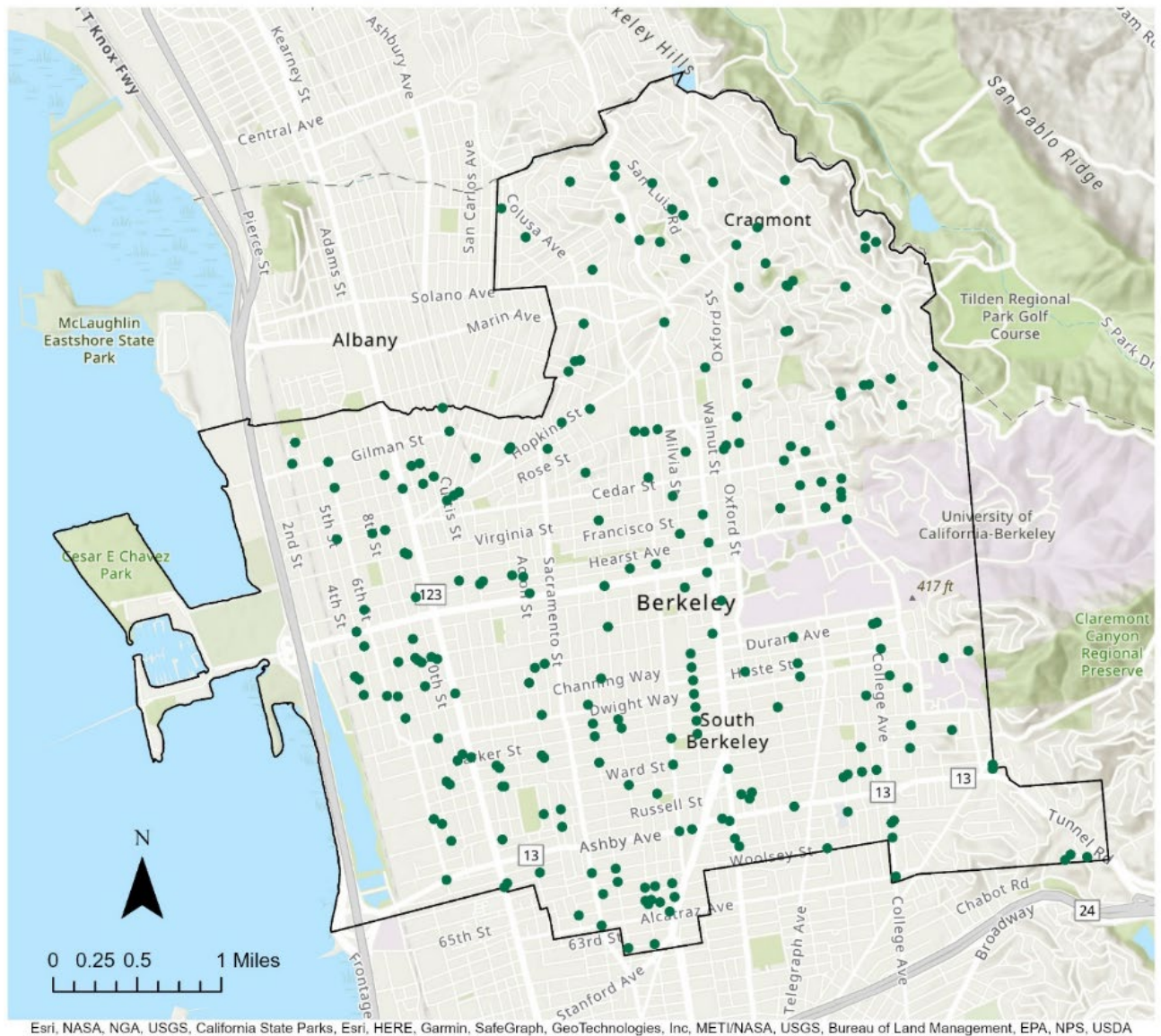
- The Potter Watershed is the largest in the City. It experiences localized flooding in many areas, and contributes some runoff to the Aquatic Park Lagoons. Tidal effects from the Bay also influence flooding issues in the Potter Watershed. This is due to the water surface of the Bay effectively reducing the discharge ability of the storm drain outfall to the Bay.
- The Codornices Watershed is regionally significant as Codornices Creek is one of the least culverted creeks in the East Bay; and is one of the few with a salmonid population.

The City is working with a contractor to develop a comprehensive stormwater master plan, which is expected to be completed at the end of 2025.

Areas of Observed Storm Drain Overflow

During storms and flooding, community members call Berkeley's 3-1-1 service to report locations of storm drain backup or other locations where water is pooling. Map 35 presents locations of community reports of these issues from January-June, 2023. This time period included two federally-declared storm emergencies. This map does not reflect locations of proactive work performed by field crews to mitigate or respond to flooding. It also does not distinguish between locations with multiple calls for service. The map shows locations throughout Berkeley.

Map 35. **Community Storm Calls for Service, Jan-June 2023**



Esri, NASA, NGA, USGS, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Creek Flooding: FEMA National Flood Insurance Program

Berkeley's creek flooding exposure is assessed through the National Flood Insurance Program (NFIP), which makes federally-backed flood insurance available to homeowners, renters, and business owners in participating communities. Participants in the NFIP must regulate development in floodplain areas in accordance with NFIP criteria.

Berkeley has participated in the NFIP since September 1, 1978 and is currently in good standing with the program. NFIP compliance is monitored by FEMA regional staff and by the California Department of Water Resources under a contract with FEMA.

Berkeley's Areas of Predicted Flooding Map shows the locations of various flood hazards that could affect the city, including:

1. Locations of the 100-year and 500-year Floodplains, sourced from FEMA's National Flood Hazard Layer tool in September 2023.
2. Street segments in the 100-year Floodplain and the 500-year Floodplain.
3. Anticipated street flooding due to storm drain overflow, sourced from the Watershed Management Plan.

Floodplains

The 100-year Floodplain shows the area that has a 1% chance of experiencing creek flooding in any given year. The 500-year floodplain has a 0.2% chance of experiencing creek flooding in a given year. Areas in the 100-year floodplain are assumed to also flood in a 500-year flood scenario. Because floods reaching the level of the 500-year Floodplain occur so rarely, they are not as well-researched and specific impacts are less known.

100-year Floodplain

As shown in Map 36: *Flood Zone Map* in medium blue, in Berkeley the 100-year Floodplain is located:

- Along the edge of the Bay
- Along the interior edge of the Aquatic Park lagoon
- Along Codornices Creek in northwest Berkeley
- Along Strawberry Creek in central Berkeley (on the University of California campus).

The following street segments are in the 100-year Floodplain:

- Along Codornices Creek: 580 Highway, 2nd St, 5th St, 6th St, 8th St, 9th St, 10th St, Sacramento St, Monterey Ave
- Potter St
- Bay St
- W Frontage Rd
- On the UC Berkeley campus: Frank Schlessinger Way, W Entrance, Wickson Rd

500-year Floodplain

As shown in Map 36: *Flood Zone Map* in light blue, the 500-year Floodplain both expands on areas in the 100-year floodplain, and adds more area to show:

- Additional inundation along the edge of the Bay
- Significant inundation of the McLaughlin Eastshore State Park in the land north of University Avenue
- Significant inundation of the Marina in the land west of Marina Blvd and south of Spinnaker Way

- Inundation in west Berkeley between Interstate 80 and approximately 4th Street
- Inundation along Strawberry Creek in Central Berkeley, from Sacramento west to Strawberry Creek Park
- Inundation along Claremont Creek in the Temescal area, on Claremont between Hazel Road to Berkeley's southern border.

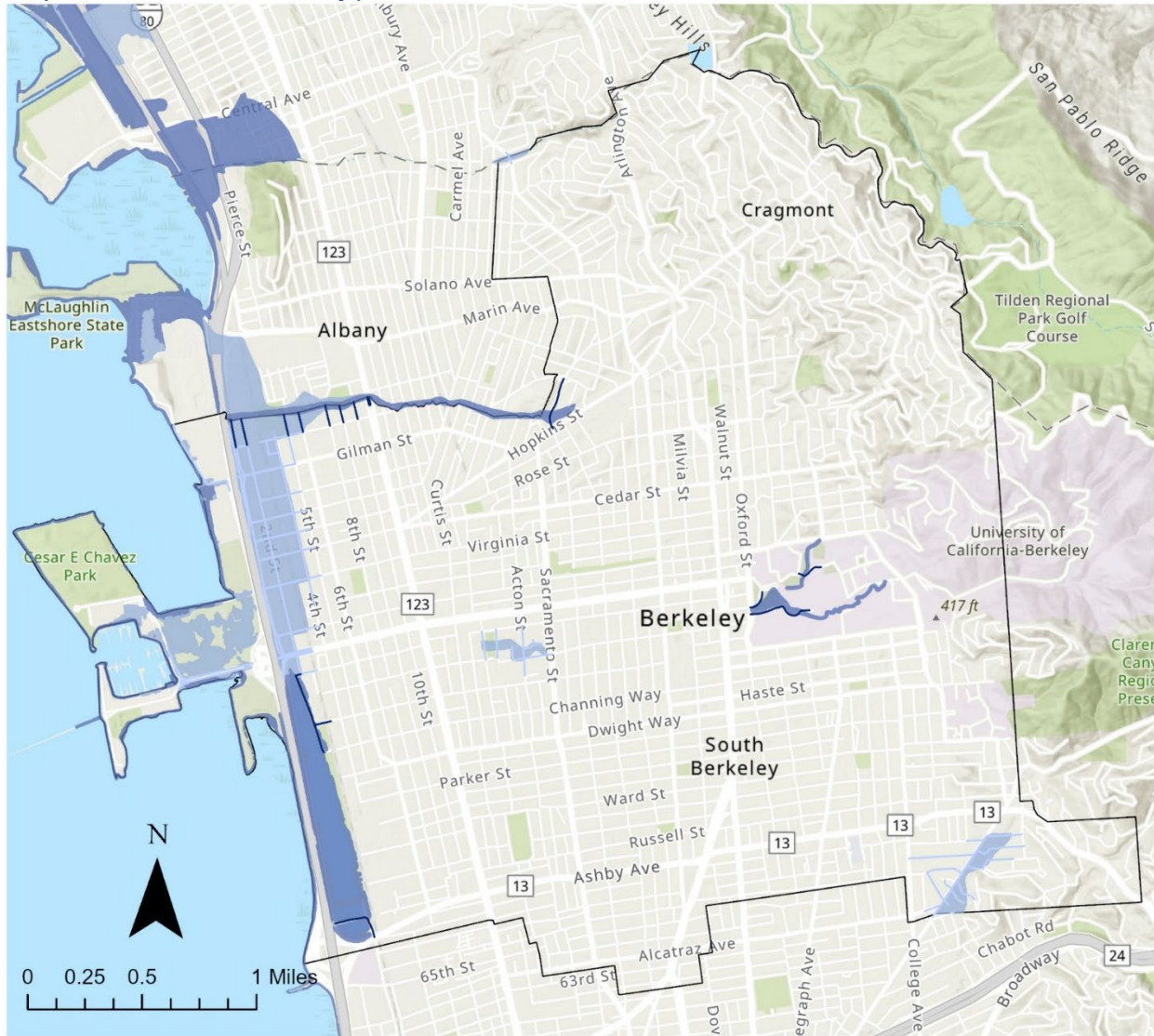
The following street segments are in the 500-year Floodplain:

- West Berkeley:
 - I-80
 - 1st St (From Harrison St to Addison St)
 - 2nd St (From Harrison St to Addison St)
 - 3rd St (From Harrison St to Addison St)
 - 4th St (From Harrison St to Addison St)
 - 5th St (From Harrison St to Addison St)
 - University Ave (Near Marina)
- North Berkeley:
 - Colusa Ave (along Cerrito Creek)
- Central Berkeley:
 - Allston Way (From N Valley St to Sacramento St)
 - Bonar St (Between Addison St and Allston Way)
 - West St (Between Addison St and Allston Way)

- N Valley St
- Acton Crescent
- Acton Circle
- Acton St (From Addison to Acroft Ct)
- Claremont:
 - Claremont Ave (Between Hazel Rd and Mystic St)
 - Alcatraz Ave (From Lewiston Ave to Claremont Ave)
 - Eton Ave
 - Eton Ct
 - Brookside Ave
 - Hillcrest Rd (Only near Claremont Creek)
 - Woolsey St (Between Eton Ave and Claremont Ave)
 - The Uplands (Only Near Claremont Creek)
 - Encina Pl
 - The Plaza Dr
 - Prince St (From College Ave to Claremont St)
 - Oakvale Ave

- Hazel Rd
- Webster St (Between Pine Ave and Claremont Ave)

Map 36. **Flood Zone Map, 2023**



Flood Zone Map

Street Segment in 500-Year Floodplain

Street Segment in 100-Year Floodplain

FEMA Floodplains

- 100 Year Floodplain
- 500 Year Floodplain

FEMA National Flood Hazard Layer
Last updated for Alameda County: June 22, 2020

Esri, NASA, NGA, USGS, FEMA, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Stormwater Master Plan

The City is working with a contractor to develop a comprehensive stormwater master plan (SWMP), which is expected to be completed at the end of 2025. The SWMP will provide an updated inventory of system-wide deficiencies and establish a capital stormwater improvement plan to address these deficiencies based on an equity and risk-based prioritization model. The SWMP will also provide updated maintenance and inspection plans for the City's stormwater assets and identify green infrastructure implementation opportunities. The SWMP will analyze potential funding mechanisms to supplement current funding levels for the program as needed to support enhanced operations, regulatory compliance implementation, and capital improvements identified in the master plan.

B.10.c Extent of Floods and Anticipated Intensities

Floods can last for a few minutes to a few weeks. This timing often depends on the duration of the rainfall and the land on which it occurs. In low and flat areas, slow moving water can linger for days or weeks. Excessive rainfall from winter storms is the most common cause of flooding between November and March.

The following factors contribute to the frequency and severity of flooding in a given event:

- Rainfall intensity and duration
- Existing saturation
- Features of the watershed
- Natural features
- Coastal conditions

For example, an intense rainstorm at the end of a rainy winter when soils are already saturated is more likely to result in flooding than if the same storm occurs at the beginning of the rainy season when soils are not as wet.

Depth and velocity are common ways of measuring the severity of a flood. These provide information on how deep the water is and how fast it is moving. The depth and velocity of a flood are good predictors of how much damage it may cause.

B.10.d Previous Flood Events

Berkeley's most recent flooding occurred in December 2022 and January 2023 when a powerful series of storm systems brought more than 15 inches of rain. This much rain in a 20-day timeframe occurs only once every 50 years, according to the National Oceanic Atmospheric Agency (NOAA). The winter months of 2023 had several severe storms that included flooding, high winds, and landslides. During January to April 2023, there were three federally declared disasters in Alameda County, including DR-4699, DR-4683, and EM-3591.

In October 2022, an atmospheric river brought heavy rains and strong winds to Berkeley, resulting in nuisance flooding as well as many downed trees and powerlines.

In 2004, widespread flooding occurred throughout Berkeley during a 25-year rainfall event. Flooding also occurred during the 1997 - 1998 El Niño season.

In the early 1960s, the Strawberry and Codornices Creeks overflowed, along with flooding of streets and intersections. The flooding was of short duration and shallow depth and occurred in small areas. A few buildings flooded, including some on the University of

California, Berkeley campus.

B.10.e Probability of Future Events

According to the National Oceanic and Atmospheric Administration Storm Events Database, there have been an estimated 45 days with flooding in Alameda County in the last 20 years. This equates to about 2 days per year, as an estimate. Climate change will likely bring stronger storms with heavy rains, increasing the number of days per year of flooding in Alameda County.

B.10.f Vulnerabilities

People

The 100 year and 500 years floodplains are concentrated in west Berkeley along the Bay and around the Aquatic Park. West Berkeley has historically been the home to underserved communities and marginalized populations, including people experiencing homelessness. People in West Berkeley may not have the resources to take household mitigation measures and or manage the impacts of floods if they occur.

Floods pose a number of risks to people. Serious injury or death can occur when people do not evacuate areas that are flooded or enter floodwaters. Urban runoff and flooding can also result in contaminated drinking water and an increase in the transmission of infectious diseases. Mold and mildew can also grow on any damp surface within 24 to 48 hours, posing additional serious health risks to people and animals.

Structures

Flooding can cause serious damage to buildings. Floods can cause structural damage,

such as loose floors or foundation cracks. There may also be broken electrical wires, appliance damage, damage to water and septic systems, and mold and mildew.

Heavy rains can also put stress on culverts. Berkeley is underlain by a patchwork of creek culverts, most privately constructed and over 100 years old. A culvert failure could be physically and economically catastrophic in an area such as Downtown Berkeley where buildings have deep basements, many underground utilities, and streets are congested with vehicle and pedestrian traffic. Most culverts are located on private property, with some located beneath private improvements. Failure of a private culvert may cause significant damage to private property, and require improvements to that property. The City intends to repair culvert breaks beneath public property as-needed, as it currently does if there is a break in a storm drain. However, many private property owners are unaware that improvements on their property may be situated above a culvert.

Flooding can impact utilities, including power, water, and gas. Severe storms and deep waters can damage power lines and underground infrastructure, impacting buildings and other infrastructure.

Systems

In past rainfall events, flooding along low-lying roadways has hindered traffic flow. Low-lying underpasses leading to Interstate 80, as well as highly-trafficked city streets, have flooded. This creates traffic impacts for community members and first responders.

Natural, historic, and cultural assets

Local gardens face a threat of contamination if they are exposed to urban runoff. Heavy

storm water runoff can contaminate the ocean, lakes, and other bodies of water with other bacteria.⁹⁹

B.10.g Potential Impacts and Losses

The potential impacts and losses associated with floods are expected to increase due to climate change. Berkeley's population continues to steadily increase, adding people exposed to the area's hazard and their cascading impacts. The 100 year and 500 years floodplains are concentrated in west Berkeley along the Bay and around the Aquatic Park. These areas haven't changed since the last update, and development in this area of the City is characterized by industrial and heavy commercial uses, although there is some residential development. Any new development would be required to comply with the applicable regulations to ensure avoidance of and/or adequate mitigation of hazard-induced risk.

GFOA's Flood Analysis

In 2006, Berkeley, along with 16 other cities in Alameda and Contra Costa counties experienced a storm that was severe enough to receive assistance from FEMA. This event was used as a starting point to simulate future storms. Data from severe storms in early 2023 also inform this model.

Frequency: There have been three severe storms in Alameda and Contra Costa counties that were received FEMA support since 1998. Berkeley was impacted by two of the storms. Hence, the model simulated an 12% annual chance of storms, with a 66% chance that Berkeley would be impacted by any given storm.

To simulate damages, per capita damage from each of the cities impacted by the 2006 storms was assessed, providing a range of potential losses. This range was then used to simulate Berkeley's potential losses from future storms: both economic losses to the community at large and financial losses to the City government.

Exhibit 16 shows the loss exceedance curve for the economic losses to the entire community from severe storms. Some very large losses seem possible, even if highly unlikely.

Exhibit 17. 5.G.1 - Loss Exceedance Curve for Tsunamis for Berkeley Community, 10 Year Risk (millions of dollars)

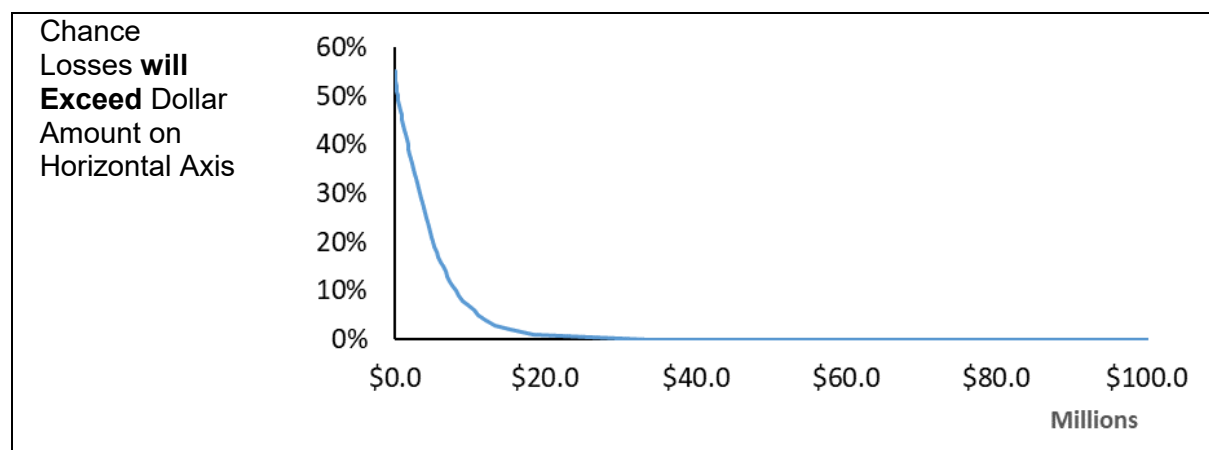


Table 14. Chance that Economic Losses Will Exceed Dollar Amounts

Time Horizon	5%	10%	50%	90%
1-Year	\$1.1M	NA*	NA*	NA*
10-Year	\$10.5M	\$8M	\$0.4M	NA*

*Not Applicable (NA) means that the loss exceedance curve intersects zero before this point. See the graph to see where the curve meets the vertical axis for the chance of losses exceeding zero.

2004 Flood Analysis

A 2004 analysis explored Berkeley's flood exposure and vulnerabilities to a one percent annual chance flood occurring in Berkeley. This analysis predicted that:

- The maximum flood depth would be two feet deep, mostly near creek channels.
- Approximately 675 structures would be impacted to various degrees:
 - The majority would be inundated by one foot or less of water.
 - Approximately 200 structures could flood with up to two feet of water.

A flood depth of one to two feet has the potential to damage structures, first floor and basement finishes, contents and appliances in exposed buildings.

The 2004 analysis used FEMA's standard loss curves to determine the percent of replacement value of damage caused by various heights of creek flooding. These curves are based on years of data from flood losses on insured properties around the country. Single-story structures with one foot of floodwater are estimated to have structural damage equal to 14% of their replacement value and damage to 21% of the structures' contents. Single-story structures with three feet of water on average experience 27% loss of their replacement value and 40% loss to their contents.

In the 2004 plan, flood losses were estimated using the following calculations:

Table 15. One Foot Flood Waters

	Value	% Damage	Damage
Structures	\$250 mill	14%	\$35 mill
Contents ¹⁰⁰	\$250 mill	21%	\$53 mill
Totals (2004)	\$500 mill		\$88 mill

Table 16. Three Feet Flood Waters

	Value	% Damage	Damage
Structures	\$70 mill	27%	\$19 mill
Contents ¹⁰¹	\$35 mill	40%	\$14 mill
Totals (2004)	\$105 mill		\$33 mill

Table 17. Combined Damages: One Foot Flood Waters and Three Foot Flood Waters

	2004	Totals (2023)¹⁰²
Structures	\$54 mill	\$90 mill
Contents ¹⁰³	\$67 mill	\$111 mill
Totals (2004)	\$121 mill	\$201 mill

The estimated losses to properties in Berkeley from a one percent annual chance flood

total \$201 million in 2023 dollars. Approximately \$90 million is damage to the building structures, including walls, finishes, etc. \$111 million is losses to contents, including damage to furniture in homes and equipment and inventory in commercial and industrial properties.

These numbers are likely significant underestimates, because they do not account for the flooding caused by storm drain overflow, which would occur concurrently with creek flooding. Berkeley's exposure to a one percent annual chance flood has likely increased since 2004 but resources are not available at this time to perform a new analysis.

Few Berkeley property owners are known to carry flood insurance, presumably because of negligible flood damage in recent decades, so those losses would be borne almost entirely by building owners.

Some of these losses could be avoided if property owners protected properties through sandbagging or other activities, particularly in areas expected to receive one foot or less of flood water. The City offers free sandbags to city occupants, but remediation activities like sandbagging require property owners to have adequate warning time and manpower.

Due to Berkeley's small watersheds and paved, urban environment, floodwaters are likely to both rise and recede quickly. This means residents and business owners may have only a short warning period for impending floodwaters, but they should be able to begin the cleanup and repair process quickly. Building cleanup will occur within a handful of days; repairing and replacing furniture and equipment will take weeks to months.

Repetitive Loss Properties

Berkeley does not have any Repetitive Loss Properties as defined by the National Flood Insurance Program.¹⁰⁴

B.11 **Utility Interruption**

B.11.a Description of Utility Interruption

Utility interruption is any loss of a public service which includes but is not limited to electrical service, telecommunications, wastewater and potable water, and natural gas. Interruption can be planned and include a warning, such as with Power Safety Power Shutoffs that proactively turn off electricity to mitigate wildfire risk, or interruption can come as a secondary impact of a natural hazard described in this plan. Interruption can also occur without a preceding natural hazard, with a variety of causes, for example maintenance and repair or accidental damage.

In Berkeley, electrical service, telecommunications, potable water, and natural gas infrastructures are not under the City's control, but rather are owned and managed by other quasi-governmental, private, or special district entities.

- Most electricity (generation) is provided by Ava Community Energy. Pacific Gas and Electric or PG&E provides a small portion of electricity, manages the transmission and distribution of electricity, responds to outages, and provides billing and customer service. Berkeley's electricity system is almost entirely aboveground, making it vulnerable to earthquake, fire, landslide, and storm damage.
- Potable water is provided by East Bay Municipal Utility District or EBMUD. EBMUD provides drinking water to approximately 1.4 million people and sewer services to 640,000 in the East Bay. EBMUD was created in 1923, and the age and extent of its system makes it particularly vulnerable to damage.

- Telecommunications are managed by a variety of private partners, including Verizon, AT&T, and Comcast, among others. Telecommunications infrastructure is spread throughout the city, and therefore susceptible to damage from the variety of natural hazards mentioned in this plan. Telecommunications also rely on the electricity system to function.
- Natural gas is managed by PG&E. The natural gas transmission line runs the length of Berkeley (north-south direction) under Seventh Street, which is an area susceptible to earthquake liquefaction.

The City manages some utility infrastructure, including storm drains and the sanitary sewer collection system that links to the EBMUD system. The sewer and storm drainage systems are also old and have weak components, making them vulnerable to damage.

The systems described in this section provide the foundation for day-to-day life in Berkeley. These systems are also vital to many of the City's disaster response activities, and restoration of these systems will be critically important to Berkeley's recovery.

Utility Poles and Wires

Aboveground utility poles and wires are both vulnerable to natural hazards and when destabilized can themselves become hazardous and create fires. Utility-caused fires have become a major contributor California's fire hazard. Aboveground utility lines are vulnerable to strong winds, earthquake shaking and ground failure, and to object coming into contact with wires. When utility poles are destabilized or wires are damaged, the wires themselves can become hazardous as they continue to conduct electricity, putting people in harm's way, creating sparks, and igniting fires. Live wires coming in contact with combustible fuel, as well as other disruptors like squirrels, rodents, birds, and vehicles knocking down utility poles, contribute to the fire ignition hazards.

Undergrounding is the process of placing overhead power lines, poles, cables, and other

utility infrastructure underground. Undergrounding reduces the likelihood of a fire ignition and has been shown to stabilize power and communications reliability, beautify the urban environment, and enhance public safety by eliminating fire ignition sources and obstruction of evacuation routes.

According to the 2018 Conceptual Study to Underground Utility Wires in Berkeley presented by the Public Works, Disaster and Fire Safety, and Transportation Commissions, Berkeley is comprised of diverse neighborhoods with a mix of commercial and residential properties. Undergrounding could be a beneficial adjustment in the city, improving safety, quality of life, and reliability from natural and human-induced disasters. Currently, approximately 16% (34.6 miles) of utility wires are undergrounded on all streets in Berkeley.

To reduce risks associated with overhead wires and other utilities, in 2023 the State adopted SB 884 (McGuire), allowing the use of federal infrastructure funds for undergrounding utility lines. Following this, PG&E committed to protecting communities from wildfire threats by undergrounding 10,000 miles of power lines in the Highest Fire Threat Districts. On January 30, 2024, the Berkeley City Council adopted a resolution to urge PG&E to underground utility wires in Berkeley's Very High Fire Hazard Severity Zone (VHFHSZ) in order to mitigate wildfire risk and limit obstruction of evacuation and ingress. See the Wildland-Urban Interface Fire section for more details on the WUI fire hazard.¹⁰⁵

Connection to climate change

Climate change is increasing the severity and variability of storms and other natural hazards. These events pose serious risks to our utilities.

Connection to hazards of concern

Most of the hazards included in this plan can impact utilities. In the Vulnerabilities Section of each hazard, there is information about how the hazard can impact Systems, including utilities.

B.11.b Location of Utility Interruption

Utility interruption is usually localized, as in the event of a damaged power line, water main, or some other relevant infrastructure. However, the natural hazards covered in this plan can create more widespread outages that can impact larger portions of the city. All locations in Berkeley may experience utility interruption. Locations with greater hazard exposure are more likely to experience utility interruption resulting from the natural hazard.

Public Safety Power Shutoff

Power Safety Power Shutoffs are planned power outages when there is high risk of wildfires. When originally begun, PG&E's Public Safety Power Shutoffs affected large portions of the Berkeley hills. Since then, PG&E has narrowed the areas affected by PSPS, but some parts of Berkeley may still experience a Public Safety Power Shutoff, including:

- Along Summit Road at Ajax Place to where it meets Grizzly Peak and Senior Avenue.
- Around the top of Marin Avenue.
- East of Vistamont Avenue to Wildcat Canyon Road.
- A portion of the Northeast Berkeley hills that includes roughly around the following streets: Santa Barbara Road, Vermont Avenue, Michigan Avenue, Cragmont

Boulevard, Spruce Street, Northampton Avenue, Acacia Avenue, Montrose Road, Euclid Avenue.

B.11.c Extent of Utility Interruption and Anticipated Intensities

The extent and severity of utility interruption depends on many factors, including cause, location, duration, and time of year. For example, the cause of the interruption directly impacts how widespread the outage will be. One broken water main will likely on impact a small geographic area, but a storm with high winds might impact power lines all across the city. Utility interruption can also range from a small localized event to a larger, regional outage. The severity of the interruption is much higher if it impacts a large geographic area, affecting more people and critical infrastructure. Longer interruptions are also more intense than shorter ones, as people rely on utilities for a variety of basic needs. Time of year also relates to severity, as losing power on a hot or cold day is more intense, especially if people need cooling or heating infrastructure.

B.11.d Previous Utility Interruption Events

There have been no federally-declared utility interruption disasters in Berkeley since the last update. There is not a comprehensive list of all the utility interruption events in the last five years in Berkeley. However, a few notable events had widespread impacts:

- Winter storms in 2023 toppled trees and power lines, resulting in over 10,000 customers losing power.
- A water main broke in 2020 cutting off running water supply to the entire Berkeley Marina.
- A pole fire in 2020 cut internet service for 5,000 customers in and around Berkeley.
- PG&E Public Safety Power Shutoffs in 2019 left thousands without power for multiple days.

B.11.e Probability of Future Events

The probability of utility interruption is high, given the number of systems involved, aging infrastructure, and significant exposure of each system to the many hazards presented in this plan.

B.11.f Vulnerabilities

People

Berkeley residents, visitors, businesses, institutions, and other partners rely on utilities for day-to-day life.

Electricity

Electricity powers everything in our daily lives, from essential domestic functions such as heating, cooling, and lighting, to a wide range of household appliances and technologies, as well as transportation, including electric cars, scooters, and public transportation. Electricity is also often used to manage industrial and hazardous materials, which can be released and cause serious damage if there is a power failure.

Loss of electricity for prolonged periods pose a significant threat to individuals who depend on specific medical equipment or medications. According to data from the U.S. Department of Health and Human Services (HHS) emPOWER program, some Berkeley residents rely on electricity- or power-dependent devices and durable medical equipment (DME), including 287 electric beds, 111 motorized wheelchairs or scooters, and 340 oxygen concentrators. Prolonged power outages increase the risks for those dependent on these devices, potentially leading to a surge in vulnerable community members requiring emergency services and hospital care.

If the electricity is out during an extreme temperature event, people who are sensitive to high or low temperatures, including the elderly, children, and people with certain medical conditions will be even more at risk. Without electricity, people may lose food supplies, especially impacting people with low incomes and people with various health needs. Businesses, grocery stores, gas stations, and other services might also have to close, impacting the local economy and people's ability to get basic necessities.

Water

The water supply is critical to human safety and survival. People rely on safe running water for daily activities, including, eating, drinking, bathing, and going to the bathroom. Consumption of contaminated water can lead to the transmission of diseases and serious illnesses and even death. While some people have emergency water supplies, many do not. People would either have to leave their home and or purchase water from nearby suppliers.

The water supply is also crucial to firefighting and emergency response activities. If there is a widespread water supply interruption, it could negatively impact firefighting capabilities.

Telecommunications

Telecommunications is a key aspect of daily life. The City government, including our first responders, use telecommunications for daily operations. Back up options are available, but may hamper services to the public.

People rely on telecommunications for personal use, work, and to report emergencies. People rely on their phones to gather information, have entertainment, and to

communicate with their families. Without this as an option, people may struggle to do these things, impacting their mental, physical, and emotional health.

Structures

In most cases utility outages do not lead directly to structural damage. However, water damage is serious, costly, and can occur in association with damage to sewer, drainage, or wastewater systems. Water damage, if not quickly addressed, can lead to mold, which is detrimental to public health and makes buildings unsafe for human use.

Systems

The utility systems in Berkeley, including electricity, water, telecommunications, and natural gas are susceptible to outages, either from day-to-day conditions or natural hazards mentioned in this plan. Further details about the utility vulnerabilities associated with the natural hazards in this plan are included in their respective sections.

Natural, historic, and cultural resources

Berkeley is home to a number of natural, historic, and cultural resources that could be negatively impacted by utility disruption. If there is damage to water systems, contaminated water could spill into the Bay or into other natural ecosystems, such as creeks and parks, around Berkeley.

Berkeley is home to many businesses that rely on water, natural gas, and electricity to operate. Not having these utilities for a long period of time could put them out of business with lost goods and profit. There are other cultural institutions in Berkeley, such as arts organizations, theatres, and businesses that cannot operate without utilities and a

prolonged outage could threaten their existence.

Activities that have meaning

Utilities are a key part of day-to-day life for Berkeley government, residents, businesses, and visitors. Electricity and internet are crucial to City operations and its ability to serve the public. Private businesses, employers, UC Berkeley, and schools also rely on utilities to operate every day and welcome their students, employers, and customers. Transportation systems rely on electricity too, which would make it difficult for people who rely on it to reach destinations and activities around the Bay Area.

B.11.g Potential Impacts and Loss Estimates

There is currently no data on the economic impacts from utility disruption for Berkeley. However, utility disruptions do cause notable economic impacts, including lost income and food for example if the power is out. There are also added costs to City operations as well as to businesses, employers, schools, and other local groups.

There may be replacement and content costs for any structures that have water damage.

B.12 Hazardous Materials Release

B.12.a Description of Hazardous Materials Release

Hazardous materials release could harm community members by exposing people to vapors that are toxic, suffocating, cause burns or are irritating. Hazardous materials release can threaten not only life and property, but also the environment, in areas such as creeks, the Aquatic Park lagoons and the San Francisco Bay.

The impacts of a release depend on its chemical characteristics, the amount and rate of substance spilled, the location, and its dispersion. Flammable and combustible materials can cause fires in areas that are largely constructed of wood; they may also cause explosions. Wind speed and direction, as well as topography, can greatly impact the dispersion plume of a release.

The City's Toxics Management Division (TMD), within the Department of Planning and Development, maintains the Hazardous Materials Area Plan, which identifies facilities that, in the event of a regional disaster, may pose the greatest risk to human health or the environment.

The Fire Department is the first responder for hazardous materials incidents within the City, and has access to chemical inventories, locations and emergency planning for all these facilities. The chemical inventories and facility maps are available electronically to the Fire Department.

The Department of Public Works manages the City's hazardous materials emergency response to spills on the right-of-way and also manages the hazardous materials emergency response contractor.

Connection to climate change

According to the Environmental Protection Agency, climate change may increase our exposure to chemicals. Climate change is causing more frequent and intense storms and varied weather, which can result in more release of hazardous materials.

Connection to hazards of concern

Most of the hazards of concerns in this plan can result hazardous materials release, including earthquake, flooding, wind, and wildland-urban interface fire.

B.12.b Locations of Hazardous Materials Release

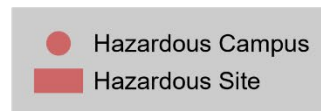
A hazardous materials release can occur throughout the city near where hazardous materials are manufactured, stored, used, or transported. Hazardous materials release can occur as a result of a natural hazard, such as earthquake shaking, or can happen accidentally. In Berkeley, a hazardous material event is more likely to occur in the City's industrial area in West Berkeley where there is a concentration of industrial sites and transportation routes.

Map 37 identifies the locations of Hazard Level 1 Industrial Sites. Level 1 industrial sites are identified as square red icons on the map.

Map 37. Level 1 Industrial Sites, 2024



Level 1 Industrial Sites Map



California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, City of Berkeley OES 10/29/24

Airborne toxic plumes, including smoke, can travel into Berkeley from surrounding cities. Petrochemical refineries and other large chemical facilities in Contra Costa County could release hazardous materials that could impact the Berkeley community.

Hazardous materials also travel through Berkeley by truck and rail. Specific routes known to carry hazardous chemicals are:

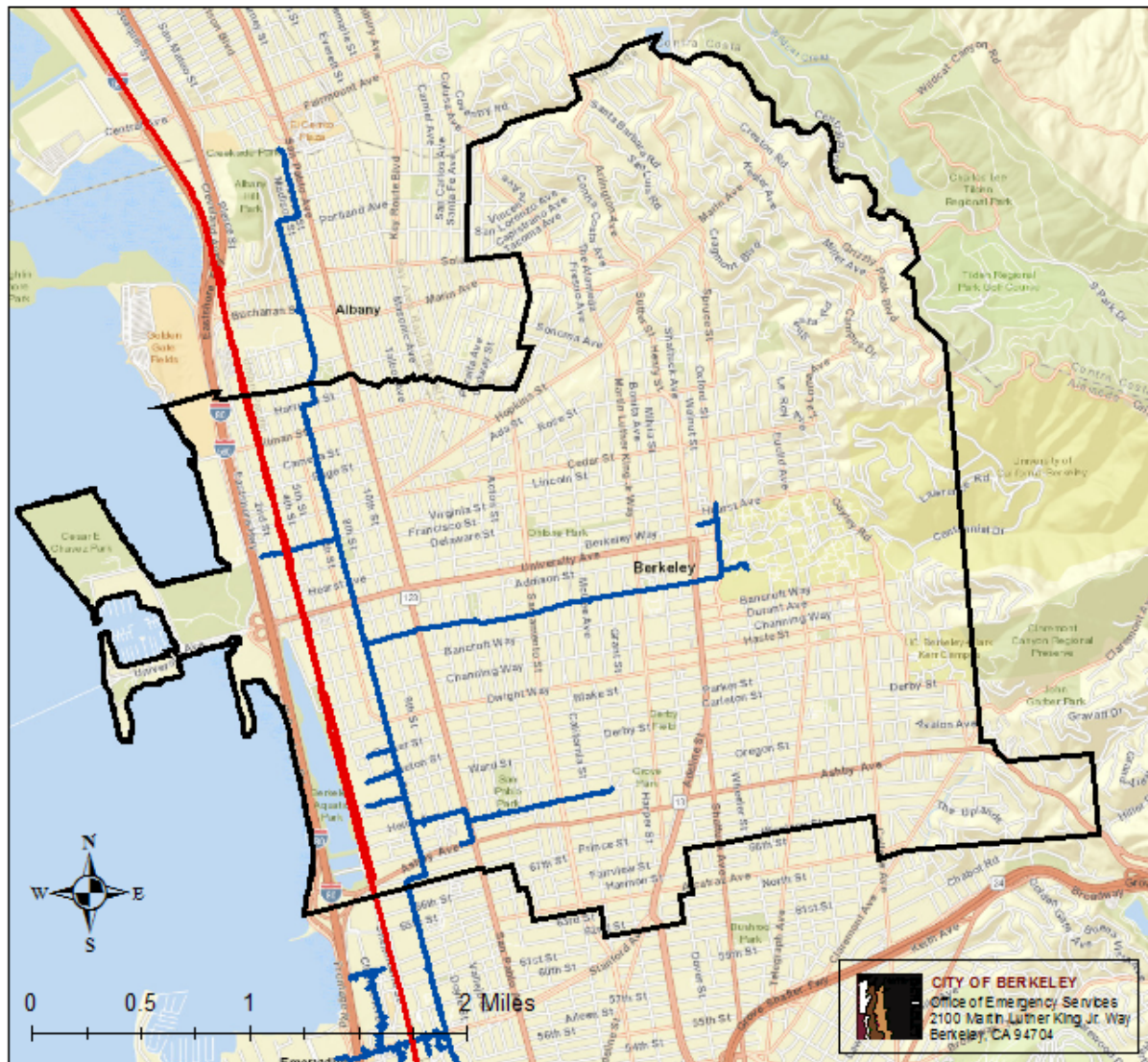
- Interstate 80
- San Pablo Avenue and the industrial areas to the west
- State Highway 13/Ashby Avenue
- Gilman Avenue
- University Avenue
- Union Pacific Railroad
- Fuel pipelines in the western edge of the City

Map 38 shows the natural gas transmission line that runs the length of Berkeley (north-south direction) under Seventh Street.

- The Seventh Street transmission line branches out to the West in four locations: Grayson, Carleton, Parker and Virginia Streets. The Virginia street branch runs almost all the way to the Eastshore Freeway.
- The Seventh Street transmission line branches out to the east in two locations. The first is at Heinz Avenue, continuing onto Russell Street after passing San Pablo Avenue. The transmission line ends where Russell Street crosses McGee Avenue. The second is at Allston Way. The transmission line extends the entire length of Allston Way, to the edge of UC Berkeley campus at Oxford Street, where it splits. One short transmission line continues into the campus and the other follows Oxford Street north just past Hearst Avenue, where it ends.

Map 38 also shows in a thick red line the location of pipelines carrying aviation fuel. These pipelines run along the Union Pacific railroad right-of-way in the western part of the city.

Map 38. Gas Transmission Pipelines and Jet Fuel Line, 2019



Sources: PG&E and Kinder-Morgan

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

- City of Berkeley
- Jet Fuel Line
- Gas Transmission Lines

B.12.c Extent of Hazardous Materials Release and Anticipated Intensities

There are 528 facilities¹⁰⁶ within Berkeley that are regulated by TMD.¹⁰⁷ TMD has grouped these facilities into Hazard Levels 1, 2 and 3:

- Level 1: Facilities that have substantial quantities of hazardous materials onsite, and/or have hazardous materials that can easily disperse or explode, and are toxic or pose other special hazards to human health and the environment.
- Level 2: Facilities that have medium to large quantities of hazardous materials onsite, and/or materials with known hazards.
- Level 3: Facilities for which Berkeley Fire Department engine companies can handle incidents without additional facility storage information, because the hazards are known or familiar (e.g., gas station without welding cylinders, or a facility with motor oil).

The majority of the 528 facilities in Berkeley are Level 3 automotive- or medically- related facilities with limited quantities of hazardous materials and hazardous waste.

B.12.d Previous Hazardous Materials Release Events

There have been no federally-declared hazardous materials release disasters in Berkeley since the last update. Berkeley has not recently experienced significant hazardous materials releases secondary another natural hazard. However, the city has experienced industrial accidents from both mobile and fixed sources. Truck accidents involving potentially harmful materials have occurred in the western part of the City, on Interstate 80 and its ramps. Industrial sites have released small amounts of dangerous substances, such as anhydrous ammonia from an ice rink and a sake brewery.¹⁰⁸ In 2011, an uncontrolled release of 1,600 gallons of diesel on the UC Berkeley campus resulted in diesel entering the stormwater system, and discharging into Strawberry Creek.¹⁰⁹ In 2017 a truck accident on Interstate 80 released approximately 200 gallons of diesel fuel on the roadway next to the estuary. The fuel was contained and the fuel did not release into the

estuary. After the incident, the roadway barriers have been strengthened and improved.

B.12.e Probability of Future Events

Transportation accidents have occurred with trucks carrying dangerous materials. These accidents will undoubtedly occur in the future.¹¹⁰ A release on the freeway or railway would most immediately impact the western industrial area of the city. Winds typically blow from the west to the east, meaning that a gaseous release could easily spread to the City's eastern residential areas.

The City has completed a Hazardous Materials Commodity Flow Study with a grant from the California Office of Emergency Services and the federal Department of Transportation. This study retrieved or collected data on bulk chemicals being transported on freeways, major city streets, and the railroad and through pipelines.

B.12.f Vulnerabilities

People

According to the Environmental Protection Agency, hazardous materials may irritate the skin or eyes, make it difficult to breath, cause headaches and nausea, or result in other types of illness. Some hazardous substances can cause far more severe health effects, including: behavior abnormalities, cancer, genetic mutations, physiological malfunctions, physical deformations, and birth defects.

Structures

Fourteen Hazard Level 1 facilities hold sufficiently large quantities of toxic chemicals to pose a high risk to the community.¹¹¹ TMD works directly with each of these sites to make

sure they meet stringent safety requirements. Facilities in Table X are at the highest risk level.

Table 18. *Berkeley industrial sites with large quantities of hazardous substances*

Name	Site Address
Airgas USA LLC	1224 Sixth Street
Bayer Healthcare LLC	800 Dwight Way
Berkeley Forge & Tool INC.	1331 Eastshore Highway
Comeback Brewing II, DBA Trumer Brauerei	1404 Fourth Street
Davlin Coatings	700 Allston Way
Electro Coatings, INC.	893 Carleton Street
Form Energy	2810 Seventh Street
Henkel Corporation	800 Grayson Street
Lawrence Berkeley National Laboratory	1 Cyclotron Road
PC Cargo	2424 Fourth Street
Polyplus Battery Company	2431 Fifth Street Suite B
Takara Sake USA, INC.	708 Addison Street
TPMG Regional Lab (KAISER)	1725 Eastshore Highway
UC Berkeley - Main Campus	200 California Hall MC

In the wildland-urban interface (WUI) in the Berkeley hills, there are two major sources of dangerous chemicals: UC Berkeley and the Berkeley Lab. Both have significant amounts of flammable and toxic chemicals, including radioactive chemicals. While both sites have active disaster preparedness programs, WUI fires are notoriously difficult to fight and hazardous materials could be released in a major conflagration.

Systems

Transportation: Roadway or railroad closes during to a transportation-related hazardous material release could have serious impacts on the local economy and the ability to provide essential services. Hazardous materials can also contaminate water systems, impacting service and public health.

Natural, historic, and cultural resources

Hazardous materials can be devastating to animals and the natural environment. Hazardous materials can kill organisms, destroy plants and animals, causing health complications in animals, and or limit the ability of the ecosystem to survive.

B.12.g Potential Impacts and Losses

Previous events can provide valuable information about potential future scenarios. The 1994 Northridge Earthquake, classified as a moderate earthquake, resulted in a long list of earthquake-induced hazardous materials releases (EIHRs). Relevant releases include a train derailment resulting in 2,000 gallons of spilled sulfuric acid, 9 ruptures along the underground petroleum pipeline, and extensive hazardous materials releases resulting in serious fires in 3 buildings at California State University, Northridge.¹¹²

Because of the uncertain nature of industrial accidents, loss estimates are not presented in this plan. City staff uses PEAC software to plan for and respond to chemical emergencies.

B.13 **Infectious Disease Outbreak**

The City of Berkeley works in alignment with Alameda County, Bay Area Region, and California Department of Public Health to plan and respond to infectious disease.

B.13.a Description of Infectious Diseases

Infectious diseases are illnesses caused by germs, such as bacteria, viruses, and fungi; that enter the body, multiply and cause an infection. Some infectious diseases are contagious, meaning they can spread from one person to another. These diseases can be spread many ways, including direct contact, insect bites, food or water contamination, and airborne transmission. A threat of infectious diseases is an epidemic, which affects a large number of people in a population, community or region, or pandemic, which affects several countries or continents.

It should also be noted that bioterrorism can also involve communicable diseases. The Centers for Disease Control (CDC) has identified high priority biological agents that have the potential for major public health impact. These include:

- Anthrax (*Bacillus anthracis*)
- Botulism (*Clostridium botulinum* toxin)
- Plague (*Yersinia pestis*)
- Smallpox (*variola major*)
- Tularemia (*Francisella tularensis*)
- Viral hemorrhagic fevers (filoviruses [e.g., Ebola, Marburg] and arenaviruses [e.g.,

Lassa, Machupo])

The State of California has a list of over 95 communicable diseases, which must be reported by health providers or laboratories to local public health officials.

Connection to climate change

According to the Center for Disease Control and Prevention, our risk for infectious diseases is increasing because of climate change.¹¹³

B.13.b Location of Infectious Diseases

All of Berkeley is susceptible to infectious diseases. The populations at the highest risk for infectious diseases are the very young, the elderly, or individuals who are immunocompromised. However, higher-poverty neighborhoods of color are at greater risk due to the effects of health and social inequalities. In addition, because of the communicable nature of these diseases, those who are especially at-risk include people experiencing homelessness and people in congregate settings, such as people in long-term care facilities or dormitories.

B.13.c Extent of Infectious Diseases and Anticipated Intensities

Infectious diseases vary in their impact and severity depending on the disease. These complications can range from minor to severe illness or death. The impact of the disease is also affected by environmental factors and human behavior.

B.13.d Previous Infectious Disease Events

Since the last update, there was a federal declared disaster for the COVID-19 pandemic (DR-4482). In 2020, the start of the COVID-19 pandemic began. A total of 23,887

polymerase chain reaction (PCR) cases were confirmed in the City of Berkeley. In response to the pandemic, City of Berkeley issued several health alerts and protocols to align with the Bay Area, California Department of Public Health (CDPH), and Centers for Disease Control (CDC) guidance to limit the spread of infection.

Berkeley residents have been affected by the following other infectious disease outbreaks, epidemics, and pandemics over the last 15 years.

- In 2009, H1N1 caused over 8,917 hospitalizations and 578 deaths in California. The California Department of Public Health (CDPH) released stockpiled N95 respirators for use by health care facilities experiencing shortages. Berkeley Public Health Division distributed supplies to Health care facilities experiencing shortages. Points of dispensing were set up Bay Area-wide to administer pandemic influenza vaccine.
- In 2011, there were 24 confirmed cases of mumps in Berkeley, with approximately 2 additional suspect cases. All confirmed cases were within the UC Berkeley campus community, and all persons had received 2 or more doses of the measles, mumps, and rubella (MMR) vaccine. In consultation with CDPH, City of Berkeley recommended a 3rd dose of MMR for UC Berkeley students living in congregate settings such as dormitories to help control the outbreak.
- In 2014, more than 54 cases of pertussis were reported in Berkeley. This was a 5-fold increase compared to previous years. Berkeley cases ranged from infants to teenagers, with most being 10 - 17 years of age. Cases involved at least two schools in the Berkeley Unified School District. The state experienced more than 1,700 cases of pertussis. Clinicians were advised to immunize women with the tetanus, diphtheria, and pertussis (Tdap) vaccine during every pregnancy between 27-36 weeks' gestation to optimize antibody transfer and protection of infants at birth, and to immunize young infants promptly with the diphtheria, tetanus, and pertussis (DTaP) as young as 6 weeks during a community outbreak.
- In 2015, California experienced a measles outbreak with over 100 confirmed cases statewide. Berkeley had 1 confirmed case; there were 6 cases in Alameda County and many in surrounding Bay Area counties. Berkeley Public Health notified schools, preschools and daycare communities recommending staff and students be protected against measles with the MMR vaccine.
- In 2018, multiple outbreaks and cases of norovirus were reported to the City of

Berkeley Public Health Division. A health alert was issued to remind ill persons to practice good handwashing and to avoid preparing food for others while they are sick and for at least 48 hours after symptoms resolve. Clinicians were advised to consider norovirus in patients presenting with diarrhea, vomiting, nausea and abdominal pain, and Instruct patients with norovirus/gastrointestinal (GI) illness to remain home from work or school until 48 hours after symptoms have resolved.

- In 2019, an outbreak in San Diego, Santa Cruz and Los Angeles counties alerted Alameda County and the City of Berkeley to take precaution, and provide post-exposure prophylaxis and pre-exposure prophylaxis to high-risk populations. Groups at highest risk included persons using illicit drugs, men who have sex with men, persons with chronic liver disease, and persons experiencing homelessness.
- In 2022, multiple clusters of monkeypox (mpox) virus were reported in several countries, including the US. Many of the cases involved men who have sex with men (MSM) without a history of travel to an endemic country. There were 16 confirmed cases in the City of Berkeley. As a precaution, multiple Bay Area counties provided post-exposure prophylaxis and pre-exposure prophylaxis to high-risk populations. City of Berkeley partnered with Alameda County, CDPH, East Bay Advance Care, Asian Health Services, and Steamworks to provide mass vaccination sites weekly at Steamworks for 5 months.

B.13.e Probability of Future Events

The concern for future events is determined by asking the following questions:

- How easily does the disease spread?
- How susceptible is the population to this disease?
- Has this disease been a recent issue?
- These questions were evaluated using the following factors:
- How easily does the disease spread?
- Mode of Transmission
- R_0 – Rate of infection in a susceptible population
- How susceptible is the population to this disease?

- Vaccine Effectiveness
- Vaccine Coverage
- Has this disease been a recent issue?
- Confirmed cases in Berkeley in 2022 alone
- Confirmed cases in Berkeley 2010-2022
- Year of the last outbreak or epidemic in Berkeley, Alameda County or California

Scores were assigned to the responses or values for each factor. Low scores indicate less concern, higher scores indicate more concern. The average of the scores for the factors available were used to determine an overall measure of no, low, medium or high concern.

Table 19. *Factor scoring table*

Factor	No concern - 0	Low Concern - 1	Medium Concern - 2	High Concern - 3
Mode of Transmission	Not transmissible	Physical contact, Fecal-oral	Respiratory droplets	Airborne
R ₀	0	<2	2-7	>7
Vaccine Effectiveness	100%	>75%	50-74.9%	<50%
Vaccine coverage for at least 1 dose	>95%	80- 94.9%	50-79.9%	<50%
Confirmed cases 2022	0	1-10	11-50	>50
Confirmed cases 2010-2022	<10	10-29	30-99	>100
Year of last outbreak/epidemic	>15 years ago	10-15 years ago	5-10 years ago	<5years ago
Concern for major outbreak or epidemic average score	Overall average score = 0-0.99	Overall average score = 1-1.99	Overall average score = 2-2.99	Overall average score = ≥3

Table 20. *Factors to determine concern for future events*

Infectious Disease	Mode of Transmission	R ₀ – Rate of infection in a susceptible population	Vaccine Effectiveness	Vaccination Coverage	Berkeley Confirmed Cases in 2022 alone	Berkeley Confirmed Cases 2010-2022	Year of last outbreak or epidemic in Berkeley, Alameda County or California	Concern for major outbreak or epidemic
Seasonal Influenza	Respiratory droplets	0.9-2.1 ^{cxiv}	19-60% ^{cxv}	US 2022– Children 6 months – 17 years old – 55.6% Adults 18+ - 47.4% ^{cxvi}	No Data	No Data	N/A	Med
2009 H1N1 Influenza	Respiratory droplets	1.46-1.48 ^{cxvii}	62% ^{cxviii}	US 2009 – all people 6 months and older– 41.2% ^{cxix}	No Data	No Data	2009	Low
COVID-19	Respiratory droplets	1.5-3.5 ^{cxx}	17-80% ^{cxxi}	Berkeley 2023 All people – 94% primary series completed; 38% up to date ^{cxxii}	15,500+	23,800+	2020-present	Med
Pertussis	Respiratory droplets	12-17 ^{cxxiii}	34-73% ^{cxxiv}	California 2018-2020 – Children 24 months old, ≥4 doses – 84% ^{cxxv} US 2013 – adults – 28.9% ^{cxxvi}	1	106	2014	Med
Mumps	Respiratory droplets	10-12 ^{cxxvii}	78-88%	California 2018-2020 – Children 24 months old, ≥1 doses – 91.4% ^{cxxix}	0	29	2011	Low

Infectious Disease	Mode of Transmission	R ₀ – Rate of infection in a susceptible population	Vaccine Effectiveness	Vaccination Coverage	Berkeley Confirmed Cases in 2022 alone	Berkeley Confirmed Cases 2010-2022	Year of last outbreak or epidemic in Berkeley, Alameda County or California	Concern for major outbreak or epidemic
Measles	Airborne respiratory droplets	12-18 ^{cxxx}	93-97% ^{cxxxix}	California 2018-2020 – Children 24 months old, ≥1 doses – 91.4% ^{cxxxii}	0	5	2015	Low
Mpox	Physical contact	1.10-2.40 ^{cxxxiii}	47.4-78.1%	California 2023 – at risk population – 66% one dose; 41% fully vaccinated ^{cxxxv}	16	16	2022	Med
Hepatitis A	Fecal-oral	1.71-3.67 ^{cxxxvi}	95-97% ^{cxxxvii}	US 2017 – Children 35 months and older – 76.6% ≥2 doses Adolescents 13-17 years old – 68.4% ≥2 doses Adults ≥19 years – 10.9% ≥2 doses	0	4	2017	Low
Norovirus	Fecal-oral	1.1-7.2 ^{cxxxviii}	No vaccine available	No vaccine available	No Data	No Data	2018	Med

B.13.f Vulnerabilities

People

Infectious diseases can be difficult to evaluate due to the wide variation in disease characteristics. Therefore, they pose difficulties in terms of comprehensive risk assessments. According to the Alameda County Department of Public Health, “In Alameda County, communities of color face inequitable conditions that increase the risk of chronic diseases. Others especially at-risk of infection and disease transmission are people experiencing homelessness and people in congregate settings.”

As of July 2023, 80 Berkeley residents lost their lives as a result of COVID-19 infections. The death rate for African Americans residents is four times greater than Latino residents and nearly six times greater than whites, demonstrating the disproportionate impact on disease and death on African American residents.

B.13.g Potential Impacts and Losses

In most infectious disease outbreak, the impact is limited, with the majority of illnesses treatable and the likelihood of fatalities low. Large-scale outbreaks like the onset of COVID-19 in the spring of 2020 can strain existing health care facilities. As of July 2023, 250 Berkeley residents have been hospitalized as a result of COVID-19 infections and 80 Berkeley residents lost their lives as a result of COVID-19 infections.

The impacts of a pandemic go far beyond positive cases, hospitalizations and deaths. During the COVID-19 pandemic the stress, collective grief, physical and social distancing needed to slow the spread of the virus, and the resulting distress from lost wages,

unemployment, and closures of educational and youth development programs created a secondary public health crisis.

End Notes

- 1 Documentation is on file at the Berkeley Planning Department
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Earthquake

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- 11 City of Berkeley Budget Book FY23-24, Community Profile Data
- 12 2020 American Community Survey (ACS) 5-year Estimates.
- 13 These buildings are categorized as SPC-2 according to the Hospital Seismic Safety Act. Structural Performance Category (SPC) 1 is the most vulnerable ranking for buildings. Many SPC 1 hospitals pose significant collapse risks. SPC 5 hospitals pose the least structural risk. Significant changes impacting life safety were made to the Building Code in 1973, particularly regarding reinforced concrete buildings. These changes built on lessons learned in California earthquakes, including the 1971 San Fernando earthquake. According to state law, SPC-2 buildings must comply with standards intended to keep hospitals open and providing medical care following a severe earthquake by 2030.

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- 14 These buildings are categorized as SPC-3 and SPC-4. Structural Performance Category (SPC) 1 is the most vulnerable ranking for buildings. Many SPC 1 hospitals pose significant collapse risks. SPC 5 hospitals pose the least structural risk.
- 15 These buildings are categorized as SPC-1. Structural Performance Category (SPC) 1 is the most vulnerable ranking for buildings. Many SPC 1 hospitals pose significant collapse risks. SPC 5 hospitals pose the least structural risk.
- 16 Methane Emissions (EPA, 2018) <https://www.epa.gov/ghgemissions/overview-greenhouse-gases#methane>
- 17 The 2004 scenario was calculated using HAZUS-MH. The program's default data on buildings (types and economic values) and soils (for liquefaction and landslides) were used. 2004 shelter figures are taken from a previous analysis conducted by the Association of Bay Area Governments. HAZUS estimates of shelter populations were lower. Special thanks to Rich Eisner for help preparing these estimates.
- 18 This 2013 LHMP Update includes impacts described in the 2008 FEMA/Cal EMA (Cal OES) Catastrophic Earthquake Incident Scenario. This scenario is based on a HAZUS-MH™ study completed by Charles A. Kircher, Hope A. Seligson, Jawhar Bouabid, and Guy C. Morrow as part of a series of papers presented at the 100th Anniversary Conference on the 1906 San Andreas Fault Earthquake. Descriptions of damage in this scenario is based on impacts expected from a magnitude 7.7 to 7.9 earthquake on the San Andreas fault, but the general level and type of impacts are expected to be similar for a Hayward fault event. The report was based on the most accurate data available at the time and the results were reviewed by peers. Additional analysis and data were prepared by Kircher, et al. for Golden Guardian 2006.
- 19 In 2004, estimate was \$1.5 billion. Updated for 2018 using Consumer Price Index Inflation Calculator at <http://data.bls.gov/cgi-bin/cpicalc.pl>.
- 20 About 20% of ignitions typically occur within the first hour after the earthquake, 50% within about 6 hours and almost all ignitions occur within the first day.
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Wildland Urban Interface

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from Map 3 and structure density data from Alameda county from 2017-2022 and
Microsoft Building Footprints from 2019-2020. The resulting risk to structures map
provides an explicit ranking for 10-acre hexagons, assigning each hexagon with a ranking
for wildfire hazard and a ranking for housing density. From a risk to structures
perspective, hexagons with high housing density and high wildfire hazard are of greatest
concern. Map 13 shows the highest hazard hexagons are located on the Eastern border
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- 78 Porter, K., Byers, W., Dykstra, D., Lim, A., Lynett, P., Ratliff, J., Scawthorn, C., Wein, A., and Wilson, R., 2013, The SAFRR tsunami scenario—Physical damage in California, chap. E in Ross, S.L., and Jones, L.M., eds., The SAFRR (Science Application for Risk Reduction) Tsunami Scenario: U.S. Geological Survey Open-File Report 2013–1170, 168 p., <http://pubs.usgs.gov/of/2013/1170/e/>.

Sea Level Rise

- 79 May, C. L.; Mohan, A.; Plane, E.; Ramirez-Lopez, D.; Mak, M.; Luchinsky, L.; Hale, T.; Hill, K. 2022. Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties. Pathways Climate Institute and San Francisco Estuary Institute. <https://www.sfei.org/documents/shallow-groundwater-response-sea-level-rise-alameda-marin-san-francisco-and-san-mateo>
- 80 California’s Fourth Climate Change Assessment San Francisco Bay Area Region Report (State of California, 2018)
<http://www.climateassessment.ca.gov/regions/docs/20180827-SanFranciscoBayArea.pdf>
- 81 California’s Fourth Climate Change Assessment San Francisco Bay Area Region Report (State of California, 2018)
<http://www.climateassessment.ca.gov/regions/docs/20180827-SanFranciscoBayArea.pdf>
- 82 State of California Sea-Level Rise Guidance 2018 Update (California Ocean Protection Council, 2018).
http://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf. This is the median probabilistic projections, meaning 50% probability sea-level rise will meet or exceed this level.
- 83 Adapting to Rising Tides Bay Area Sea Level Rise Analysis and Mapping Project (ART, 2017) <http://www.adaptingtorisingtides.org/project/regional-sea-level-rise-mapping->

-
- and-shoreline-analysis/
84 ART Bay Shoreline Flood Explorer (adaptingtorisingtides.org)
85 California's Fourth Climate Change Assessment San Francisco Bay Area Region Report
(State of California, 2018)
<http://www.climateassessment.ca.gov/regions/docs/20180827-SanFranciscoBayArea.pdf>
86 Mathieu Casado, Raphaël Hébert, Davide Faranda & Amaelle Landais. The quandary of
detecting the signature of climate change in Antarctica. Nature Climate Change, Volume
13, October 2023, pages 1082-1088.
87 Assessment of California's Natural Gas Pipeline Vulnerability to Climate Change
(California Energy Commission, 2017).
<http://www.energy.ca.gov/2017publications/CEC-500-2017-008/CEC-500-2017-008.pdf>
88 San Francisco Bay Conservation and Development Commission, 2011, p. 5
89 Land Subsidence in the United States, USGS Fact Sheet (USGS, 2000).
<https://water.usgs.gov/ogw/pubs/fs00165/>
90 <http://www.adaptingtorisingtides.org/wp-content/uploads/2018/07/BATA-ART-SLR-Analysis-and-Mapping-Report-Final-20170908.pdf>
91 Adapting to Rising Tides Bay Area Sea Level Rise Analysis and Mapping Project (ART,
2017) <http://www.adaptingtorisingtides.org/project/regional-sea-level-rise-mapping-and-shoreline-analysis/>
92 Climate change and harmful algal blooms | US EPA. (2022, December 15). US EPA.
<https://www.epa.gov/nutrientpollution/climate-change-and-harmful-algal-blooms>

Floods

- 93 In Berkeley, culverted creeks are below ground and within a pipe or box-shaped conduit
in a creek bed.
94 The City of Berkeley Watershed Management Plan Appendix D, Page 9 lists design
storms. The depth of the 10-year, 6 hour duration event varies from 1.81" to 2.27"
depending on if the desired location is in the Bay Plains or in the hills.
95 The City uses a 10-year design storm as representation of a rainfall event that reflects
local conditions.
96 [Possible viral infections in flood disasters: a review considering 2019 spring floods in Iran
- PMC \(nih.gov\)](#)
97 [Shallow Groundwater Response to Sea Level Rise | San Francisco Estuary Institute
\(sfei.org\)](#)
98 The Potter Watershed drains approximately one-third of the land area of the City
through storm drain pipe infrastructure. The Codornices Watershed drains about one-
tenth of the City through open watercourses and creek culverts. Findings from these
two watersheds could be extrapolated to the other watersheds, but it is preferable to
continue hydraulic modeling of the remaining watersheds.
99 California Adaptation Planning Guide, July 2012.
100 Contents were assumed to be worth 50% of the total structural replacement value for
single-family homes and 100% of the total structural replacement value for commercial

and industrial properties. The majority of structures in the zone with up to 3 feet of floodwaters are residential, so contents for all structures in this zone were estimated at 50% of structure value. The majority of structures in the zone with up to 1 foot of water are commercial or industrial, and contents value was assumed to equal structure value for these properties.

101 Contents were assumed to be worth 50% of the total structural replacement value for single-family homes and 100% of the total structural replacement value for commercial and industrial properties. The majority of structures in the zone with up to 3 feet of floodwaters are residential, so contents for all structures in this zone were estimated at 50% of structure value. The majority of structures in the zone with up to 1 foot of water are commercial or industrial, and contents value was assumed to equal structure value for these properties.

102 In 2023, loss estimates quoted in the narrative were updated using Consumer Price Index Inflation Calculator at <http://data.bls.gov/cgi-bin/cpicalc.pl>.

103 Contents were assumed to be worth 50% of the total structural replacement value for single-family homes and 100% of the total structural replacement value for commercial and industrial properties. The majority of structures in the zone with up to 3 feet of floodwaters are residential, so contents for all structures in this zone were estimated at 50% of structure value. The majority of structures in the zone with up to 1 foot of water are commercial or industrial, and contents value was assumed to equal structure value for these properties.

104 Repetitive loss properties are those that have submitted claims for flood reimbursement through the National Flood Insurance Program at least twice in the last ten years. The goal of mapping these properties is to identify what locations flood repetitively and seek to mitigate the problem to reduce flood damage.

Utility Interruption

105 Public Works Commission, Disaster and Fire Safety Commission, and Transportation Commission. 2018. CONCEPTUAL STUDY TO UNDERGROUND UTILITY WIRES IN BERKELEY, p. 1-214. <https://loridroste.com/wp-content/uploads/2022/11/Conceptual-Study-for-Undergrounding-2018.pdf>

Hazardous Materials Release

106 Of the 528 facilities indicated, 469 meet chemical minimums; the remainder are smaller hazardous waste only generators that do not meet volume thresholds quotes. There are many more facilities that have some sort of hazardous materials on their sites, but they are not regulated by the City's Toxics Management Division (per Jamie Cooney, City Toxics Management Division, August 2023).

107 These facilities have a minimum of 55 gallons of aggregate liquid chemicals, 500 pounds of aggregate solid chemicals, or 200 cubic feet of aggregate gaseous chemicals, or they may generate hazardous waste.

108 Both of these accident sites no longer store anhydrous ammonia.

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- 109 UC Berkeley and Berkeley Lab have since evaluated their storm water systems as
potential hazardous materials conduits to the creeks.
- 110 The Northridge earthquake derailed a train carrying 2,000 gallons of sulfuric acid that
began leaking. Firefighters were on the scene within two hours and the situation was
stabilized with three and a half hours.
- 111 City Toxics Management Division, as of July 2023.
- 112 Earthquake-Induced Hazardous Materials Releases: Lessons from the Northridge
Earthquake, Michael K. Lindell & Ronald W. Perry, August 1995.

Infectious Disease

- 113 <https://www.cdc.gov/nceid/what-we-do/climate-change-and-infectious-diseases/index.html>
- 114 <https://sph.umich.edu/pursuit/2020posts/how-scientists-quantify-outbreaks.html>
- 115 <https://www.cdc.gov/flu/vaccines-work/effectiveness-studies.htm>
- 116 <https://www.cdc.gov/flu/fluview/dashboard/vaccination-dashboard.html>
- 117 <https://sph.umich.edu/pursuit/2020posts/how-scientists-quantify-outbreaks.html>
- 118 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3647645/>
- 119 https://www.cdc.gov/flu/fluview/coverage_0910estimates.htm
- 120 <https://sph.umich.edu/pursuit/2020posts/how-scientists-quantify-outbreaks.html>
- 121 <https://covid.cdc.gov/covid-data-tracker/#vaccine-effectiveness>
- 122 <https://berkeleyca.gov/safety-health/covid-19/covid-19-dashboards>
- 123 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8489951/>
- 124 <https://www.cdc.gov/vaccines/vpd/dtap-tdap-hcp/about-vaccine.html#:~:text=In%20studies%20demonstrating%20the%20efficacy,people%204%20years%20after%20vaccination>
- 125 <https://downloads.aap.org/AAP/Vaccine/index.html>
- 126 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5819000/>
- 127 [https://www.ajicjournal.org/article/S0196-6553\(20\)30994-9/pdf](https://www.ajicjournal.org/article/S0196-6553(20)30994-9/pdf)
- 128 [https://www.cdc.gov/vaccines/vpd/mmr/public/index.html#:~:text=One%20dose%20of%20MMR%20vaccine%20is%2093%25%20effective%20against%20measles,\(weakened\)%20live%20virus%20vaccine](https://www.cdc.gov/vaccines/vpd/mmr/public/index.html#:~:text=One%20dose%20of%20MMR%20vaccine%20is%2093%25%20effective%20against%20measles,(weakened)%20live%20virus%20vaccine)
- 129 <https://downloads.aap.org/AAP/Vaccine/index.html>
- 130 <https://pubmed.ncbi.nlm.nih.gov/28757186/>
- 131 [https://www.cdc.gov/vaccines/vpd/mmr/public/index.html#:~:text=One%20dose%20of%20MMR%20vaccine%20is%2093%25%20effective%20against%20measles,\(weakened\)%20live%20virus%20vaccine](https://www.cdc.gov/vaccines/vpd/mmr/public/index.html#:~:text=One%20dose%20of%20MMR%20vaccine%20is%2093%25%20effective%20against%20measles,(weakened)%20live%20virus%20vaccine)
- 132 <https://downloads.aap.org/AAP/Vaccine/index.html>
- 133 <https://www.mdpi.com/2076-393X/11/6/1093>
- 134 <https://www.nejm.org/doi/full/10.1056/NEJMoa2215201>
- 135 <https://www.cdc.gov/poxvirus/mpox/cases-data/mpx-jynneos-vaccine-coverage.html>
- 136 <https://www.jstor.org/stable/26515647>;
[https://www.thelancet.com/journals/lanep/article/PIIS2666-7762\(22\)00120-X/fulltext](https://www.thelancet.com/journals/lanep/article/PIIS2666-7762(22)00120-X/fulltext);

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6152969/#:~:text=The%20different%20statistical%20methods%20suggest,are%20consistent%20with%20this%20range
137 https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/hepa.pdf
138 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5851036/#:~:text=However%2C%20we%20found%20that%20the,values%20estimated%20for%20particular%20outbreaks

c. **Mitigation Strategy**

Berkeley aims to be a disaster-resilient community that can survive, recover from, and thrive after a disaster. Berkeley envisions a community in which the people, buildings, and infrastructure in and serving Berkeley, are resilient to disasters; City government provides critical services in the immediate aftermath of a devastating event of any kind; and basic government and commercial functions resume within thirty days of a damaging earthquake or other significant event.

Disaster mitigation reduces or eliminates long-term risks to people and property from hazards and their effects, and/or provides passive protection at the time of disaster impact. Disaster mitigation is a foundational element of disaster resilience.

Element C of this plan outlines Berkeley's mitigation strategy, and how it connects to Berkeley's disaster resilience vision. The strategy identifies and analyzes a comprehensive range of specific mitigation actions and activities being considered to reduce the effects of each hazard described in Element B: Risk Assessment. The Strategy is based on existing authorities, policies, programs, and resources, as well as Berkeley's ability to expand on and improve these existing mitigation tools as described in Elements C.1 of this plan.

C.1 **Authorities, Policies, Programs, and Resources**

The table on the following pages highlights some of the regulatory authorities, policies, programs and other resources that support Berkeley’s hazard mitigation efforts. The “Category” columns indicate whether the resource includes Planning and Policy, Financial, Administrative and Technical, and/or Training and Outreach Elements. The “Ability to support mitigation activities” column overviews the City’s ability to use the identified resource to expand on and improve mitigation activities.

Following the table is a detailed discussion of these and other authorities, policies, programs, and resources. Finally, this section provides a table of State and federal requirements related to hazard mitigation and describes how Berkeley complies with these requirements.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Guiding Policies and Goals	x				Many City policies shape Berkeley's growth. In addition to disaster resilience, City goals include protecting the environment, promoting sustainable development, providing low-income housing, preserving historic structures, and maintaining City infrastructure. Some of these policies directly support mitigation efforts; together they all ensure that mitigation activities account for City values.
Public Works	x		x		The City of Berkeley's Public Works Department is the largest department in the City and provides both direct services to the community, as well as critical support services to the City organization.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Emergency Management	x		x	x	The City's Fire Department - Office of Emergency Services (OES) works to increase the Berkeley's readiness through community education, staff support to the Disaster and Fire Safety Commission, and coordination of the City's emergency management activities. OES develops, maintains, and exercises the City's Emergency Operations Plan as well as the Local Hazard Mitigation Plan.
Taxing Authorities		x			The City's General Fund gets the majority of its money from: a) property taxes and property-based revenues; b) economically sensitive revenues such as sales tax, business license tax, transient occupancy tax, etc.; and c) interest and fees such as ambulance fees; and parking and traffic fines.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Measure T1		x			Measure T1 provides \$100 million of funding from bond revenue to pay for improvements to City infrastructure and facilities. Berkeley voters passed Measure T1 in November 2016. Measure T1 funds are used for a variety of infrastructure improvements, including upgrading Senior Centers and Community Centers to immediate occupancy and increase their ability to serve the community regularly and during disasters. Future mitigation actions could include upgrading additional buildings and or building new ones.
Measure FF		x			On November 2020, Berkeley voters passed Measure FF with 74.2% approval. Measure FF provides \$8.5 million in funding annually from parcel taxes to pay for fire services, emergency response, 9-1-1 communication, hazard mitigation and wildfire prevention.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Measure GG		x			In November 2008, Berkeley voters passed Measure GG, which authorizes the levying of a special tax that funds fire protection and emergency responses and preparedness.
City Budget		x			The City's budget process assigns resources to address the goals, objectives, and community priorities set by the City Council. This process determines if and when money is spent on mitigation actions.
Municipal Building Improvements	x	x	x		The City, supported by an active public, local and State bond measure funding and FEMA grants, has strengthened and rebuilt numerous key buildings in Berkeley. Since 2014, the City has continued its program to strengthen or replace key at-risk structures.
Building Code	x		x		The City enforces disaster-resistant development through the application of the California Building Code, as well as more stringent local code amendments.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Plan Set A	x			x	The City's adoption of Standard Plan Set A educates homeowners and contractors about measures to improve seismic resistance of their homes. Contractors' adherence to this Standard simplifies the City's plan review and inspection process.
Mandatory Retrofit Ordinances	x				The City has approved ordinances requiring owners of unreinforced masonry buildings and soft story buildings with five or more units to evaluate their buildings, obtain retrofit permits and complete seismic retrofits according to a schedule based on each building's risk categorization. Future mitigation actions include ensuring that these retrofits happen and exploring future ordinances for other hazardous buildings.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Retrofit Grants Program	x	x	x	x	The Building and Safety Division of the Planning Department developed a Retrofit Grants program with funding from a Hazard Mitigation Grant from the Federal Emergency Management Agency (FEMA) and the California Governor's Office of Emergency Services (Cal OES). Mitigation actions include disbursing grants, and continuing to seek Hazard Mitigation Grants to fund future rounds of the Retrofit Grants Program.
City Transfer Tax Rebate Program	x	x	x	x	By ordinance, the City created a program to rebate up to one-third of the transfer tax amount to be applied to earthquake upgrades on homes. Mitigation actions include advertising this program and conducting outreach to homeowners.

Name of Authority, Policy, Program, or Resource	Category					Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach		
Earthquake Brace + Bolt	x	x	x	x		The City participates in the Earthquake Brace + Bolt (EBB) program, a grant program administered by the California Earthquake Authority, which provides grants of up to \$3,000 for seismic retrofits of owner-occupied residential buildings with 1-4 dwelling units. Mitigation actions include advertising this program and conducting outreach to building owners.
Earthquake Soft Story (ESS)	x	x	x	x		The City participates in the Earthquake Soft-Story (ESS) Retrofit grants, offered by California Residential Mitigation Program, providing homeowners grants of up to \$13,000 for seismic retrofits of single-family houses with a “soft story” living space built over a garage. Mitigation actions include advertising this program and conducting outreach to building owners.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Expanded Inventory of Potentially Seismically Vulnerable Buildings	x		x		With the launch of the Retrofit Grants Program, staff conducted extensive research to update and refine the City's inventory of potentially seismically vulnerable buildings. In addition to soft story buildings not currently subject to mandatory retrofit such as those with 3-4 residential units or commercial uses, Berkeley has numerous non-ductile concrete and tilt-up or other rigid wall-flexible diaphragm (RWFD) buildings. Future expansion includes conducting research to determine other hazardous buildings that should be inventoried and exploring additional mandatory retrofit ordinances.
Property Assessed Clean Energy (PACE)		x			Property owners can borrow money to pay for green building improvements and spread the cost out over time with PACE financing.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Fire Department: Prevention Division	x		x	x	Berkeley Fire Departments Fire Prevention Division works to decrease the number and severity of all fires in Berkeley. Mitigation actions include active code-enforcement program, public education activities, and engineering and plan review.
Fire Code	x		x		The City of Berkeley adopted the 2022 California Fire Code along with more stringent Local Amendments. Mitigation actions include code updates and enforcement.
Hazardous Fire Area Zones	x		x		The City has established and adjusted fire zones in Berkeley. While the zones were initially established to address urban fire issues, they have evolved to designate the City's WUI fire hazard. Currently, the Berkeley Fire Department has divided the city into Fire Zones 1, 2, and 3, designated in order of ascending fire risk.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Fire Department: WUI Division	x		x	x	City of Berkeley Fire Department instituted a WUI division in 2021 supported with funding from Measure FF. The WUI Division is primarily responsible for the coordination of wildland mitigation efforts and related inspection activities. The ability for the Division to expand on mitigation activities is outlined in the Action Plan of the Community Wildfire Protection Plan (CWPP).
Defensible Space Inspections and Home Hardening Assessments	x		x		The WUI Division coordinates defensible space inspections and home hardening assessments of all homes in Fire Zones 2 and 3.
Resident Assistance Program		x			The resident assistance program aims to provide financial assistance to residents who demonstrate physical or financial hardship in completing their required prescriptions for defensible space. Mitigation actions include expanding the program to more residents.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Community Wildfire Protection Plan	x				In 2023, the City of Berkeley approved its first Community Wildfire Protection Plan (CWPP). The CWPP is a roadmap for fire hazard mitigation and preparedness at both the City and neighborhood levels, identifying ways to mitigate Berkeley’s wildfire risk. The CWPP strategy includes goals for improving wildfire response, community preparedness, fuels management, infrastructure, ignition reduction, and home hardening.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Firewise Communities	x			x	The Firewise USA® program, led by the National Fire Protection Association (NFPA), offers a structured approach for communities to enhance their wildfire resilience in California. The Berkeley Fire Department staff provide guidance to help interested neighborhoods achieve Firewise recognition. Currently, Berkeley has multiple Firewise communities. Future mitigation actions include expanding the number of communities.
Vegetation Management	x		x	x	The City runs a number of vegetation management programs to reduce fuel loads. Future mitigation actions include searching for funding to expand and add programs.
Hills Emergency Forum	x			x	The City of Berkeley is a charter member of the Hills Emergency Forum, a consortium of nine agencies working on fire mitigation measures for the East Bay Hills. Future mitigation actions include partnering with the other agencies to reduce collective wildfire risk.

Name of Authority, Policy, Program, or Resource	Category				Ability to support mitigation activities
	Planning and Policy	Financial	Admin & Technical	Training & Outreach	
Diablo Firesafe Council	x			x	The City is involved with Diablo Fire Safe Council (DFSC), a 501(c)3 nonprofit organization.
Community Readiness	x		x	x	The City runs a number of programs aimed to help enhance the resilience of people in the Berkeley community by providing disaster preparedness outreach, training, and materials. Training is provided in person and online, to individuals, neighborhoods, and community-based organizations. A number of these programs teach residents about mitigation actions that they could take individually, such as reducing earthquake hazards in the home and preparing their homes for wildfire season. Future mitigation actions include expanding on the household mitigation actions included in this plan and identifying powerful ways to deliver that information to residents.

c.1.a Guiding Policies and Goals

Many City policies shape Berkeley's growth. In addition to disaster resilience, City goals include protecting the environment, promoting sustainable development, providing low-income housing, preserving historic structures, and maintaining City infrastructure. Key policies impacting development are detailed below.

Sustainable Development

Berkley promotes sustainable development policies. The General Plan includes policies to maintain sufficient land zoned for high-and medium-density residential development. These policies allow for sufficient new construction to meet Berkeley's fair share of regional housing needs. Policies are coordinated to ensure that all new development is sensitive to Berkeley's unique physical character and scale, and that new housing and future development occur in areas of the city that are best served by public transportation.

Affordable Housing

Berkeley also promotes affordable, seismically-safe housing. The General Plan includes policies promoting access to quality housing for people at the lowest income levels, and inclusion of low-income groups in new housing development. The General Plan also encourages maintenance and improvements to prepare buildings for a major seismic event, with the expectation that improvements do not necessitate substantial rent increases for tenants. In January 2023, City Council adopted the Housing Element, which identifies policies and programs to provide and preserve healthy, resilient housing at a range of prices, with special attention given to special needs housing, homelessness prevention, and affirmatively furthering fair housing (AFFH).

Restoration of Natural Waterways

The General Plan's Environmental Management section encourages the restoration of natural waterways. Many Berkeley streams were culverted in the 1960s as a flood control measure. Any change in the status of these culverts, already in a weakened state, would alter the Berkeley's flood risk.

Climate Mitigation and Adaptation

As outlined in Berkeley's 2009 Climate Action Plan, Berkeley has community-wide goals to reduce emissions and mitigate our impact on global anthropogenic climate change. This includes reducing energy and water usage, moving toward clean energy in our buildings and transportation, reducing our waste, and ensuring sustainable and equitable development. In addition, the Berkeley community must adapt to the current impacts the community is already facing from the changing climate, as well as plan for future impacts projected to occur. Climate mitigation strategies are outlined in the Climate Action Plan, and continue to be implemented Citywide. The City's climate adaptation strategies are included in the Local Hazard Mitigation Plan and the Resilience Strategy.

Preserving Historic Character

The City values preserving historic character. Any hazard, and earthquakes and fires in particular, could destroy many historic structures, which tend to be more vulnerable to these hazards than newly-constructed buildings. The General Plan's Urban Design and Preservation Element encourages support of long-term protection of historically- or architecturally-significant buildings to preserve neighborhood and community character through maintenance of the historic resources inventory, and use of the State Historical Building Code, Rehabilitation Tax Credits, and Mills Act contracts preservation incentives.

Disaster Resilience

The Berkeley community recognizes that disasters have the potential to undercut all of the City's goals. As stated in the General Plan:

The city's healthy environment with its unique character and quality of life based on cultural, social and economic diversity could be dramatically and enduringly altered by a serious hazard event. Berkeley must protect what we already have as well as what we build through employing sound development practices and building and planning code enforcement, and continuously working to reduce the vulnerability of existing buildings and infrastructure, to improve emergency response and to prepare for recovery. Without these measures, disasters will occur and the other goals of the General Plan will be lost.

c.1.b Public Works

The City of Berkeley's Public Works Department is the largest department in the City and provides both direct services to the community, as well as critical support services to the City organization. Public Works is responsible for maintaining the City's physical assets and infrastructure in a safe and serviceable condition. Public Works provides services ranging from refuse and recycling collection, diversion and disposal, to property management, infrastructure improvements, and improving safety in the public right-of-way.

Significant objectives expected to be accomplished by the department during FY 2023 and FY 2024 include the replacement of the City's Transfer Station, developing a Zero Waste Strategic Plan, updating the citywide watershed management and storm drain master plans, construction of the underground utility district #48, and developing a Sewer Master Plan.

Three publicly-staffed commissions provide community oversight over Public Works activities:

- Commission on Disability
- Transportation and Infrastructure Commission
- Zero Waste Commission

c.1.c Fire Department

The Berkeley Fire Department provides 24-hour response to fires, medical emergencies, hazardous materials events, water rescues, disasters, and other life-threatening situations. The Department serves the City of Berkeley and UC Berkeley and responds to over 16,000 calls each year.

Berkeley Fire Department's Fire Prevention Division works to decrease the number and severity of all fires in Berkeley through an active code-enforcement program, public education activities, engineering and plans review, and vegetation management. When fires do occur, Fire Prevention staff investigate fire origin and cause and, if needed, prosecute those who are responsible.

The Fire Department established a WUI division in 2021 using funds from voter-approved Measure FF. The WUI Division is primarily responsible for the coordination of wildland fire mitigation efforts and related inspection activities. This Division manages or assists wildfire suppression operations, emergency scenarios, planning department-wide activities and functions, programs, and coordinating personnel for the purpose of community service and fire protection.

The Disaster and Fire Safety Commission serves as the citizens' oversight committee for expenditure of the proceeds of tax measures FF and GG.

c.1.d Emergency Management

The City's Fire Department - Office of Emergency Services (OES) works to increase the

Berkeley's readiness through community education, staff support to the Disaster and Fire Safety Commission, and coordination of the City's emergency management activities. OES staff meets regularly with City's designated emergency response staff to provide training and coordination. OES develops, maintains and exercises the City's Emergency Operations Plan. OES has 4 FTE positions.

Emergency management is a shared responsibility among all City departments. Department Directors are responsible for ensuring their respective departments' readiness to contribute to disaster response activities. All City staff members are Disaster Service Workers and are required to provide services in the event of an emergency or disaster.

The Disaster and Fire Safety Commission participates in the review of emergency, disaster and mutual aid plans and agreements and makes recommendations to the City Council regarding legislation and regulations needed to implement such plans and agreements.

c.1.e Taxing Authorities

The City's General Fund gets the majority of its money from: a) property taxes and property-based revenues; b) economically sensitive revenues such as sales tax, business license tax, transient occupancy tax, etc.; and c) interest and fees such as ambulance fees; and parking and traffic fines. The balance of the City budget is comprised of other funding sources such as grants, special tax revenue (e.g. parks, libraries and paramedic services), and fees for specific services (marina berth fees, garbage and sewer fees, building permits, etc.).

California property taxes are set at 1% of the assessed value of the property. The City of Berkeley receives about a third of every property tax dollar collected in Berkeley, and schools get 43% of every property tax dollar. These proportions have been about the same since 1979.

Property tax revenue goes into the General Fund. This revenue is dependent on the fluctuating real estate market, and can vary dramatically from year to year. To protect City services from this volatility, much of this revenue is used for one-time infrastructure needs, such as streets and transportation projects.

c.1.f Measure FF

In November 2020, Berkeley voters passed Measure FF with 74.2% approval. Measure FF provides \$8.5 million in funding annually from parcel taxes to pay for fire services, emergency response, 9-1-1 communication, hazard mitigation and wildfire prevention. The Fire Department manages the emergency response and preparedness projects funded by Measure FF, and the Disaster and Fire Safety Commission and the City Council review and approve projects to receive Measure FF funding. In the 2022 fiscal year, the City of Berkeley spent \$3 million on 11 projects in the areas of disaster preparedness, department operations, emergency medical services, and employee development and training. \$1.5 million was spent on disaster preparedness through three key projects:

1. Established a Wildland Urban Interface Division within the Fire Department to focus on improving the City's preparedness for and resilience to wildfire. This team inspected 8,500 properties (83% more than the previous year) to ensure that they meet the City's requirements for 'defensible space,' buffer between buildings and any combustible materials (such as vegetation).
2. Initiated public outreach for the development of a Community Wildfire Protection Plan, which has since been approved by City Council. The CWPP identifies the risks that Berkeley faces from wildfires along with goals and projects to help manage these risks.
3. Purchased a citywide outdoor warning system to assist with emergency notifications. Installation of the 15 sirens is expected to be complete in 2024.

c.1.g Measure GG

In November 2008, Berkeley voters passed Measure GG, which authorizes the levying of a special tax that funds fire protection and emergency responses and preparedness. In fiscal year 2024, the estimated total collections were around \$5 million. Tax proceeds are first used to eliminate rotating closures of operating fire stations and to provide advanced life support personnel and equipment on all first responder vehicles. The funds are also used to hire additional training officers, hire staff to conduct Community Emergency Response Training and other similar public disaster training and preparedness efforts, as well as equipment to allow compatible radio communications throughout the City and with outside public agencies.

c.1.h City Budget

The City's budget process assigns resources to address the goals, objectives, and community priorities set by the City Council. The City's FY 2023 & FY 2024 Biennial Budget was adopted by the Berkeley City Council at its June 28, 2022 meeting. The FY 2024 Adopted Update was approved by the Council at the June 27, 2023 meeting. The City's budget follows the fiscal year - beginning on July 1st and ending on June 30th.

The City's FY 2024 General Fund budget is approximately \$276 million. The balance of the City's budget is made up of special funds (\$452 million combined), which are dedicated to specific services. While special fund revenue is dedicated, it is not guaranteed. Special funds also shrink in tough economic times.

There are three broad categories of special funds:

1. Special Revenue and Grant Funds are legally restricted to a specific service, e.g.:
Federal transportation funds, State public health funds, and the Parks, Library, and Paramedic Tax Funds.

2. Special Assessment Funds are for the financing of public improvements or services, such as the Clean Storm Water Fund and the Streetlight Assessment District Fund. Those two funds are examples of special funds where the revenues have not kept pace with the cost of delivering the service.
3. Enterprise Funds come from the collection of the fees associated with providing the service or program. For example, the Refuse Fund pays for the pickup and collection of garbage, recycling, and green waste. Services in this category include the Permit Service Center, the Sanitary Sewer Fund, and the Marina Enterprise Fund.

Additionally, the City has deferred maintenance on much of its capital infrastructure. As the economy begins to slowly recover, the City is being mindful of the need to address deferred maintenance, as well as to remain prepared to address the impacts of future cost increases in areas such as health and pension benefits.

The City Council has adopted budget development policies that have served Berkeley well over the long term, including:

1. Focusing on the long-term fiscal health of the City by adopting a two-year budget and conducting multi-year planning.
2. Building a prudent reserve based upon the City's adopted General Fund Reserve policy and using the goal of reaching a reserve of 30% of General Fund revenues by 2027 as a guideline.
3. Developing long-term strategies to reduce unfunded liabilities.
4. Controlling labor costs while minimizing layoffs and promoting recruitment and retention of City staff.

5. Primarily allocating one-time revenue for one-time expenditures (e.g., capital investments and deferred maintenance).
6. Requiring enterprise and grant funds to balance and new programs to pay for themselves.
7. Any new expenditure requires new revenue or expenditure reductions.
8. Property transfer tax:
 - a. Allocate excess property transfer tax over the baseline to short-term operational needs, General Fund reserves and the City's capital infrastructure plan, including funding an approach to returning and maintaining the City's roads at an acceptable Pavement Condition Index.
 - b. Increase the property transfer tax baseline for operational needs to \$18.0 million for fiscal years 2023 and 2024, with a permanent adjustment to \$16.0 million beginning in fiscal year 2025.
9. Revenue generated from Measure P is excluded (exempt) from this policy.
10. As the General Fund subsidy to the Safety Members Pension fund declines over the next several years, the amount of the annual decrease will be used to help fund the new Police Employee Retiree Health Plan.
11. Allocating annual savings derived from the prepayment of the annual CalPERS unfunded liability payments to the City's Section 115 Pension Trust up to \$5.5 million per fiscal year or as advised by the City's actuarial and staff.
12. Allocating any additional revenue earned from investments that is over the annual (fiscal year) baseline of \$6 million in the following manner:

- a. 1/3 to the Section 115 Pension Trust up to \$5.5 million per fiscal year, or as advised by the City's actuarial and staff,
- b. 1/3 to General Fund reserves up to 30% of General Fund revenue, or as recommended by Council policy, and
- c. 1/3 to address the City's capital infrastructure plan.

c.1.i City Buildings and Systems

Municipal Building Improvements

The City, supported by an active public, local and State bond measure funding and FEMA grants, has strengthened and rebuilt numerous key buildings in the city. Since 2014, the City has continued its program to strengthen or replace key at-risk structures.

In 2021, work was completed on the Live Oak Community Center. A seismic structural update was necessary in order to prevent major damage to the building and to achieve an "immediate occupancy" rating in the event of an earthquake or other major disaster, as the site is included on the City's list of potential shelters. Other upgrades for energy efficiency and sustainability were included to come closer to meeting the City's climate action plan and resiliency goals. The project also included necessary upgrades to increase accessibility at the site to meet new and current building codes. Funding sources included Measure T1 and Measure F bonds.

In 2022, work was completed on the North Berkeley Senior Center. The renovations and seismic upgrade project modernized the interior and provides much needed upgrades to improve safety and functionality of the building, including seismic for "care and shelter" requirements as well as ADA compliance.

Currently, the City is using T1 Funds on the MLK Jr. Youth Services Center Retrofit and

Renovation project and the Willard Park Clubhouse and Restroom Replacement Project. Both of these facilities will be upgraded to immediate occupancy status, meaning that post earthquake, only limited structural damage will have occurred. The Willard Park Clubhouse is currently under construction and the MLK Jr. Youth Services Center is in the design part of the process. Using T1 and General Funds, the African American Holistic Resource Center is currently in the design part of the process. The African American Holistic Resource Center (AAHRC) will be a facility to house culturally relevant services to help eliminate inequities within Berkeley's African American Community. The vision for the African American Holistic Resource Center is to host services to benefit the community with education, employment, health, mental health, and housing advocacy and supports. It will be built to immediate occupancy status.

Using funds from Measure T1 and funding from a FEMA grant, the South Berkeley Senior Center is being renovated to include disaster preparedness, electrification, energy efficient building systems, and other enhancements to the community building. It's in the design phase.

The City is currently seeking opportunities for funding and grants to develop the design and complete construction for the Frances Albrier Community Center.

The City is regularly assessing vulnerabilities of other key City buildings and is developing funding strategies to upgrade buildings with known vulnerabilities.

Emergency Water Supply for Firefighting

In 2010, the City put into operation an aboveground, portable water system that can pump water from any source, including the San Francisco Bay, in the event of drained tanks or damaged pipelines. This system is designed to carry up to 20,000 gallons of water per minute for a distance of one mile and elevation gain of 100 feet; it will also carry smaller flows to higher elevations.

c.1.j Privately-Owned Buildings

The City offers a comprehensive suite of programs to encourage the community to strengthen buildings to be more hazard-resistant. A number of City incentive programs and educational efforts promote seismic strengthening activities.

Building Codes

The City enforces disaster-resistant development through the application of the California Building Code, as well as more stringent local code amendments. The Provisions of the California Building Code are applicable to all new construction, additions, alterations and repairs.

Plan Set A

The City's adoption of Standard Plan Set A educates homeowners and contractors about measures to improve seismic resistance of their homes. Contractors' adherence to this Standard simplifies the City's plan review and inspection process.

Mandatory Retrofit Ordinances

The City of Berkeley has worked diligently to enhance public safety and reduce physical threats from earthquakes by requiring owners of soft story and unreinforced masonry buildings to retrofit their structures. Berkeley Municipal Code (BMC) Chapter 19.39, effective January 4, 2014, mandated owners of soft story (also known as soft, weak or open front / "SWOF") buildings with five or more dwelling units to apply for a building permit for a seismic retrofit by December 31, 2016. Owners were given two years to complete the work upon submission of the permit application. Previously, the City approved an ordinance in 1991 (BMC 19.38) requiring owners of unreinforced masonry (URM) buildings to evaluate their buildings, obtain retrofit permits and complete seismic retrofits according to a schedule based

on each building's risk categorization but in all cases no later than 2001.

Through these hazard mitigation measures, the City of Berkeley hopes to increase the safety and resilience of the city's building stock to prevent injury and loss of life and reduce post-disaster recovery time.

Soft Story Ordinance for Buildings with Five or More Dwelling Units

Soft story buildings are characterized as multi-story wood-frame buildings with extensive ground story openings such as windows, storefronts, garage openings, or open-air spaces such as parking. These buildings may have few perimeter or interior walls at the ground level, leading to a relatively soft or weak lateral load resisting system in this lower story. Since the collapse of soft story buildings in the 1989 Loma Prieta and the 1994 Northridge earthquakes, there has been considerable concern in California about tenant safety and the seismic deficiencies in these buildings. In 2005, Berkeley was the first city in the country to pass an ordinance to address this potentially unsafe condition.

Berkeley's original 2005 ordinance added Chapter 19.39 to the Berkeley Municipal Code, requiring owners of soft story buildings with five or more dwelling units to submit a seismic engineering evaluation report analyzing the ability of the building to resist earthquake forces and describing possible work to remedy weaknesses. The ordinance also required owners to notify tenants of the building's soft, weak or open front (SWOF) condition and post an earthquake warning notice at the building entrance.

On December 3, 2013, Council adopted amendments to Berkeley Municipal Code Section 19.39.110 establishing mandatory seismic retrofit requirements for soft story buildings with five or more dwelling units. The ordinance established December 31, 2016 as the deadline for property owners to apply for a building permit. Owners must complete retrofits within two years of submitting the permit application.

The initial wood-frame SWOF inventory included 321 buildings. As of September 2023, the inventory has increased to 364 buildings, containing 3,935 units. Buildings are typically added to the soft-story inventory as a result of building permit application submittal, staff research, or an inquiry submitted to the City by a tenant or property owner. The table below describes the status of the 364 soft story buildings subject to mandatory retrofit as of September 2023.

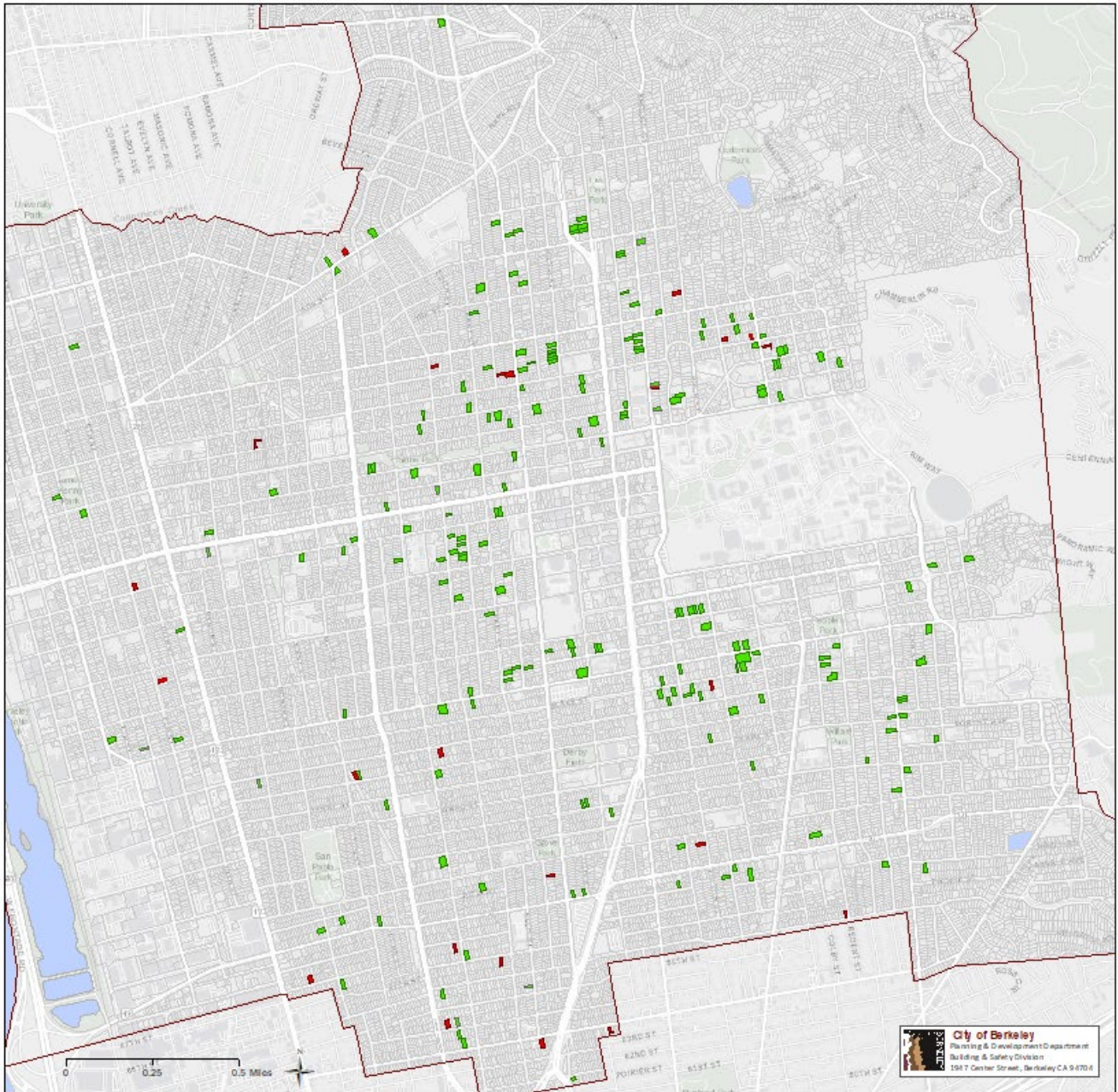
Table 21. Berkeley Soft-Story Building Status as of September 2023

Number of buildings	Percent*	Status
278	76	Retrofit Complete
7	2	Permit
12	3	Applied for Permit
5	1	Not Compliant or Newly Added
62	17	Removed from Inventory for Other Reasons
364	100%	<i>Total buildings identified as soft-story</i>

*Due to rounding, percentages do not add up to 100 percent.

Map 1 below shows the retrofit status of soft story buildings subject to mandatory retrofit, as of September 2023. Green symbols depict parcels with retrofitted buildings, and red symbols shows parcels with buildings either out of compliance with BMC 19.39 or buildings recently added to the soft-story inventory.

Map 39. Status of Soft Story Buildings Subject to Mandatory Retrofit (September 2023)



- Mandatory Soft-Story Retrofit Completed
- Not Compliant with BMC 19.39 (Includes Newly Added Buildings)

Unreinforced Masonry (URM) Ordinance

Unreinforced masonry (URM) buildings are generally constructed of brick, block, tile, stone, or other types of masonry, and were built prior to modern earthquake-resistant design. During an earthquake, unreinforced masonry walls that were originally built without adequate reinforcement (from embedded steel bars) are susceptible to collapse. In addition, URM buildings often include unreinforced masonry parapets, chimneys, and high brick veneers that tend to disconnect from the building and fall outward, creating a hazard for people below and in some instances causing the building to collapse. Weak or nonexistent connections between the masonry walls and the floors and roofs place occupants, pedestrians, and adjacent buildings in harm's way.

Unreinforced masonry buildings are no longer constructed today, and existing URM buildings can be retrofitted to reduce risks caused by earthquake activity. If these buildings are not retrofitted and suffer major damage in an earthquake, the costs of repair after the earthquake could be prohibitively high and may result in demolition or loss of use.

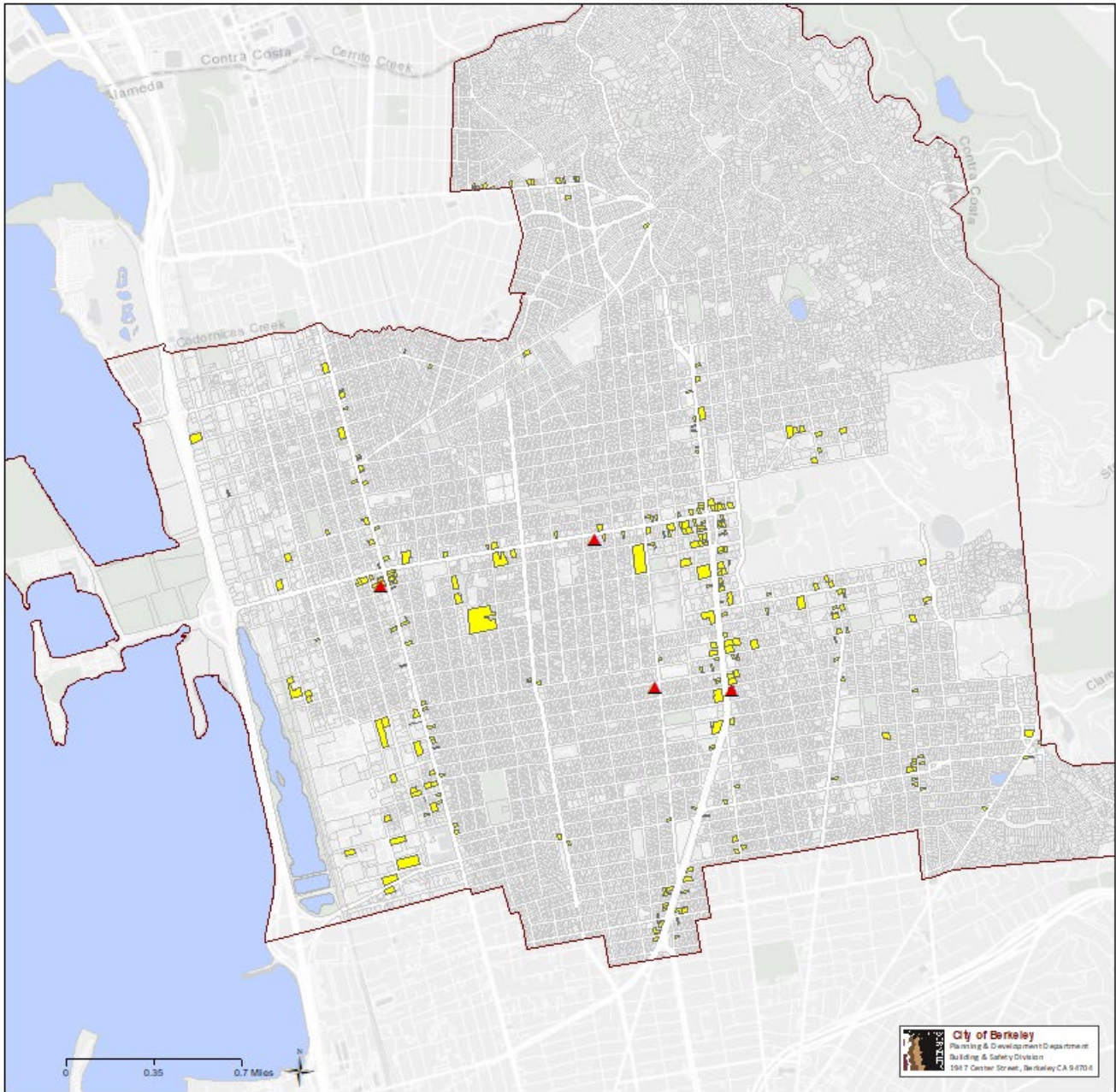
In response to State law, the City of Berkeley compiled an inventory of unreinforced masonry buildings in 1989, identifying approximately 700 residential and commercial URM buildings that were built prior to 1956. In 1991, the City adopted the Unreinforced Masonry Ordinance 6088-N.S. Subsequent amendments to the ordinance required owners of unreinforced masonry buildings to evaluate their buildings, obtain necessary permits and complete seismic retrofits by 2001.

Of the approximately 700 buildings originally included in the City's unreinforced masonry (URM) inventory, hundreds were removed from the list after owners provided evidence the buildings adequately met building standards or that the buildings were not unreinforced masonry structures. Of the original list, roughly 99% have been seismically retrofitted,

demolished or demonstrated to have adequate reinforcement. As of September 2023, four buildings are still required to retrofit in order to avoid further penalties. Two of the four building owners have applied for retrofit permits.

Map 2 shows the unreinforced masonry (URM) inventory as of September 2023. Parcels in yellow contain buildings that are compliant with the Unreinforced Masonry Ordinance 6088-N.S. Red triangular symbols denote unreinforced masonry buildings still subject to mandatory retrofit, including those currently in the permitting process.

Map 40. **Berkeley Parcels with Unreinforced Masonry Building Types (September 2023)**



- Compliant with URM Ordinance
- Not Compliant with URM Ordinance

c.1.k Financial Incentives for Buildings

Retrofit Grants

In early 2017, the Building and Safety Division developed a new Retrofit Grants program with funding from a Hazard Mitigation Grant from the Federal Emergency Management Agency (FEMA) and the California Governor’s Office of Emergency Services (Cal OES).

The groundbreaking program incentivizes both mandatory and voluntary retrofits of seismically vulnerable buildings through disbursement of design and construction grants to qualifying property owners. The Retrofit Grants Program initially focused on potentially hazardous unreinforced masonry buildings and “soft story” buildings with five or more residential units. The program later expanded to include three- and four-unit apartment buildings and non-residential wood-framed buildings with soft story conditions, as well as non-ductile concrete buildings, and rigid wall/flexible diaphragm buildings (including tilt-up buildings).

The Retrofit Grants Program, launched with the Building and Safety Division’s first Hazard Mitigation Grant in 2017, led to the strengthening of 61 buildings within the City of Berkeley and disbursement of \$1,561,842.78 to individual property owners.

Table 22. Completed Retrofits by Building Type under 2017 Retrofit Grants Program:

Building Type	Quantity of Retrofits Completed
Mandatory Soft Story Retrofit	43
Voluntary Soft Story Retrofit	8
Unreinforced Masonry (URM) Retrofit	1
Rigid Wall – Flexible Diaphragm Retrofit	9
TOTAL	61

In 2020, the City was awarded an additional Hazard Mitigation Grant, enabling the Building &

Safety Division to launch a second iteration of the Retrofit Grants Program. Under this new round of the Retrofit Grants Program, the list of building types eligible for grant funding was further expanded to include other wood-framed buildings with seismic deficiencies, including those with inadequate anchorage to foundation and/or inadequate cripple wall bracing, multi-family “weak story” buildings, one-story open-front buildings, and buildings with unique configurations.

As of September 2023, the 2020 Retrofit Grants Program has led to an additional 32 buildings being strengthened, with more retrofits scheduled for completion prior to grant closeout in early 2025.

Although single-family homes and duplexes are not typically eligible for funding under the Retrofit Grants Program, other funding opportunities are available for property owners and are detailed below.

City Transfer Tax Rebate Program

By ordinance, the City created a program to rebate up to one-third of the transfer tax amount for expenses from voluntary seismic upgrades to homes. When the owner wishes to sell the house and the sale amount has been determined, the buyer and seller place a portion of the real estate transfer tax amount in an escrow account to be drawn down after improvements are complete. Since July 2002, the City has distributed over \$17 million to homeowners through this program.

Earthquake Brace + Bolt

The City participates in the Earthquake Brace + Bolt (EBB) program, a grant program administered by the California Earthquake Authority, providing grants of up to \$3,000 for seismic retrofits of owner-occupied residential buildings with 1-4 dwelling units.

The EBB program provides incentives to homes most vulnerable to severe damage in an earthquake, typically those built before 1979 with raised foundations and unbraced “cripple walls,” the wood-framed walls which surround the crawl space. Bracing the cripple walls with plywood and using anchor bolts to improve the connection between a home’s wood framing and its foundation are seismic improvements that can help reduce potential damage to a home during an earthquake.

The program supplements other programs to subsidize or finance seismic improvements in Berkeley homes; these programs can be used in combination or separately.

Earthquake Soft Story (ESS)

Earthquake Soft-Story (ESS) Retrofit grants, offered by the California Residential Mitigation Program, reimburses owners of single-family houses up to 75% of the total cost of code-compliant seismic retrofits, capped at \$13,000, on properties with a “soft story” living space built over a garage.

This new program was launched in spring of 2023 to incentivize homeowners to strengthen houses constructed pre-2000 with seismic vulnerabilities from living space constructed over a garage. The program supplements other programs to subsidize or finance seismic improvements in Berkeley homes; these programs can be used in combination or separately.

c.1.1 Expanded Inventory of Seismically Vulnerable Buildings

With the launch of the Retrofit Grants Program, staff conducted extensive research to update and refine the City's inventory of seismically vulnerable buildings. In addition to soft story buildings not currently subject to mandatory retrofit such as those with 3-4 residential units or commercial uses, Berkeley has numerous non-ductile concrete and tilt-up or other rigid wall-flexible diaphragm (RWFD) buildings. These additional building types may also be highly susceptible to adverse effects from earthquakes.

Although no ordinance currently requires property owners of these building types to retrofit, the City of Berkeley has encouraged owners to apply for grant money under the City's Retrofit Grants Program.

Non-Ductile Concrete Buildings

Non-ductile concrete buildings built prior to the mid-1970's and modern seismic code standards have performed very poorly in recent earthquakes, and have resulted in catastrophic collapses. In older concrete buildings, the detailing and construction of the reinforcing steel may be inadequate to safely resist large seismic forces caused by ground motions on these heavy structures. The most vulnerable buildings contain elements like columns, wall piers, and joints of beams and slabs that can fail in an earthquake. These buildings are considered "non-ductile" (i.e. brittle) concrete buildings and pose a high risk during a major earthquake. Retrofits of these buildings can vary widely in terms of scope and level of difficulty, and are often expensive to retrofit or rebuild.

Rigid Wall-Flexible Diaphragm (RWFD) Buildings Including Tilt-Up Buildings

Tilt-up or other rigid wall-flexible diaphragm building types are typically one- or two-story commercial buildings with reinforced concrete or reinforced masonry (brick or concrete block) walls. A "tilt-up" building is a specific type of building with precast concrete walls and is

distinguished by its method of construction. RWFD have “flexible” roof diaphragms that consist of wood or steel beams, trusses, or rafters with wood sheathing or metal decking above. They may also have flexible diaphragms at intermediate floor levels. These buildings commonly include warehouses, manufacturing facilities, large retail stores, and other similar structures. The most common deficiency is an inadequate connection between the rigid walls and the roof (and floors) leading walls to pull away and collapse during ground shaking. Buildings designed under codes that predated the 1998 California Building Code are of primary concern.

Soft Story and Other Wood-Framed Buildings Not Subject to Mandatory Retrofit

Similar to Soft Story buildings subject Berkeley Municipal Code Section 19.39.110, those with only 3-4 unit or commercial uses are also vulnerable to collapse in the event of an earthquake due to weak lateral load resisting systems.

Other wood-framed buildings with seismic deficiencies include those with inadequate cripple wall bracing and anchorage to the foundation and can result in buildings sliding off supporting foundations and cripple wall collapses. Additionally, the lowest story of multi-story buildings (3+ stories) may also be vulnerable to significant damage due to high demand to-capacity ratios and are primarily found to the south of UC Berkeley (Southside) and extending along College Avenue and nearby streets.

Open front one-story buildings common to major commercial corridors, while having less mass to drive seismic response than multi-story buildings, are still anticipated to have very significant torsional response and have potential concerns of partial or complete collapse. Buildings with unique configurations that could potentially be vulnerable to an earthquake have also been observed within the Berkeley building stock. These buildings are anticipated to be of an age that engineering for seismic loading would not have been provided at the time

of construction.

Process for Updating the Inventory of Seismically Vulnerable Buildings

The City has worked diligently to update and broaden its inventory of seismically vulnerable buildings to include potentially non-ductile concrete and rigid wall-flexible diaphragm buildings, and soft story buildings with 3-4 residential units or commercial uses. This effort began with extensive staff research to identify vulnerable buildings using City and other data sources. It was followed by a field study with the Earthquake Engineering Research Institute (EERI) to assess a portion of the newly identified non-ductile concrete and rigid-wall flexible-diaphragm buildings and a “virtual survey” to identify potential soft story buildings. This inventory has been utilized to target outreach efforts for the Retrofit Grants Program and to alert property owners of potential grant funding opportunities. Many of the buildings included in the inventory have not been evaluated by a licensed professional and are therefore viewed as “potentially vulnerable” to seismic activity. Assessment by a structural engineer or other qualified professional is required to determine whether or not seismic deficiencies exist within specific buildings.

Inventory of Potentially Seismically Vulnerable Buildings

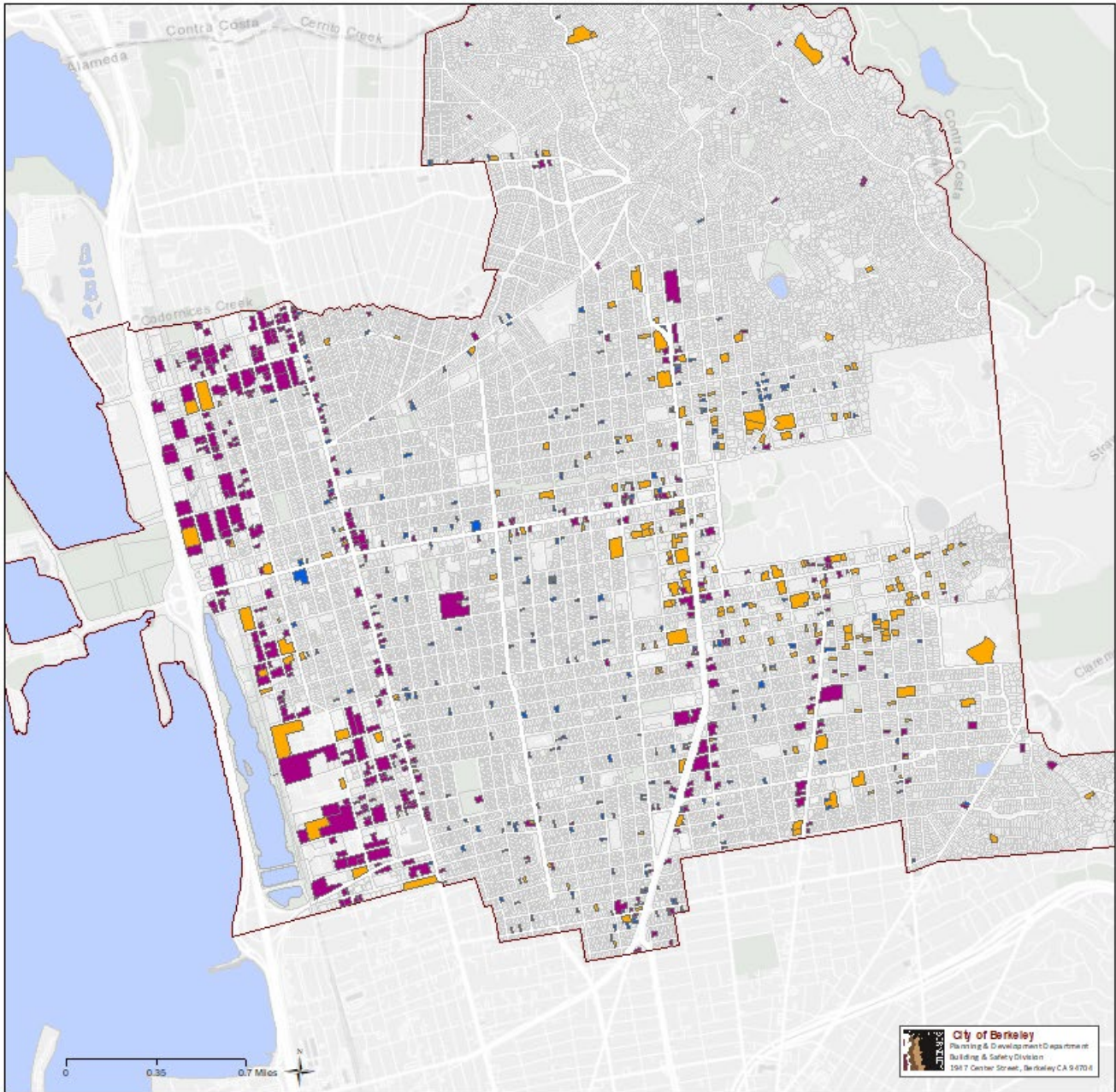
Previously, the City identified 1,047 potentially seismically vulnerable buildings that did not already appear on the soft story or URM inventories, including 230 potentially non-ductile buildings and nearly 550 buildings that may be rigid wall-flexible diaphragm, including tilt-ups. The City also added to the inventory approximately 240 soft story buildings not subject to mandatory retrofit under Chapter 19.39 of the Berkeley Municipal Code. Some of these buildings have now completed retrofits under the City of Berkeley’s Retrofit Grants Program.

Map 3 shows Berkeley’s Inventory of Potentially Seismically Vulnerable buildings, developed in 2018. Potentially soft, weak or open front (SWOF) buildings are somewhat evenly spread

throughout the City. Potentially non-ductile concrete buildings and rigid wall-flexible diaphragm buildings are more heavily concentrated along commercial corridors and west of San Pablo Avenue. Non-ductile concrete buildings are also clustered in central Berkeley, and near the UC Berkeley Campus. Soft story buildings are depicted in blue, non-ductile concrete buildings in orange, rigid wall-flexible diaphragm buildings in purple, and unreinforced masonry buildings in red.

This map reflects properties that may be eligible for funding under the City of Berkeley Retrofit Grants Program.

Map 41. Inventory of Potentially Seismically Vulnerable Buildings (September 2023)



- Parcel with Potentially Non-Ductile Concrete Building
- Parcel with Potentially Rigid Wall-Flexible Diaphragm Building (Including Tilt-up)
- Parcel with Potentially Soft Weak or Open Front Wood-Framed Building

c.1.m Fire Risk Reduction

The City, working together with key partners, is using a comprehensive strategy to aggressively mitigate Berkeley's wildland-urban interface (WUI) fire hazard. These approaches include prevention through development regulations; natural resource protection through vegetation management; protection of the built environment through defensible space and home hardening; improvement of access and egress routes; and infrastructure maintenance and improvements to support first responders' efforts to reduce fire spread.

Fire Prevention Division

City of Berkeley Fire Departments Fire Prevention Division works to decrease the number and severity of all fires in Berkeley. Mitigation actions include active code-enforcement program, public education activities, and engineering and plan review.

Fire Code

The City of Berkeley adopted the 2022 California Fire Code with Local Amendments. The Fire Code incorporates the latest knowledge and state regulations to protect people and property against known risk in both structural and non-structural building and site components. Mitigation actions including expanding the number of inspected properties and enforcing code requirements that contribute to life safety.

Hazardous Fire Area Zones

The City has established and adjusted fire zones in Berkeley. While the zones were initially established to address urban fire issues, they have evolved to designate the City's WUI fire hazard. Currently, the Berkeley Fire Department has divided the city into Fire Zones 1, 2, and 3, designated in order of ascending fire risk. Fire Zones 2 and 3 are in the hills area of the City. Mitigation actions include maintaining the strictest standards for fire prevention and

vegetation management measures in Fire Zones 2 and 3.

Wildland Urban Interface (WUI) Division

City of Berkeley Fire Department instituted a WUI division in 2021 supported with funding from Measure FF. The WUI Division is primarily responsible for the coordination of wildland mitigation efforts and related inspection activities.

Community Wildfire Protection Plan (CWPP)

In 2023, the City of Berkeley approved its first Community Wildfire Protection Plan (CWPP). The CWPP is a roadmap for fire hazard mitigation and preparedness at both the City and neighborhood levels, identifying ways to mitigate Berkeley's wildfire risk. The CWPP strategy includes goals for improving wildfire response, community preparedness, fuels management, infrastructure, ignition reduction, and home hardening.

Defensible Space and Home Hardening Inspection Program

The WUI Division coordinates defensible space inspections and home hardening assessments of all homes in Fire Zones 2 and 3. Dedicated inspectors from the WUI Division inspect 8,600 parcels on an annual basis, providing mitigation actions to property owners. Inspections provide an opportunity for specific education of property owners regarding steps to mitigate the risk of WUI fire on their properties. Data gathering from these inspections helps the Fire Department to better profile and model the risk of WUI fire to Berkeley.

Resident Assistance Program

The resident assistance program aims to provide financial assistance to residents who demonstrate physical or financial hardship in completing their required prescriptions for defensible space. In 2024 CalFIRE announced that the BFD was awarded a grant to fund its Defensible Space Resident Assistance Program (RAP) in the VHFHSZ over a three-year

period to interrupt the contiguous vegetative fuel in these pathways and inhibit the transmission of wildfires. The RAP will provide financial assistance to Berkeley Hills residents who are low-income, senior citizens 65 years or older, and those with physical disabilities to help achieve defensible space within Zone 0, Zone 1 and Zone 2 on their properties in compliance with State law and best practice.

Vegetation Management Programs

The City also runs a number of vegetation management programs to reduce fuel loads, including:

- The Fire Fuel Chipper Program, a popular yard waste collection service, expanded citywide. It includes free curbside chipping, pickup, and disposal of vegetation materials from residential properties to assist residents in their efforts to create and maintain a defensible space around their home. The expanded program now makes it easier to schedule free chipping and disposal.
- A fire fuel abatement program on public land. This program was maintained in order to reduce fire fuel on public property.
- The Fire Fuel Debris Bin Program is coordinated by the Department of Public Works' Zero Waste Division, which delivers and removes 30-yard roll-off boxes from requesting neighborhoods.
- Additionally, residential and commercial plant debris and commercial food waste is collected each year through weekly curbside collection and converted to compost.
- The Eucalyptus Understory Cleanup is a program that provides a one-time service to bring properties into compliance with best practice hazardous vegetation management practices. Planted in plantations over 100 years ago, eucalyptus groves can produce

between 10 to 30 tons of dry matter per acre per year, increasing the potential to spread a ground fire. Eucalyptus trees can be extremely expensive to remove due to their size and age. Following participation in this program, residents will be required to maintain properties in adherence with the Fire Code.

- Planning for the City of Berkeley Fuel Break Project began in October 2023 and implementation will begin in 2024. Experienced fuel reduction crews, registered professional foresters, and traffic control crews will work to create fuel breaks along 40+ miles of high-traffic areas within Berkeley.
- The Fire Department's WUI Division is also working to develop a comprehensive WUI work plan that will provide strategic guidance for related work for the next five years. Plans are to expand existing programs and extend some services citywide, including fuel reduction on public lands and roadsides, private land incentives, debris bins, and citywide chipping services. Since 2019, Berkeley has removed nearly 300 hazardous trees (mostly eucalyptus and Monterey Pine) from City parks, paths, and street rights-of-way. Another roughly 40 trees have been trimmed or cut back.

Firewise Communities

The Firewise USA® program, led by the National Fire Protection Association (NFPA), offers a structured approach for communities to enhance their wildfire resilience in California. This initiative promotes collaborative efforts among residents, the Fire Departments, and other key stakeholders to bolster the fire resistance of homes and surroundings. Neighborhoods raise awareness, organize at the community level, coordinate work, and take action to create fire-adapted communities through the implementation of defensible space standards. The Berkeley Fire Department staff provide guidance to help interested neighborhoods achieve Firewise recognition. Currently, Berkeley has multiple Firewise communities.

Hills Emergency Forum

The City of Berkeley is a charter member of the Hills Emergency Forum, a consortium of nine agencies working on fire mitigation measures for the East Bay Hills. Future mitigation actions include partnering with the other agencies to reduce collective wildfire risk.

Diablo Firesafe Council

The City is involved with Diablo Fire Safe Council (DFSC), a 501(c)3 nonprofit organization. The Council's role in Alameda and Contra Costa Counties is to serve as a catalyst for bringing together people, agencies, and the means to substantially reduce the impact of wildland fire on our communities.

c.1.n Community Readiness

Outdoor Warning System: Emergency Siren Network

In 2023, the City of Berkeley introduced a new outdoor warning system to alert people outdoors to emergency conditions. The outdoor warning system will broadcast siren tones and spoken life safety instructions over any of 15 sirens to be located on top of buildings throughout Berkeley. The system will be used alongside other alert and warning tools, including AC Alert, Berkeley's Emergency Map, and Wireless Emergency Alerts. Sirens are expected to be fully installed by the end of 2024.

Community Disaster Preparedness Training and the Community Emergency Response Team (CERT) Program

The City of Berkeley offers free disaster readiness classes to Berkeley community members. One curriculum is from the CERT program, which includes disaster preparedness, fire safety,

disaster medical operations, light search and rescue operations, CERT Organization, and continuing education courses.

City staff instructors have developed additional training modules tailored to the Berkeley community, including Improvisational Leadership, fire extinguisher training and hands-only CPR. Staff continues to develop additional courses to reach more community members with disaster readiness education.

Instructors provide community trainings at the Fire Department training facility and City libraries. They also meet community members in their neighborhoods to provide disaster readiness trainings in their communities.

Community Emergency Supply Program (Disaster Caches)

For more than 20 years, the Disaster Cache Program incentivized community-building for disaster readiness. The City has awarded caches of disaster response equipment to neighborhoods, congregations, and UC Berkeley Panhellenic groups that have undertaken disaster readiness activities – chief among them, participation in the CERT program. Civilian CERT instructors also help recipient neighborhoods with “cache checks” to help community members with initial or refresher training on how to use the items in the cache.

A 2024 program assessment by researchers at the UC Berkeley Goldman School for Public Policy identified that the program has connected neighbors around disaster preparedness topics, but also that it has notable gaps in equity, sustainability, and scalability. Staff is considering the findings in this report in an effort to redesign the program to help meet community needs the next 20 years.

Community Resilience Center (CRC) Program

Through the CRC program, the City of Berkeley’s Office of Emergency Services and Public

Health Emergency Preparedness Divisions partner with community organizations serving marginalized community members on disaster readiness topics. The CRC Program’s goal is to enhance the resilience of the people of Berkeley by strengthening the organizations they depend on day-to-day and providing disaster preparedness outreach and training through organizations they know and trust. The City selected CRC organizations based on their connection to Berkeley community members who have not been reached by the City’s existing preparedness programs. CRC organizations agree to host trainings and participate in disaster preparedness-related events that are customized to fit their audiences. In return for hosting training they receive emergency supplies to help them serve their community following a disaster.

Community Oversight

The Disaster and Fire Safety Commission advises the City Council on all matters affecting fire safety and/or disaster resilience within Berkeley. The Commission also serves as the citizens’ oversight committee for expenditure of the proceeds of Measures FF and GG.

c.1.o State and Federal Programs

Many City ordinances and programs are based on State requirements. The State has numerous laws that regulate issues ranging from hospital seismic safety to coastal development. The table below highlights important State laws related to hazards, and describes how Berkeley complies with these laws.

Table 23. State Mitigation Requirement and Berkeley Implementation

Statewide Requirements	Berkeley Implementation
Mandatory Building Code. The State requires all communities to enforce the	Berkeley enforces the State building code with additional local provisions for seismic

<p>State- mandated building code. The building code applies to new buildings and additions, renovations and remodeling of existing buildings. The effectiveness of designs based on the code to resist earthquakes has improved incrementally over time. The code is not applied retroactively, meaning that building owners do not have to retrofit existing buildings to improve earthquake, fire or flood resistance unless the work proposed exceeds previously-defined thresholds. Certain types of buildings designed to early codes have characteristics that make them vulnerable to collapse in catastrophic earthquakes.</p>	<p>and fire safety. The City has adopted the 2022 California Building Code and 2022 California Residential Code. Berkeley's application of WUI fire standards exceeds current State requirements.</p>
<p>Essential Services Buildings. State law requires that new essential services buildings, such as police, fire, and emergency operations and communications centers, meet a higher safety standard than other buildings. The standards include backup utilities and design and construction checks by</p>	<p>The Public Safety Building, which houses the 9-1-1 emergency communications center and Emergency Operations Center, along with all seven fire stations, the Fire Warehouse and the Ratcliff building, have all been built or retrofitted to meet essential services requirements.</p>

inspectors following State guidelines.	
<p>Safety Element and General Planning Requirement. State law requires all cities and counties to prepare, adopt and keep current a general plan. Part of the plan is the “Safety Element” which defines the community approach to disaster preparedness and mitigation.</p>	<p>Berkeley completed updates to the General Plan, including the Disaster Preparedness and Safety Element, in 2003. One of the plan’s key goals is to make a disaster-resilient community. The Safety Element has a mitigation approach and significant policy and action recommendations. The 2004 mitigation plan built directly from the General Plan, and this 2024 update continues to use the General Plan as a strategic guide.</p> <p>Additionally, as of 2024 the City has begun work on updates to the Disaster Preparedness & Safety Element of the General Plan, as well as a new Environmental Justice Element.</p>
<p>Environmental Review. The California Environmental Quality Act requires that government entities consider the environmental consequences of discretionary decisions having a substantial environmental impact. CEQA guidelines require evaluation of the effect</p>	<p>The City of Berkeley complies with State CEQA requirements.</p>

<p>of hazards on development and the resulting consequences for the environment.</p> <p>On occasion, certain emergency safety projects are exempted from the CEQA process.</p>	
<p>Fault Zones. Alquist-Priolo Earthquake Fault State requirements prohibit construction of public schools and buildings within the designated fault zones. Houses with three or fewer units are exempt from these provisions. Real estate law requires disclosure of the fault zone at the time of sale, and requires zone maps to be available for review by the public.</p>	<p>The California Geological Survey created maps that delineate a ¼-mile-wide fault zone through the east side of the city, where the Hayward Fault is located. The Risk Assessment of this mitigation plan replicates these maps. Because of the well-defined surface expression of fault, it is reasonable to expect ground surface rupture in this area during future earthquakes.</p>
<p>Seismic Hazards Maps. The California Geologic Survey mapped seismic zones where earthquake-induced landslides and liquefaction are likely. The State requires site-specific investigations for new building in these zones.</p>	<p>Seismically-induced landslide risk maps are available in the Risk Assessment of this plan. The City enforces State requirements by requiring site-specific investigations and feasible mitigation measures.</p>

<p>Disclosure of Earthquake Risk. Four State laws work in tandem with State real estate requirements that mandate full disclosure of information pertinent to building purchase decisions. Owners of homes built before 1960 and certain commercial buildings are required to provide information on seismic vulnerability. Sellers must also disclose if the parcel is located in a mapped fault zone or seismic hazard area.</p>	<p>The City of Berkeley complies with this State law.</p>
<p>Bayfront Development. The City of Berkeley abuts San Francisco Bay. All land inundated by the highest tides is within the jurisdiction of the San Francisco Bay Conservation and Development Commission (BCDC).</p>	<p>Developments within the City-owned and -operated Berkeley Marina require a permit from BCDC. The BCDC's Engineering Criteria Review Board subjected the restaurants, harbormaster building and piers to rigorous independent review before construction. Full consideration is given to the effects of deep- saturated, bay mud soils and fill material. All development in this zone must be elevated one foot over flood levels.</p>

<p>Hospital Seismic Safety Act. The Office of Statewide Health Planning and Development (OSHPD) regulates hospital construction and renovation. By 2013, all hospital buildings built before 1973 must be replaced or retrofitted so they can reliably survive earthquakes without collapsing or posing threats of significant loss of life. By 2030, all existing hospitals (including those built after 1973) must be seismically evaluated and retrofitted, if needed, so they are reasonably capable of providing services to the public after disasters.</p>	<p>There is one acute care hospital in Berkeley, Alta Bates, owned and operated by the Sutter Health Corporation. The corporation is planning to close by 2030.</p>
<p>Unreinforced Masonry Building Law. The State required all jurisdictions to identify unreinforced masonry (URM) buildings, to notify owners regarding the expected performance of these buildings, and to adopt a plan to deal with the threat.</p>	<p>Berkeley identified 700 URMs and designated a mandatory retrofit ordinance. Of the original list, roughly 99% have been seismically retrofitted, demolished or demonstrated to have adequate reinforcement.</p>
<p>Emergency Response Plans. In the wake of the 1991 Tunnel Fire, the State requires that all jurisdictions practice the Standardized Emergency Management</p>	<p>The City complies with all State requirements.</p>

System (SEMS), a uniform approach to disaster response based on the fire service's Incident Command System (ICS).	
Field Act. Originally passed in 1933, the Field Act regulates the design, construction and renovation of public school buildings, and the inspection of existing school buildings. Many subsequently adopted State laws, amendments to the Field Act, and supplementary laws, call for additional safety measures for all public K- 12 schools in the state. California has the most stringent safety codes for school buildings in the U.S.	All public schools have been upgraded to the standards of the Field Act and its amendments.
AB1409. Requires that the Safety Element to be reviewed and updated as necessary to identify evacuation locations.	The City of Berkeley is completing this analysis and will include results in the new edition of the General Plan's Disaster Preparedness & Safety Element.

<p>SB99. Requires that the Safety Element shall be reviewed and updated to identify residential developments in any hazard area identified in the Safety Element that do not have at least two evacuation routes.</p>	<p>The City of Berkeley is completing this analysis and will include results in the new edition of the General Plan's Disaster Preparedness & Safety Element.</p>
<p>AB747. Requires that the Safety Element shall identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios.</p>	<p>The City of Berkeley is completing this analysis and will include results in the new edition of the General Plan's Disaster Preparedness & Safety Element.</p>

C.2 National Flood Insurance Program

Berkeley's creek flooding exposure is assessed through the National Flood Insurance Program (NFIP), which makes federally-backed flood insurance available to homeowners, renters, and business owners in participating communities. Participants in the NFIP must regulate development in floodplain areas in accordance with NFIP criteria.

Berkeley has participated in the NFIP since September 1, 1978 and is currently in good standing with the Program. NFIP compliance is monitored by FEMA regional staff and by the California Department of Water Resources under a contract with FEMA.

As part of Berkeley's effort to comply with the requirements of the NFIP, Berkeley has adopted various floodplain management measures. Thanks to the fact that the City has abided by and enforced federal flood insurance program requirements since the 1970s, flood insurance claims have been extremely low.

Berkeley's Flood Zone Development Ordinance regulates development in areas identified in the Flood Insurance Study and Flood Insurance Rate Maps.

The Current Flood Insurance Rate Map are presented in this Plan's Risk Assessment (Element B.10.b *Location of Floods*)

To file insurance claims with FEMA for flood damage, owners of parcels in this area must have FEMA flood insurance, and comply with the terms and conditions of the insurance. Few Berkeley homeowners are known to carry flood insurance, presumably because of

negligible flood damage in recent decades, so those losses would be borne almost entirely by building owners.

The City last updated Berkeley Municipal Code (BMC) Chapter 17.12: Flood Zone Development Ordinance in September 2009 to maintain Berkeley's continued compliance with FEMA National Flood Insurance Program requirements. The Ordinance regulates all publicly- and privately-owned land within the areas of special flood hazard. BMC 17.12 automatically incorporates new FIRM panels. BMC 17.12 establishes the Director of the Public Works Department as the Floodplain Administrator for the City and addresses standards for construction, utilities, subdivisions, manufactured homes and recreational vehicles.

The City of Berkeley will maintain participation in the National Flood Insurance Program under the Public Works Department's Engineering Division and the Planning and Development Department's Land Use Planning and Building and Safety Divisions. The Supervising Civil Engineer will work with FEMA and other partners to continue to update and revise flood maps for the City, and to continue to incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards. The Zoning Officer and Building Official are responsible for applying BMC requirements to private property projects.

Implementation of substantial improvement/damage provisions after an event

In the City of Berkeley, implementing the substantial improvement or damage provisions of the floodplain management regulations involves a structured process aimed at ensuring that properties affected by substantial improvement or damage comply with

floodplain regulations.

In the City of Berkeley, the Director of Public Works or their designee is the Floodplain Administrator (FPA), and they coordinate with the Zoning Officer, Building Official, and City Engineer. After an event such as flooding or any other incident causing substantial improvement or damage to properties in flood-prone areas, the Building and Safety Division of the Planning Department assesses the extent of the damage and proposed improvement. This includes checking if the improvements meet the required elevation standards, use of flood-resistant materials, and other relevant criteria.

Applicants are required to provide the following:

1. Plans in duplicate, drawn to scale.
2. Certification from a registered civil engineer or architect that the nonresidential flood proofed building meets the floodproofing criteria.
3. For a crawl-space foundation, location and total new area of foundation openings as required and detailed in FEMA Technical Bulletins 1-93 and 7-93.
4. All appropriate certifications.

The FPA reviews all permits for development that fall within the special flood hazard area (SFHA) and qualify as new construction or substantial improvement to determine whether:

1. The application is complete;

2. The requirements have been satisfied, including determination of substantial improvement and substantial damage of existing structures;
3. All other required state and federal permits have been obtained;
4. The site is reasonably safe from flooding;
5. The proposed development does not adversely affect the carrying capacity of areas where base flood elevations have been determined but a floodway has not been designated. This means that the cumulative effect of the proposed development when combined with all other existing and anticipated development will not increase the water surface elevation of the base flood more than one foot at any point within the City of Berkeley; and
6. All letters of map revision (LOMRs) for flood control projects have been approved prior to the issuance of building permits. Building permits must not be issued based on conditional letters of map revision (CLOMRs). Approved CLOMRs allow construction of the proposed flood control project and land preparation as specified in the "start of construction" definition.

The FPA uses FEMA Publication 213, "Answers to Questions About Substantially Damaged Buildings," to develop detailed procedures for identifying and administering requirements for substantial improvement and substantial damage, to include defining "market value." When base flood elevation data has not been provided in accordance with regulations, the Floodplain Administrator shall obtain, review, and reasonably utilize any base flood elevation and floodway data available from a federal or state agency, or

other source, in order to administer this chapter.

The FPA is responsible for notification of other agencies, including:

1. Notifying adjacent communities and the California Department of Water Resources prior to alteration or relocation;
2. Submitting evidence of such notification to the Federal Emergency Management Agency; and
3. Assuring that the flood carrying capacity within the altered or relocated portion of said watercourse is maintained.
4. If the Base Flood Elevation Changes Due to Physical Alterations, within six months of information becoming available or project completion, whichever comes first, the FPA shall submit or assure that the permit applicant submits technical or scientific data to FEMA for a letter of map revision (LOMR). All LOMRs for flood control projects are approved prior to the issuance of building permits. Building permits must not be issued based on conditional letters of map revision (CLOMRs). Approved CLOMRs allow construction of the proposed flood control project and land preparation as specified in the "start of construction" definition. Such submissions are necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and floodplain management requirements are based on current data.
5. Notifying FEMA in writing whenever the corporate boundaries have been modified by annexation or other means and include a copy of a map of the community

clearly delineating the new corporate limits.

The Building and Safety Division enforces compliance with floodplain regulations through inspections and monitoring. They ensure that the construction or improvements proceed according to the approved plans and that all regulatory requirements are met. Given that the City of Berkeley participates in the NFIP (National Flood Insurance Program), the FPA coordinates with FEMA to ensure that their implementation of substantial improvement/damage provisions meets federal requirements. This collaboration helps maintain eligibility for NFIP benefits and ensures consistency with national floodplain management standards.

For example, the FPA is responsible for the following:

1. Obtaining and maintaining for public inspection all Documentation of Floodplain Development.
2. Maintaining a record of all variance actions, including justification for their issuance, and report such variances issued in its biennial report submitted to FEMA.
3. Making interpretations where needed, as to the exact location of the boundaries of the areas of special flood hazard, where there appears to be a conflict between a mapped boundary and actual field conditions. The person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation.
4. Taking actions to remedy violations.

5. Completing and submitting a biennial report to FEMA.
6. Assuring the community's General Plan is consistent with floodplain management objectives.

C.3 Disaster Mitigation Goals

Berkeley will focus on five goals to reduce and avoid long-term vulnerabilities to the hazards identified in Element B: *Risk Assessment*

- Reduce the potential for loss of life, injury, and economic damage to Berkeley residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, extreme heat, poor air quality, infectious disease, sea level rise, wind, utility disruption and their secondary impacts.
- Increase City government's ability to serve the community during and after hazardous events by mitigating risk to key City functions.
- Protect and enhance quality of life in Berkeley.
- Connect with residents, community-based organizations, institutions, businesses, and essential lifeline systems in order to increase mitigation actions and disaster resilience in the community.
- Co-create mitigation plans, policies, and programs with Berkeley's underserved communities, elevating the voices of these community members and prioritizing their needs to prepare for and adapt to climate change and natural hazards.

C.4 Overview of Actions

This plan identifies and analyzes 33 mitigation actions to reduce the impacts from hazards

described in Element B: *Risk Assessment*. This suite of actions addresses every natural hazard posing a threat to Berkeley, with an emphasis on new and existing buildings and infrastructure. Given the number of new hazards included in the plan, several new actions and proposed activities were considered and added.

Plan actions were developed through a multi-step, broadly-inclusive process. The City convened an interdepartmental planning team, which reviewed the actions identified in the 2019 mitigation plan, as well as Berkeley’s progress on these actions since 2019. This Team then revised these actions, identified new actions, and established priorities to guide Berkeley’s mitigation strategy for the next five years. Actions with clear funding mechanisms were given greatest consideration. Based on feedback from community members, staff revised actions and incorporated them into this 2024 First Draft Plan. Additional detail on the process used to identify actions is provided in Element A: *Planning Process*.

Tables 4, 5, and 6 below summarize all of the actions. The tables group actions by their priority level (see Element C.5.a for details on prioritization of actions), and identify the hazard(s) that each action addresses.

The 2024 Strategy Actions Spreadsheet in the Appendix includes further detail about each action, including how each action benefits socially vulnerable populations. Actions that were considered but not prioritized are included in the second tab of the Strategy Actions Spreadsheet.

Table 24. *High-Priority Actions in mitigation strategy*

Action	Hazards
Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.	Multi-hazard
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Multi-hazard
Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.	Multi-hazard
Implementation of the Retrofit Grants Program which helps Berkeley building owners increase safety and mitigate the risk of damage caused by earthquakes	Earthquake
Continue implementation of the Soft Story Retrofit Program, which mandates seismic retrofit of soft story buildings with 5+ residential units.	Earthquake
Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.	Earthquake
Monitor passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices.	Earthquake
Reduce fire risk in existing development through fire code updates and enforcement.	Wildland-Urban Interface Fire
Reduce fire risk in existing development through vegetation management.	Wildland-Urban Interface Fire
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Earthquake Wildland-Urban Interface Fire
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Earthquake Wildland-Urban Interface Fire
Research, identify, and implement infrastructure improvements to facilitate emergency evacuation.	Wildland-Urban Interface Fire Tsunami
Mitigate wildfire risk to Berkeley's overnight camps	Wildland-Urban Interface Fire

Action	Hazards
Reduce fire risk through utility undergrounding.	Earthquake Wildland-Urban Interface Fire High Winds
Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.	Earthquake Wildland-Urban Interface Fire
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Extreme Heat Poor Air Quality
Mitigate hazards associated with natural gas usage, including disaster damage and energy service disruption, by minimizing need for energy use and moving toward use of electricity in lieu of natural gas.	Multi-hazard
Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.	Multi-hazard
Maintain City participation in the National Flood Insurance Program.	Floods
Maintain City programs and projects to mitigate the impacts of infectious diseases in Berkeley.	Infectious Disease
Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.	Multi-hazard
Coordinate with and encourage mitigation actions of key City partners.	Multi-hazard
Coordinate regional wildfire mitigation strategies with key partners and stakeholders	Wildland-Urban Interface Fire
Advance equitable community resilience, with a focus on disadvantaged communities.	Multi-hazard

Table 25. Medium-Priority Actions in mitigation strategy

Action	Hazards
Reduce Berkeley's vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.	Landslide Floods

Action	Hazards
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Extreme Heat Poor Air Quality
Implement energy assurance strategies at critical City facilities.	Multi-hazard Utility Interruption
Implement existing City programs, plans, and projects designed to reduce emissions that contribute to poor air quality.	Poor Air Quality Extreme Heat
Mitigate the impacts of sea level rise in Berkeley.	Sea Level Rise Flood

Table 26. *Low-Priority Actions in mitigation strategy*

Action	Hazards
Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.	Multi-hazard
Collaborate with partners to increase the security of Berkeley's water supply from climate change impacts.	Multi-hazard
Mitigate Berkeley's tsunami hazard.	Tsunami
Give priority to project applications that would rebuild to current standards following disasters.	Multi-hazard

C.5 Action Prioritization

The City's Core Planning Team incorporated eight key factors into the prioritization strategy used for 2024 mitigation actions. These criteria are described below and summarized in the table that follows.

Key Factors

Support of goals and objectives

Actions that support multiple goals and objectives are prioritized.

Cost/benefit relationship

A detailed benefit cost analysis is required for FEMA grant eligibility. A less formal approach is taken here to weigh the relative costs and benefits of various actions. Because some projects may not be implemented for up to 10 years, the associated costs and benefits may change significantly over time. The following parameters were used to establish high, medium and low costs and benefits.

Costs

- *High:* Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).
- *Medium:* The project could be implemented with existing funding but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- *Low:* The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Benefits

- *High:* Project will provide an immediate reduction of risk exposure for life of property.
- *Medium:* Project will have a long-term impact on the reduction of risk exposure for life of property, or project will provide an immediate reduction in the risk exposure for property.
- *Low:* Long-term benefits of the project are difficult to quantify in the short term.
- Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly.

Funding availability

Actions with secured funding are prioritized.

Hazards addressed

Actions addressing the Plan's hazards of greatest concern (earthquake and wildland-urban interface fire) are prioritized.

Public and political support

Actions with public and political support are prioritized.

Adverse environmental impact

Actions with low environmental impact are prioritized.

Environmental benefit

Actions that provide an environmental benefit are prioritized.

Benefit for marginalized communities

Actions that serve marginalized populations are prioritized.

Timeline for completion

Actions that are ongoing, or that can be completed in the short-term, are prioritized.

- Ongoing: Currently being funded and implemented under existing programs
- Short-term: To be completed in 1-5 years
- Long-term: To be completed in more than 5 years

The following table summarizes prioritization criteria. Using these factors, mitigation actions have been divided into high, medium, and low priorities. Some actions may not meet all criteria within their prioritization category. In these cases, the City's Core

Planning Team assigned the most suitable category.

Table 27. 2024 Action Prioritization Structure

Factors	Priority		
	High	Medium	Low
Support of goals and objectives	Supports multiple goals and objectives	Supports goals and objectives	Will mitigate the risk of a hazard
Cost/benefit relationship ¹	Benefits exceed cost	Has benefits that exceed costs	Benefits do not exceed the costs or are difficult to quantify
Funding availability ²	Funding has not been secured, but the action is grant eligible under identified grant programs	Funding has not been secured, but the action is grant eligible under identified grant programs	Funding has not been secured, and a grant funding source has not been identified
Hazards addressed	Addresses hazards of greatest concern	May not address hazards of greatest concern	Addresses hazards identified in Hazard Analysis
Public and political support	Has public and political support	Has public and political support	May not have public and political support
Adverse environmental impact	No environmental impact	Low environmental impact	May not have a low environmental impact
Environmental benefit	Environmental benefit	No environmental benefit	No environmental benefit
Benefit for marginalized communities	Benefit	Maybe some benefit	No benefit
Timeline for completion	Can be completed in the short term (1 to 5 years) or is ongoing	Can be completed in the short-term, once funding is secured	Timeline for completion is long-term (6-10 years)

¹ Actions that address other hazards, but for which benefits exceed costs, may also be considered high priority.

² Medium priority projects will become high priority projects once funding is secured.

C.5 Household Mitigation Actions

The Local Hazard Mitigation Plan is designed to address and recognize how the whole community can and does work together to mitigate Berkeley's natural hazards. The following steps are ways that individual community members and households reduce their own risks and contribute to Berkeley's collective mitigation efforts:

Earthquakes

Secure your home

- Store heavy and breakable objects on low shelves
- Bolt bookshelves and heavy furniture to the wall
- Move or secure hanging objects over beds, sofas, and chairs
- Use quake gel or putty to secure breakable objects in place

For homeowners

- Assess your home by hiring a structural engineer
- Retrofit your home if needed
- Understand available retrofit grants, including the City's Brace and Bolt program
- Consider earthquake insurance

For renters

- Talk to your landlord:
- When was the house built?

- What materials were used?
- Is the building retrofitted?
- Does it require retrofitting?
- Consider earthquake insurance

Prepare to be safe at home

- Store water (enough for 1 gallon per person per day for 3 days)

Practice what to do during an earthquake

- Drop, cover, and hold on
- Do not stand in a doorway, run, or get into the “triangle of life”. The 'Triangle of Life' is a misguided idea about the best location a person should try to occupy during an earthquake. Based on observations of past earthquakes, this idea doesn't apply to buildings constructed within the United States. Please do not consider this as a safe hiding spot.
- Learn how to turn off gas, electricity, and water at your house. If you rent, check in with your landlord.
- If after an earthquake you smell gas, contact PG&E and tell them to shut it off or call 9-1-1

Wildland-Urban Interface Fire

Berkeley hills residents (Fire Zone 2 & 3):

- Review home's Defensible Space Report and follow the instructions on defensible space and home hardening.
- Create Defensible Space: Understand that all of Berkeley is at risk of wildland-urban interface fire. Further, 95% of property in Berkeley is privately owned, meaning that owners have to act to make their properties defensible.
- Defensible space is the area around a home where vegetation has been specifically maintained, and flammable items have been specifically positioned, in

order to reduce the spread of wildfire.

- Keep Zone 0, or the first five feet from your home, clear of combustible materials. Use hardscape like gravel or concrete, remove dead or dying plants, remove branches from chimneys, limit combustible items like patio furniture, relocate firewood, replace any combustible fencing, and consider relocating garbage containers outside this zone.
- In Zone 1, or five to 30 feet around your home, remove all dead plants and dry leaves, and trim trees regularly. Create a separation between items like shrubs and items that catch fire like patio furniture and swing sets.
- In Zone 2, or 30 to 100 feet from your home, reduce potential fuel within 100 feet of the property line. This includes cutting annual grass, creating space between shrubs and trees, removing fallen leaves, and keeping clearance around exposed wood piles.
- Harden your home to decrease the likelihood of fire igniting the structure. The highest priority items are:
 - Install a fire resistive roof
 - Clear and maintain decks and covered porches
 - Regularly clear tree debris
 - Remove large rugs and combustible wood, wicker, or plastic furniture
 - Ensure any small items like cushions are small enough to be moved inside on Red Flag or Extreme Weather days
 - Remove anything stored under the deck or stairs
 - Include a five-foot noncombustible buffer around deck and stairs
 - Install non-combustible gutter guards to keep tree debris out
 - Ensure the vents to your attic, basement, and crawlspace will block wind-blown embers from entering your home. You can install ember-resistant vents or cover Be ready to receive emergency information.

For all Berkeley residents:

- Use the free [Berkeley Chipper Day Program](#) for curbside pickup, chipping, and disposal of vegetation material from your residential property.
- [Sign up for AC Alert](#)
- Bookmark and get familiar with [Berkeley's Emergency Map](#)
- Get familiar with the test and emergency tones from [Berkeley's Outdoor Warning System](#)
- Make your [household fire weather plan](#).
- Stay out of the hills during extreme fire weather days.

Extreme Heat

Prepare to be safe at home

- Gather supplies to keep yourself cool, including:
 - Ice – fill up all your ice trays and freeze them and any ice packs overnight
 - Spray bottle – to spray mist on yourself to keep cool
 - Personal fan – fan to point at yourself
 - Towel – to wet and put on your body
- Plan to [keep your home cool on hot days without air conditioning](#), using:
 - A larger fan – to move hot air out of your home
 - An indoor/outdoor thermometer – set this up to know when to let cooler outside air into your home
 - Be ready to block sunlight and heat, using blackout curtains, reflective film, solar blankets or cardboard. Blocking your windows with a light-colored sheet facing out, followed by a dark-colored sheet facing in, can help to reflect light away and keep your home cooler.

- Prepare for potential power outages (*see utility disruption section*)

Make a plan for where to go (and how to get there) if your home gets too hot.

- Consider locations you could visit that have air conditioning, like malls, stores, or community cooling centers.
- Make a transportation plan – consider using friends and family, public transit, carpooling, or using a taxi or rideshare service.
- If you use a wheelchair or other mobility device, you may also consider:
- Pre-scheduling a paratransit trip to a cool location before the hottest hours of the day
- Using [Easy Does It](#) for a Rescue Ride or Routine Transportation ([BRSD members only](#))

Buddy up with your friends, family, and neighbors:

- Make a plan to check on friends, family and neighbors at least twice a day during a heat wave. Check to see if people are developing signs of heat exhaustion or heat stroke. Remember that people who live alone are at the greatest risk in a heat wave because no one will notice if they develop heat stroke.
- Think about how to work together to get to a location with air conditioning or a community cooling center if someone's home gets too hot.

Monitor the heat

- The Occupational Health and Safety Administration (OSHA) [Heat Safety Tool](#) helps you understand how hot it is where you are located.

During a heat wave

- Get Plenty to Drink: Sweating removes needed salt and minerals from the body. When it is hot, drink more water, juice and sports drinks. Avoid drinks with caffeine (tea, coffee, and cola) and alcohol. Be sure to eat regularly.
- Stay safe in your home:
 - Wear as little clothing as possible when you are at home. Choose

lightweight, loose-fitting clothing.

- Spray yourself with water or make your skin wet with towels, then stand in front of a fan. When the water evaporates it will pull heat away from your body.
- Keep windows open at night to capture the cool air. Closing windows to trap the cool air in the morning can be helpful before the heat of the day comes. If you have an indoor/outdoor thermometer, monitor temperatures inside and outside your home. When it is cooler outside, open windows and doors to let in cool air. When temperatures are equal, close windows and doors to keep cool air in as the outdoors heats up.
- If you must go outside:
 - Choose lightweight, light-colored, loose-fitting clothing. In the hot sun, a wide-brimmed hat will keep the head cool. If you will be in direct sun, use a sunscreen with a sun protection factor (SPF) of 15 or higher and follow package directions. Reapply every 2 hours while in the sun.
 - Schedule Outdoor Activities Carefully: Try to be less active during the hottest part of the day, late afternoon. If you must be out in the heat, plan your activities so that you are outdoors either before noon or in the evening. While outdoors, rest often in a shady area.
- Never leave children or pets in a parked car.
- Pace Yourself: If you are not used to working or exercising in hot weather, start slowly and pick up the pace gradually. Take frequent, regularly scheduled breaks. If activity in the heat makes your heart pound or leaves you gasping for breath, stop activity, get into a cool or shady area, and rest. Especially if you become lightheaded, confused, weak or feel faint.

Poor Air Quality

Get air quality information

- Be familiar with the [Air Quality Index](#)
- Bookmark websites with key air quality information:
- Forecasts: [AirNow.gov](#)

- Real-time readings: [US EPA/US Forest Service Fire and Smoke Map](#)

Prepare your home for poor air quality

- Keep outside pollution outside by replacing or sealing leaky windows and doors. This will also make your home more energy efficient and comfortable.
- People on limited incomes should check out California Weatherization Assistance Program services offered by [Spectrum Community Services](#).
- Purchase equipment to clean the air inside your home, with filters for your HVAC system or portable air cleaners.
- HVAC system filters: If properly configured and maintained, air cleaners and specialized filters designed for use in HVAC systems may have the greatest potential to improve your entire home's air quality because most HVACs circulate very large volumes of filtered air throughout the home.
- Install a high-efficiency filter (MERV 13 rating or higher) with a MERV rating as high as your system can handle, based on manufacturer recommendations.
- Portable air cleaners: These units are usually best for single room use, rather than multiple room or whole-house use, because of their limited capacity to circulate large volumes of filtered air.
- Purchase one or more [California Certified Air Cleaners](#) for room(s) in your home. Make sure your cleaner is on this certified list so you can be sure it will not emit harmful ozone when you use it.
- Use the "Clean Air Delivery Rate" (CADR) to [calculate the correct size portable air cleaner for the room](#).
- If an air cleaner is out of your price range, you can [construct one with a box fan](#) for a cost of \$45-\$75.

Key Actions during poor air quality events (see the California Air Resources Board's [Smoke Ready California](#) site for details)

- **Stay inside:** The best way to prevent breathing harmful particles is to stay indoors with windows and doors closed.

- If you have a central-ducted heating/air conditioning and heating system, be sure to set the system to “on” to ensure air is being filtered constantly, rather than “auto,” which runs the system intermittently.
- If your system brings fresh air into the home, close the fresh-air intake so that it operates in in recirculation mode to prevent outdoor smoke from getting inside.
- Filter the air: Use a CARB-certified portable air cleaner and run continuously on the highest setting. This can greatly reduce indoor particle levels to further reduce impacts from smoke.
- Gather people in a room with the air purifier. A portable air cleaner will clean the air around it, but cannot is not designed to clean the air in your whole home.
- Do not run whole house fans or swamp coolers.
- Avoid activities that increase indoor pollution, such as burning candles, using gas stoves and vacuuming.
- Use a damp cloth or mop to trap settled dust and particles.
- Stay cool. Run fans, or run air conditioning on “recirculate” setting with a new filter. NOTE: If poor air quality happens at the same time as extreme heat, do whatever you need to stay cool, even if it means opening windows and doors. Heat will kill more quickly than air pollution.
- **If you must go outdoors** for long periods of times in areas of heavy smoke, you may want to wear a NIOSH-certified N95 respirator mask. Those with existing respiratory, lung or heart conditions should limit their exposure by staying indoors. Since wearing a respirator can make it harder to breathe, those with lung or heart conditions should check with their doctor before using one.
- If you purchase N95 masks, make sure they are [NIOSH-approved](#). Choose a size and model that fits your face and has no gaps. Test it by doing a [seal check](#).
- Keep a very close eye on children, who are less likely to notice or report symptoms than adults, even when they are affected.
- Look out for [signs that you or those around you need cleaner air](#). Symptoms can include:
 - Coughing

- Throat irritation
- Pain, burning, or discomfort in the chest when taking a deep breath
- Chest tightness, wheezing, or shortness of breath

High Wind

Keep trees properly maintained.

- City trees:

City trees grow between the sidewalk and the street, in a street median, in a public park, or on any other property owned by the City of Berkeley. View a [map of Berkeley City trees](#).

- To submit a request for pruning or removal of a City tree, call 311 or email trees@berkeleyca.gov.

Privately owned trees

- All other trees are privately owned, and maintenance is the responsibility of the owner. Similarly, if a private tree or limb falls, cleanup and damages are also the responsibility of the homeowner.
- Get a professional arborist assessment to identify any signs of decay, dead branches, or other structural issues that could lead to problems in the future.

Before a wind event

- Bring any loose outdoor items such as holiday decorations and chairs inside, or securely tie them up. Beside the risk of these items being blown away or damaged, airborne debris can be dangerous.
- Be ready for power outages. In winter months, consider raising the temperature on your thermostat, in case you lose power for a few hours or longer.

During high winds

- If you must be outdoors, keep your distance from trees.

- Avoid driving during the strongest winds, especially in high-profile vehicles. Your vehicle could be blown off the road. Trees could fall in the road ahead of you, which could be hard to see at night until it's right in front of you, or they could fall on your vehicle.

Landslide

Protect your home

- Have flexible pipe fittings installed to avoid gas or water leaks, as flexible fittings are more resistant to breakage. (Note, only PG&E or other professionals should install gas fittings).
- Plant ground cover on slopes and build retaining walls.
- In mudflow areas, build channels or deflection walls to direct the flow around buildings. Remember: If you build walls to divert debris flow and the flow lands on a neighbor's property, you may be liable for damages.
- If you live in an area susceptible to landslide (See Maps 23 and 24), familiarize yourself with [Landslide Warning Signs](#) and preparedness/response actions.
- Remember that landslide damage on private property is the homeowner's responsibility. Homeowner's insurance does not typically cover landslide damage. A Difference in Coverage Insurance Policy can help cover this gap, if you live in an area susceptible to landslide.

Tsunami

For all Berkeley residents

- Understand Berkeley's tsunami inundation area (Map 25 in the Risk Assessment) to identify whether you might find yourself in the tsunami inundation zone
- If your home or business is in the tsunami inundation zone, consider purchasing flood insurance.
- Be ready to act on tsunami alerts
- [Sign up for AC Alert](#)

- Bookmark and get familiar with [Berkeley's Emergency Map](#)
- Get familiar with the test and emergency tones from [Berkeley's Outdoor Warning System](#)

If you live in the tsunami inundation zone, make your household evacuation plan for tsunami, including:

- Where will you go – east, out of the tsunami zone
- What will you pack
- How will you get there, using which routes
- Who can help if you need it
- Know nature's warning signs of a near-source tsunami:
 - Earthquake with strong ground shaking for 20 seconds or more (making it difficult to stand or walk)
 - Loud ocean roar
 - Quickly receding water
 - If you are near the water and see these signs, move inland and to higher ground immediately. If there is time (a distant source tsunami) officials will send out alerts and instructions.
- If a tsunami alert is issued
 - Monitor your phone, the Outdoor Warning System, Berkeley's Emergency Map, and TV and radio for updates
 - Follow evacuation orders – as scientists get more information about what created the tsunami, the area that needs to evacuate will become more clearly defined
 - Do not go towards the tsunami – it makes things harder for first responders and for your fellow residents.

Maritime Community

- The City of Berkeley will evacuate docks and shut them down within 1 hour of a tsunami's estimated arrival.
- Make a plan for your boat
- Should you take your boat OFFSHORE?
- Generally, it is safer to keep your boat docked during a tsunami because most tsunamis are relatively small. On the rare occasion when a larger tsunami is expected (Warning level), you may consider taking your boat offshore. Berkeley's Harbormaster may provide the best advice, considering
 - The SIZE of the tsunami,
 - How much TIME until it arrives onshore, and
 - The PREPAREDNESS of the boat and its captain.
- You may consider hauling your boat out of the water when possible for smaller events. Expect congested boat ramps and remember that you have to get your boat out of the water and to the trailer, and out of the tsunami zone before the tsunami arrives (or before officials close the docks).
- Understand whether or not your boat insurance will cover damage caused by a tsunami. Tsunami coverage is entirely dependent on your policy and how much comprehensive coverage you have purchased.
- Make sure your boat is secured and ready. Keep in mind that the City will shut down the dock 1 hour before the tsunami's anticipated arrival time.
- Secure your boat to the dock and tie down any loose gear.
- Check your dock line condition and replace any worn dock lines.
- Do not install fendering to the dock.
- Remove as much loose boating gear onboard as possible, especially electronics and important documents. Any gear that will remain on your boat should be secured.

- Turn off and disconnect shore power cords, water supply hoses and propane or other gas valves.
- Secure and lock all hatches and port holes. Check for leaks, and seal them as necessary.
- Prepare a go-bag or backpack that you can grab and bring with you if you need to evacuate quickly for a near-source tsunami. Include:
 - Flashlight/headlamp
 - Area map, marked with driving/walking evacuation routes
 - Printed list of phone numbers and email addresses for important contacts
 - Battery-powered radio and extra batteries
 - Prescriptions or critical medications
 - Extra eyeglasses or contact lenses
 - Extra set of keys
 - Cell phone charger
 - Copies of important documents
 - Toiletries and change of clothing
 - Hand sanitizer
 - As you leave, grab your wallet and cell phone
 - Make a list of the other items you will want to bring if you have more time to prepare to evacuate. Consider:
 - Items to be safe and comfortable while you are away
 - Medications, prescriptions, and medical devices
 - Computers, electronics and chargers

- Irreplaceable items (family treasures, art, photo albums)
- Other valuables

Floods

For all Berkeley residents, protect your home and neighborhood

- Flooding often occurs due to storm drain blockage. Protect your neighborhood and keep water flowing by participating in the [adopt a drain program](#).
- Direct water away from your building.
- Routinely clean and maintain gutters, downspouts, and splash blocks so that rainwater from your roof flows easily away from your home.
- During an average rainstorm, watch how water flows or accumulates around your home to identify potential trouble spots. If stormwater does not drain away from the building, change your landscaping to improve runoff. This may include building up any sunken areas around the foundation, digging small depressions to properly channel water, and otherwise improving the yard so that it slopes away from your home.
- If you have a sump pump, make sure it has a battery-operated backup in case of power failure during a rainstorm.

Residents near Berkeley creeks, or who have experienced flooding in the past

- Implement [low-cost projects to reduce your flooding risk](#)
- Make your sandbag plan
- Learn [how to sandbag](#) and whether sandbags will be protective for your property
- If you are unable to sandbag, connect with neighbors and friends who can assist you in sandbagging to protect your home during severe storms
- Make a plan for where you'll get sandbags in significant storms. The City usually offers sandbags, and they are also available at a low cost from hardware stores.
- Consider flood insurance, since typical homeowners insurance policies do not

cover flooding.

- During heavy rains
 - Elevate important items, if possible, during heavy rains, especially from first floor/garage.
 - Do not walk, swim or drive through flooded waters. Turn around, don't drown.
 - experienced flooding in the past

After a flood

- If your home floods, review this [Field Guide for Flooded Home Cleanup](#).

Utility Interruption

Power Outage

- Know the location of your circuit breakers and/or fuse boxes and how to check them.
- Make sure PG&E can reach you and alert you of an outage by calling 1-800-743-5000 and updating your contact information.
- Make a plan to stay safe and comfortable during power outages.
- First, think about your household's emergency power needs. What will you need to stay warm? To keep food cool? To operate any medical devices?
- Determine the power draw of the devices that you want to keep operating, and how long you want to operate them.
- Consider purchasing a power bank or generator to provide the power you need to stay safe in your home in short-duration outages.
- Make a plan to stay with family, friends, or at a hotel if your home is affected by a long-term power outage.
- When power outages are planned or likely (for example, severe storms or heat

waves are forecast):

- Fully charge your phone and any chargeable devices including battery packs and even electric vehicles.
- Make sure you have flashlights and fresh batteries close at hand.
- Prepare to use your alternate plans for refrigerating medicines or operating power-dependent medical devices.
- When a power outage occurs:
 - Unplug all electric appliances to avoid overloading circuits or damaging devices when the power turns back on.
 - Leave 1 lamp plugged in with the switch “on.” When the lamp turns back on you’ll know your home has power again. Turn your appliances back on one at a time when power is restored.
 - If you encounter a downed power line, always stay away and call 9-1-1 immediately. Do not touch anything that touching the lines or drive over them.

Water Outage

- Each person in your household will need 1-2 gallons of water daily for drinking, washing, and cooking. Store as much water as you can. At minimum, store water for 3 days (3-6 gallons per person).
- Options for storing water include: single gallons of water, water barrels, water cubes, or canned water. When choosing the best option for your household, consider cost, ease of storage, required maintenance, and how easy it will be to access and use during an emergency.

Wastewater Outage

If you don't have water to flush with or your sewage system isn't working:

- Modify your own toilet to collect waste without flushing. Turn the water valve to off. Flush out any water still in the bowl (the toilet shouldn't refill). Put some kitty litter, peat moss, lime, or something similar that will absorb liquid and help reduce odors into the inner bag. Go to the bathroom in the inner bag. You may be able to use the same bag more than once before replacing. Once the inner bag is full or you

feel it needs to be replaced, tie it up. Insert a new inner bag and add absorbent/odor reducer for the next use.

- Use a 5-gallon bucket. You can add a toilet seat and set it up as described above.
- If sewage from plumbing fixtures backs up into your home, avoid contact with the sewage as it may contain harmful pathogens.

Telecommunications Outage

- Establish a backup communication with your family. Choose a meeting place and time in case you can't call each other.
- Keep a battery-powered AM/FM radio handy to receive emergency alerts if internet, phone, and television aren't working.
- Print important documents or save them to a thumb drive in case of internet outage.
- During emergencies or large events, high demand for cellular networks can make it hard to place a call. A text message may go through when voice calls cannot, because text messages require less bandwidth from the cellular network.
- If you lose cellular service completely to your phone but the internet is still working, you can switch your phone's settings to turn on "Wi-Fi" calling to make calls through the internet.

D. Plan Maintenance

D.1 Ongoing Public Participation in the Plan Maintenance Process

The City's Disaster and Fire Safety Commission will serve as the advisory body for implementation of this Plan. This group was created by ordinance to advise the City Council on disaster-related issues. All meetings of this Commission are held in public. Staff will present progress on implementation of mitigation strategy actions as part of program management.

The City will maintain the BerkeleyCA.gov/Mitigation website and the Mitigation@berkeleyca.gov email address. Community members will be able to submit feedback during the implementation of this plan through this website and email address. Community members are able to write and mail or hand-deliver feedback to the City Manager's Office at any time. The City will also use the website to report implementation progress to the community.

As part of the 2024 update to the LHMP, the City created new outreach materials dedicated to teaching the public about mitigation and incorporating their efforts into the mitigation strategy. These materials include videos, guides, and posters that help the community review the LHMP's Risk Assessment data, information, and mitigation actions. These materials also recognize the crucial role community members play in collective hazard mitigation and encourage actions that individuals and households can take to

reduce their risks. The City plans to continue to use these materials to educate the public and receive feedback on the Mitigation Actions. The ultimate goal is to determine how to measure and report the individual and household mitigation actions taken throughout Berkeley that reduce our risks.

The City will offer presentations of these materials as well as post them regular on social media and in public spaces. Examples of these materials are included in Element G: Community Education.

D.2 Plan Monitoring, Evaluating, and Updating

The City of Berkeley will monitor, evaluate, and update the 2024 LHMP's Risk Assessment and Mitigation Strategy throughout the five-year plan cycle. The City will incorporate these efforts into a comprehensive plan evaluation and update for the 2029 LHMP.

Risk Assessment

The City's Office of Emergency Services (OES) monitors newly-emerging information that will inform updates to the Risk Assessment of the LHMP, including:

- Type, location, and extent of all the natural hazards covered in the 2024 LHMP as well as newly-emerging hazards,
- Occurrences of hazards (inside and outside Berkeley) and estimated probabilities

of future hazard events, and

- Hazard impacts and community vulnerabilities

Hazard impacts and community vulnerabilities.

OES staff will continue to monitor relevant hazard occurrences and new scientific discoveries that may impact the 2024 LHMP's Risk Assessment. OES will provide this information to City staff, partners, and the public through the website, social media, and through outreach programs.

Actions in 2024 LHMP's Mitigation Strategy

Each action in the Mitigation Strategy identifies a Department or Division Lead. As part of their day-to-day work, Departments or Divisions will monitor, evaluate, and report on the progress of their assigned LHMP actions at necessary meetings with other staff, community partners, the Disaster Council, relevant City commissions, and the Berkeley City Council.

Annually, the Office of Emergency Services will coordinate a monitoring, evaluation, and reporting effort for the entire LHMP. As part of this effort, OES will collect an updated progress report from each identified Lead for each action. The progress report will:

- Provide qualitative and quantitative evaluation of City progress on activities,
- Identify any necessary changes to the action in order to more effectively achieve stated purpose and goals, and
- Identify new Plan actions to be incorporated into the Strategy

In this way the actions in the plan will be monitored, evaluated, and updated each year

during the five-year cycle. The Office of Emergency Services will maintain this information in order to facilitate the next update of all elements of the LHMP.

Comprehensive Plan Evaluation and Update

A comprehensive plan evaluation update will occur if a disaster occurs, or no later than the 4-year mark of the 2024 plan (late 2028). In either case, OES will reconvene the Core Planning Team to perform a thorough evaluation of the plan, including the ongoing efforts to update the Risk Assessment and mitigation action information.

The evaluation will include examination of:

- Significant developments in or affecting Berkeley, in order to update the Risk Assessment and Mitigation Strategy,
- Current data, scientific discoveries, and recent hazard events since plan adoption, in order to update hazard profiles and vulnerability assessments in the Risk Assessment,
- New policy, priority, and planning changes affecting Berkeley, in order to update the Mitigation Strategy, and
- Progress on actions in the 2024 Plan's mitigation strategy, in order to update plan goals, objectives, and mitigation actions for 2029.

The Core Planning Team, coordinated by the Office of Emergency Services, will use these assessments to create the updated Internal First Draft 2029 LHMP. The Core Planning Team will first share this internal document with City staff, hazard experts, and community partners for review and feedback. Following their review and relevant changes, the Core Planning Team will provide the First Draft 2029 LHMP to the Berkeley community for review. Public feedback, including that of Berkeley Commissions and individual community members, will inform development of the Final Draft 2029 LHMP,

which will be provided for review to the California Governor's Office of Emergency Services, and then to the Federal Emergency Management Agency (FEMA).

Following approval pending adoption from FEMA, the 2029 LHMP will go to the City's Planning Commission and the Disaster and Fire Safety Commission for recommendations to the City Council for adoption. The Berkeley City Council is the governing body that adopts the updates to the City of Berkeley Local Hazard Mitigation Plan.

The table on the following page summarizes the City's approach to monitoring, evaluating, and updating the 2024 LHMP.

	Risk Assessment	Monitoring 2024 Mitigation Strategy	Comprehensive Plan Evaluation and Update
WHO	Office of Emergency Services	Department or Division Leads, with Office of Emergency Services as Coordinator	Core Planning Team, with Office of Emergency Services as Lead
WHEN	Ongoing	Ongoing/annually	After a disaster event, or Comprehensive Evaluation and Update process starts <u>2 years prior</u> to plan expiration
HOW	Monitors hazard information Reports information to stakeholders and public through City website and outreach programs	Leads will monitor, evaluate and report on the progress of their assigned LHMP actions through day-to-day work OES collects progress reports annually	Review/revise Plan accounting for: <ul style="list-style-type: none"> • Development affecting Berkeley • Hazard/vulnerability data and recent hazard events • Policy, priority, and planning changes • Progress on actions in 2024 Mitigation Strategy

D.3 Mitigation Plan Integration

The City of Berkeley develops its updated Local Hazard Mitigation Plan every five years. The planning process brings together staff from every department to develop the risk assessment, mitigation strategy, and report on progress since the last update. After this process, staff continue to work closely together on maintaining the LHMP as well as on new projects. Core Planning Team members bring their knowledge and experience with the LHMP to their respective departments and ensure its integrated into their other ongoing work. For example, the 2019 LHMP was incorporated into the 2023 City's

Housing Element.

The Risk Assessment is crucial to the City's understanding of its hazards, vulnerabilities, and potential losses. It is used to educate City staff, partners, community members, and elected officials about the hazards that can occur in Berkley and what is at risk. The Office of Emergency Services works to maintain the Risk Assessment and ensure that the latest data, science, and information is used and integrated in educational materials and planning processes. For example, the 2019 LHMP Risk Assessment informed the City's Community Wildfire Preparedness Plan (CWPP) as well as Extreme Heat Workshops for the City's Emergency Operations Plan (EOP).

The actions outlined in the Mitigation Strategy are developed and prioritized in collaboration with every Department that is involved in the work. To ensure that the list of actions remains manageable, only actions that have a confirmed clear and viable funding source are included. As a result, the LHMP is closely aligned with the City Budget and Capital Improvement Plan. Each year, the City assesses potential capital improvement projects and available funding as it implements its Five-Year Capital Improvement Plan. Capital improvement actions in the Plan are assessed as part of this annual process.

List of Planning Mechanisms

As with prior LHMP updates, this Plan will be well-integrated into the City's existing and future plans. This list of planning mechanisms where the Plan will be integrated are listed below.

Budget Process

Because the 2024 LHMP will be adopted by the City Council into the General Plan, the data and information from the Risk Analysis as well as the hazard mitigation goals and actions in the Mitigation Strategy will help guide the City's budget process. The budget process assigns resources to address the goals, objectives, and community priorities set by the City Council. The budget process is the final step of assigning resources to implement mitigation actions. The Budget process is described in detail in Element C: Mitigation Strategy.

Community Outreach

Community outreach is a key component of any planning mechanism. The City's Office of Emergency Services has been trying to augment its outreach capacity, in addition to improving the outreach associated with the LHMP. The 2024 LHMP planning process inspired a whole suite of new outreach materials designed to educate community members about hazard risks and the mitigation strategy, including actions they can take to reduce risk. These materials are designed to be relevant and adjustable so that they can be used after the 2024 LHMP is adopted.

LHMP as an Appendix to the General Plan

Upon its adoption by the Berkeley City Council, the 2024 LHMP will be incorporated as an appendix to the Disaster Preparedness and Safety Element of the City's General Plan. The Berkeley General Plan is a comprehensive, and long-range statement of community priorities and values developed to guide public decision-making in future years. The Plan's goals, objectives, and policies serve as a guide for day-to-day decisions that are

essential for responsive government. Decisions made by Berkeley City Council and its advisory boards, and commissions about the physical development of the City should be consistent with the goals, objectives, and policies of the General Plan. The City Council and Planning Commission will use the General Plan when evaluating land use changes and making funding and budget decisions. It will be used by the Zoning Adjustments Board and City staff to help regulate development proposals and make decisions on projects. The policies of the Plan apply to all property, both public and private, within the Berkeley city limits.

Upcoming General Plan Updates and Additions

From 2024-2026 the City will be updating the General Plan's Safety Element, and creating a new Environmental Justice Element. The data and information in the 2024 LHMP's Risk Assessment, as well as the actions in the Mitigation Strategy, will directly inform the updated goals for both of these critical new documents. Many of the 2024 LHMP's Core Planning Team members will continue their collaborative mitigation work by participating in the process to develop the Safety Element updates and new Environmental Justice Element.

Berkeley Climate Equity Collaborative

The City is also working with the Berkeley Climate Equity Collaborative (Collaborative), a group of local community-based organizations representing disadvantaged communities, as community partners in developing the Environmental Justice Element and update to the Safety Element. The LHMP will be used as a resource to inform the Collaborative members of the hazards facing Berkeley, and will ultimately support the Collaborative's

efforts in these General Plan updates.

City of Berkeley Strategic Plan

On January 16, 2018, the City Council adopted the City of Berkeley 2018-2019 Strategic Plan. The City's Office of Emergency Services will be responsible for working with Department leaders to further incorporate actions from this Mitigation Strategy into future Strategic Plan updates. City staff indicated under "Lead Organizations and Staff Leads" will be responsible for further developing the project plans, schedules and budgets outlined for actions in the Mitigation Strategy. Implementation of many of these actions will be dependent on outside funding sources.

Capital Improvement Plan

Each year, the City assesses potential capital improvement projects and available funding as it implements its Five-Year Capital Improvement Plan. Capital improvement actions in this Plan will be assessed as part of this annual process. Many actions presented in the 2024 LHMP Mitigation Strategy are already a part of the City's Five-Year Capital Improvement Plan. Implementation of many of these actions will be dependent on outside funding sources.

Resilience Strategy

In 2014 the City of Berkeley was selected to participate in the 100 Resilient Cities (100RC) Initiative, pioneered by The Rockefeller Foundation. The City conducted extensive research that included community outreach and engagement as well as review of existing plans, including the 2014 LHMP, as it developed its Resilience Strategy, which was

released in April 2016. Building on existing efforts and with guidance from the Mayor, the City Council, and the community, the Berkeley Resilience Strategy identifies six long-term goals and recommends specific short-term actions to help address some of Berkeley's most pressing challenges. One of the goals is to adapt to the changing climate, which integrates information from the LHMP.

The Resilience Strategy is being implemented through projects, programs and plans across the City, and the LHMP will continue to be a key planning document that influences these processes. The City continues to have a Chief Resilience Officer (CRO) and participates in organizations such as the Resilient Cities Network and the Bay Area Climate Adaptation Network (BayCAN). As an example of a current resilience project, the City is working to implement solar photovoltaic arrays and backup batteries at critical municipal facilities to provide clean, reliable energy assurance in the face of a disaster and/or power outage.

Waterfront Specific Plan

The Waterfront Specific Plan is a four-year planning project (formerly "Berkeley Marina Specific Area Plan") that will provide a path for achieving a financially self-sustainable, publicly owned marina that preserves and enhances infrastructure to support current and future community needs, while adapting to climate change and promoting environmental stewardship. Key to this goal is consideration of the waterfront-specific hazards, including sea level rise and flooding. The 2024 LHMP's data, information, and mitigation strategies are being developed hand-in-hand with the Waterfront Specific Plan (WSP), which will designate areas for commercial redevelopment and recreation opportunities and provide

design guidelines for future projects.

Climate Action Plan

The 2019 and 2024 updates to the LHMP support concepts outlined in the Berkeley Climate Action Plan, which was developed through a community-wide process and was adopted by City Council on June 2, 2009. The Climate Action Plan outlines a vision, goals and policies to reduce community-wide greenhouse gas emissions by 33 percent below 2000 levels. Further, in 2018, then-Governor Brown committed California to carbon neutrality by 2045, the Berkeley City Council resolved to become a “Fossil Fuel-Free City,” and the Council declared a Climate Emergency, all steps to signal the urgency of these ambitious goals and the need to act on climate threats in an equitable manner.

Because climate change impacts can cause or exacerbate many of Berkeley’s hazards of concern, in 2014 the LHMP was updated to include climate change as a hazard of concern. Historically, the City of Berkeley has used the Climate Action Plan to present activities to mitigate climate change itself by addressing ways to reduce greenhouse gas emissions, and the LHMP to present climate adaptation actions, which would better prepare the community to adapt to the changes in climate we are already seeing. In this way both plans reflect and support one another. The City continues to implement the initiatives set forth in the Climate Action Plan through other plans such as the Electric Mobility Roadmap (adopted in 2020) and Existing Buildings Electrification Strategy (adopted in 2021), and this and future updates to the LHMP will continue to inform these implementation plans and include actionable climate adaptation strategies. For example, the City is implementing the Pilot Climate Equity Fund and Just Transition Pilot Programs,

both of which address transitioning away from gas in buildings, which can be hazardous as described in the LHMP's Risk Assessment.

In the 2024 LHMP, climate change has been more thoroughly integrated into each hazard of concern rather than as a standalone hazard. As a result, there are more actions in this plan that relate to reducing emissions and mitigating climate change as a way of reducing the impacts of various natural hazards.

E. Plan Update

E.1 Changes in Development

The people and structures in Berkeley are continually changing. Since 2000, the City's population has grown steadily, increasing approximately nine percent each decade. The Department of Finance estimates that the City's population was 122,580 in 2020. Berkeley's population is anticipated to continue to grow steadily between 2020 and 2040 according to the Association of Bay Area Government's Plan Bay Area 2040 projections. The City's population is anticipated to reach about 136,000 by 2030 and 141,000 by 2040.

According to the Department of Finance, there were 51,523 housing units in Berkeley in 2020. This represents a four percent increase from 2010 and a 10 percent increase since 2000. Due to the built-out nature of the city's development pattern, the majority of new units constructed in the last ten years are part of multi-family buildings containing five or more units, and are located on in-fill sites, mostly along existing commercial corridors. Overall, the number of multi-family units in the City increased by seven percent while the number of single-family units increased by less than one percent.

The University of California, Berkeley is expanding its facilities both on and off the campus. UC Berkeley's 2021 Long Range Development Plan projects that the campus population will increase 22% in the next 15 years. To accommodate this growth, UC Berkeley is planning to add over 2 million gross square feet to the campus footprint, an additional 11,000 student housing units, and over 1,000 new parking spaces in the vicinity

of the existing campus, which is located at the eastern portion of the city.

Residents ages 15 to 24 comprise the largest age group in Berkeley, followed by people ages 25 to 34, likely due to the presence of UC Berkeley. The majority of households are renter-occupied (57%), and there is a sizeable proportion of the population residing in group quarters (about 11%) due to dormitories and other student housing associated with the University. The senior population (ages 64 to 84) represents about 12% of the residents in Berkeley, and has increased by 40% since 2010. Overall, 42 percent of Berkeley's households are considered lower income, earning less than 80 percent of the area median income (AMI). Special needs populations in Berkeley include senior-headed households (27% of total households), extremely low-income households earning up to 30% of AMI (21%), seniors living alone (12%), persons with a disability (8%), single-parent households, including those with children (8%), and large family households over five or more persons (4%). Additionally, about 1,100 persons (1%) are experiencing homelessness in Berkeley as of February 2022.

Housing cost burden is a prevalent issue in Berkeley, impacting over half of lower income households, and one third of moderate-income households. As of 2017, about 40 percent of Berkeley households are cost burdened with 23 percent experiencing a severe cost burden. Cost burden is notably more prevalent among renter households, with over half of renter households paying more than 30 percent of their income to housing expenses. Building new housing is one way to reduce housing cost burden in the city. As of December 2023, approximately 4,600 new housing units were in the pipeline for development, representing almost 9% of the existing housing stock in Berkeley. Due in part to the City's inclusionary housing ordinance, approximately 13% (620 units) of those

units are deed-restricted affordable according to federal and State statutory limits on household size and income.

City plans and policies guide decision-making to address the housing needs of Berkeley's residents. City resources should focus on housing affordability for people at the lowest income levels, and maintain and improve existing housing that will prepare buildings for a major seismic event. The City is working to expand the supply of housing for all residents through zoning amendments to increase the production of accessory dwelling units and infill 'middle housing' in high resource neighborhoods. Further, the City is focusing on housing for special needs groups through numerous programs and actions that prevent homelessness, seek solutions for those who are experiencing homelessness, and encouraging housing projects that include affordable units and those suitable for households with children and large families.

Effects on Berkeley's Risks and Vulnerabilities

As more people join the Berkeley community, the city will have more people who are exposed to the area's hazards. Additionally, as density and population increase, the demand for fire and emergency services also increases. For example, 911 calls will increase, with each call having an impact on the system, including the availability of resources. In 2023, the City completed a Standards of Coverage and Community Risk Assessment (SOC) to define appropriate levels of service based on a comprehensive analysis which included the impacts of increased density and vertical growth. The SOC determined that fire and emergency resources need to be enhanced to meet current and future demand.

Since the last plan was approved, because of Berkeley's built-out nature, new development tends not to add new geographic areas of hazard exposure. But with increased density, more people will be exposed to the area's hazards. All of Berkeley is exposed to earthquake shaking. All of Berkeley is exposed to wildland-urban interface fire, but the areas of heightened exposure are in the eastern hills. New state laws are mandating increased density throughout the city, including in the eastern hills, which are more exposed to wildland-urban interface fire and landslides.

The 100 year and 500 years floodplains are concentrated in west Berkeley along the Bay and around the Aquatic Park. These areas haven't changed since the last update, and development in this area of the City is characterized by industrial and heavy commercial uses. Any new development would be required to comply with the applicable regulations to ensure avoidance of and/or adequate mitigation of hazard-induced risk.

The city's western edge is also exposed to tsunami inundation and sea level rise from climate change. The tsunami inundation has increased slightly since the last update to reflect new science and local features. New science has also emerged evaluating the impact of shallow groundwater rising in low-lying coastal areas. Ultimately, low-lying inland areas could flood from below by emergent groundwater long before coastal floodwaters overtop the shoreline. Data shows that Berkeley already faces high groundwater in multiple areas in the west, meaning that the scenarios for sea level rise impacts are likely worse than previously thought. However, the actual areas of sea-level rise exposure, as well as the impacts of sea-level rise on the area's liquefaction and flooding hazards, are not yet clear, as it depends on carbon emissions.

New development in part reduces Berkeley's vulnerability to natural hazards. New construction adheres to modern design codes, including regulations for structural resistance to earthquakes, landslide mitigation efforts, fire-resistant materials, fire mitigation measures, and elevation above flood levels. Replacing or significantly renovating older structures significantly increases the Berkeley community's protection from natural hazards.

E.2 Changes in Priorities and Progress on Local Mitigation Efforts

While the City's goals and objectives have remained very similar to the 2019 plan, the 2024 LHMP reflects thorough revisions from the 2019 document. The 2024 Risk Assessment accounts for newly available science and research and emerging hazards. As a result of significant hazard events since the 2019 update, Poor Air Quality, Infectious Disease, Wind, and Utility Disruption have their own sections in the Risk Assessment. Climate change has been thoroughly integrated into each hazard, instead of having its own section, inspired by community outreach that overwhelming suggested that it shouldn't stand alone. The 2024 mitigation actions account for progress made on mitigation actions since 2019, changes in development in Berkeley, and our new understanding of the hazards we face. There are several new actions related to mitigating the risk of Wildland Urban Interface Fire, resulting from the creation of a new WUI Division in the Fire Department and the development of the Community Wildfire Protection Plan

(CWPP).

There are also new actions associated with mitigating the risks associated with Sea Level Rise and Flooding near the waterfront, especially in light of new data about the risks of rising groundwater.

The Mitigation Strategy also includes new actions associated with abiding by new state laws around evacuation and the upcoming process to update the City's General Plan, Environmental Justice and Safety Element.

For the first time, this Mitigation Strategy highlights the work that community members do to reduce risk in Berkeley. There are Actions listed for individuals and households to take to reduce their risks and contribute to collective mitigation efforts.

Status of 2019 Mitigation Actions

This Plan was last adopted on December 20, 2019. Since that date, Berkeley has made steady progress on implementing 2019 plan actions and supporting activities.

The following categories are used to describe the progress made since 2019:

- Completed: Activity has been completed as written.
- Completed with modifications: Over the course of completing this action, the City modified the activity to better meet the associated objective.
- In Progress: Progress has been made since 2019, but the activity is still ongoing.
- Deferred: Progress has not been made since 2019, but the activity is still relevant.
- Deferred with Modifications: Progress has not been made since 2019, but the activity is still relevant, and the City modified the activity to better meet the

associated objective.

- Deleted: Progress has not been made since 2019, and the activity is no longer relevant.

In Progress activities are incorporated into the 2024 LHMP's mitigation strategy.

The Progress on the 2019 Actions are detailed in the Appendix in Status of 2019 Actions Spreadsheet.

Integration of Information

As with previous updates, the 2019 LHMP was well integrated into other planning mechanisms.

LHMP as an Appendix to the General Plan

Upon its adoption by the Berkeley City Council, the 2019 LHMP was incorporated as an appendix to the Disaster Preparedness and Safety Element of the City's General Plan. The Plan's goals, objectives, and policies serve as a guide for day-to-day decisions that are essential for responsive government. Decisions made by Berkeley City Council and its advisory boards, and commissions about the physical development of the City should be consistent with the goals, objectives, and policies of the General Plan. The City Council and Planning Commission use the General Plan when evaluating land use changes and making funding and budget decisions. It will be used by the Zoning Adjustments Board and City staff to help regulate development proposals and make decisions on projects. The policies of the Plan apply to all property, both public and private, within the Berkeley city limits.

Budget Process

Because the 2019 LHMP was by the City Council into the General Plan, the data and information from the Risk Assessment as well as the hazard mitigation goals and actions in the Mitigation Strategy influenced the City's budget process. The budget process assigns resources to address the goals, objectives, and community priorities set by the City Council. The budget process is the final step of assigning resources to implement mitigation actions.

In 2022 and 2023, the City of Berkeley considered the implication that extreme events, like natural disasters, could have on the City government's financial condition, particularly its reserve levels for the general fund. In this plan for the first time, some hazard sections Risk and Loss Estimates include analysis from the GFOA. The City engaged the GFOA to produce a recommendation to help it decide the appropriate reserve level for the general fund, given the risks from extreme events. GFOA is a non-profit association of more than 23,000 state and local government finance professionals and elected officials from across North America. A key part of GFOA's mission is to promote best practices in public finance, including reserve policies. The analysis by GFOA also shed light on the potential broader economic losses to the community from the risks posed by extreme events and created additional analysis incorporated into the 2024 LHMP.

Community Wildfire Protection Plan

The Community Wildfire Protection Plan approved in 2023 integrates information from the 2019 LHMP, expanding upon the 2019 Hazard Analysis and Mitigation Strategy. The Community Wildfire Protection Plan is a roadmap for fire hazard mitigation and

preparedness at both the City of Berkeley and neighborhood level and offers ways to mitigate the risks posed by wildfires, including goals for improving wildfire response, community preparedness, fuel management, infrastructure, ignition reduction, home hardening, and more. Demonstrating the connection between these documents, the Community Wildfire Protection Plan provided additional data, information, and hazard mitigation goals related to wildland-urban interface fires

Vision 2050

Berkeley's Mayor Arreguin launched Vision 2050, an initiative to encourage long-term planning to meet the serious challenges to our infrastructure, including climate change, inequality, population increases, and obsolescence. The Berkeley community voiced their support for Vision 2050 with the passage of Measure R in the November 2018 election. The Vision 2050 Task Force was formed in Spring 2018 and included over 40 Berkeley community members with technical expertise and in-depth knowledge. The task force was organized into four working groups: quality of life, environment, technology, and finance/ management. The LHMP was one of the key plans reviewed and incorporated into the Vision 2050 Framework, particularly on the topics of earthquakes and landslides.

Housing Element

In 2023, the City of Berkeley adopted a 2023-2031 Housing Element, deemed in compliance with State Housing Element Law by the California Department of Housing and Community Development on February 28, 2023. This Housing Element Update, incorporated into Berkeley's General Plan, contains goals, policies, and programs to guide the City's decision-making around the development and rehabilitation of housing,

to meet the City's Regional Housing Needs Determination target of 8,934 new units of housing, across income levels, in Berkeley over 8 years.

The 2019 LHMP was used as a background document in the development of the 2023-2031 Housing Element and was referenced in regards to environmental constraints to housing production. Specifically, the comprehensive strategy from the 2019 LHMP used to mitigate Berkeley's WUI fire hazard, including annual property inspections, more restrictive local building code amendments, and vegetation management and defensible space, was used to determine safe housing development and rehabilitation in this area within the 2023-2031 Housing Element.

F. Plan Adoption

The public review process is considered a key step in the City Council's adoption of the 2024 Local Hazard Mitigation Plan. To that end, City staff has engaged with City Commissions and the City Council and throughout the process to develop this plan. Two City Commissions play a key role in plan review and adoption:

Disaster and Fire Safety Commission

The Disaster and Fire Safety Commission (DFSC) is made up of nine members appointed by the City Council, per the guidance of a local ordinance. This Commission meets in public monthly, and advises the City Council on all matters affecting fire safety and/or disaster resilience within Berkeley. For this reason, following FEMA's issuance of Approval Pending Adoption for the Final Draft 2024 LHMP, staff will request the Commission's recommendation to Council on the Final Draft 2024 LHMP.

Planning Commission

The Planning Commission oversees and reviews the planning process and planning issues. Revisions to the General Plan come before the Planning Commission, which meets twice each month in public. Because the Local Hazard Mitigation Plan is an appendix to the City of Berkeley's General Plan, following FEMA's issuance of Approval Pending Adoption for the Final Draft 2024 LHMP, staff will request the Commission's recommendation to Council on the Final Draft 2024 LHMP.

Additional Commissions

Concerned citizens staff nearly forty Berkeley commissions, boards and committees addressing a wide range of issues important to the community. All of these commissions meet in public.

Because of the wide scope of issues covered in the mitigation plan, the City invited all Commissions to review the First Draft Plan during the public comment period from May 24 to August 8, 2024.

Following the public feedback deadline, City staff reviewed feedback from Commissions and community members, and incorporated appropriate changes into the Final Draft Plan.

Following FEMA's issuance of approval pending adoption, City staff will bring the Final Draft 2024 LHMP to the City's Disaster and Fire Safety Commission and Planning Commission for their recommendations to City Council to adopt the Final Draft Plan. Following those meetings, staff will bring the Final Draft 2024 LHMP to the Berkeley City Council for adoption.

List of LHMP Commission and Council Meetings

- September 27, 2023: Disaster and Fire Safety Commission to introduce First Draft Plan
- October 4, 2023: Planning Commission to introduce First Draft Plan
- June 5, 2024: Planning Commission to review First Draft Plan
- June 26, 2024: Disaster and Fire Safety Commission to review First Draft Plan

- July 15, 2024: Public Safety Committee (City Council) to review First Draft Plan
- January 2025: Disaster and Fire Safety Commission to review Final Draft Plan and recommend Adoption
- February 2025: Planning Commission to review Final Draft Plan and recommend Adoption
- March 2025: Council for Adoption

G. Community Education

In the 2024 LHMP Planning Process, the City endeavored to make the Risk Assessment more applicable and accessible to individuals and households. First, to help the community understand the hazards and associated risks, the City of Berkeley Office of Emergency Services [made videos available on YouTube](#) that describe each hazard in this Plan. The videos also include a list of Community Actions to reduce risk as well as City Actions in the 2024 LHMP Mitigation Strategy. Additional videos related to mitigating wildfire risk are available on www.BerkeleyFire.Com.

Traditionally, this Plan has focused on the Actions that the City takes, with partner support, to mitigate risks. This plan recognizes that individuals and households also take actions to reduce risk and contribute to the community's collective mitigation efforts. To support this work further, the end of Element C: Mitigation Strategy has a list of individual and household actions to reduce risks associated with that hazard. The Appendix also includes the list of Community Actions for individuals and households in a spreadsheet format that also includes how much time, money, and effort each Action might take.

Appendix

Status of 2019 Actions

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.	Continue analysis of structures supporting critical emergency response and recovery functions, and make recommendations for structural and nonstructural improvements.	In Progress	Yes	The City continues to analyze structures that support critical functions and make recommendations for improvements. The City is about to embark on a Seismic Evaluation of 1947 Center Street.
Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.	Continue to prioritize analysis of remaining structures based on occupancy and structure type, taking historic significance into consideration. Use analysis to make recommendations for structural and nonstructural improvements.	In Progress	Yes	The City continues to prioritize further analysis on non-critical structures and make recommendations for improvements.
Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.	Continue to integrate unsafe structures into a prioritized program for retrofit or replacement.	In Progress	Yes	The City continues to integrate unsafe structures into a prioritized program for retrofit or replacement.
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Retrofit North Berkeley Senior Center	Completed	No	This retrofit was completed in 2022.
Strengthen or replace City buildings in the identified prioritized order as funding is available.	West Berkeley Service Center	In Progress	Yes	The West Berkeley Service Center is being strengthened with minor improvements and is currently in the design process.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Old City Hall	In Progress	Yes	The City has completed Phase 1 of the Civic Center Vision Plan, which would re-envision Old City Hall and make it safe to use. Phase 2 starts in Summer 2023 to select a design and funding plan.
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Veterans Memorial Building	In Progress	Yes	The City has completed Phase 1 of the Civic Center Vision Plan, which would re-envision Veterans Memorial Building and make it safe to use. Phase 2 starts in Summer 2023 to select a design and funding plan.
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Live Oak Community Center	Completed	No	This retrofit was completed in 2021.
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Seek funding to seismically strengthen or replace additional City buildings in a prioritized order.	In Progress	Yes	The City continuously looks for funding opportunities to strengthen or replace City buildings.
Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.	Periodically update and adopt the California Building Standards Code with local amendments to incorporate the latest knowledge and design standards to protect people and property against known seismic, fire, flood and landslide risks in both structural and non-structural building and site components.	Ongoing	Yes	The City continues to update and adopt California Building Standards Code with local amendments every 18 months.
Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.	Explain requirements and provide guidance to owners of potentially hazardous structures to facilitate retrofit, including owners participating in the Earthquake Brace and Bolt program and those applying for Transfer Tax rebates.	Ongoing	Yes	The City continues to explain requirements and provide guidance to owners to facilitate retrofits. This action has changed slightly to add the Earthquake Soft Story (ESS) Program launched in April 2023 by the California Residential Mitigation Program.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Implement the Retrofit Grants Program, which helps Berkeley building owners increase safety and mitigate the risk of damage caused by earthquakes.	Assist participating property owners with the grant process, including dissemination of program rules and guidelines.	In Progress	Yes	Current federal funding for the Retrofits Grant Program participants is available through late 2025. City staff continue to seek additional grant funding to implement future rounds of the program.
Implement the Retrofit Grants Program, which helps Berkeley building owners increase safety and mitigate the risk of damage caused by earthquakes.	Project Manager will: a. Respond to inquiries from owners, tenants, engineers and contractors about the grant program, including FEMA compliance procedures and requirements b. Environmental and Historic Preservation Reviews (EHP) for specified projects c. Review plan submittals for compliance with City guidelines and FEMA requirements d. If more funding is secured, conduct outreach to property owners to offer additional Retrofit Grants to increase tenant safety	In Progress	Yes	The City continues to implement the Retrofit Grants Program, following the activities listed. As of 8/2/2023, 63 design grants and 75 construction grants have been disbursed to Berkeley property owners under the Retrofit Grants Program.
Continued Implementation of the Soft Story Retrofit Program, which mandates seismic retrofit of soft story buildings with 5+ residential units.	Continue to inform impacted property owners of the requirement to seismically retrofit their buildings.	In Progress	Yes	The City continues to inform impacted property owners of requirements.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Continued Implementation of the Soft Story Retrofit Program, which mandates seismic retrofit of soft story buildings with 5+ residential units.	Designated project manager will: a. Respond to inquiries from owners, tenants, engineers, contractors and realtors about the mandatory program, compliance procedures and requirements b. Review plan submittals for soft-story seismic retrofits c. Issue permits and perform field inspections d. Remove retrofitted buildings from the Soft-Story Inventory e. Review appeals to accommodate unique circumstances preventing owners from meeting program requirements; consider time extensions, etc. f. Enforce soft story ordinance; issue citations to owners who are out of compliance.	In Progress	Yes	The City continues to implement the program, following the listed activities. As of July 2023, 277 buildings have completed their retrofit, 26 buildings still need to be retrofitted, and 61 buildings were removed from the inventory for other reasons. These reasons include: the building was determined to have fewer than 5-units or that a soft story condition was not present.
Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.	Work with owners of remaining potentially hazardous URM buildings to obtain structural analyses of their buildings and to undertake corrective mitigation measures to improve seismic resistance or to remove the buildings and replace them with safer buildings.	In Progress	Yes	The City continues to work with owners of remaining potentially hazardous URM buildings. As of July 2023, four buildings still need to be retrofitted.
Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.	Apply available legal remedies, including but not limited to citations, to owners who fail to comply with the URM ordinance.	In Progress	Yes	The City continues to apply available legal remedies to owners who fail to comply with ordinance.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Monitor passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices.	Monitor mandatory seismic retrofit ordinances for concrete buildings passed by other municipalities for effectiveness and best practices	In Progress	Yes	The City continues to monitor mandatory seismic retrofit ordinates for concrete buildings.
Monitor passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices.	Communicate and collaborate with other cities and Structural Engineers Association of California (SEAOC) regarding implementation challenges and successes.	In Progress	Yes	The City continues to communicate and collaborate with other cities and SEAOC on implementation. The City is newly exploring the possibility of developing retrofit ordinances for rigid wall-flexible diaphragm and non-ductile concrete buildings.
Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.	Maintain a program to provide free automatic gas shutoff valves to community members who attend disaster readiness training. Provide subsidized permit fee waivers for low-income homeowners.	Completed with Modifications	No	The City completed the pilot gas valve shutoff incentive program. The City determined not to make program permanent due to extraordinarily high staff time requirements to manage program, along with low community participation and benefit.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.	Promote electrification of buildings, both existing buildings and new construction, to mitigate hazards associated with natural gas usage and the impacts of damage to infrastructure after a hazard occurs.	In Progress	Yes with updates	<p>Berkeley City Council adopted a Prohibition of Natural Gas Infrastructure in New Construction Ordinance (2019) and the Berkeley Existing Building Electrification Strategy (2021) to support and guide this work. The Berkeley Emissions Saving Ordinance (BESO) was amended in 2020 to include building electrification assessments when buildings are sold, and upgrade requirements are being evaluated.</p> <p>The City continues to promote the benefits of building electrification, including the health and safety benefits. For example, through the City’s Pilot Climate Equity Fund, the City is working with a group of community organizations representing disadvantaged communities to provide education and resilience benefits including around building electrification and is using the Fund to install building electrification features in the homes of low-income residents. The City is also partnering with local trades and workforce groups to promote and advance building electrification and high road jobs for contractors.</p>
Reduce fire risk in existing development through fire code updates and enforcement.	Periodically update the Berkeley Fire Code and adopt the California Fire Code with local amendments to incorporate the latest knowledge and State regulations to protect people and property against known risks in both structural and non- structural building and site components.	Ongoing	Yes	Berkeley Fire Code was adopted with local amendment in 2023. The City will continue to monitor and update the Fire Code to incorporate the latest knowledge and State regulations.
Reduce fire risk in existing development through fire code updates and enforcement.	Evaluate Fire Prevention Division staffing necessary to adequately perform and enforce required inspections for both Annual and HFA inspections.	In Progress	No	The City has taken serveral action steps to improve staffing, increasing inspection staff in the Fire Prevention Division and creating the WUI Division. The WUI Division has an internship program to help with defensible space inspections.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Reduce fire risk in existing development through fire code updates and enforcement.	Consider expansion of the number of properties to be included in the Hazardous Fire Area inspection program.	Completed with Modifications	No	The concept of the Hazardous Fire Area has been replaced by the expanded WUI Enforcement Program, which includes Fire Zones 2 and 3 and 8,600 properties (many of which are multi-parcel).
Reduce fire risk in existing development through fire code updates and enforcement.	Explore possibility of a program to inspect vacant lots throughout the city.	Completed with Modifications	No	The City now will do vacant lot inspections as part of the WUI Enforcement Program in Fire Zones 2 and 3 annually. For Zone 1, inspections will be done on a complaint driven basis.
Reduce fire risk in existing development through fire code updates and enforcement.	Maintain Fire Department efforts to reduce fire risk through inspections: annual building inspections in all Fire Zones, Hazardous Fire Area Inspections, Multi-unit-residential building inspections in all Fire Zones.	Ongoing	Yes with updates	The Fire Department has replaced Hazardous Fire Area inspections with annual Defensible Space inspections in Zone 2 and 3. This includes home hardening evaluations and education.
Reduce fire risk in existing development through fire code updates and enforcement.	Evaluate inspection procedures and adjust inspection cycle annually based on changing climatic conditions.	Ongoing	Yes	The WUI Division has created 9 zones that include a hazards and climatic conditions analysis. The schedule of inspections is based on the climate and needs of each of the zones. This is revisited annually adjust for changing conditions. The work to enforce this is ongoing.
Reduce fire risk in existing development through fire code updates and enforcement.	Develop and enforce Fire Code requirement for fire fuel clearance on public roadways.	In Progress	Yes with updates	Developed the Fire Code requirement in July 2022. Enforcement is ongoing in Fire Zones 2 and 3. The City has applied for a grant to do more enforcement.
Reduce fire risk in existing development through fire code updates and enforcement.	Create a standard for written vegetation management plans for major construction projects in Fire Zones 2 and 3.	Completed with Modifications	No	The Plan Check Division has an initial draft completed. Since this work cannot be completed until there is guidance from the State Board of Forestry on Zone 0, this Action is considered completed with modifications for now.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Reduce fire risk in existing development through vegetation management.	Maintain Fire Fuel Chipper Program.	Ongoing	Yes with updates	As a result of the passage of Measure FF, a new brush chipping program started in the summer of 2023. The program is called Chipper Days and is now under the leadership of the Berkeley Fire Department.
Reduce fire risk in existing development through vegetation management.	Maintain Fire Fuel Abatement Program on Public Land	In Progress	Yes	The City continues to maintain this program in order to reduce fire fuel on public property. From May to mid-August each year, an average of 125 tons of debris are removed from approximately 98 public sites, including parks, roadways, and landscaped medians.
Reduce fire risk in existing development through vegetation management.	Maintain Fire Fuel Debris Bin Program	In Progress	Yes	The Fire Fuel Debris Bin Program is coordinated by the Department of Public Works' Zero Waste Division, which delivers and removes 30-yard roll-off boxes from requesting neighborhoods. This effort yields an average of 132 tons of plant debris per year.
Reduce fire risk in existing development through vegetation management.	Maintain Weekly Curbside Plant Debris Collection	In Progress	Yes	30,000 tons of residential and commercial plant debris and commercial food waste is collected each year through weekly curbside collection and converted to compost.
Reduce fire risk in existing development through vegetation management.	Pursue external funding to increase education and awareness of vegetation management standards for fire fuel reduction.	Ongoing	Yes with updates	The City continues to pursue external funding to increase education and awareness of vegetation management standards. The City has applied for multiple grants to support public education around Grizzly Peak as well as funding to clean up private parcels in Cerrito Canyon. In 2024 Plan, this Action is combined with related Action in row 38.
Reduce fire risk in existing development through vegetation management.	Work with partners and stakeholders to identify fire fuel reduction zones and to promote and facilitate removal of vegetation in those zones to mitigate fire spread.	Completed	No	The Community Wildfire Protection Plan identifies the fire fuel reduction zones and describe how the City will promote and facilitate removal of vegetation in those zones. The City will continue to evaluate these zones and the CWPP on an annual basis.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Reduce fire risk in existing development through vegetation management.	Pursue external funding to perform vegetation management on public and private property.	In Progress	Yes with updates	The City has applied for multiple grants to fund this work. In the 2024 Plan, this Action is combined with related Action in row 36.
Reduce fire risk in existing development through vegetation management.	Develop and enforce Fire Code requirement for fire fuel clearance on public roadways (see Fire Code action for details)	In Progress	Yes	Developed the Fire Code requirement in July 2022. Enforcement is ongoing in Fire Zones 2 and 3. The City has applied for a grant to do more enforcement.
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Public Works Staff will maintain paths on an as-needed basis, and will coordinate with the Berkeley Path Wanderers to maintain public pathways to provide safe pedestrian evacuation routes from the hill areas.	Ongoing	Yes	Public Works Staff continues to maintain paths on an as needed basis coordinating with the Berkeley Pathwanderers.
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Maintain signage for public pathways to identify safe and accessible pedestrian evacuation routes from the hill areas.	Ongoing	Yes	Public Works Staff continue to maintain signage for public pathways.
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Update City maps of all emergency access and evacuation routes to include pedestrian pathways.	Completed	No	The City has worked with the Berkeley Path Wanderers to create a GIS map of Berkeley's pedestrian pathways. This map was included in the 2019 LHMP and the GIS layer remains available for use.
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Publicize up-to-date maps of all emergency access and evacuation routes.	In Progress	Yes	The CWPP has up to date maps of emergency access and evacuation routes. The City continuously updates these maps and publishes them on the City website. The City also uses real-time evacuation maps with Zonehaven.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Maintain and improve roadways in Fire Zones 2 and 3.	Ongoing	Yes	The City continues to maintain and improve roadways in Fire Zones 2 and 3. From 2019-2022 the City completed 3.78 miles in Zones 2 and 3. By the end of 2023, the City will complete 1.52 miles in Zone 2. The City plans to complete 11.64 miles in Zone 2 from 2024-2028.
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Maintain community-driven process to identify and consider areas for parking restrictions and red curbing.	Completed with Modifications	No	The City has contracted to complete an Evacuation Time Study, which includes a robust public outreach process, to understand what restrictions may promote a safer and more efficient evacuation of residents during unsafe fire conditions. The results of the study will inform what actions are taken next such as parking restrictions, so this action is considered completed for now.
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Explore options for comprehensive parking restrictions in Fire Zones 2 and 3 during Red Flag and/or Extreme Fire Weather conditions.	In Progress	Yes	The City has contracted to complete an Evacuation Time Study, which includes a robust public outreach process, to understand what restrictions may promote a safer and more efficient evacuation of residents during unsafe fire conditions. The wording of this action has been updated for 2024.
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Develop and enforce Fire Code requirement for fire fuel clearance on public roadways (see Fire Code action for details)	In Progress	Yes with updates	Developed the Fire Code requirement in July 2022. Enforcement is ongoing in Fire Zones 2 and 3. The City has applied for a grant to do more enforcement.
Reduce the potential threat of overhead utility wires in the Berkeley Hills.	Construction of undergrounding in the Berkeley Hills within UUD No. 48 (portions of Grizzly Peak Blvd., Summit Rd., Avenida Dr., Fairlawn Dr., and Senior Ave.)	In Progress	Yes	This undergrounding project is under construction, estimated to be completed in three years.
Reduce the potential threat of overhead utility wires in the Berkeley Hills.	Construction of undergrounding of overhead utility wires within UUD No. 35A (Vistamont Ave., Rochdale Way, and Rosemont Ave from Woodmont Ave. to Vistamont Ave.)	Deleted	No	Due to lack of funding, there has been no progress on this action since 2019. However, the City continues to explore funding options for additional undergrounding projects.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Reduce the potential threat of overhead utility wires in the Berkeley Hills.	Construction of undergrounding of overhead utility wires on Bayview Place	Deleted	No	Due to lack of funding, there has been no progress on this action since 2019. However, the City continues to explore funding options for additional undergrounding projects.
Reduce the potential threat of overhead utility wires in the Berkeley Hills.	Complete the Phase 3 undergrounding study spearheaded by the Undergrounding Subcommittee in collaboration with Public Works Department, Fire Department, and Public Works Commission. This is a citywide study to underground overhead wires on arterial and collector streets as a component of maintaining ingress and egress on roads during a major disaster.	Completed	No	The City completed the Phase 3 Undergrounding Study in February 2020.
Reduce the potential threat of overhead utility wires in the Berkeley Hills.	Explore other strategies, including funding mechanisms, for reducing the potential threats of overhead utility wires	In Progress	Yes	The City continues to explore other strategies, funding and otherwise, to reduce the thread of overhead utilities.
Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.	Coordinate with EBMUD regarding plans to install a new 48-inch aqueduct by 2020 to be able to continue potable and firefighting water supply following a seismic event.	Completed	No	The major portion of the Wildcat Aqueduct project is complete in Berkeley. In winter 2023-2024 EBMUD will be installing a valve and pipe at Colusa and Marin, which is the second and final phase.
Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.	Explore project approaches with EBMUD to expedite replacement of problem pipelines in Berkeley neighborhoods exposed to wildland-urban interface fire and seismic ground failure.	Completed	No	EBMUD has a process in place to prioritize and replace pipelines.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.	Coordinate with EBMUD to ensure that pipeline replacement projects and upgrades are coordinated with the City's five-year street paving program and other City programs.	Completed	No	The City meets with EBMUD quarterly to ensure coordination on pipeline replacement projects and upgrades are in alignment with the City's programs.
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Monitor and support regional and State-level efforts to forecast the impact of climate change on temperatures and incidence of extreme heat events in Berkeley and the region, and integrate extreme heat event readiness, focusing on the most vulnerable populations impacted and improving access to resources, into City operations and services.	In Progress	Yes	The City has been monitoring the latest science related to extreme heat, including studies conducted by Alameda County. The City of Berkeley has been coordinating both internally within multiple departments, as well as externally with regional, national and international entities to learn and develop effective extreme heat planning measures, focusing on the most vulnerable populations. The City is participating in a regional extreme heat planning group being coordinated by UC Berkeley.
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Continue to create and maintain shading by maintaining the health of existing trees and sustaining municipal tree planting with a focus on efforts in areas where there are fewer trees.	Ongoing	Yes	The City has secured state grants to expand tree planting in lower canopied areas while still planting trees elsewhere. The City continues the effort to plant the right tree for the location in order to provide maximum environmental and social benefits while limiting negative impacts to the surrounding infrastructure and existing trees. This includes tree placement in relation to inhabited structures, shade and wind breaks around recreational areas, and adjacent to paved roads and parking lots.
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Continue to implement energy efficiency ordinances for existing residential and commercial buildings to improve building comfort, including in extreme weather conditions, and to reduce energy use.	Ongoing	Yes	The City continues to promote and implement energy efficiency in buildings including assuring compliance with Berkeley's Energy and Green Building Codes (adopted in 2022). Energy efficiency measures will also be incorporated in low-income homes that are part of the City's Climate Equity Fund and Just Transition Residential Electrification Pilot Programs.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Reduce Berkeley’s vulnerability to extreme heat events and associated hazards.	Encourage cooling strategies for the built environment through voluntary programs to mitigate the urban heat island effect. This can include strategies like green roofs, cool roofs, and cool pavements, increased vegetation, as well as electric heat pumps and natural ventilation which can provide cooling to buildings in an extreme heat event.	Ongoing	Yes with updates	The spirit of this action continues in three new actions in the 2024 document.
Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.	Implement the following programs: ~Hazardous Materials Release Response Plans and Inventories (HMRRP) Program ~Implement California Accidental Release Prevention (CalARP) Program ~Underground Storage Tank (UST) Program Aboveground Petroleum Storage Act Requirement for Spill Prevention ~Hazardous Waste Generator and Onsite Hazardous Waste Treatment Programs ~Implement Hazardous Materials Management Plans (HMMP) and Hazardous Materials Inventory Statements per California Fire Code	Ongoing	Yes	The Toxic Management Division continues to maintain these inspection and enforcement programs to mitigate hazardous materials release in Berkeley.
Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.	Enforce California Fire Code for Hazardous Materials Compliance (See Fire Code Action)	Ongoing	Yes	Improved Fire Prevention staffing level is improving ability to review and enforce hazardous materials storage and use conditions. New staff also includes individuals that have hazardous materials enforcement experience.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Define clean air standards for buildings during poor air quality events and use those standards to assess facilities for the Berkeley community.	Participate in regional efforts to define standards and tools to predict buildings' ability to deliver clean air to occupants during poor air quality events.	Completed with Modifications	No	Air Quality Index levels of health concern have been established by the Bay Area Air Quality Management District.
Define clean air standards for buildings during poor air quality events and use those standards to assess facilities for the Berkeley community.	Apply standards and tools to assess City facilities' ability to provide clean air to occupants during poor air quality events.	Completed with Modifications	No	Since 2019, air filters have been installed into HVAC systems at many City sites, and portable air filters have been distributed to many other sites.
Define clean air standards for buildings during poor air quality events and use those standards to assess facilities for the Berkeley community.	Coordinate with willing Berkeley partners to apply standards and tools to partner facilities.	Completed with Modifications	No	Using a grant from the Bay Area Air Quality Management District, the City received and distributed air cleaners to City libraries and recreation centers for use during poor air quality days.
Define clean air standards for buildings during poor air quality events and use those standards to assess facilities for the Berkeley community.	Use findings to develop a list of potential clean air facilities (City-run and partner-run) to the community.	Completed with Modifications	No	Designated sites are communicated during poor air quality events.
Maintain City participation in the National Flood Insurance Program.	Continue to use the most current FEMA information defining flood areas.	Ongoing	Yes	The City keeps the Berkeley Municipal Code Chapter 17.12: Flood Zone Development Ordinance consistent with the FEMA National Flood Insurance Program requirements.
Maintain City participation in the National Flood Insurance Program.	Continue to incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards.	Ongoing	Yes	The City performs the suggested actions by keeping the Berkeley Municipal Code Chapter 17.12: Flood Zone Development Ordinance consistent with FEMA National Flood Insurance Program requirements.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.	Track changes in hazard risk using the best-available information and tools.	Ongoing	Yes	The Office of Emergency Services continues to track changes in hazard risk by conducting research and consulting with subject matter experts.
Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.	Collect and share up-to-date hazard maps identifying areas subject to heightened risk from hazards.	Ongoing	Yes	The Office of Emergency Services continues to provide updated hazard maps online and in the Local Hazard Mitigation Plan.
Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.	Publicize financial and technical assistance resources for risk reduction.	Ongoing	Yes	The Office of Emergency Services and other City Departments publicize technical assistance resources on the City website as its available.
Coordinate with and encourage mitigation actions of key City partners.	Coordinate with and encourage mitigation actions of: <ul style="list-style-type: none">• Institutions serving the Berkeley community• Berkeley organizations and nonprofits• Other partners whose actions affect the Berkeley community	Ongoing	Yes	City staff connect and collaborate with a variety of nonprofits to encourage and support both ongoing preparedness and mitigation actions. Through the Community Resilience Center Program and Apartment Resilience Center Program, City staff maintain connections with organizations serving marginalized populations in Berkeley. The City regularly shares information about upcoming mitigation opportunities with participating organizations.
Reduce Berkeley’s vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.	Use development standards to ensure that new development does not contribute to an increase in flood potential.	Ongoing	Yes	Land Use Planning Division, Building and Safety Division, Office of Energy and Sustainable Development, and Department of Public Works coordinate efforts to ensure stormwater management best practices are followed.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Reduce Berkeley’s vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.	Complete the Watershed Management Plan to recommend improvements to problem areas in individual watersheds. Develop a Stormwater Master Plan to perform hydraulic analysis and condition assessment, and identify flow capacity and flooding issues as basis for the Watershed Management Plan.	In Progress	Yes with updates	<p>The City has begun development of the Stormwater Master Plan, to be completed at the end of 2025. The Stormwater Master Plan will identify deficiencies in the City’s stormwater system, prioritize capital improvement projects, identify funding needs, develop City specific drainage design standards, and update maintenance and inspection plans for stormwater facilities.</p> <p>The Stormwater Master Plan is a new assessment that will provide an updated assessment of the Potter and Codornices Watersheds, as well as the other watersheds not included in the 2011 Watershed Management Plan.</p>
Reduce Berkeley’s vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.	Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio- filtration systems.	Ongoing	Yes	The City has installed Green Infrastructure facilities at five locations. The City is also in the process of daylighting Codornices Creek at Kains Avenue to increase channel volume, in order to minimize potential flooding.
Implement energy assurance strategies at critical facilities.	Identify potential actions to mitigate energy assurance vulnerabilities at critical City facilities during planning/conceptual design of both retrofits and new construction.	In Progress	Yes	The City continues to identify ways to mitigate energy assurance vulnerabilities. Currently, the City is exploring solar and battery-operated energy systems.
Implement energy assurance strategies at critical facilities.	Provide guidance to help the City consider opportunities to design, finance and implement clean energy assurance strategies (e.g., photovoltaic-supplemented generation, energy efficiency activities, and/or mobile charging stations).	In Progress	Yes	The City is currently in the process of contracting with East Bay Community Energy (EBCE) to install solar + storage at several critical municipal facilities, as well as several electric vehicle DC Fast Chargers for public charging. The City is also in process of installing EV charging stations for City fleet vehicles.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Implement energy assurance strategies at critical facilities.	Work with partners to identify additional non-City critical facilities and develop strategies to provide clean backup power at these sites.	In Progress	Yes	The City of Berkeley is working through its Community Resilience Center (CRC) program to understand backup power needs at critical community sites. The Office of Energy and Sustainable Development is evaluating funding opportunities that could support clean backup power at CRCs and/or other critical community sites.
Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.	Determine staffing needs to monitor research and oversee integration of climate change adaptation into City operations and services	Completed	No	Staff is working within current staffing capacity to advance integration of climate change adaptation into City operations and services.
Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.	Develop and implement a process to integrate adaptation planning into City operations including ways to address potential climate impacts in municipal capital and land use planning.	In Progress	Yes with updates	Training on climate change was provided to City staff. The City is including climate change considerations in its municipal capital projects (such as T1 bond), and included climate change considerations in its Housing Element update. The City will also be including climate change considerations in its forthcoming General Plan Safety Element Update and new Environmental Justice Element.
Mitigate the impacts of sea level rise in Berkeley.	Monitor and participate in regional and State-level research on projected sea-level rise in Berkeley and the region.	Completed	No	The City has conducted a sea level rise study for the Marina area, and continues to stay apprised of regional and state-level research on sea-level rise, including as a member of the Bay Area Climate Adaptation Network.
Mitigate the impacts of sea level rise in Berkeley.	Develop guidelines, regulations, and review development standards to ensure new and existing public and private developments and infrastructure are protected from floods due to sea-level rise.	Ongoing	Yes with updates	The Land Use Division of the Planning Department manages the permitting process for new development and conditions projects to ensure that it does not contribute to an increase in flood potential due to sea-level rise.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Collaborate with partners to increase the security of Berkeley’s water supply from climate change impacts.	Partner with East Bay Municipal Utility District (EBMUD) to provide and market incentives for residents, businesses and institutions to conserve water.	Completed	No	The City has promoted and will continue to promote EBMUD incentives.
Collaborate with partners to increase the security of Berkeley’s water supply from climate change impacts.	Partner with agencies such as EBMUD and StopWaste to encourage private property owners and public agencies (including the City government) to use sustainable landscaping techniques that require less water and energy to maintain.	Ongoing	Yes	The City continues to implement the State of California's Water Efficient Landscaping Ordinance (WELO) in partnership with relevant agencies such as EBMUD and StopWaste.
Collaborate with partners to increase the security of Berkeley’s water supply from climate change impacts.	Encourage water efficiency and conservation in existing buildings, such as incorporating water assessments into existing policies or creating a compliance program for SB407.	Ongoing	Yes	The City continues to encourage water efficiency and conservation in buildings, through requiring a certificate of compliance that water-conserving plumbing fixtures have installed when a property is undergoing additions, alterations, or improvements. Additional opportunities for promoting or requiring water, and energy, efficiency in existing are being monitored.
Mitigate Berkeley’s tsunami hazard.	Continue to fund and replace damaged finger docks.	In Progress	Yes	The City continues to fund and replace damaged finger docks on an going basis as needed. Since 2019, the City has used City funds and grant funds in total of \$1.2 million to replace damaged finger docks.
Mitigate Berkeley’s tsunami hazard.	Secure funding for replacement of D and E docks; begin the permitting process once funding is secure	In Progress	Yes	PRW received approval for a loan from the General Fund to replace D and E docks. The project is scheduled to break ground in 2024-2025.
Mitigate Berkeley’s tsunami hazard.	Begin the permitting process for piling replacement.	Completed	No	Compromised pilings throughout the Marina have been replaced.
Mitigate Berkeley’s tsunami hazard.	Repair University Avenue, Marina Boulevard, and Spinnaker Way in order to mitigate tsunami vulnerabilities.	Completed with Modifications	No	Roads have been rebuilt to modern-day standards and are now more likely to withstand tsunami impacts than before.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Mitigate Berkeley’s tsunami hazard.	Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to document and explore additional tsunami hazard mitigation measures for Berkeley’s maritime communities.	Ongoing	Yes	The City regularly collaborates with external partners to explore additional tsunami mitigation measures.
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Explore a Zoning Amendment to BMC 23C.04.100 that streamlines the Zoning permitting process to allow damaged industrial and commercial buildings, and dwelling units to rebuild by right following disasters.	Deleted	No	Due to limited capacity, no progress has been made since 2019, but the activity is still relevant. The City has updated the language of this Action for the 2024 LHMP to clarify next steps.
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Consider different treatment for buildings in high-risk areas.	Deleted	No	Due to limited capacity, no progress has been made since 2019, but the activity is still relevant. The City has updated the language of this Action for the 2024 LHMP to clarify next steps.
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Define the standard for documentation of current conditions for residential and commercial property owners to rebuild by right (in conformity with current applicable codes, specifications and standards) following disasters.	Deleted	No	Due to limited capacity, no progress has been made since 2019, but the activity is still relevant. The City has updated the language of this Action for the 2024 LHMP to clarify next steps.
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Define the process for the City to accept and file this documentation.	Deleted	No	Due to limited capacity, no progress has been made since 2019, but the activity is still relevant. The City has updated the language of this Action for the 2024 LHMP to clarify next steps.
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Outreach to property owners about this documentation process.	Deleted	No	Due to limited capacity, no progress has been made since 2019, but the activity is still relevant. The City has updated the language of this Action for the 2024 LHMP to clarify next steps.

Action Description	Proposed Activities	Status	Carried Over to Plan Update	Comments
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Evaluate location of essential public facilities prior to rebuild in order to prioritize development outside high-risk areas when feasible.	Deleted	No	Due to limited capacity, no progress has been made since 2019, but the activity is still relevant. The City has updated the language of this Action for the 2024 LHMP to clarify next steps.
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Explore how other cities provide protections for people that may be vulnerable during the rebuilding process.	Deleted	No	Due to limited capacity, no progress has been made since 2019, but the activity is still relevant. The City has updated the language of this Action for the 2024 LHMP to clarify next steps.

2024 Mitigation Strategy Actions

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Advance equitable community resilience, with a focus on disadvantaged communities.	Work with community partners to co-create solutions to improve community resilience, including through the Climate Equity Collaborative.	High	Multi-hazard	The Climate Equity Collaborative represents underserved communities, and will directly benefit these communities through meaningful involvement to identify needs and priorities.	Planning Department: Office of Energy and Sustainable Development	Seed funding secured through the Climate Equity Fund Pilot (\$100,000 for the Climate Equity Collaborative)	Ongoing
Advance equitable community resilience, with a focus on disadvantaged communities.	Develop General Plan Environmental Justice Element and update the existing Safety Element, with community-identified priorities related to climate adaptation.	High	Multi-hazard	Direct benefit through involvement to identify needs/solutions	Planning Department: Land Use Division Planning Department: Office of Energy and Sustainable Development	Funding obtained through a \$497,042 Adaptation Planning Grant Program from the CA Governor's Office of Planning and Research. City General Fund and Enterprise Fund.	Short term (1-5 years)

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Collaborate with partners to increase the security of Berkeley's water supply from climate change impacts.	Support EBMUD through the design and environmental review process to expand recycled water pipelines in Berkeley and increase the security of the water supply.	Low	Multi-hazard	Water security and efficiency will have financial benefits in addition to environmental benefits, especially for disadvantaged and/or low-income communities.	Public Works Department Planning Department: Office of Energy and Sustainable Development	Federal funding from Water Resources Development Act and EBMUD	Long term (5-10 years)
Collaborate with partners to increase the security of Berkeley's water supply from climate change impacts.	Continue to partner with agencies such as EBMUD and StopWaste to encourage private property owners and public agencies (including the City government) to use sustainable landscaping techniques that require less water and energy to maintain.	Low	Multi-hazard	Underserved communities are most impacted by climate change.	Planning Department: Office of Energy and Sustainable Development	City General Fund City Permit Service Center Fund City Enterprise Fund	Ongoing
Collaborate with partners to increase the security of Berkeley's water supply from climate change impacts.	Encourage water efficiency and conservation in existing buildings.	Low	Multi-hazard	Water efficiency and conservation will have financial benefits in addition to environmental benefits, especially for disadvantaged and/or low-income communities.	Planning Department: Office of Energy and Sustainable Development	City General Fund	Ongoing
Collect and share information with the Berkeley community about hazards and associated risk reduction techniques.	Create new formats and user-friendly guidance to educate the public, especially underserved populations, on Berkeley hazards.	High	Multi-hazard	Ensure that underserved communities have access to hazard information and materials.	Fire Department - Office of Emergency Services	City General Fund	Ongoing
Collect and share information with the Berkeley community about hazards and associated risk reduction techniques.	Provide key hazard information and best practices to Berkeley's business and arts community through established networks, for example by exploring opportunities for local business to share best practices and	High	Multi-hazard	Small businesses, arts organizations, and nonprofits often serve socially vulnerable populations. Small businesses and cultural institutions themselves run on small margins and are especially vulnerable to shocks and stresses.	City Manager's Office - Office of Economic Development	City General Fund	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
	resources during utility interruptions.						
Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.	Continue to work with owners of remaining potentially hazardous URM buildings.	High	Earthquake	Multi-unit housing is more affordable and serves a large percentage of socially vulnerable and underserved communities. Inspections help to ensure the safety of this housing stock.	Planning Department: Building and Safety Division	Hazard Mitigation Grant Program (HMGP)	Ongoing
Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.	Continue analysis of structures supporting critical emergency response and recovery functions, and make recommendations for structural and nonstructural improvements.	High	Multi-hazard	City facilities and structures serve socially vulnerable populations day to day and during emergencies.	Public Works Department: Supervising Civil Engineer for Facilities	City General Fund T1 Bond	Ongoing
Continue implementation of the Soft Story Retrofit Program, which mandates seismic retrofit of soft story buildings with 5+ residential units.	Continue to inform impacted property owners of the requirement to seismically retrofit their buildings, including newly added properties to the soft story inventory.	High	Earthquake	Multi-unit housing is more affordable and serves a large percentage of socially vulnerable and underserved communities. Inspections help to ensure the safety of this housing stock.	Planning Department: Building and Safety Division	Hazard Mitigation Grant Program (HMGP)	Ongoing
Continue to implement the Retrofit Grants Program, which helps Berkeley building owners increase safety and mitigate the risk of damage caused by earthquakes.	Assist participating property owners with the grant process, including dissemination of program rules and guidelines and approving design and disbursement construction grants.	High	Earthquake	Multi-unit housing is more affordable and serves a large percentage of socially vulnerable and underserved communities. Inspections help to ensure the safety of this housing stock.	Planning Department: Building and Safety Division	Hazard Mitigation Grant Program (HMGP)	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Continue to monitor passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices.	Continue to monitor mandatory seismic retrofit ordinances for concrete buildings passed by other municipalities for effectiveness and best practices. Communicate and collaborate with other cities and Structural Engineers Association of California (SEAOC) regarding implementation challenges and successes.	High	Earthquake	Multi-unit housing is more affordable and serves a large percentage of socially vulnerable and underserved communities. Inspections help to ensure the safety of this housing stock.	Planning: Building and Safety Program and Administration Manager	City General Fund	Ongoing
Coordinate regional wildfire mitigation strategies with key partners and stakeholders	Coordinate local fire mitigation, prevention, and funding strategies with the East Bay Hills Wildfire Prevention Coordination Group	High	WUI Fire	Wildfires disproportionately impacts people with access and functional needs and collaborating with local partners helps reduce wildfire risks.	Fire Department - WUI Division	City General Fund Measure FF	Ongoing
Coordinate regional wildfire mitigation strategies with key partners and stakeholders	Coordinate regional efforts to mitigate wildfire risk in the Oakland - Berkeley hills through the Hills Emergency Forum	High	WUI Fire	Wildfires disproportionately impacts people with access and functional needs and collaborating with local partners helps reduce wildfire risks.	Fire Department - WUI Division	City General Fund Measure FF	Ongoing
Coordinate with and encourage mitigation actions of key City partners.	Coordinate with and encourage mitigation actions of institutions serving the Berkeley community.	High	Multi-hazard	Benefits institutions serving the Berkeley community.	Fire Department: Office of Emergency Services	City General Fund Measure GG	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Implement energy assurance strategies at critical facilities.	Identify potential actions to mitigate energy assurance vulnerabilities at critical City facilities during planning/conceptual design of both retrofits and new construction.	Medium	Multi-hazard Utility Interruption	City facilities and structures serve socially vulnerable populations day to day and during emergencies.	Public Works Department: Supervising Civil Engineer (Facilities)	City General Fund T1 Bond Measure GG Ratepayer funds from PG&E East Bay Community Energy Grants from Energy Foundation Urban Sustainability Directors Network California Energy Commission California Air Resources Board	Ongoing
Implement energy assurance strategies at critical facilities.	Provide guidance to help the City consider opportunities to design, finance and implement clean energy assurance strategies (e.g., photovoltaic-supplemented generation, energy efficiency activities, and/or mobile charging stations).	Medium	Multi-hazard Utility Interruption	Clean energy assurance solutions could provide backup and critical power benefit underserved communities who wouldn't otherwise have access to power during an emergency.	Planning Department: Office of Energy and Sustainable Development	City General Fund	Ongoing
Implement energy assurance strategies at critical facilities.	Work with partners to identify additional non-City critical facilities and develop strategies to provide clean backup power at these sites.	Medium	Multi-hazard Utility Interruption	By working with organizations serving disadvantaged communities to help advance their energy assurance, this would directly benefit both underserved organizations and community members served by these organizations.	Planning Department: Office of Energy and Sustainable Development	City General Fund	Ongoing
Implement existing City programs, plans, and projects designed to reduce emissions that contribute to poor air quality.	Continue to implement the traffic safety capital construction projects identified and prioritized in the Berkeley Pedestrian Plan (2021), Berkeley Bicycle Plan (2017), Berkeley Vision Zero Action Plan (2020), and Berkeley Transit-First Implementation Plan; these projects are	Medium	Extreme Heat Poor Air Quality	Poor air quality disproportionately impacts communities of color, and South and West Berkeley.	Public Works Department - Transportation Division	City General Fund County Transportation Sales Tax	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
	intended to encourage non-driving modes						
Implement existing City programs, plans, and projects designed to reduce emissions that contribute to poor air quality.	Continue to implement the City's Electric Mobility Road Map which includes electric shared mobility (bikes and scooters) as well as electric and hybrid car-sharing, and the installation of public charging stations.	Medium	Extreme Heat Poor Air Quality	Poor air quality disproportionately impacts communities of color, and South and West Berkeley.	Public Works Department - Transportation Division	City General Fund County Transportation Sales Tax	Ongoing
Implement existing City programs, plans, and projects designed to reduce emissions that contribute to poor air quality.	Transportation program coordination with transit providers, Berkeley Unified School District (Safe Routes to Schools), Berkeley Police Department (Vision Zero), and others, to promote transit efficiency and traffic safety for non-driving modes.	Medium	Extreme Heat Poor Air Quality	Poor air quality disproportionately impacts communities of color, and South and West Berkeley.	Public Works Department - Transportation Division	City General Fund County Transportation Sales Tax	Ongoing
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Continue to enforce Fire Code requirement for fire fuel clearance on public roadways.	High	WUI Fire	Wildfires disproportionately impact people with access and functional needs and enforcing the Fire Code reduces risks.	Fire Department: WUI Division	Measure FF	Ongoing
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	With multiple agency partners, clear hazardous vegetation along 45 roadways in Fire Zone 2 protecting evacuation routes.	High	WUI Fire	Evacuation is more difficult for people with disabilities and people with access and functional needs.	Fire Department: WUI Division	Measure FF Cal Fire Grant	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Develop process to increase parking enforcement in fire-vulnerable areas during fire weather.	High	WUI Fire	Evacuation is more difficult for people with disabilities and people with access and functional needs.	Fire Department: Office of the Fire Chief Public Works Department: Transportation Division Police Department: Traffic Division	Measure FF	Ongoing
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Maintain and improve roadways in Fire Zones 2 and 3.	High	WUI Fire	Evacuation is more difficult for people with disabilities and people with access and functional needs.	Public Works Department: Supervising Civil Engineer	City General Fund	Ongoing
Maintain City participation in the National Flood Insurance Program.	Continue to use the most current FEMA information defining flood areas.	High	Flood	Flooding disproportionately impacts in South and West Berkeley.	Public Works Department: Manager of Engineering	City General Fund Permit Service Center Enterprise Fund Measure M Bond Funds Building Resilient Infrastructure and Communities (BRIC) Grant Program Hazard Mitigation Grant Program (HMGP)	Ongoing
Maintain City participation in the National Flood Insurance Program.	Continue to incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards.	High	Flood	Flooding disproportionately impacts in South and West Berkeley.	Planning Department: Land Use Division	City General Fund Permit Service Center Enterprise Fund Measure M Bond Funds Building Resilient Infrastructure and Communities (BRIC) Grant Program Hazard Mitigation Grant Program (HMGP)	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Maintain City programs and projects to mitigate the impacts of infectious diseases in Berkeley.	Continue surveillance and epidemiology, which is the ongoing collection, analysis, interpretation, and sharing of data in order to prevent and control disease.	High	Infectious Disease	In Alameda County, communities of color face inequitable conditions that increase the risk of chronic diseases	Health, Housing & Community Services Department, Public Health Officer Unit, Public Health Division	Public Health Emergency Preparedness Grants Future of Public Health Grant City General Fund	Ongoing
Maintain City programs and projects to mitigate the impacts of infectious diseases in Berkeley.	Implement non-pharmaceutical interventions, like personal protective measures such as masks and communitywide measures such as quarantining, aimed at reducing exposure.	High	Infectious Disease	In Alameda County, communities of color face inequitable conditions that increase the risk of chronic diseases	Health, Housing & Community Services Department, Public Health Officer Unit, Public Health Division	Public Health Emergency Preparedness Grants	Ongoing
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Publicize up-to-date maps of all emergency access and evacuation routes.	High	WUI Fire	Evacuation is more difficult for people with disabilities and people with access and functional needs.	Department of Information Technology: GIS Division- GIS Coordinator Fire: OES- Emergency Services Coordinator	City General Fund	Ongoing
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Maintain signage for public pathways to identify safe and accessible pedestrian evacuation routes from the hill areas.	High	WUI Fire	Evacuation is more difficult for people with disabilities and people with access and functional needs.	Public Works Department: City Traffic Engineer	City General Fund	Ongoing
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Public Works Staff will maintain paths on an as-needed basis, and will coordinate with the Berkeley Path Wanderers to maintain public pathways to provide safe pedestrian evacuation routes from the hill areas.	High	WUI Fire	Ensure that people with access and functional needs can use the pedestrian paths.	Public Works Department: Assistant Public Works Engineer	City General Fund	Ongoing
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Install handrails on all public pathways, prioritizing areas with high usage and steep inclines to increase pedestrian safety and accessibility.	High	WUI Fire	Ensure that people with access and functional needs can use the pedestrian paths.	Public Works Department - Traffic Engineering	City General Fund	Short term (1-5 years)

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Mitigate Berkeley's tsunami hazard at the Berkeley Marina.	<p>Continue to repair and replace damaged finger docks at the Berkeley Marina.</p> <p>Complete the demolition and replacement of D&E docks.</p> <p>Consider reconstruction or repair to J docks as funding becomes available.</p>	Low	Tsunami	10% of Marina boaters have a permit to live aboard their vessels. Many of these boaters are low-income.	Parks, Recreation, and Waterfront Department: Waterfront Division	T1 State Coastal Conservancy City General Fund Marina Fund Building Resilient Infrastructure and Communities (BRIC) Grant Program Hazard Mitigation Grant Program (HMGP) City General Fund City-Issued Bonds	Ongoing
Mitigate Berkeley's tsunami hazard at the Berkeley Marina.	Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to document and explore additional tsunami hazard mitigation measures for Berkeley's maritime communities.	Low	Tsunami	10% of Marina boaters have a permit to live aboard their vessels. Many of these boaters are low-income.	Fire Department: Office of Emergency Services Parks, Recreation, and Waterfront Department: Waterfront Division	Building Resilient Infrastructure and Communities (BRIC) Grant Program Hazard Mitigation Grant Program (HMGP) City General Fund City-Issued Bonds	Ongoing
Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.	Develop and implement a process to integrate adaptation planning into City operations, including ways to address climate impacts in municipal capital and land use planning.	Low	Multi-hazard	Underserved communities are most impacted by climate change.	Planning Department: Office of Energy and Sustainable Development	City General Fund	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.	Implement the following programs: ~Hazardous Materials Release Response Plans and Inventories (HMRRP) Program ~Implement California Accidental Release Prevention (CalARP) Program ~Underground Storage Tank (UST) Program Aboveground Petroleum Storage Act Requirement for Spill Prevention ~Hazardous Waste Generator and Onsite Hazardous Waste Treatment Programs ~Implement Hazardous Materials Management Plans (HMMP) and Hazardous Materials Inventory Statements per California Fire Code	High	Multi-hazard Hazardous Materials Release	Hazardous materials are located in south and west Berkeley.	Planning Department: Toxics Division	City General Fund	Ongoing
Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.	Enforce California Fire Code for Hazardous Materials Compliance (See Fire Code Action)	High	Multi-hazard Hazardous Materials Release	Hazardous materials are located in south and west Berkeley.	Fire Department: Fire Prevention Division	City General Fund	Ongoing
Mitigate hazards associated with natural gas usage, including disaster damage and energy service disruption, by minimizing need for energy use and moving toward use of electricity in lieu of natural gas.	Promote energy efficiency and electrification of buildings, both existing buildings and new construction.	High	Multi-hazard	City funds are targeted at underserved populations.	Planning Department: Office of Energy and Sustainable Development	City General Fund	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Mitigate impacts of sea level rise	Continue to ensure new and existing public and private developments and infrastructure are protected from floods due to sea-level rise through the permitting process for new development and conditions.	Medium	Sea Level Rise	Waterfront provides many free and low-cost recreational amenities for the community and is adjacent to lower-income communities in South and West Berkeley, which historically had fewer parks and less green space.	Planning Department: Land Use Division	City General Fund	Ongoing
Mitigate impacts of sea level rise	Identify funding and nature-based solutions to adapt to sea level rise at Berkeley Waterfront areas at risk of future inundation at the shoreline at the north segment of Marina Blvd between the Virginia Street Extension and the entrance to Cesar Chavez Park.	Medium	Sea Level Rise	Waterfront provides many free and low-cost recreational amenities for the community and is adjacent to lower-income communities in South and West Berkeley, which historically had fewer parks and less green space.	Parks, Recreation, and Waterfront Department	State Coastal Conservancy Grant	Short term (1-5 years)
Mitigate impacts of sea level rise	Identify funding and nature-based solutions to adapt to sea level rise at Berkeley Waterfront areas at risk of future inundation at the shoreline to the south of University Avenue between West Frontage Road and Marina Blvd.	Medium	Sea Level Rise	Waterfront provides many free and low-cost recreational amenities for the community and is adjacent to lower-income communities in South and West Berkeley, which tend to have fewer parks and green space.	Parks, Recreation, and Waterfront Department	FHWA PROTECT Discretionary Grant Program	Short term (1-5 years) (if FHWA grant received)
Mitigate impacts of sea level rise	Identify funding and nature-based solutions to adapt to sea level rise at Berkeley Waterfront areas at risk of future inundation at the northeast corner of the inner harbor of the Marina.	Medium	Sea Level Rise	Waterfront provides many free and low-cost recreational amenities for the community and is adjacent to lower-income communities in South and West Berkeley, which tend to have fewer parks and green space.	Parks, Recreation, and Waterfront Department	Adapting to Rising Tides, San Francisco Bay Conservation & Development Commission, National Oceanic & Atmospheric Administration, Urban Sustainability Director's Network, or Resource Legacy Fund	Long term (5-10 years)

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Mitigate impacts of sea level rise	Conduct a groundwater study on impacts of groundwater rise combined with sea level rise on underground toxic materials	Medium	Sea Level Rise	There is a risk of underground toxic materials shifting as groundwater and sea level rise, impacting those nearby. This study will shed light on potential impacts, on places such as West Berkeley which has a history of industrial use and environmental pollution, and is also where many low-income and disadvantaged communities live.	Planning Department: Office of Energy and Sustainable Development	This work is included in the funding obtained through a \$497,042 Adaptation Planning Grant Program from the CA Governor's Office of Planning and Research	Short term (1-5 years)
Mitigate wildfire risk to Berkeley's overnight camps.	Analyze fire risk at overnight camps and identify appropriate mitigation actions.	Medium	WUI Fire	The Berkeley overnight camps offer opportunities for recreations for people with access and functional needs and people with low incomes.	Fire Department - WUI Division Parks, Recreation, and Waterfront Department	Measure FF	Short term (1-5 years)
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Continue to seek out funding to use cool paving materials on streets when feasible to reduce urban heat island impacts.	Medium	Extreme heat	Urban heat island effects are more prominent in the Berkeley flats, which are more paved and less vegetated, and which is where more underserved communities live.	Planning Department: Office of Energy and Sustainable Development	State grants from Office of Planning and Research	Ongoing
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Continue to implement energy efficiency ordinances for existing residential and commercial buildings to improve building comfort, including in extreme weather conditions, and to reduce energy use.	Medium	Extreme heat	Extreme heat in places with bad ventilation or uncomfortable conditions impact the health and wellbeing of elderly and disabled populations.	Planning Department: Office of Energy and Sustainable Development	City General Fund	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Encourage passive and energy-efficient strategies to cool buildings such as natural ventilation, shading, insulation, cool roofs, whole-house fans, and heat pump HVAC systems.	Medium	Extreme heat	Extreme heat in places with bad ventilation or uncomfortable conditions impact the health and wellbeing of elderly and disabled populations.	Planning Department: Office of Energy and Sustainable Development	City General Fund	Ongoing
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Monitor and support regional and State-level efforts to forecast the impact of climate change on temperatures and incidence of extreme heat events in Berkeley and the region, and integrate extreme heat event readiness, focusing on the most vulnerable populations impacted and improving access to resources, into City operations and services.	Medium	Extreme Heat	Low income populations have less access to resources and readiness. Extreme heat impacts the flats due to urban heat island effect, and there is a large low-income population living in the flats.	Fire Department: Office of Emergency Services Planning Department: Office of Energy and Sustainable Development	City General Fund	Ongoing
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Continue Urban Forestry Unit's tree maintenance and planting programs to increase canopy coverage for extreme heat events to provide shade and mitigate impacts from poor air quality.	Medium	Extreme Heat Poor Air Quality	Reduces heat island effect, mitigates through carbon sequestration	Parks, Recreation, and Waterfront Department - Parks Division - Urban Forestry Unit	Parks Tax State of CA Environmental Enhancement and Mitigation Project Grant State of CA Urban Greening Grant Urban and Community Forestry Grants through the Inflation Reduction Act	Short term (grant-funded efforts will be completed by end of FY27) and ongoing
Reduce Berkeley's vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements	Use development standards to ensure that new development does not contribute to an increase in flood potential.	Medium	Flood	Flooding disproportionately impacts in South and West Berkeley.	Planning Department: Land Use Division	City General Fund	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
to stormwater drainage facilities.							
Reduce Berkeley's vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.	Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio-filtration systems.	Medium	Flood	Flooding disproportionately impacts in South and West Berkeley.	Public Works: Engineering	City General Fund Permit Service Center Enterprise Fund Measure M Bond Funds Building Resilient Infrastructure and Communities (BRIC) Grant Program Hazard Mitigation Grant Program (HMGP)	Ongoing
Reduce Berkeley's vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.	Renovate all eight tide tubes that remove storm water from Berkeley Aquatic Park and Potter Street to the Bay.	Medium	Flood	Flooding disproportionately impacts in South and West Berkeley.	Parks, Recreation, and Waterfront Department	Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT) Grant Parks Tax	Medium Term (3-5 years)
Reduce Berkeley's vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.	Complete a Stormwater Master Plan for all City stormwater infrastructure, to identify system deficiencies, establish a capital stormwater improvement plan, and identify funding mechanisms.	Medium	Flood	Flooding disproportionately impacts in South and West Berkeley.	Public Works: Engineering	City Stormwater Fund (\$1.5M) City General Fund (\$400k)	Short term (1-5 years)
Reduce fire risk in existing development through fire code updates and enforcement.	Continue to evaluate inspection procedures and adjust inspection cycle annually based on changing climatic conditions.	High	WUI Fire	Wildfires disproportionately impact people with access and functional needs and ensuring inspections are up to date reduces risk.	Fire Department - WUI Division	Measure FF	Ongoing
Reduce fire risk in existing development through fire code updates and enforcement.	Maintain Fire Department efforts to reduce fire risk through inspections through annual building inspections in all Fire Zones, including Multi-	High	WUI Fire	Multi-unit housing is more affordable and serves a large percentage of socially vulnerable and underserved communities. Inspections help to ensure the safety of this housing stock.	Fire Department: Fire Prevention Division	City General Fund UC Settlement Fund	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
	unit-residential building inspections.						
Reduce fire risk in existing development through fire code updates and enforcement.	Maintain Fire Department efforts to reduce fire risk through Defensible Space Inspections in Fire Zones 2 and 3.	High	WUI Fire	Provides career and workforce development in public safety for local youth.	Fire Department: WUI Division	Measure FF YouthWorks Program funds	Ongoing
Reduce fire risk in existing development through fire code updates and enforcement.	Continue YouthWorks pilot program to staff expansion of Defensible Space inspections in Fire Zones 2 and 3.	High	WUI Fire	Provides career and workforce development in public safety for local youth.	Fire Department - WUI Division	Measure FF Youth Works Program funds	Ongoing
Reduce fire risk in existing development through fire code updates and enforcement.	Continue to periodically update the Berkeley Fire Code and adopt the California Fire Code with local amendments to incorporate the latest knowledge and State regulations to protect people and property against known risks in both structural and non-structural building and site components.	High	WUI Fire	The Fire Code incorporates the latest knowledge in protecting the diverse buildings that house the Berkeley community.	Fire Department: Fire Prevention Division	City General Fund UC Settlement Fund Permit Service Center Enterprise Fund	Ongoing
Reduce fire risk in existing development through vegetation management.	Explore additional options to provide collaborative, citywide vegetation management on private and public property.	High	WUI Fire	Expand access to vegetation management.	Fire Department - WUI Division	Measure FF	Short term (1-5 years)
Reduce fire risk in existing development through vegetation management.	Maintain Weekly Curbside Plant Debris Collection	High	WUI Fire	Expand access to vegetation management.	Public Works Department: Zero Waste Division	City General Fund Refuse Fee	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Reduce fire risk in existing development through vegetation management.	Pursue external funding to perform vegetation management on public and private property and to increase education and awareness of vegetation management standards for fire fuel reduction, home hardening, and ignition controls.	High	WUI Fire	Expand access to vegetation management.	Fire Department - WUI Division	Measure FF City General Fund	Ongoing
Reduce fire risk in existing development through vegetation management.	Maintain Fire Fuel Debris Bin Program	High	WUI Fire	Expand access to vegetation management.	Public Works Department: Zero Waste Division	City General Fund Refuse Fee	Ongoing
Reduce fire risk in existing development through vegetation management.	Maintain Fire Fuel Abatement Program on Public Land with technical assistance from WUI Division	High	WUI Fire	Expand access to vegetation management.	PRW: Senior Landscape Supervisor WUI Division	City General Fund Refuse Fee Measure FF	Ongoing
Reduce fire risk in existing development through vegetation management.	Continue to allocate UC Settlement Funding to do vegetation management projects on UC Berkeley properties.	High	WUI Fire	Expand access to vegetation management.	Fire Department - WUI Division	UC Settlement Fund	Ongoing
Reduce fire risk in existing development through vegetation management.	Maintain redesigned and expanded citywide fire fuel chipper program to provide curbside pickup, chipping, and disposal of vegetation material from residential properties.	High	WUI Fire	Expanded program provides access to vegetation management support to all City residents and is no longer limited.	Fire Department - WUI Division	Measure FF	Ongoing
Reduce fire risk in existing development through vegetation management.	Manage the Eucalyptus Understory Cleanup Program	High	WUI Fire	Expand access to vegetation management.	Fire Department - WUI Division	Measure FF	Short term (1-5 years)

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Reduce fire risk through residential assistance program.	Continue to implement Resident Assistant Program pilot to provide home hardening materials and defensible space materials and instructions to low income residents in targeted high fire risk areas.	High	WUI Fire	Provides subsidized materials to residents at greatest risk of WUI fire.	Fire Department - WUI Division	Measure FF	Short term (1-5 years)
Reduce fire risk through utility undergrounding.	Urge PG&E to perform utility undergrounding in Berkeley's Very High Fire Hazard Severity Zone (VHFHSZ) to mitigate wildfire risk and limit evacuation and ingress obstruction. Coordinate efforts with the State of CA Public Utilities Commission, and elected officials.	High	WUI Fire Earthquake High Wind	Berkeley's Very High Fire Severity Zone has residents with access and functional needs that may have trouble evacuating in a wildfire.	Berkeley City Council	City General Fund	Short term (1-5 years)
Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.	Continue to periodically update and adopt the California Building Standards Code with local amendments to incorporate the latest knowledge and design standards to protect people and property against known seismic, fire, flood and landslide risks in both structural and non-structural building and site components.	High	Multi-hazard	Underserved communities live in old housing stock and multi-family buildings.	Planning Department: Building and Safety Division	City General Fund	Ongoing
Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.	Explain requirements and provide guidance to owners of potentially hazardous structures to facilitate retrofit, including owners participating in the Earthquake Brace and Bolt program, Earthquake Soft Story Program, and those applying for Transfer Tax rebates.	High	Multi-hazard	Underserved communities live in old housing stock and multi-family buildings.	Planning Department: Building and Safety Division Finance Department (for Transfer Tax applications and disbursement)	City General Fund	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Reduce wildfire risk throughout Berkeley by implementing the Action Plan identified in the Community Wildfire Protection Plan (CWPP).	Implement the Action Plan in the CWPP.	High	WUI Fire	The CWPP has identified actions that support low income residents in conducting home hardening and vegetation management.	Fire Department: WUI Division	Measure FF Cal Fire Grants	Ongoing
Research, identify, and implement infrastructure improvements to facilitate emergency evacuation.	Complete implementation of the Evacuation and Response Time Study to identify necessary roadway safety improvements, along with prioritized roadways, to facilitate safe evacuation during emergency scenarios.	High	Multi-hazard	Evacuation is more difficult for people with disabilities and people with access and functional needs.	Fire Department	Measure FF	Short term (1-5 years)
Research, identify, and implement infrastructure improvements to facilitate emergency evacuation.	Complete evacuation analysis required by new State evacuation laws under SB99, AB747, and AB1409. Incorporate findings into the updated Safety Element of the General Plan.	High	Multi-hazard	Evacuation is more difficult for people with disabilities and people with access and functional needs.	Fire Department: Office of Emergency Services	Measure FF	Short term (1-5 years)
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Give priority to project applications that would rebuild to current standards following disasters.	Low	Multi-hazard	This makes it easier to rebuild post disaster, hopefully allowing for diverse populations to stay in Berkeley.	Planning Department: Land Use Division	City General Fund	Short term (1-5 years)
Strengthen or replace City buildings in the identified prioritized order as funding is available.	West Berkeley Service Center Old City Hall Veterans Memorial Building	High	Multi-hazard	City facilities and structures serve socially vulnerable populations day to day and during emergencies.	Public Works Department: Supervising Civil Engineer for Facilities	Building Resilient Infrastructure and Communities (BRIC) Grant Program Hazard Mitigation Grant Program (HMGP) City General Fund T1 Bond	Ongoing
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Continue to seek funding to seismically strengthen or replace additional City buildings in a prioritized order.	High	Multi-hazard	City facilities and structures serve socially vulnerable populations day to day and during emergencies.	Public Works Department: Supervising Civil Engineer for Facilities	Building Resilient Infrastructure and Communities (BRIC) Grant Program Hazard Mitigation Grant Program (HMGP) City General Fund T1 Bond	Ongoing

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline
Strengthen or replace City buildings in the identified prioritized order as funding is available.	MLK Junior Youth Services Center, Williard Clubhouse, African American Holistic Resource Center.	High	Multi-hazard	The Center operates a lot of free programs for the Berkeley community.	Parks, Recreation, and Waterfront Department	City General Fund T1 Bond Parks Tax	Short term (1-5 years)
Evaluate potential land use controls impacts on emergency services	Ensure that Fire Department staff have the opportunity to review any proposed revisions to land use controls that would increase allowed densities, evaluate how the revised land use controls could impact the provision of emergency services, and convey that information to City Council prior to final action.	High	Multi-hazard	Ensure that the provision of emergency services to underserved and socially vulnerable populations doesn't decline.	Fire Department Planning Department: Land Use Planning	City General Fund	Ongoing

Other Actions Considered

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline	Notes
Reduce fire risk in existing development through vegetation management.	Explore options for developing a City-run hand crew to implement vegetation management projects on public and private property.	High	WUI Fire	Expand access to vegetation management. Potential workforce development opportunity people who were formerly incarcerated.	Fire Department - WUI Division	Measure FF	Long Term	Action considered but for longer time than in the next five years.
Reduce fire risk through community-focused education, training, and fire code updates.	Conduct multi-unit-residential building inspections in all Fire Zones.	High	WUI Fire	Lower income people live in multi-residential-unit housing.	Fire Department - Fire Prevention	General Fund	Ongoing	Goal, but need more capacity

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline	Notes
Reduce fire risk through community-focused education, training, and fire code updates.	Using community volunteers, through WUI Ambassador Program, to educate people city-wide on vegetation management, home hardening, and defensible space.	High	WUI Fire	Expand access to educational programs and reach people who would not otherwise receive information.	Fire Department - WUI Division	Measure FF	Short term (1-5 years)	Pilot program in 2023-24, need to evaluate what next steps might be
Reduce fire risk through community-focused education, training, and fire code updates.	Conduct annual building inspections in all Fire Zones.	High	WUI Fire		Fire Department - Fire Prevention	General Fund	Ongoing	Goal, but need more capacity
Advance opportunities for water reuse.	Research and support opportunities to advance purple pipe implementation.	Medium	Multi-hazard	Increases the security of Berkeley's water supplies from climate change impacts for all residents	Planning and Public Works	EBMUD is expected to fund	2024-2030 (estimated)	Goal, but not the top of the priority list
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Tree planting/urban forestry program	High	Poor Air Quality, Extreme Heat	Reduces heat island effect, mitigates through carbon sequestration	Parks and Rec	In progress; needs PRW vetting and input	In progress; needs PRW vetting and input	Some new actions included around urban forestry, but room to build out more capacity in the future
Reduce flood risk	Nature based solutions at shoreline	Medium	Flooding	Underserved communities are most likely to live in/near areas that would be impacted	Public Works and Parks	Needs PRW/PW vetting and input	Needs PRW/PW vetting and input	Some new actions included around nature-based solutions on the shoreline, but room to build out more capacity in the future
Implement existing City programs, plans, and projects designed to reduce emissions that contribute to poor air quality.	Continue to manage on-street parking and maintain City parking garages to reduce emissions by making it easier to find a parking space more quickly (reducing the time spent circling around looking for parking).	Air Quality	Extreme Heat, Poor Air Quality	Poor air quality disproportionately impacts communities of color, and South and West Berkeley.	Public Works Department - Transportation Division	City funds, County Transportation Sales Tax, and Grant Funding	Ongoing	This is something that the City does and has infrastructure for, but not entirely sure the research is there that it helps reduce emissions. Further work to expand air quality mitigation measures for next round

Action Description	Proposed Activities	Priority Level	Related Natural Hazard(s)	How would this benefit underserved communities and socially vulnerable populations?	Lead Office, Division, or Department	Funding Sources	Timeline	Notes
Strengthen or replace City buildings in the identified prioritized order as funding is available.	South Berkeley Senior Center	High	Multihazard	The South Berkeley Senior Center serves South Berkeley, the area of Berkeley with higher numbers of people of color and low income residents.	Parks, Recreation, and Waterfront Department	CRC grant	Short term (1-5 years)	The City applied for a CRC grant to fund this effort, but was not awarded. New funding must be identified.

2024 Community Actions

Hazard	Action Type	Action	Cost	Time Commitment	Resources
Air Quality	Home Improvement	Replace or seal leaky windows and doors	High	High	https://www.csd.ca.gov/Pages/Low-Income-Weatherization-Program.aspx
Air Quality	Buy	Purchase equipment to clean air inside your home	Medium	Low	https://ww2.arb.ca.gov/list-carb-certified-air-cleaning-devices
Air Quality	Buy	Construct an air cleaner with a box fan and a filter	Low	Low	https://ww2.arb.ca.gov/resources/fact-sheets/indoor-air-cleaners-and-wildfire-smoke-faq-0
Air Quality	Stay updated	Be familiar with the Air Quality Index	None	Low	https://www.airnow.gov/aqi/aqi-basics/
Air Quality	Stay updated	Bookmark sites with key information, like AirNow.gov and Fire.AirNow.gov	None	Low	
Air Quality	Protect Yourself and Others	When there is poor air, stay indoors with the windows and doors closed	None	Low	
Air Quality	Learn	Know the signs that you or those around you need clean air	None	Low	https://www.epa.gov/ozone-pollution-and-your-patients-health/patient-exposure-and-air-quality-index
Earthquake	Home Improvement	Secure your home by storing heavy and breakable objects on low shelves	None	Low	

Hazard	Action Type	Action	Cost	Time Commitment	Resources
Earthquake	Home Improvement	Secure your home by securing bookshelves to the wall	Low	Low	
Earthquake	Home Improvement	Move beds and sitting areas away from windows	None	Low	
Earthquake	Home Improvement	Move or secure hanging objects away fro beds, sofas, and chairs	Low	Low	
Earthquake	Home Improvement	Use quake gel to secure breakable items in place	Low	Low	
Earthquake	Home Improvement	Assess your home by hiring an engineer and checking building permits	Medium	Medium	
Earthquake	Home Improvement	Retrofit your home if needed	High	High	
Earthquake	Home Improvement	Understand available grants for seismic retrofits	None	Low	https://berkeleyca.gov/construction-development/seismic-safety/funding-seismic-retrofits
Earthquake	Buy	Consider purchasing earthquake insurance	High	Low	
Earthquake	Buy	Store water for a week (7 gallons per person)	Medium	Low	
Earthquake	Learn	Practice what to do in an earthquake (drop, cover, and hold on)	None	Low	
Earthquake	Learn	Learn how to turn off gas, electricity, and water at your house.	None	Low	
Extreme Heat	Buy	Gather supplies to keep yourself cool, including ice, spray bottle, and personal fan.	Low	Low	
Extreme Heat	Home Improvement	Plan to keep your home cool on days without air conditioning.	Medium	Low	https://www.youtube.com/watch?v=4BLfYtE4Kow
Extreme Heat	Make a Plan	Decide where you will go and how you will get there if it gets too hot.	None	Low	Malls, stores, and community cooling centers usually have air conditioning.
Extreme Heat	Volunteer	Check on friends, family, and neighbors.	None	Medium	
Flood	Protect Yourself and Others	During a heat wave, drink plenty of water, wear loose, lightweight clothing, spray yourself with water	Low	Medium	
Flood	Volunteer	Protect your neighborhood and keep water flowing by	None	Medium	https://berkeleyca.gov/community-recreation/volunteering/adopt-drain

Hazard	Action Type	Action	Cost	Time Commitment	Resources
		participating in the adopt a drain program			
Flood	Home Improvement	Routinely clean and maintain gutters, downspouts, and splash blocks.	Medium	Medium	
Flood	Home Improvement	If stormwater does not drain away from building, change landscaping to improve runoff.	Medium	Medium	
Flood	Home Improvement	Implement lower cost projects to reduce your flooding risk	Medium	Medium	https://www.fema.gov/sites/default/files/documents/fema_protect-your-home-from-flooding-brochure_2020.pdf
Flood	Home Improvement	Elevate important items	None	Low	
Flood	Learn	How to sandbag and whether sandbags will be protective for your property	Low	Medium	https://www.cityofmadison.com/flooding/during-a-flood/how-to-sandbag
Flood	Protect Yourself and Others	Do not walk, swim, or drive through flood waters	None	Low	
High Wind	Home Improvement	Keep trees near your home properly maintained.	Medium	Medium	
High Wind	Home Improvement	Bring in or secure any loose outdoor items, such as holiday decorations and chairs.	None	Low	
High Wind	Protect Yourself and Others	During high winds, if you must be outdoors, keep your distance from trees	None	Low	
High Wind	Protect Yourself and Others	During high winds, avoid driving, especially in high profile vehicles.	None	Low	
Landslides	Home Improvement	Have flexible pipe fittings installed to avoid gas or water leaks, as flexible fittings are more resistant to breakage.	Medium	Medium	Note, only PG&E or other professionals should install gas fittings
Landslides	Learn	If you learn you're in an area susceptible to landslides (Berkeley hills generally), familiarize yourself with landslide warning signs.	None	Low	https://www.usgs.gov/programs/landslide-hazards/landslide-preparedness#:~:text=assistance%20to%20evacuate.-,Evacuate.,if%20escape%20is%20not%20possible
Landslides	Buy	Consider a "Difference in Coverage" Insurance Policy to cover the gap in typical homeowner's insurance.	High	Low	

Hazard	Action Type	Action	Cost	Time Commitment	Resources
Tsunami	Learn	Understand Berkeley's tsunami inundation area to identify whether you might find yourself in the tsunami inundation zone	None	Low	
Tsunami	Learn	Know nature's warning signs of a near source tsunami	None	Low	Earthquake with ground shaking, loud ocean roar, quickly receding water
Tsunami	Stay updated	Be ready to act on tsunami alerts by signing up for AC Alert	None	Low	https://member.everbridge.net/453003085612570/login
Tsunami	Stay updated	Bookmark and get familiar with Berkeley's Emergency Map	None	Low	https://protect.genasys.com/search?z=15.664002727664615&latlon=37.867534308013134%2C-122.2869101
Tsunami	Stay updated	Get familiar with the test and emergency tones from Berkeley's Outdoor Warning System	None	Low	https://berkeleyca.gov/your-government/our-work/capital-projects/outdoor-warning-system-emergency-siren-network
Tsunami	Make a Plan	If you live in the inundation zone, make your household evacuation plan for tsunami.	None	Medium	Decide where you will go, what you will pack, how you will get there, and who can help
Tsunami	Make a Plan	If you are part of the maritime community, plan for your boat.	None	Medium	
Tsunami	Protect Yourself and Others	If you are part of the maritime community, prepare a go bag or backpack if you need to evacuate quickly.	Medium	Medium	
Tsunami	Protect Yourself and Others	If a tsunami alert is issued, monitor your phone, follow evacuation orders, and do not go towards the tsunami.	None	Low	
Utility Disruption	Buy	Have an emergency supply kit that includes water, food, medications, flashlights, batteries, important documents, and cash.	Medium	Medium	
Utility Disruption	Buy	Consider having a battery-powered portable charger	Varies	Medium	Depends on what kind of water you buy - some vessels are expensive, but last longer.
Utility Disruption	Buy	Store water for a week (7 gallons per person)	Medium	Low	
Utility Disruption	Make a Plan	Make a plan to stay safe and comfortable during power outages	Medium	High	

Hazard	Action Type	Action	Cost	Time Commitment	Resources
Utility Disruption	Make a Plan	Explore alternative sources of information and entertainment when internet access is unavailable	None	Medium	
Utility Disruption	Make a Plan	Make a backup communications plan with your family. Choose a meeting place if you can't reach each other.	None	Medium	
Utility Disruption	Make a Plan	Make sure PG&E can reach you and alert you to an outage by calling 1-800-743-5000 and updating your contact information.			
Utility Disruption	Home Improvement	Modify your toilet to collect waste without flushing or use a five-gallon bucket	Medium	Medium	
Utility Disruption	Protect Yourself and Others	Know the location of your circuit breakers and fuse boxes and how to check them	None	Low	
Wildfire	Home Improvement	If you're in Fire Zones 2 or 3, review your home's Defensible Space Report and follow the instructions on defensible space and home hardening.	Varies	Varies	
Wildfire	Home Improvement	Use the Free Chipper Day program to remove vegetation material from your property	None	Medium	https://www.chipperday.com/berkeley/
Wildfire	Home Improvement	Use guidance on BerkeleyFire.Com to harden your home and create defensible space	Varies	Varies	
Wildfire	Make a Plan	Make your household fire weather plan	None	High	https://berkeleyca.gov/sites/default/files/2022-02/berkeley-fire-weather-planning-tool.pdf
Wildfire	Protect Yourself and Others	Stay out of the hills on extreme fire weather days	Varies	Varies	https://berkeleyca.gov/sites/default/files/2022-02/berkeley-fire-weather-planning-tool.pdf
Wildfire	Protect Yourself and Others	Sign up for AC Alert to receive evacuation and other emergency notifications	None	Low	https://member.everbridge.net/453003085612570/login
Wildfire	Protect Yourself and Others	Bookmark the Berkeley Emergency Map	None	Low	https://protect.genasys.com/search?z=15.664002727664615&latlon=37.867534308013134%2C-122.2869101

Attachment 1: Documentation for State and Federal Reviewers

Documentation includes the following in this order in the PDF:

1. List of Core Project Team, City Staff, and Stakeholders
2. Core Project Team Meetings
 - a. June 20, 2024
 - b. August 2
 - i. Slides
 - ii. Attendance Photo
 - c. August 29
 - i. Slides
 - d. September 12
 - i. Slides
 - e. November 6
 - i. Notes
 - ii. Attendance Photo
 - f. February 8
 - i. Notes
 - ii. Attendance Photo
3. Public Engagement in the Planning Process
 - a. Photos of the following events
 - i. National Night Out
 1. Event photos
 2. Hazards of Concern Posters
 - ii. Winter Weather Workshop
 1. Photos
 2. Slides
 - iii. Tsunami Waterfront Event
 1. Photos
 2. Slides
 - b. Stakeholder Engagement
 - i. Emails
 - c. Hazard Expert Engagement
 - i. Emails
4. Key Commission and Council Presentations
 - a. Disaster and Fire Safety Commission – September 27 (Plan is coming)
 - i. Minutes
 - ii. Presentation
 - b. Planning Commission – October 4 (Plan is coming)
 - i. Minutes
 - ii. Presentation
 - c. Planning Commission – June 5 (First Draft)
 - i. Minutes
 - ii. Presentation
 - d. Disaster and Fire Safety Commission – June 26 (First Draft)
 - i. Minutes
 - ii. Presentation
 - e. Public Safety Committee – July 15 (First Draft)
 - i. Minutes
 - ii. Presentation

5. Public Review of First Draft Plan
 - a. Website Screenshot
 - b. City Newsletter
 - c. Berkeley Ready Newsletter
 - d. Social media
 - e. News and media coverage
 - f. City Manager Memos to Commission and City Council
 - g. Stakeholder Engagement
 - i. Emails for public comment
 - ii. Received comments on First Draft Plan
 - h. Public Review Workshops
 - i. Photos of workshop
 - ii. Poster boards from workshop
 - i. YouTube Videos
 - i. Slides
6. Summary of changes to First Draft Plan

List of people that were contacted to help draft the plan

City Staff

- Daniel Akagi, Supervising Civil Engineer, Public Works Department
- Joy Brown, Operations Manager, Public Works Department
- Jamie Cooney, Hazardous Materials Specialist, Planning Department
- Sean Crothers, Waterfront Supervisor, Parks, Recreation, and Waterfront Division
- Thomas Dodge, Forestry Technician, Parks, Recreation, and Waterfront Division
- Ali Endress, Waterfront Manager, Parks, Recreation, and Waterfront Division
- Makinde Falade, GIS Coordinator, Information Technology Department
- Lam Inthavong, Hazardous Materials Manager, Planning Department
- Leticia Jauregui, Solid Waste and Recycling Manager, Public Works Department
- Elmar Kapfer, Supervising Civil Engineer, Public Works Department
- David Lopez, Building Official, Building and Safety Division
- Jenny McNulty, Resilient buildings Program Manager, Building and Safety Division
- Rebecca Milliken, Sustainability Outreach Specialist, Office of Energy and Sustainable Development
- Hamid Mostowfi, Supervising Traffic Engineer, Public Works Department
- Srinivas Muktevi, Supervising Civil Engineer, Public Works Department
- Ron Nevels, Supervising Civil Engineer, Public Works Department
- Alene Pearson, Deputy Director of Planning and Development, Planning Department
- Ruth Raisner, Health Services Program Specialist, Public Health Emergency Preparedness and Immunization Program
- Billi Romain, Manager, Office of Energy and Sustainable Development
- Marna Schwartz, Sustainability Coordinator, Office of Energy and Sustainable Development
- Alisa Shen, Principal Planner, Planning Department
- Katharine Sullivan, COVID-19 Response Coordinator, Health, Housing, and Community Services
- Ron Torres, Division Manager, Environmental Health
- Katie Van Dyke, Chief Resilience Officer, Office of Energy and Sustainable Development

External Hazard Experts

- Jackie Bott, Engineering Geologist, California Geological Survey
- Sarah Church, Sustainability Project Manager, County of Alameda
- Brian Garcia, Warning Coordination Meteorologist, National Weather Service
- Eric Geist, Research Geophysicist, United States Geological Survey
- Nick Graehl, Engineering Geologist, California Geological Survey
- Anne Wein, Operations Research Analyst, United States Geological Survey
- Rick Wilson, Senior Engineering Geologist, California Geological Survey

Community Partners

- Ed Roberts Campus: a nonprofit formed by disability organizations that share a common history in the Independent Living Movement of People with Disabilities.

- Berkeley Youth Alternatives: a community-based organization dedicated to providing a secure and nurturing environment for children, you, and families.
- McGee Baptist Church
- La Peña Cultural Center: a place for Latinx, Caribbean, and Indigenous diasporic communities of the Bay Area to preserve and celebrate cultural traditions.
- YMCA Head Start Preschool
- Harriet Tubman Terrace Apartments
- Easy Does It: a non-profit that provides seniors and people with disabilities non-medical emergency services and other essential support to enable and enhance independent living.
- Oregon Park Senior Apartments
- Ecology Center
- Berkeley Humane
- Multicultural Institute: is a vibrant and diverse institution dedicated to promoting cultural understanding and appreciation in the community.
- Berkeley Pathwanderers: dedicated to the creation, preservation and restoration of public paths, steps and walkways in Berkeley for the use and enjoyment of all.
- Berkeley City College
- Bay Area Rapid Transit
- City of Oakland
- Alameda County Sheriff's Office - Office of Homeland Security and Emergency Services
- Lawrence Berkeley National Lab
- Kinder Morgan Corporation
- East Bay Municipal Utility District
- Union Pacific Railroad
- UC Berkeley
- Bayer
- Caltrans
- City of Albany
- City of Emeryville
- Union Pacific Railroad
- East Bay Regional Parks District
- Kensington Fire
- PG&E

Local Hazard Mitigation Plan

Core Planning Team Meeting # 1
June 20, 2023



Agenda

- Introductions
- What is Mitigation?
- What is the LHMP?
- Review and provide input on plan:
 - Hazards of concern
 - Goals
 - Mitigation Strategy – 2019 Actions and 2024 Actions
- Homework and Next Steps

What is Mitigation?



What is Mitigation?

- Two ways to deal with hazards:
 - Increase emergency *response* capability
 - **Increase actions taken to *reduce or eliminate the impacts* of future incidents**
- Mitigation is sustained actions:
 - To **reduce or eliminate long-term risks** to people and property from hazards and their effects
 - That provide **passive protection** at the time of disaster impact



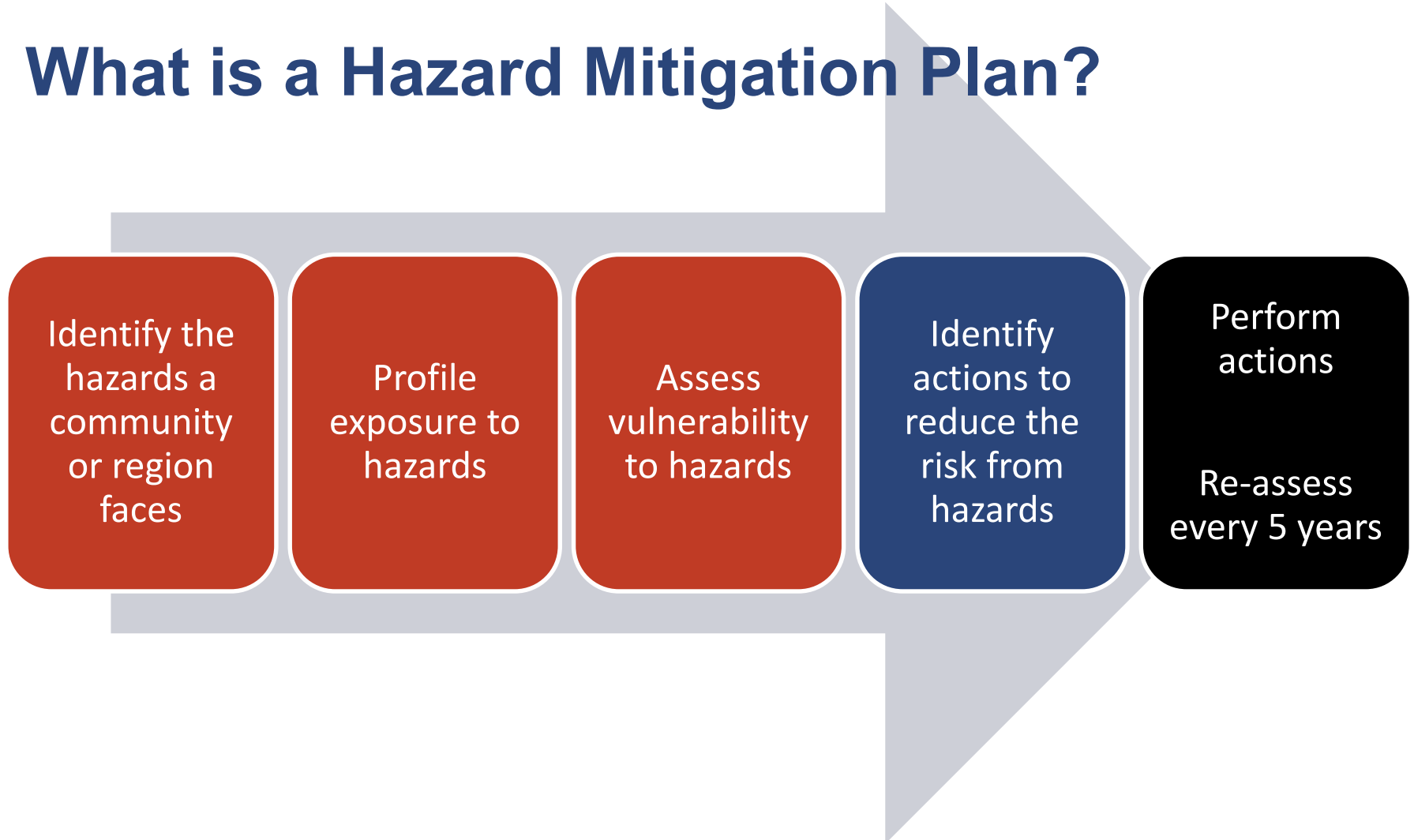
What is Mitigation?

- Mitigation is:
 - Strengthening structures
 - Making land use decisions that will minimize damage
 - Reducing vegetation in high-fire areas
 - Strapping down water heaters

- Mitigation is not:
 - Purchasing equipment to use in emergency response
 - Conducting drills
 - Disaster awareness programs
 - Storage of disaster supplies for post-disaster relief

Local Hazard Mitigation Plan

What is a Hazard Mitigation Plan?





Why does this plan matter to Berkeley?

- Now: FEMA Grant Funding
 - Pre- and post-disaster
 - City has grant-funded projects completed, underway, and proposed
- In the next disaster: may reduce Berkeley's disaster recovery costs
 - Can eliminate the 6.25% local match requirement for the City of Berkeley to receive post-disaster public assistance from FEMA



Activity	Timeline
Review and update Plan Seek input from public, key partners, stakeholders Produce <i>First Draft Plan</i>	<i>June – October 2023</i>
Seek input from public and Commissions Hold Council Work Session Present First Draft Plan to Disaster and Fire Safety Commission and Planning Commission (1 st Public Hearing) Public Comment Period Open October - February	<i>October 2023 – January 2024</i>
Consider feedback and update plan as appropriate Produce <i>Final Draft Plan</i>	<i>February 2024 – April 2024</i>
Submit plan to Cal EMA/FEMA for review, comment and preliminary approval (est 5 months)	<i>April – August 2024</i>
Seek Adoption of approved <i>Final Draft Plan</i> by City Council (Plan's 2 nd Public Hearing)	<i>November 2024</i>
Seek Final FEMA approval	<i>December 2024</i>

Hazards of Concern



Hazards of Concern (2019)

- Earthquake
- Wildland-Urban Interface (WUI) Fire
- Flood
- Landslide
- Tsunami
- Extreme Heat
- Hazardous Materials Release
- Climate Change
- (Terrorism)



New Hazards of Concern in 2024?

Mitigation Goals



2019 LHMP

- A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, extreme heat, and their secondary impacts.
- B. Increase City government's ability to serve the community during and after hazardous events by mitigating risk to key City functions.
- C. Connect with residents, community-based organizations, institutions, businesses, and essential lifeline systems in order to increase mitigation actions and disaster resilience in the community.
- D. Preserve Berkeley's unique character and values from being compromised by hazardous events.
- E. Protect Berkeley's historically underserved populations from the impacts of hazardous events by applying an equity lens, including equal access to mitigation efforts.

Mitigation Strategy



Mitigation Strategy Update Process

- OES will reach out to Department contacts to update status of 2019 mitigation actions, copying in you (spreadsheet)
 - Describe progress on actions
 - Remove completed or unworkable actions
- OES will circle back with you if we need help getting responses
- Next steps
 - Propose new actions for the 2024 Mitigation Strategy (July)
 - Prioritize actions in 2024 Mitigation Strategy (August)
 - Following initial public outreach process, re-prioritize actions as appropriate (September/October)

Homework and Next Steps



Homework and Next Steps

- Work with your Department Contacts to update current status of **2019 Actions**
- Work with your Department to Brainstorm new **Actions** for **2024 Mitigation Strategy**. Try to consider actions that benefit underserved communities. (Tab in the spreadsheet)
- ***Be Prepared to come to the July meeting ready to share at least 3 new Actions.***
- **Hazard Analysis Follow Up Meetings for:**
 - Building and Safety (Earthquake)
 - Office of Energy and Sustainability (Climate Change and Extreme Heat)
 - Public Works (Flooding)
 - Parks, Rec, and Waterfront (Tsunami)
 - Fire (Wildland-Urban Interface)



Upcoming Meetings

- Individual Department Hazard Analysis Meeting (June/July)
- July Core Team meeting
 - Confirm new hazards to include in the Plan
 - Mitigation Strategy
 - Propose new actions for 2019
 - Public Process
 - Overview and Planning
- Core Team meetings in August, September, and October

June 20, 2023 LHMP Core Team Screenshot

Attendees

The screenshot displays a Zoom meeting interface. The main window shows a grid of 11 participants. The participants list on the right side of the screen is as follows:

Participant Name	Audio	Video
Sarah Lana (Me)	On	On
Jamie Albrecht (Host)	On	On
Ashley James	On	On
Scott Ferris	On	On
Daniel Green	On	On
Galadriel Burr	On	On
Meagan Jones	On	On
Ruth Raisner	On	On
Sarah Moore, Berkeley (she/her)	On	On
Steve Riggs- Berkeley Fire Dept.	On	On
Zoe Covello	On	On

The grid view shows the following participants in the top row: Jamie Albrecht, Sarah Lana, and Galadriel Burr. The middle row shows Daniel Green, Zoe Covello, and Meagan Jones. The bottom row shows Sarah Moore, Berkeley (she/her), Ashley James, and Steve Riggs- Berkeley Fire Dept. Below the grid, there are two smaller video feeds for Scott Ferris and Ruth Raisner.



Local Hazard Mitigation Plan

Core Planning Team Meeting
August 2, 2023



Agenda

- Mitigation Strategy
 - Finalize 2024 Goals and Objectives
 - Review 2019 actions
 - Celebrate completed actions
 - In progress actions become 2024 actions
 - Review what information we still need
- Public Process
 - Overview and Planning
- Hazard Analysis Updates and Review
- Homework and Next Steps

Mitigation Goals (Second Draft)



2024 Draft Mitigation Goals

- A. Reduce the potential for loss of life, injury, **environmental and** economic damage to Berkeley residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, heat waves, **poor air quality, infectious disease, utility disruption**, and their secondary impacts.
- B. Increase City government's ability to serve the community during and after hazard events by mitigating risk to key City functions.
- C. Preserve Berkeley's unique character and values from being compromised by hazard events.**
- D. Connect with residents, community-based organizations, institutions, businesses, and essential lifeline systems in order to increase mitigation actions and disaster resilience in the community.
- E. Protect Berkeley's historically underserved populations from the impacts of hazardous events by applying an equity focus to mitigation efforts.
 - A. Protect Berkeley's underserved communities from the impacts of climate change and natural hazards by incorporating their needs and voices into mitigation planning and decision-making.**

Completed Mitigation Actions



2019 Completed Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Retrofit North Berkeley Senior Center	All	PW	This retrofit was completed in 2022.
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Live Oak Community Center	All	PRW	This retrofit was completed in 2021.



2019 Completed Action

Mitigation Action	Activity	Related Hazards	Lead	Comments
Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.	Maintain a program to provide free automatic gas shutoff valves to community members who attend disaster readiness training. Provide subsidized permit fee waivers for low-income homeowners.	Earthquake	OES	The free automatic gas shutoff program ran as a pilot program and has concluded as of 2023.

2019 Completed Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce fire risk in existing development through fire code updates and enforcement.	Consider expansion of the number of properties to be included in the Hazardous Fire Area inspection program.	WUI	Fire Department	The concept of the Hazardous Fire Area has been replaced by the expanded WUI Enforcement Program, which includes Fire Zones 2 and 3 and 8,600 properties (many of which are multi-parcel).
Reduce fire risk in existing development through fire code updates and enforcement.	Explore possibility of a program to inspect vacant lots throughout the city.	WUI	Fire Department	The City now will do vacant lot inspections as part of the WUI Enforcement Program in Fire Zones 2 and 3 annually. For Zone 1, inspections will be done on a complaint driven basis.



2019 Completed Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce fire risk in existing development through vegetation management.	Maintain Fire Fuel Chipper Program.	WUI	PRW	As a result of the passage of Measure FF, a new brush chipping program started in the summer of 2023. The program is called Chipper Days and is now under the leadership of the Berkeley Fire Department.
Reduce fire risk in existing development through vegetation management.	Work with partners and stakeholders to identify fire fuel reduction zones and to promote and facilitate removal of vegetation.	WUI	Fire Department	The Community Wildfire Protection Plan identifies the fire fuel reduction zones and describes how the City will promote and facilitate removal of vegetation in those zones. The City will continue to evaluate these zones and the CWPP on an annual basis.
Reduce fire risk in existing development through fire code updates and enforcement.	Evaluate inspection procedures and adjust inspection cycle annually.	WUI	Fire Department	The WUI Division has created 9 zones that include a hazards and climatic conditions analysis. The schedule of inspections is based on the climate and needs of each of the zones. This is revisited annually adjust for changing conditions. The work to enforce this is ongoing.



2019 Completed Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.	Explore project approaches with EBMUD to expedite replacement of problem pipelines.	WUI and EQ	PW	EBMUD has a process in place to prioritize and replace pipelines.
	Coordinate with EBMUD regarding plans to install a new 48-inch aqueduct by 2020 to be able to continue potable and firefighting water supply following a seismic event.	EQ and WUI	PW	The major portion of the Wildcat Aqueduct project is complete in Berkeley. In winter 2023-2024 EBMUD will be installing a valve and pipe at Colusa and Marin, which is the second and final phase.



2019 Completed Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Mitigate Berkeley's tsunami hazard.	Begin the permitting process for piling replacement.	Tsunami	PRW	Permitting and engineering process is complete and construction is underway. This project is scheduled to be finished in Fall 2023.
Mitigate Berkeley's tsunami hazard.	Repair University Avenue, Marina Boulevard, and Spinnaker Way in order to mitigate tsunami vulnerabilities.	Tsunami	PRW	Roads, including bioswales, bio retention have been repaired and rebuilt. Spinnaker Way has true grid permeable gravel parking to mitigate tsunami risk.

In Progress Mitigation Actions



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.	Continue analysis of structures supporting critical emergency response and recovery functions, and make recommendations for structural and nonstructural improvements.	All	PW	The City continues to analyze structures that support critical functions and make recommendations for improvements. The City is about to embark on an Seismic Evaluation of 1947 Center Street.
	Continue to prioritize analysis of remaining structures based on occupancy and structure type, taking historic significance into consideration. Use analysis to make recommendations for structural and nonstructural improvements.	All	PW	The City continues to prioritize further analysis on non critical structures and make recommendations for improvements.
	Continue to integrate unsafe structures into a prioritized program for retrofit or replacement.	All	PW	The City continues to integrate unsafe structures into a prioritized program for retrofit or replacement.



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Strengthen or replace City buildings in the identified prioritized order as funding is available.	West Berkeley Service Center	All	PW	The West Berkeley Service Center is being strengthened with minor improvements and is currently in the design process.
	Old City Hall	All	PW	The City has completed Phase 1 of the Civic Center Vision Plan, which would re-envision Old City Hall and make it safe to use. Phase 2 starts in Summer 2023 to select a design and funding plan.
	Veterans Memorial Building	All	PW	The City has completed Phase 1 of the Civic Center Vision Plan, which would re-envision Veterans Memorial Building and make it safe to use. Phase 2 starts in Summer 2023 to select a design and funding plan.
	Seek funding to seismically strengthen or replace additional buildings.	All	PW	The City continuously looks for funding opportunities to strengthen or replace City buildings.



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.	Periodically update and adopt the California Building Standards Code with local amendments	All	Planning: Building and Safety	The City continues to update and adopt California Building Standards Code with local amendments every 18 months.
	Explain requirements and provide guidance to owners of potentially hazardous structures to facilitate retrofit, including owners participating in the Earthquake Brace and Bolt program, the Earthquake Soft Story (ESS) Program , and those applying for Transfer Tax rebates.	All	Planning: Building and Safety	The City continues to explain requirements and provide guidance to owners to facilitate retrofits. This action has changed slightly to add the Earthquake Soft Story (ESS) Program launched in April 2023 by the California Residential Mitigation Program.



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Implementation of the Retrofit Grants Program which helps Berkeley building owners increase safety and mitigate the risk of damage caused by earthquakes	Assist participating property owners with the grant process, including dissemination of program rules and guidelines.	All	Planning: Building and Safety	Current federal funding for the Retrofits Grant Program participants is available through late 2025. City staff continue to seek additional grant funding to implement future rounds of the program.
	Project Manager will: a. Respond to inquiries from owners, tenants, engineers and contractors about the grant program. b. Environmental and Historic Preservation Reviews (EHP) for specified projects. c. Review plan submittals for compliance. d. If more funding is secured, conduct outreach to property owners to offer additional Retrofit Grants to increase tenant safety.	All	Planning: Building and Safety	The City continues to implement the Retrofit Grants Program, following the activities listed.



2019 ?Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
	Continue to inform impacted property owners of the requirement to seismically retrofit their building	Earthquake	Planning: Building and Safety	The City continues to inform impacted property owners of requirements.
Continued Implementation of the Soft Story Retrofit Program, which mandates seismic retrofit of soft story buildings with 5+ residential units.	Project manager will: <ul style="list-style-type: none"> a. Respond to inquiries from owners, tenants, engineers, contractors and realtors about the mandatory program, compliance procedures and requirements b. Review plan submittals for soft-story seismic retrofits c. Issue permits and perform field inspections d. Remove retrofitted buildings from the Soft-Story Inventory e. Review appeals to accommodate unique circumstances f. Enforce soft story ordinance. 	Earthquake	Planning: Building and Safety	The City continues to implement the program, following the listed activities. As of July 2023, 277 buildings have completed their retrofit, 26 buildings still need to be retrofitted, and 61 buildings were removed from the inventory for other reasons. These reasons include: the building was determined to have fewer than 5-units or that a soft story condition was not present.



2019 ?Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.	Work with owners of remaining potentially hazardous URM buildings to obtain structural analyses of their buildings and to undertake corrective mitigation measures to improve seismic resistance or to remove the buildings and replace them with safer buildings.	Earthquake	Planning: Building and Safety	The City continues to work with owners of remaining potentially hazardous URM buildings. As of July 2023, four buildings still need to be retrofitted.
	Apply available legal remedies, including but not limited to citations, to owners who fail to comply with the URM ordinance.	Earthquake	Planning: Building and Safety Program Manager	The City continues to apply available legal remedies to owners who fail to comply with ordinance.



2019 ? Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Monitor passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices..	Monitor mandatory seismic retrofit ordinances for concrete buildings passed by other municipalities for effectiveness and best practices	Earthquake	Planning: Building and Safety	The City continues to monitor mandatory seismic retrofit ordinances for concrete buildings. The City is newly exploring the possibility of developing retrofit ordinances for rigid wall-flexible diaphragm and non-ductile concrete buildings.
	Communicate and collaborate with other cities and Structural Engineers Association of California (SEAOC) regarding implementation challenges and successes	Earthquake	Planning: Building and Safety	The City continues to communicate and collaborate with other cities and SEAOC on implementation.



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce fire risk in existing development through fire code updates and enforcement.	Periodically Update Fire Code	WUI	Fire Dept	Berkeley Fire Code was adopted with local amendment in 2023. The City will continue to monitor and update the Fire Code to incorporate the latest knowledge and State regulations.
	Evaluate Fire Prevention Division staffing.	WUI	Fire Dept	The City has taken several action steps to improve staffing, including the split of Fire Prevention and the creation of the WUI Division. The City has increased inspection staff for both, but there are still some open positions to fill. The new Volunteer Ambassador and Paid Internship Programs are designed to support inspection capacity.
	Maintain Fire Department efforts to reduce fire risk through inspections.	WUI	Fire Dept	The Fire Department has replaced Hazardous Fire Area inspections with annual Defensible Space inspections in Zone 2 and 3. This includes home hardening evaluations and education.



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce fire risk in existing development through fire code updates and enforcement.	Develop and enforce Fire Code requirement for fuel clearance on public roadways.	WUI	Fire Dept	The City developed the Fire Code requirement in July 2022 and enforcement is in progress in Fire Zones 2 and 3. The City has applied for a grant to do more enforcement.
	Create a standard for written vegetation management plans for major construction projects in Fire Zones 2 and 3.	WUI	Fire Dept	The Plan Check Division has an initial draft completed. It is anticipated that it will need to be modified for Zone 0 compliance, pending Board of Forestry guidance.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce fire risk in existing development through vegetation management	Maintain Fire Fuel Abatement Program on Public Land	WUI		The City continues to maintain the Fire Fuel Abatement Program.
	Maintain Fire Fuel Debris Bin Program	WUI	PW	The City continues to maintain the Fire Fuel Debris Program.
	Maintain weekly Curbside Plan Debris Collection	WUI	PW	The City continues to maintain the weekly Curbside Plan Debris Collection.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce fire risk in existing development through vegetation management	Pursue external funding to increase education and awareness of vegetation management standards for fire fuel reduction	WUI	Fire Dept	The City continues to pursue external funding to increase education and awareness of vegetation management standards. The City has applied for multiple grants to support public education around Grizzly Peak as well as funding to clean up private parcels in Cerrito Canyon.
	Pursue external funding to perform vegetation management on public and private property	WUI	Fire Dept	The City has and will continue to apply for multiple grants to fund this work.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Public Works Staff will maintain paths on an as-needed basis, and will coordinate with the Berkeley Path Wanderers to maintain public pathways to provide safe pedestrian evacuation routes from the hill areas.	WUI	PW	Public Works Staff continues to maintain paths on an as needed basis coordinating with the Berkeley Path wanderers.
	Maintain signage for public pathways to identify safe and accessible pedestrian evacuation routes from the hill areas.	WUI	PW	Public Works Staff continue to maintain signage for public pathways.
	Publicize up-to-date maps of all emergency access and evacuation routes.	WUI	Fire Dept	The CWPP has up to date maps of emergency access and evacuation routes. The City continuously updates these maps and publishes them on the City website. The City also uses real-time evacuation maps with Zonehaven.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Maintain and improve roadways in Fire Zones 2 and 3.	WUI	PW	The City continues to maintain and improve roadways in Fire Zones 2 and 3. From 2019-2022 the City completed 3.78 miles in Zones 2 and 3. By the end of 2023, the City will complete 1.52 miles in Zone 2. The City plans to complete 11.64 miles in Zone 2 from 2024-2028.
	Maintain community-driven process to identify and consider areas for parking restrictions and red curbing.	WUI	PW/Fire	The City has contracted an Evacuation Time Study, which includes a robust public outreach process, to understand what restrictions may promote a safer and more efficient evacuation of residents during unsafe fire conditions.
	Explore options for comprehensive parking restrictions in Fire Zones 2 and 3.	WUI	Fire Dept	The City has contracted an Evacuation Time Study to understand what restrictions may promote a safer and more efficient evacuation of residents during unsafe fire conditions.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce the potential threat of overhead utility wires in the Berkeley Hills.	Construction of undergrounding in the Berkeley Hills within UUD No. 48 (portions of Grizzly Peak Blvd., Summit Rd., Avenida Dr., Fairlawn Dr., and Senior Ave.)	WUI	PW	This undergrounding project is under construction, estimated to be completed in three years.
	Explore other strategies for reducing the potential threats of overhead utility wires	WUI	PW	The City continues to explore other strategies, funding and otherwise, to reduce the thread of overhead utilities.



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.	Coordinate with EBMUD to ensure that pipeline replacement projects and upgrades are coordinated with the City's five-year street paving program and other City programs	All	PW	The City meets with EBMUD quarterly to ensure that projects and upgrades are aligned with the City's programs.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.	Implement Hazardous Materials Release Response Plans and Inventories (HMRRP) Program	All	Planning: Hazardous Materials	The Toxic Management Division continues to maintain these inspection and enforcement programs to mitigate hazardous materials release in Berkeley.
	Implement California Accidental Release Prevention (CalARP) Program	All	Planning: Hazardous Materials	
	Implement Underground Storage Tank (UST) Program	All	Planning: Hazardous Materials	
	Implement Aboveground Petroleum Storage Act Requirement for Spill Prevention	All	Planning: Hazardous Materials	

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.	Implement Hazardous Waste Generator and Onsite Hazardous Waste Treatment Programs	All	Planning: Hazardous Materials	The Toxic Management Division continues to maintain these inspection and enforcement programs to mitigate hazardous materials release in Berkeley.
	Implement Hazardous Materials Management Plans (HMMP) and Hazardous Materials Inventory Statements per California Fire Code	All	Fire Dept	Improved Fire Prevention staffing level is improving ability to review and enforce hazardous materials storage and use conditions. New staff also includes individuals that have hazardous materials enforcement experience.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Maintain City participation in the National Flood Insurance Program.	Continue to use the most current FEMA information defining flood areas.	Flood	PW	The City keeps the Berkeley Municipal Code Chapter 17.12: Flood Zone Development Ordinance consistent with the FEMA National Flood Insurance Program requirements.
	Continue to incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards.	Flood	Planning: Land Use	The Land Use Division continues to ensure that City plans and procedures consider FEMA guidelines and suggestions.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.	Track changes in hazard risk using the best-available information and tools.	All	OES	The Office of Emergency Services continues to track changes in hazard risk by conducting research and consulting with subject matter experts.
	Collect and share up-to-date hazard maps identifying areas subject to heightened risk from hazards.	All	OES	The Office of Emergency Services continues to provide updated hazard maps online and in the Local Hazard Mitigation Plan.
	Publicize financial and technical assistance resources for risk reduction.	All	OES	The Office of Emergency Services and other City Departments publicize technical assistance resources on the City website as its available.



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Coordinate with and encourage mitigation actions of key City partners.	Coordinate with and encourage mitigation actions of: <ul style="list-style-type: none"> •Institutions serving the Berkeley community •Berkeley organizations and nonprofits •Other partners whose actions affect the Berkeley community 	All	OES	The City works with partners to encourage mitigation actions as well as coordinates on collaborative efforts to mitigate risks.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce Berkeley's vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.	Use development standards to ensure that new development does not contribute to an increase in flood potential.	Flood	Planning: Land Use	The Land Use Division of the Planning Department manages the permitting process for new development and conditions the project to ensure that it does not contribute to an increase in flood potential.
	Complete the Watershed Management Plan to recommend improvements to problem areas in individual watersheds, and develop a Stormwater Master Plan.	Flood	PW	The City is in the process of hiring a consultant to complete the Stormwater Management Plan over the course of the next two years.
	Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio- filtration systems.	Flood	PW	The City has installed Green Infrastructure facilities at five locations. The City is also in the process of daylighting the Codornices Creek at Kains Avenue to increase channel volume, in order to minimize potential flooding.



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Implement energy assurance strategies at critical facilities.	Identify potential actions to mitigate energy assurance vulnerabilities at critical City facilities during planning/conceptual design of both retrofits and new construction.	All	PW	The City continues to identify ways to mitigate energy assurance vulnerabilities. Currently, the City is exploring solar and battery operated energy systems.



2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Mitigate the impacts of sea level rise in Berkeley.	Develop guidelines, regulations, and review Use development standards to ensure new and existing public and private developments and infrastructure are protected from floods due to sea-level rise.	Climate Change, flood	OESD	The Land Use Division of the Planning Department manages the permitting process for new development and conditions projects to ensure that it does not contribute to an increase in flood potential due to sea-level rise.

2019 In Progress Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Mitigate Berkeley's tsunami hazard.	Fund and replace damaged finger docks.	Tsunami	PRW	The City continues to fund and replace damaged finger docks on an going basis as needed. Since 2019, the City has used City funds and grant funds in total of \$885,000 to replace damaged finger docks.
	Secure funding for replacement of D and E docks; begin the permitting process once funding is secure	Tsunami	PRW	The City is exploring a loan from the General Fund in place of California Division of Boating and Waterways loan. If approved, drawings are at 90% and ready to move forward.
	Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to document and explore additional tsunami hazard mitigation measures.	Tsunami	OES	The City regularly collaborates with external partners to explore additional tsunami mitigation measures.

? Action – Air Quality

2019 ? Action

Mitigation Action	Activity	Related Hazards	Lead	Comments
Define clean air standards for buildings during poor air quality events and use those standards to assess facilities for the Berkeley community.	Participate in regional efforts to define standards and tools to predict buildings' ability to deliver clean air to occupants during poor air quality events.	WUI and Poor Air		
	Apply standards and tools to assess City facilities' ability to provide clean air to occupants during poor air quality events.	WUI and Poor Air		
	Coordinate with willing Berkeley partners to apply standards and tools to partner facilities.	WUI and Poor Air		
	Use findings to develop a list of potential clean air facilities (City-run and partner-run) to the community.	WUI and Poor Air		

Public Process



Public Outreach Activities and Timeline

August through October

- Surveys and short conversations at in-person popular events (National Night Out, Solano Stroll, 1923 Fire Anniversary, Farmer's Markets, etc.).
- Short online survey, distributed via flyers, social media, website.
- Presentations and conversations with neighborhood groups

October – February (around/post First Draft Plan release)

- Presentations at Planning and Disaster and Fire Safety Commissions.
- Council Work Session
- Continued presentations and conversations with neighborhood groups, or hosted by local partners
- Short online videos that explore the Plan in bite sized chunks and provide a way for people to comment.
- Open email address for people to write in comments
- Drafts at each Library
- Flyers and social media encouraging responses

Hazard Analysis



Hazard Analysis Updates and Review

Previous Plan

- Earthquake
- Wildland-Urban Interface Fire
- Rainfall-Triggered Landslide
- Tsunami
- Flood
- Extreme Heat
- Climate Change
- Hazardous Materials Release

New this year

- Poor Air Quality
- Utility Disruption
- Infectious Disease
- Wind?
- Cyber attacks/IT?

Homework and Next Steps



Homework and Next Steps

- Finalize current status of 2019 **Actions (if you haven't finished yet)**
- Continue to brainstorm and send Jamie new **Actions** for 2024 **Mitigation Strategy**
 - Make sure to consider new Hazards included in this year's plan.
 - New actions will be the focus of the next meeting!
- Work with Jamie on the Hazard Analysis (varies by Department/Division)

Actions that need status updates (depts still working on them)



2019 ? Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.	Promote electrification of buildings, both existing buildings and new construction, to mitigate hazards associated with natural gas usage and the impacts of damage to infrastructure after a hazard occurs.	All	OESD	

2019 ? Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce the potential threat of overhead utility wires in the Berkeley Hills.	Construction of undergrounding of overhead utility wires within UUD No. 35A (Vistamont Ave., Rochdale Way, and Rosemont Ave from Woodmont Ave. to Vistamont Ave.)	WUI		
	Construction of undergrounding of overhead utility wires on Bayview Place	WUI		
	Complete the Phase 3 undergrounding study spearheaded by the Undergrounding Subcommittee in collaboration with Public Works Department, Fire Department, and Public Works Commission.	WUI		

2019 ? Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Monitor and support regional and State-level efforts to forecast the impact of climate change on temperatures and incidence of extreme heat events in Berkeley and the region, and integrate extreme heat event readiness.	Extreme heat	OESD	
	Continue to create and maintain shading by maintaining the health of existing trees and sustaining municipal tree planting with a focus on efforts in areas where there are fewer trees.	Extreme heat	PRW	
	Encourage cooling strategies for the built environment through voluntary programs to mitigate the urban heat island effect.	Extreme heat	OESD	

2019 ?Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Implement energy assurance strategies at critical facilities.	Provide guidance to help the City consider opportunities to design, finance and implement clean energy assurance strategies (e.g., photovoltaic-supplemented generation, energy efficiency activities, and/or mobile charging stations).	All	OESD	
	Work with partners to identify additional non-City critical facilities and develop strategies to provide clean backup power at these sites.	All	OESD	

2019 ? Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.	Determine staffing needs to monitor research and oversee integration of climate change adaptation into City operations and services	All, Climate Change	OESD	
	Develop and implement a process to integrate adaptation planning into City operations. Activities include: Train City staff on the basic science and impacts of climate change and on climate adaptation strategies and develop policy and programs to address potential climate impacts in municipal capital and land use planning	All, Climate Change	OESD	



2019 ? Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Mitigate the impacts of sea level rise in Berkeley.	Determine staffing needs to monitor research and oversee integration of climate change adaptation into City operations and services	Climate Change	OESD	

2019 ? Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Collaborate with partners to increase the security of Berkeley's water supply from climate change impacts.	Partner with East Bay Municipal Utility District (EBMUD) to provide and market incentives for residents, businesses and institutions to conserve water.	Climate Change	OESD	
	Partner with agencies such as EBMUD and StopWaste to encourage private property owners and public agencies (including the City government) to use sustainable landscaping techniques that require less water and energy to maintain.	Climate Change	OESD	
	Encourage water efficiency and conservation in existing buildings, such as incorporating water assessments into existing policies or creating a compliance program for SB407.	Climate Change	OESD	

2019 ? Actions

Mitigation Action	Activity	Related Hazards	Lead	Comments
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Explore a Zoning Amendment to BMC 23C.04.100 that streamlines the Zoning permitting process to allow damaged industrial and commercial buildings, and dwelling units to rebuild by right following disasters.	All	Planning: Land Use	
	Consider different treatment for buildings in high-risk areas.	All	Planning: Land Use	
	Define the process for the City to accept and file this documentation..	All	Planning: Land Use	



2019 ? Actions

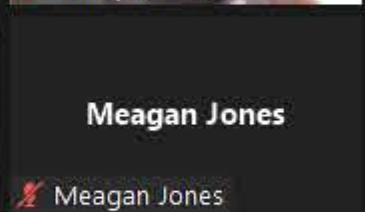
Mitigation Action	Activity	Related Hazards	Lead	Comments
Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Outreach to property owners about this documentation process.	All	Planning: Land Use	
	Evaluate location of essential public facilities prior to rebuild in order to prioritize development outside high risk areas when feasible.	All	Planning: Land Use	
	Explore how other cities provide protections for people that may be vulnerable during the rebuilding process	All	Planning: Land Use	



Internal

Agenda

- Mitigation Strategy
 - Finalize 2024 Goals and Objectives
 - Review 2019 actions
 - Celebrate completed actions
 - In progress actions become 2024 actions
 - Review what information we still need
- Public Process
 - Overview and Planning
- Hazard Analysis Updates and Review
- Homework and Next Steps

 Jamie Albrecht	 Sarah Lana - City of Berkeley
 Zoe Covello	 Sarah Moore, City of Berkeley
 Steve Riggs- Berkeley Fire Department	 Ashley James
 Galadriel Burr, City of Berkeley	 Meagan Jones
 Dan Green	 Frederick Ferris

File Home

New App

Calendar

My Calendar

- ☒ Calendar
- ☐ BFD Meeting
- ☐ Birthday
- ☐ Calendar
- ☐ Calendar
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- ☐ Calendar
- ☐ Daily Task

Shared Calendar

- ☐ United States

Items: 25

Local Hazard Mitigation Plan

Core Planning Team Meeting
August 29, 2023



Agenda

- Mitigation Strategy
 - Finalize 2024 Goals and Objectives
 - Review Proposed New Action for 2024
- Next Steps

Mitigation Goals (Third Draft)



2024 Draft Mitigation Goals

- A. Reduce the potential for loss of life, injury, environmental and economic damage to Berkeley residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, heat waves, poor air quality, **infectious disease, sea level rise, wind, utility disruption**, and their secondary impacts.
- B. Increase City government's ability to serve the community during and after hazard events by mitigating risk to key City functions.
- C. Protect and enhance quality of life in Berkeley.**
- D. Connect with residents, community-based organizations, institutions, businesses, and essential lifeline systems in order to increase mitigation actions and disaster resilience in the community.
- E. Protect Berkeley's historically underserved populations from the impacts of hazardous events by applying an equity focus to mitigation efforts.
 - **Co-create mitigation plans, policies, and programs with Berkeley's underserved communities, elevating the voices of these community members and prioritizing their needs to prepare for and adapt to climate change and natural hazards.**

Proposed New Actions by Hazard

Priority Levels

Factors	High	Medium	Low
Support of goals and objectives	Supports multiple goals	Support goals and objectives	Will mitigate the risk
Cost/benefit	Benefits exceed cost	Has benefits that exceed costs	Benefits do not exceed cost
Funding availability	Funding is secured	Funding not secured by identified	Funding not secured or identified
Hazards addressed	Addresses hazards of greatest concern and or multiple hazards	Addresses hazards of concern	Does not address identified hazard
Support	Political and public support	Has support	Mixed or no support
Environmental impact	None	Low	Has more environmental impact
Environmental benefit	Benefit	Unsure/or some	None
Timeline	Short term	Maybe short term depending on funding	Long term (6-10 years)
Benefits underserved communities	Benefits underserved communities	Might benefit underserved	Does not benefit underserved



Multi-hazard

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Collect and share information with the Berkeley community about hazards and associated risk reduction techniques.	Creating new formats and user friendly guidance to educate the public, especially underserved populations, on the hazards in Berkeley.	Office of Emergency Services	General Fund	Short term (1-5 years)	High
	Provide key information, best practices, and information to Berkeley businesses through cultivated networks.	Office of Economic Development	General Fund	Ongoing	High
Advance equitable community resilience, with a focus on disadvantaged communities.	Work with community partners to co-create solutions to improve community resilience, including through the Climate Equity Collaborative.	Office of Energy and Sustainable Development	Climate Equity Fund Pilot	Short term (1-5 years)	High
	Develop Environmental Justice Element and update the existing Safety Element, with community-identified priorities related to climate adaptation.		Adaptation Planning Grant from CA OPR		



Multi-hazard

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Improve emergency access to the Berkeley waterfront.	Implementation of the Berkeley Pier with Ferry Access project.	Parks, Recreation, and Waterfront	WETA, Grants, maybe Marina Fund	Short term (1-5 years)	High
Collaborate with partners to increase the security of Berkeley's water supply from climate change impacts.	Research and support opportunities to advance purple pipe implementation [need more detail on what this means and how it contributes to mitigation efforts]	Public Works and Planning Departments	[need more information on PW, Cal Trans, EBMUD, etc]	Long term (5-10 years)	Medium

This is what I have on #2 from Sarah M and team: EMBUD interest and investment -- their East Bayshore Recycled Water Project (EBRWP) is planned to provide recycled water from the East Bayshore Recycled Water Facility (EBRWF) at the East Bay Municipal Utility District (EBMUD) Main Wastewater Treatment Plant (MWWTP or SD-1) to portions of Oakland, Emeryville, Berkeley, Albany, and Alameda. Expansion of the EBRWF is planned to include an Emeryville-Albany and UC Berkeley expansion, both of which would serve users in Berkeley. Coordination with the City will be required.

Wildland Urban Interface Fire

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Reduce fire risk through home hardening.	Implement program to provide home hardening materials and instructions to residents in high risk fire areas.	Fire Department – WUI Division	Measure FF	Ongoing	High
Reduce fire risk through defensible space.	Implement Resident Assistance Program to help cover the costs to remove vegetation and meet requirements.	Fire Department – WUI Division	Measure FF	Ongoing	High
Reduce fire risk in existing development through vegetation management.	Explore additional options to support vegetation management on private property.	Fire Department – WUI Division	Measure FF	Ongoing	High
				Ongoing	High

Wildland Urban Interface Fire

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Reduce fire risk in existing development through vegetation management.	Explore options for developing city run hand crew to implement vegetation management projects on public and private property.	Fire Department – WUI Division	Measure FF	Short term (1-5 years)	High
	Continue to allocate UC Settlement Funding to do vegetation management projects on UC Berkeley properties.	Fire Department – WUI Division	UC Settlement Fund	Ongoing	High



Wildland Urban Interface Fire

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Reduce fire risk in existing development through fire code updates and enforcement.	Implement Fire Internship Program to provide local youth with career development opportunities and to increase inspection capacity in Fire Zones 2 and 3.	Fire Department – WUI Division	Measure FF and Youth Works Program	Ongoing	High
Maintain redesigned and expanded city wide fire fuel chipper program.	Provide curbside pickup, chipping, and disposal of vegetation material from residential properties.	Fire Department – WUI Division	Measure FF	Ongoing	High



Wildland Urban Interface Fire

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Educate people city-wide on vegetation management, home hardening, and defensible space to reduce fire risk.	Continue to implement the WUI Ambassador Program, which trains volunteers to educate residents.	Fire Department – WUI Division	Measure FF	Ongoing	High
Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Install handrails on all public pathways, prioritizing areas with high usage and steep inclines to increase pedestrian safety and accessibility.	Public Works: Traffic Engineering	General Fund and T1	Short term (1-5 years)	High
Mitigate wildfire risk to Berkeley overnight camps.	Analyze fire risk at overnight camps and identify appropriate mitigation actions.	Fire Department and Parks Rec and Waterfront	General Fund	Short Term (1-5 years)	High



Earthquake

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Strengthen or replace City buildings in the identified prioritized order as funding is available.	Retrofit and or strengthen South Berkeley Senior Center	Health, Housing, and Community Services Department	Grant	Short term (1-5 years)	High
	MLK Junior Youth Services Center	Parks, Recreation, and Waterfront	Grant	Short term (1-5 years)	High

Extreme Heat/Poor Air Quality

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Implementing new requirement for new construction and development to have larger spaces for trees to be planted where there is available space, especially to increase the number of trees being planted in industrial areas.	Parks, Recreation, and Waterfront Department		Ongoing	High
	Expanding Urban Forestry Staff to plant and maintain more trees, especially in West Berkeley.	Parks, Recreation, and Waterfront Department		Short Term (1-5 years)	High



Poor Air Quality

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Implement existing City programs and projects to reduce emissions that contribute to poor air quality.	Implement the traffic safety capital construction projects identified and prioritized in the Berkeley Pedestrian Plan (2021), Berkeley Bicycle Plan (2017), Berkeley Vision Zero Action Plan (2020), and Berkeley Transit-First Implementation Plan; these projects are intended to encourage non-driving modes	Public Works: Transportation Division			High
	Implementing the City's Electric Mobility Road Map which includes electric shared mobility (bikes and scooters) as well as electric and hybrid car-sharing, and the installation of public charging stations				High
	Manage on-street parking and maintain parking garages to reduce emissions by making it easier to find a parking space more quickly (and thus reduce the time spent circling around looking for parking)				High

Sea Level Rise

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Mitigate the impacts of sea level rise in Berkeley.	Implement project to protect low spots on Virginia Street, in collaboration with East Bay Regional Parks.	Parks, Recreation, and Waterfront Division	Grants, Parks Tax	Short Term (1-5 years)	Low
	Identify funding and nature based solutions to adapt to sea level rise between Caesar Chavez Park, the Marina, all the way to University Avenue in collaboration with East Bay Regional Park.			Long term (5-10 years)	Low
	Implement project to protect low spots near Seabreeze Market and incorporate the turn on University Avenue.			Short term (1-5 years)	Low
	Identify funding and potential solutions to protect low spots in back of Doubletree Hotel.			Ongoing	Low
	Conduct a groundwater study on impacts of groundwater rise combined with sea level rise on underground toxic materials	Office of Energy and Sustainable Development	Adaptation Planning Grant from CA OPR	Short term (1-5 years)	Low



Flood (Tsunami and Sea Level Rise)

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Reduce Berkeley's vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.	Repair and improve the six tide tubes that remove storm water from Berkeley Aquatic Park into the Bay.	Parks, Recreation, and Waterfront Division	Grants, Parks Tax		Medium



Utility Disruption

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Support energy assurance strategies at non City facilities.	Explore opportunities for local business to share best practices and resources during utility interruptions.	Office of Economic Development	General Fund	Short-Term (1-5 years)	High

Infectious Disease

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Mitigate impacts of infectious diseases in Berkeley.	<i>Surveillance / Epidemiology</i> <i>Non-pharmaceutical Interventions (NPIs)</i> <i>Infrastructure</i>	Public Health	General Fund	Ongoing	High



Wind actions?

Mitigation Action	Activity	Lead	Funding	Timeline	Priority
Something from parks and rec on tree maintenance? Other work					



Other actions?

Mitigation Action	Activity	Lead	Funding	Timeline	Priority



Next Steps



Next Steps

- Finalize any New Actions discussed today for your Department or Division
- Support OES in collecting any missing information for previous Actions
- Support OES with remaining hazard analysis or content needed for the Plan
 - B&S: reviewing earthquake section
 - Land Use: need your help with the “changes in development” section
 - OESD: supporting Sea Level Rise, Extreme Heat, Utility Disruption



Local Hazard Mitigation Plan

Core Planning Team Meeting
September 13, 2023



Agenda

- Public outreach strategy
- Follow ups on new actions from last meeting
- Final wrap up with Jamie
- Next Steps



Public Outreach Strategy (First Draft Plan- Est Fall 2023)



Public Outreach

1. Community presentations on specific hazards in accessible locations, like libraries, community centers, senior centers, Berkeley Bowl, Northbrae Community Church, etc.
2. Record videos on specific hazards and post to website.
3. Two presentations at Disaster and Fire Safety Commission
4. Two presentations at Planning Commission
5. Briefings with individual councilmembers
6. Letters to Council
7. Letters to all other Commissions
8. Posting to City website, Berkeleyfire.com
9. Social Media
10. Copies at local libraries? (Planning, is this a requirement?)
11. Open for public comment for two months (multiple ways to send in feedback)

Public Outreach Strategy (Final Draft Plan – Est Fall 2024)



Public Outreach

1. Presentation at Disaster and Fire Safety Commission
2. Presentation at Planning Commission (public hearing)
3. Council adoption meeting

Next Steps



Next Steps

- Finalize the hazard analysis sections
 - Sarah might reach out for additional support on finishing up some sections, but they are pretty close to being done
- Finalize new actions
 - Sarah maybe reaching out to confirm language
- Support with public outreach

Core Project Team Meeting 5

November 6 2023

Attendees:

Meagan Jones

Leah Greenbaum

Galadriel Burr

Sarah Moore

Zoe Covello

Ruth Raisner

Agenda

1. Review project schedule
2. Review Presentation schedule and plan

Core Project Team Meeting 6

February 8 2024

Attendees:

Meagan Jones

Sarah Lana

Galadriel Burr

Sarah Moore

Zoe Covello

Ruth Raisner

Steven Riggs

Scott Ferris

Agenda

1. Review project schedule
2. Review Draft Mitigation Strategy
3. Review action prioritization structure
4. Review outreach strategy



15:35



Chat



People



Raise



React



View



More



Camera



Mic



Share



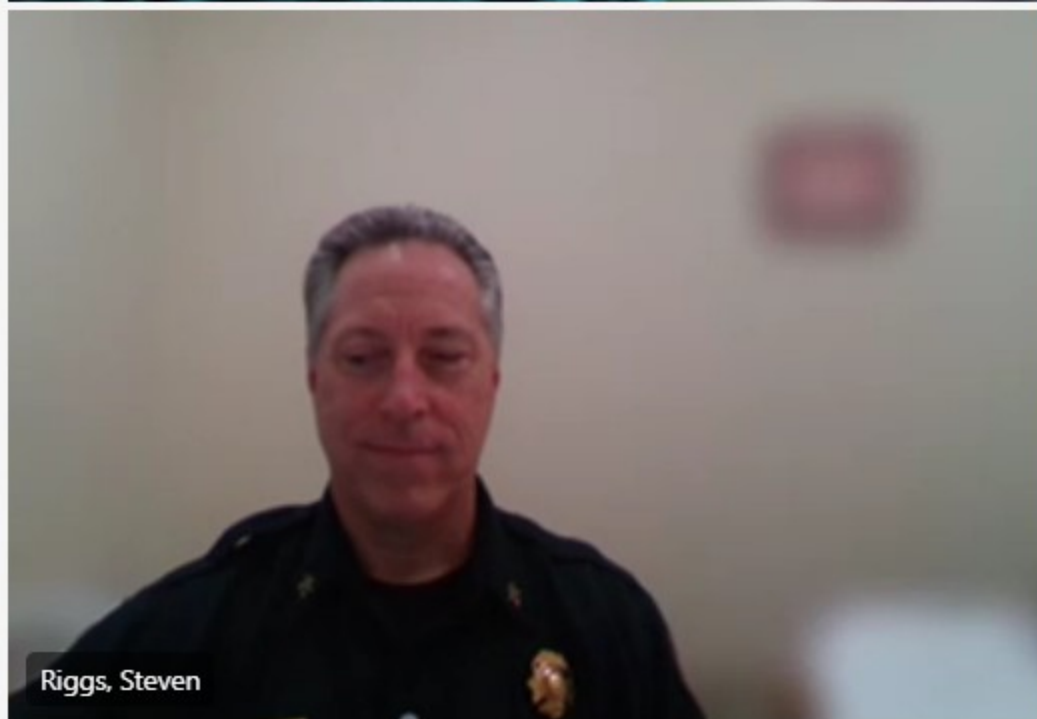
Leave



Covello, Zoe



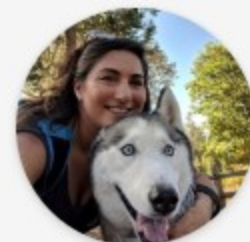
Burr, Galadriel



Riggs, Steven



Jones, Meagan



Raisner, Ru...



Moore, Sar...



Ferris, Scott













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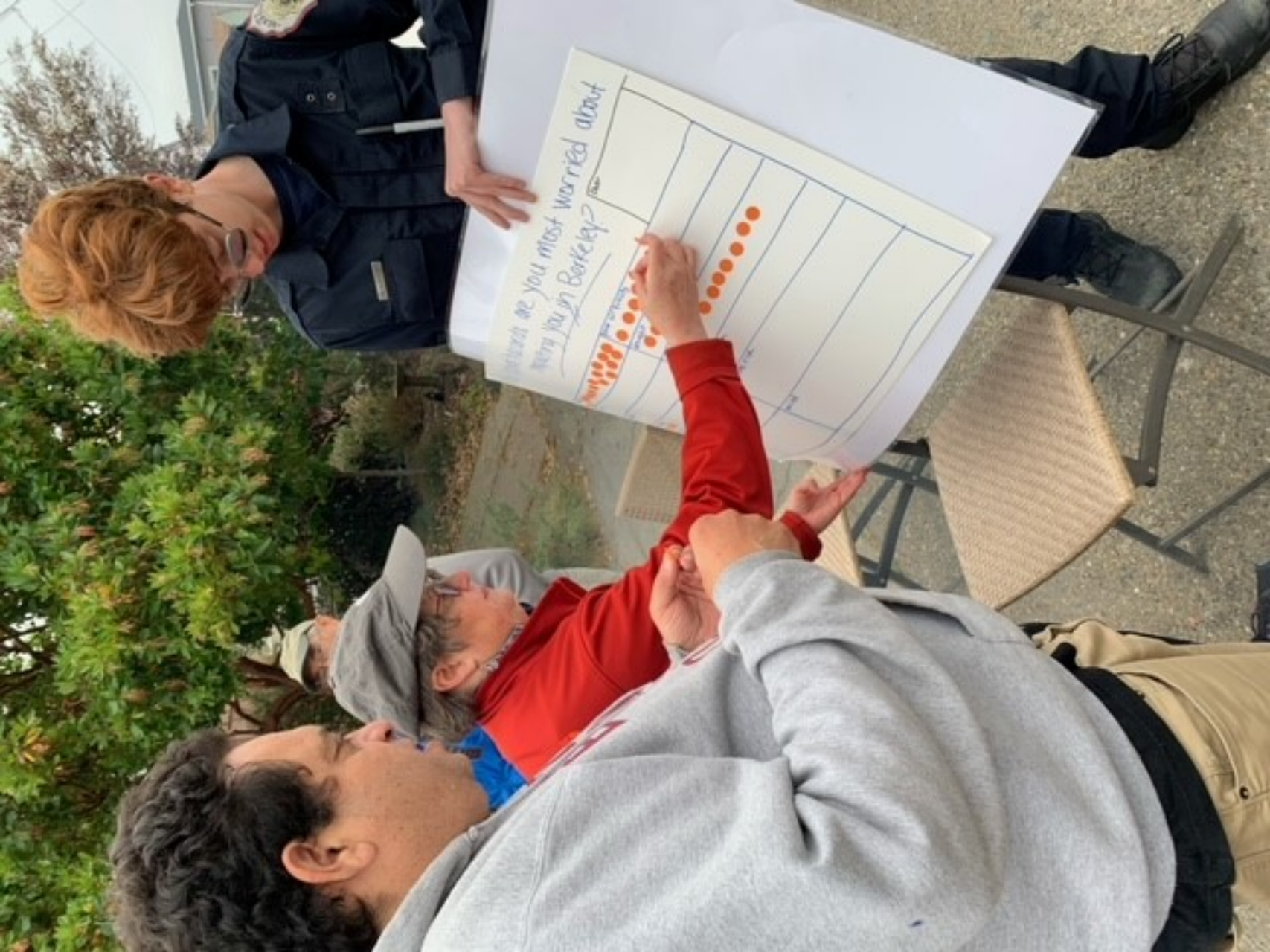




Global Access: are you ready to go?





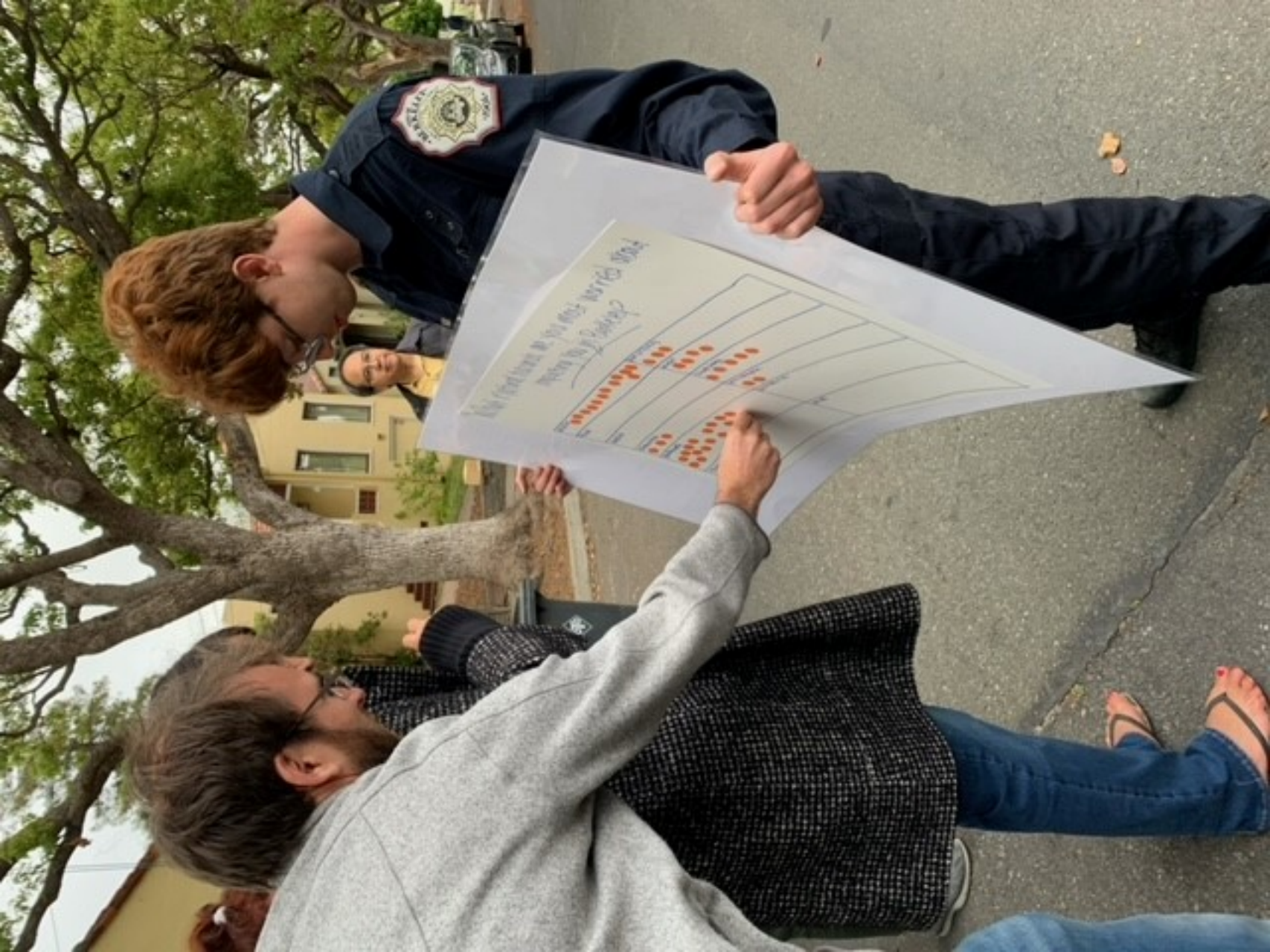
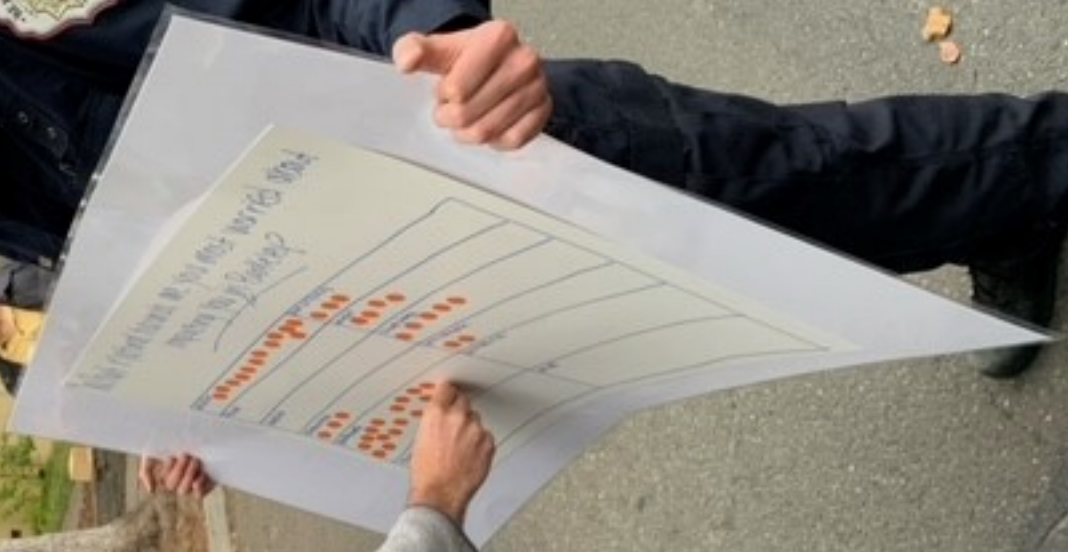


What are you most worried about living in Berkeley?















What natural hazard are you most worried about impacting you in Berkeley?

Hazard

How worried are you?

Not at all

Very worried

Flood

Earthquake

Wildfire

Landslide

Drought

Other

Not at all

Very worried



How likely are you to respond to a fire alarm?

Response	Very likely	Probably	Probably not	Not likely
Yes	●	●	●	●
No	●	●	●	●
Maybe	●	●	●	●
Not sure	●	●	●	●
Other	●	●	●	●

Make Life Better!

BERKELEY
FIRE

OESQ

What natural hazards are you most worried about impacting you in Berkeley?

Deer
Crows
Raccoons



What natural hazards are you most worried about impacting you in Berkeley?

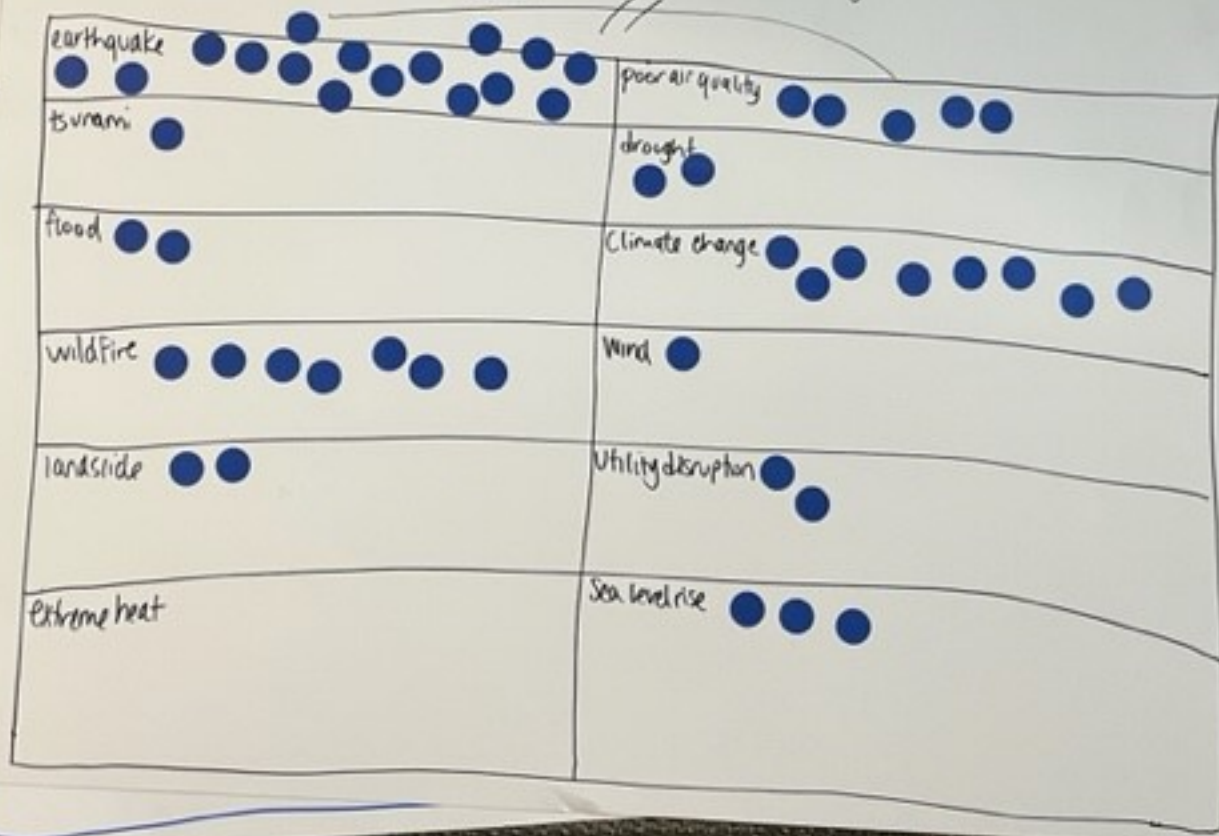


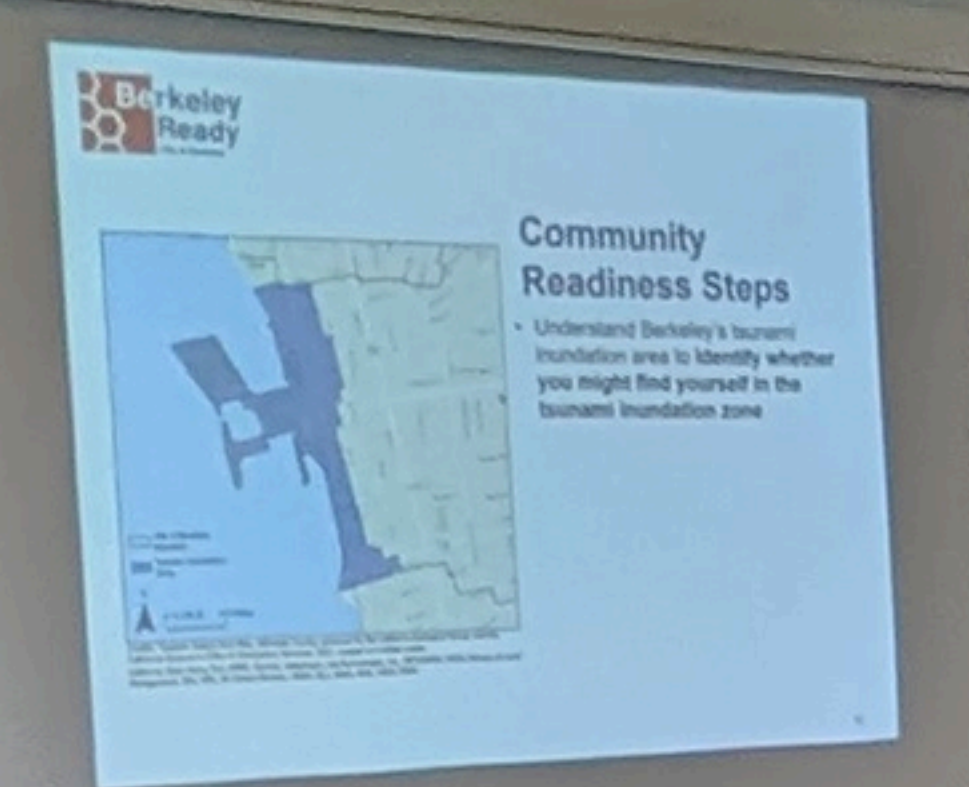
What natural hazards are you most worried about impacting you in Berkeley?

Blue
(most worried)
Yellow
(less worried)



What natural hazards are you most worried about impacting you in Berkeley?





Before you leave

- ☐ Sign up for A/C Alert
- ☐ Bookmark Berkeley Emergency Map
- ☐ Draw your Household Tsunami Plan
- ☐ Note on your Seismic Mitigation Action

Which Mitigation Strategy is Most Important for Your Business?

Multiple Berkeley Business Prepared at the Berkeley Room

Continuing to repair and replace

Collaborate with the County Office to develop a plan, the County Office will provide the necessary resources and support to develop a plan and implement mitigation actions



- Before you leave**
- ☐ Sign up for AC Alert
 - ☐ Bookmark Berkeley Emergency Map
 - ☐ Draft your House hold Tsunami Plan
 - ☐ Vote on your local mitigation action

Which Mitigation Strategy is most important to place a shelter?

Mitigation Strategy: House hold at the Berkeley Room

Continuing to repair and replace damaged structures

Collaborate with the County Office to develop a plan for the future during the next emergency and to be able to discuss and discuss future mitigation actions

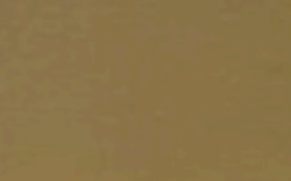
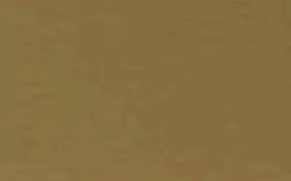
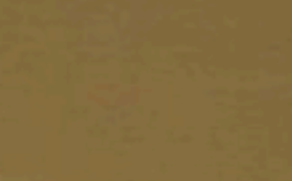
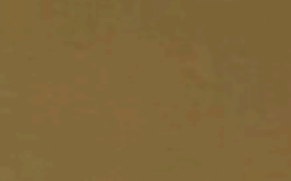
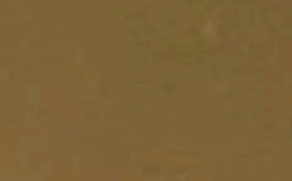
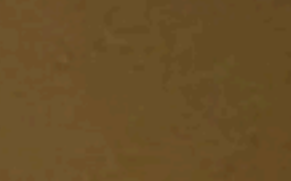
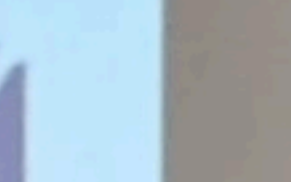
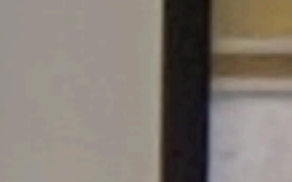
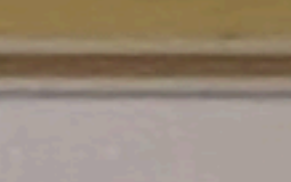
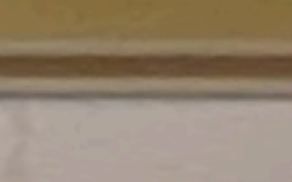
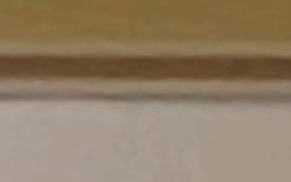
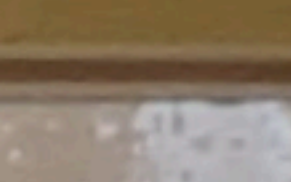
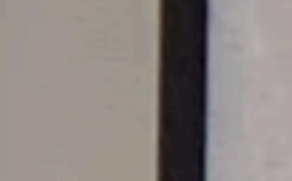
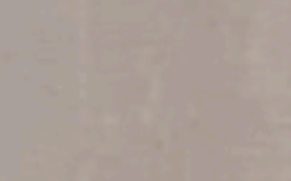
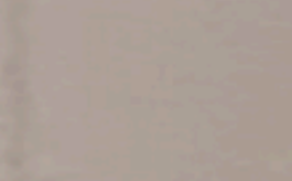
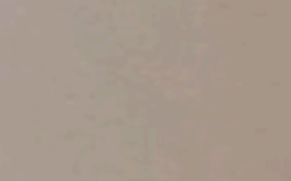
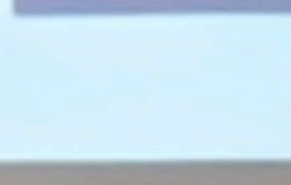
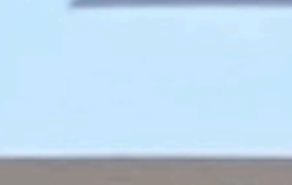
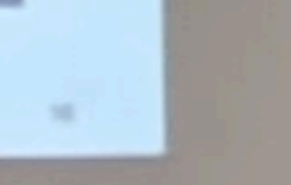
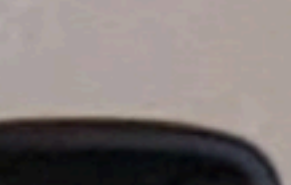
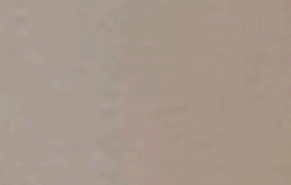
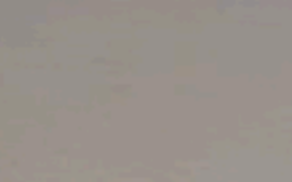
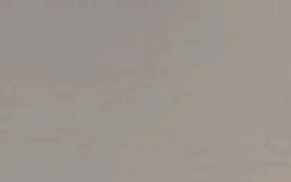
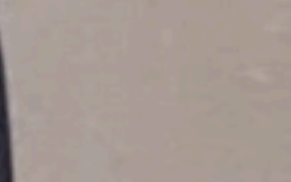
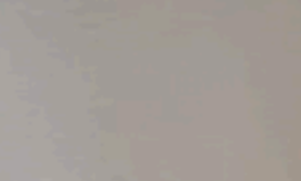
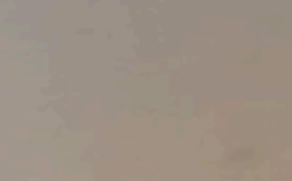
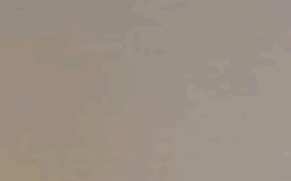
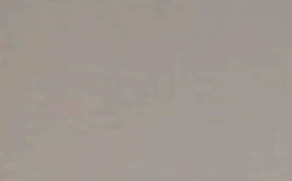
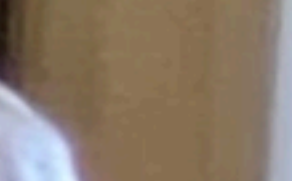
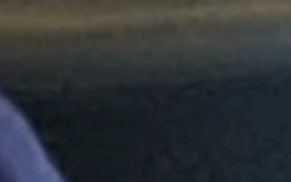
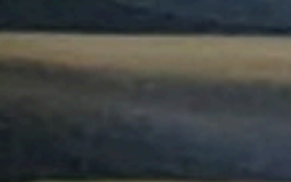
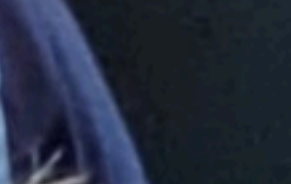
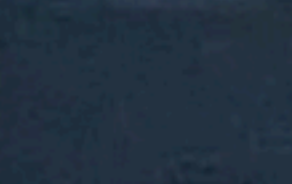
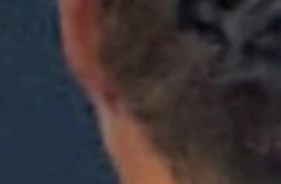
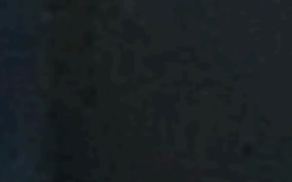
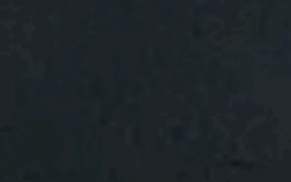
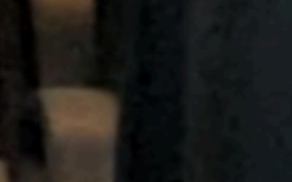
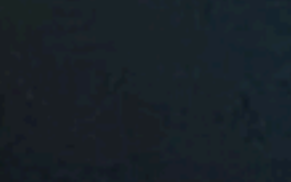
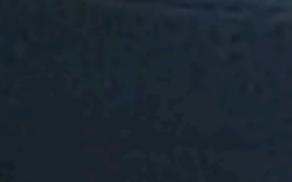
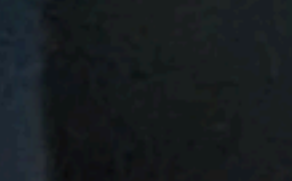
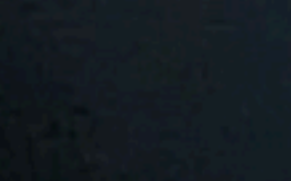
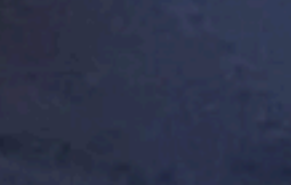
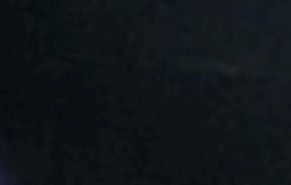
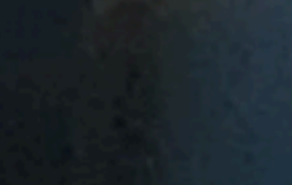
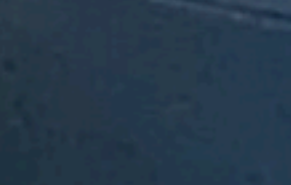
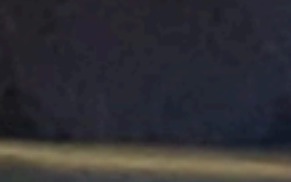
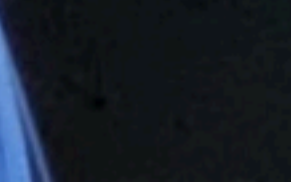
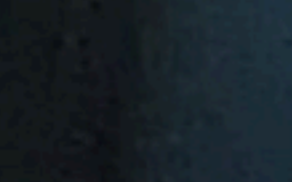
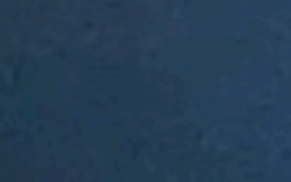
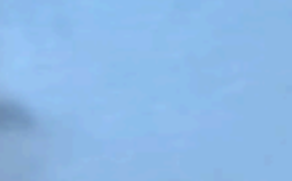
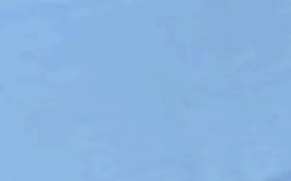
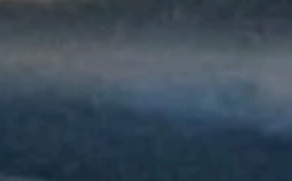
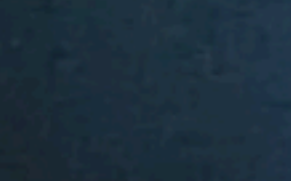
Your plan for emergency mitigation:



Community Readiness Steps

NATURAL

Tsunami Warning Signs





Berkeley Ready

Community Readiness Steps

NATURAL

Tsunami Warning Signs

Strong shaking

Water level changes

Unusual waves

Be a tsunami safe

Be a tsunami safe

Be a tsunami safe

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OFFICIAL

Tsunami Warnings

(Broadcast through)

Sirens

Radio

Outdoor sirens

TV

Telephone

Emergency alerts

Be a tsunami safe

Be a tsunami safe

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EXIT









Berkeley Ready
City of Berkeley

Be Connected. Be Prepared. Be Berkeley.



Installing
FREE
Smoke Alarms
in your neighborhood

Let us make your home safer today!
RedCross.org/SmokeAlarmInstallNorCal

Public Works



Public Works

Berkeley Ready

red. Be Berkeley. Be Connected. Be Prepared. Be Berkeley.





Public Wo

Be Connected. Be Prepared. Be Berkeley.



WELCOME TO YOUR PARK
Park Rules
• Open 6 am to 10 pm (M-F) 6:30 (S-S)
• Dogs Must Be on Six-Foot Leash
• Dog Litter Must Be Removed
• No Unattended Property or
Objects 10 lbs. or More Without
Permit (M-F 8:30-10:00)
• No Smoking, Alcoholic Beverages,
Littering, Motorized Vehicles, or
Overnight Camping (M-F 12:00-10:00,
S-S 12:00-10:00, 8:30-10:00)
• No Feeding Wildlife (M-F 8:30-10:00)
Enjoy a Clean and Healthy Park

LOST
808 722 9921



Hello Winter Weather!

Flooding and High Winds:
The hazards, the City's work, and steps to stay safe

December 9, 2023

Winter Weather Outlook

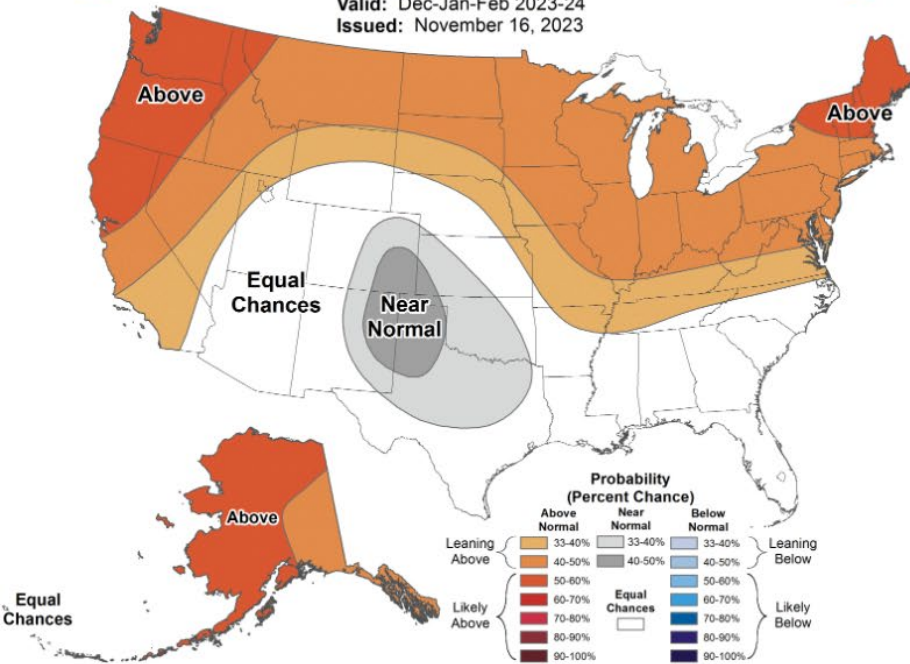
NOAA predicts “strong” El Niño conditions



Seasonal Temperature Outlook



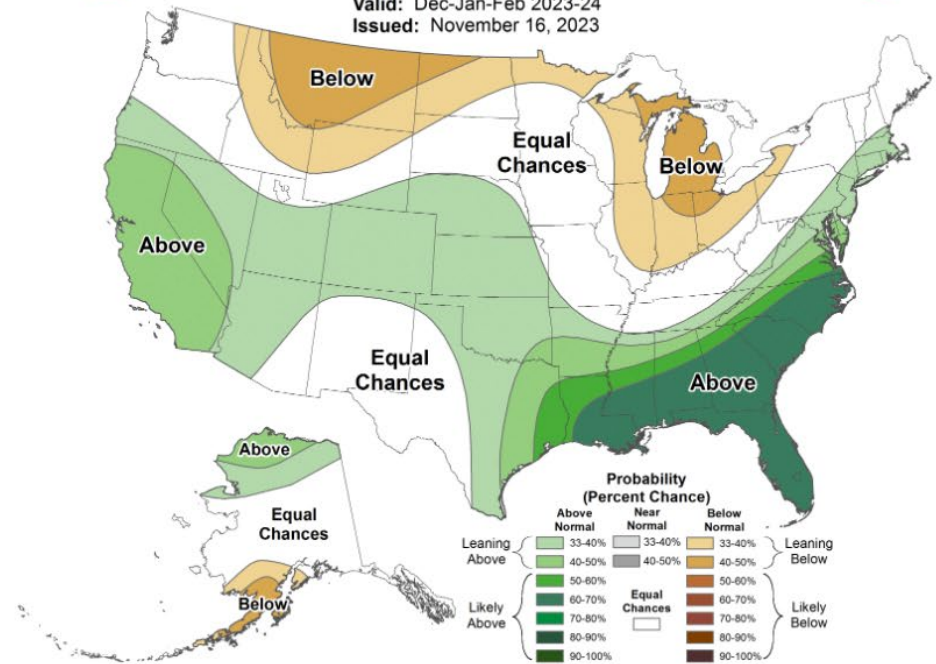
Valid: Dec-Jan-Feb 2023-24
Issued: November 16, 2023



Seasonal Precipitation Outlook



Valid: Dec-Jan-Feb 2023-24
Issued: November 16, 2023



Flooding

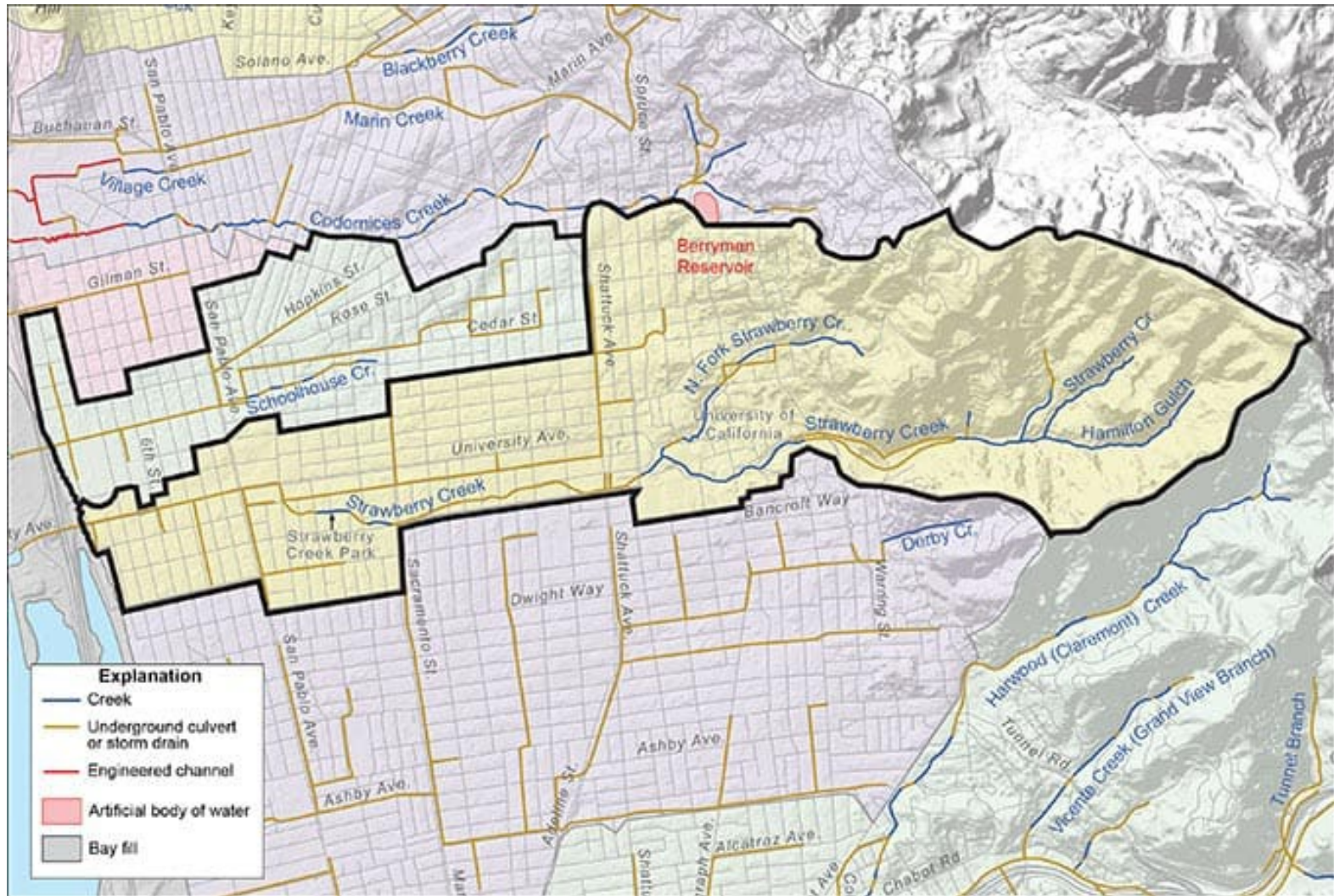
What is flooding?



Flooding on Parker Street near Longfellow School. Photo: Mark Coplan

Creek Flooding

Creeks & Berkeley

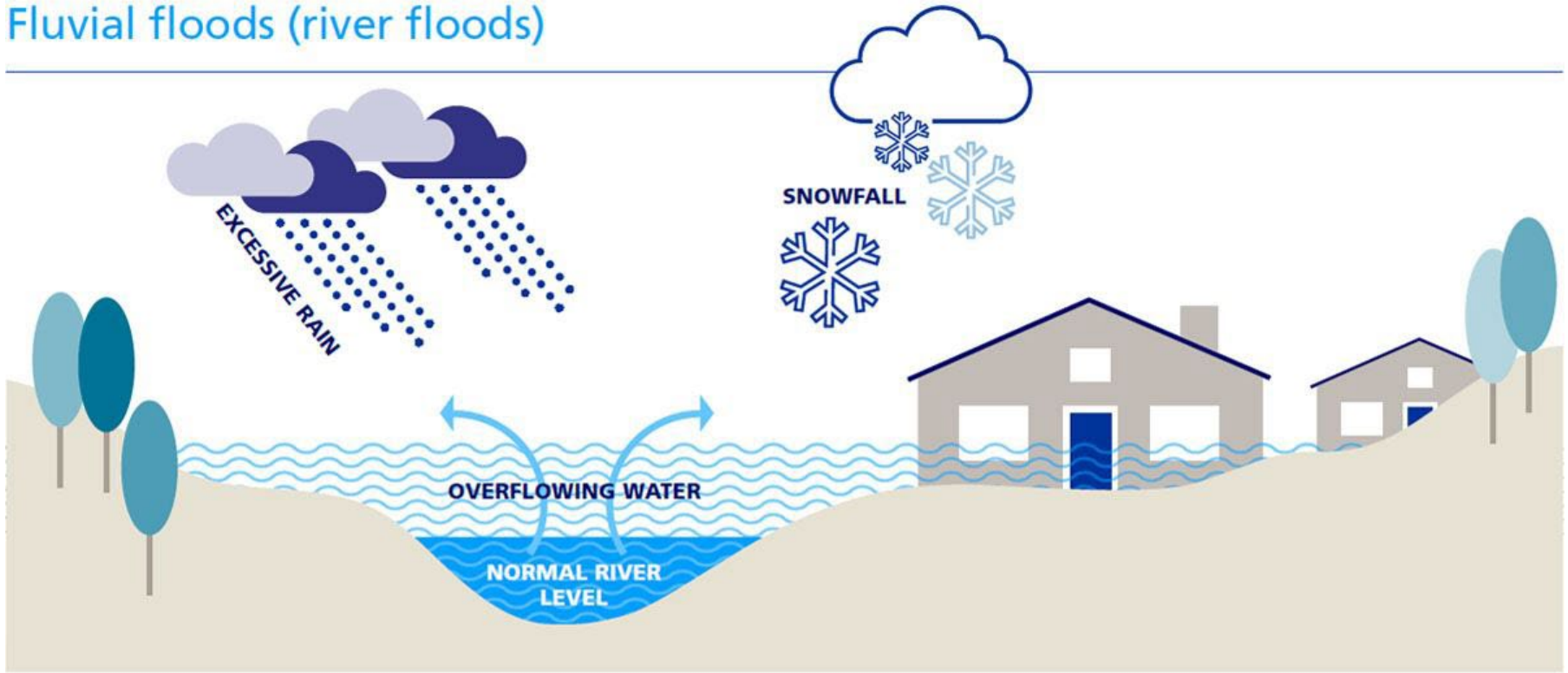


What is Creek Flooding?

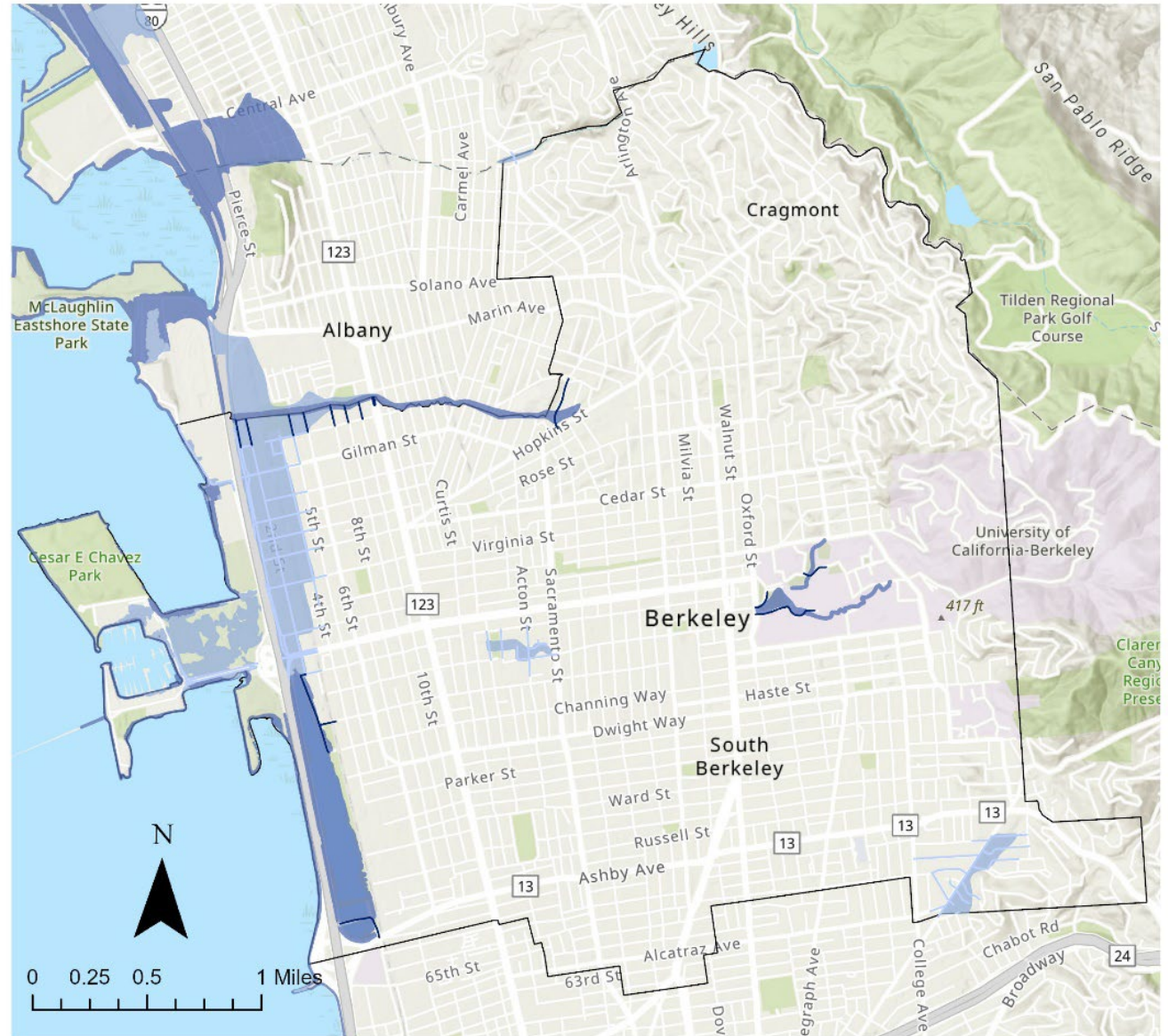


What is Creek Flooding?

Fluvial floods (river floods)

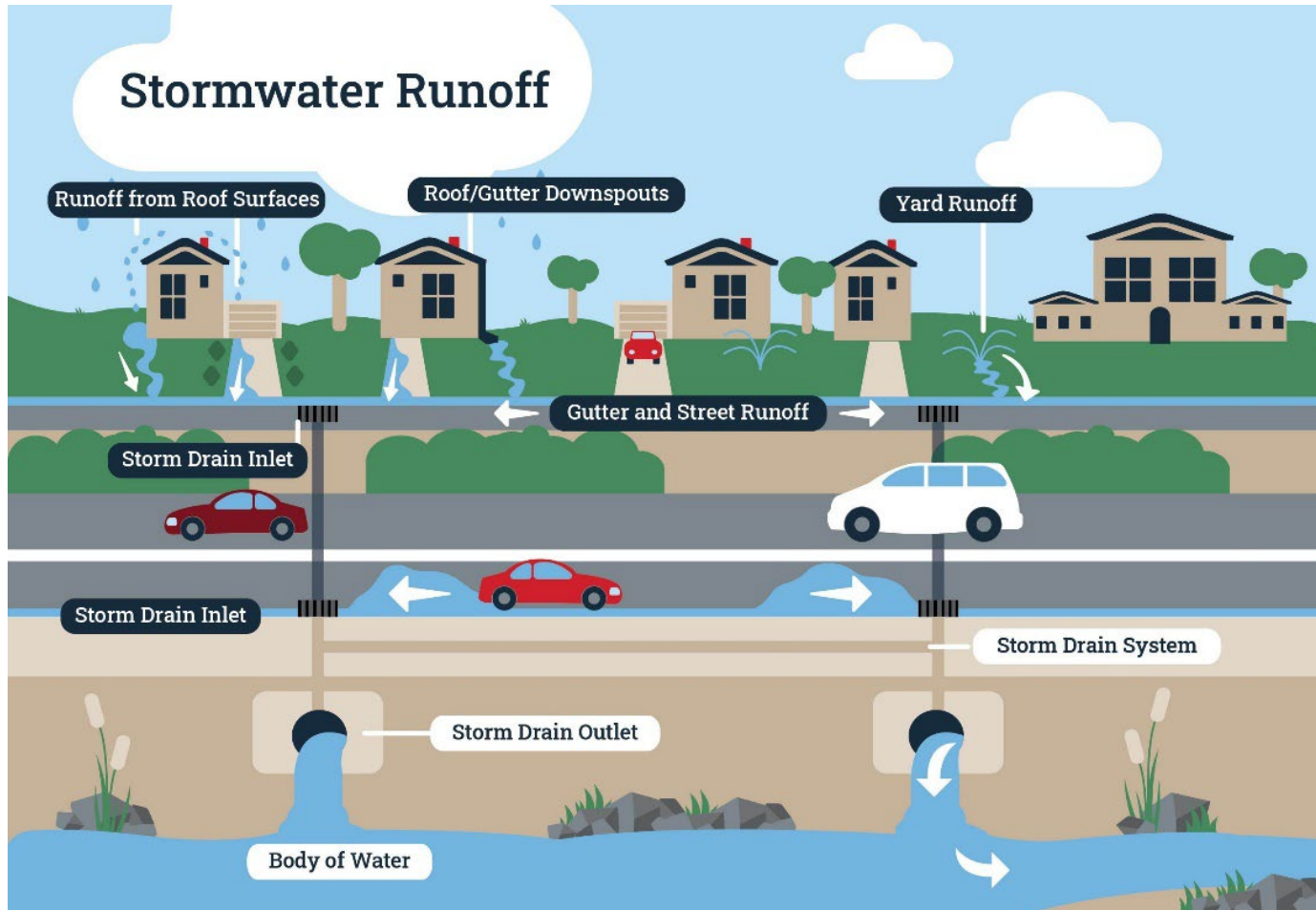


Berkeley Floodplains



Storm Drain Overflow

What is Storm Drain Overflow?



Storm Drain Infrastructure

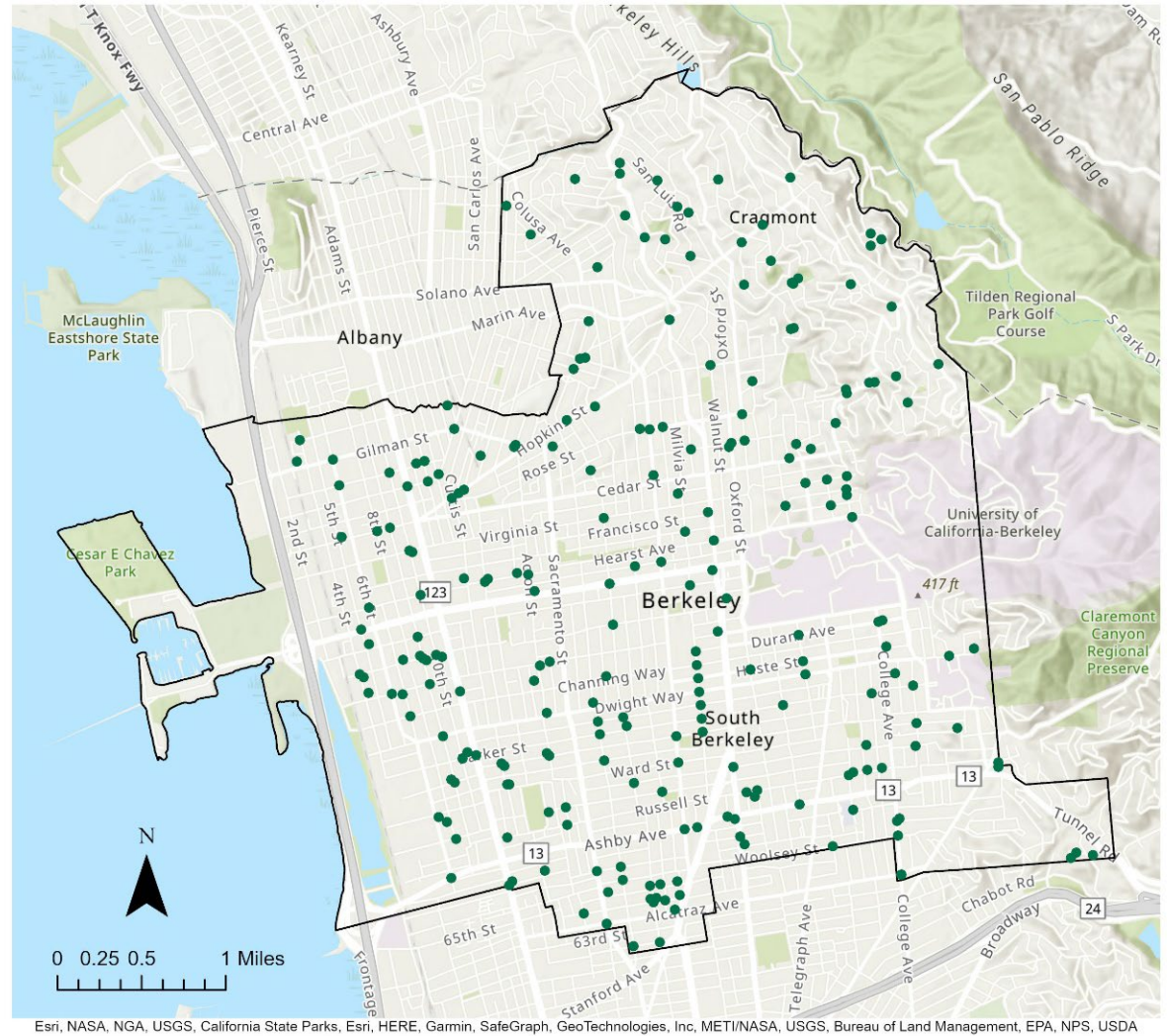
- Designed to handle 2 inches in 6 hours
- Some components of Berkeley's storm drain infrastructure are over 90 years old



Flooding in Southwest Berkeley during [last October's record-breaking storm](#).

Credit: [Guillaume Pierre](#)

Storm Drain Issues



Storm Drain System Issues, Jan-June 2023

- Areas of Observed Storm Drain Overflow

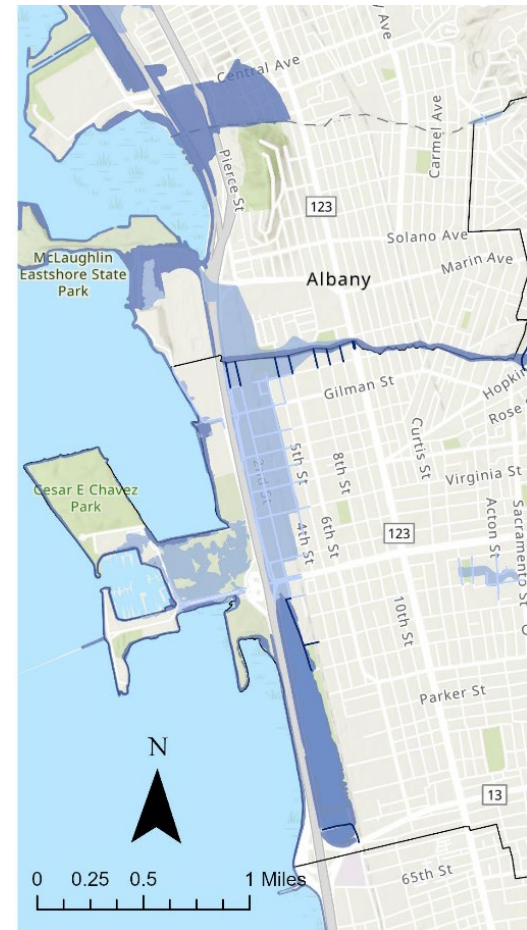
2024 Draft Mitigation Plan: Flooding Strategy

Maintain City participation in the National Flood Insurance Program.

- Use updated FEMA maps
- Incorporate FEMA guidance into City plans and procedures



FEMA



Development Standards

- Use development standards to ensure that new development does not contribute to an increase in flood potential.



Stormwater Master Plan

Complete a Stormwater Master Plan for all City stormwater infrastructure, to:

- Identify system deficiencies
- Establish a capital stormwater improvement plan, and
- Identify funding mechanisms.



Tide Tubes

- Renovate the tide tubes that remove storm water from Berkeley Aquatic Park and Potter Street to the Bay.



Designing Public Improvements

- Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio-filtration systems.



Bioswale at Rose and Hopkins

What can you do about flooding?

Protect your neighborhood

- Flooding often occurs due to storm drain blockage. Keep water flowing by participating in the [adopt a drain program](#).



Protect your home

- Direct water away from your building.
- Watch how water flows or accumulates around your home to identify potential trouble spots.



Flood Insurance

- Consider **flood insurance**, since typical homeowners insurance policies do not cover flooding.



FEMA



Are sandbags right for you?

**Do you live near a
Berkeley creek?**

**Have you experienced
flooding in the past?**

- Learn [how to sandbag](#)
- Learn whether sandbags will be protective for your property



Make your sandbag plan

- If you are unable to sandbag, connect with neighbors and friends who can assist you in sandbagging to protect your home during severe storms
- Make a plan for where you'll get sandbags in significant storms.



Where to get sandbags?

- Local hardware stores
- [City's Corporation Yard](#)
 - 10 free bags during storm season
 - Monday-Friday, 8 am - 4 pm
 - Berkeley residents and businesses only; bring ID or a business card).



During heavy rains



- Elevate important items, if possible, especially from first floor/garage.
- Do not walk, swim or drive through flooded waters. Turn around, don't drown.
- Be ready for power/internet outage
- If your home floods, be ready for cleanup.

High Wind Events

How is Wind formed?

Wind is air in motion, traveling between areas of high pressure to low pressure

The steeper the difference in air pressure, the stronger the wind is



Wind in Berkeley

In Berkeley, high wind events are associated with the seasons

- **Winter:** weather systems and cold fronts
- **Summer:** temperature and pressure differences between the Pacific Ocean and the interior valleys to the east create strong winds from the west
- **Spring & Fall:** warm, dry offshore winds from the northeast, known as “Diablo Winds”

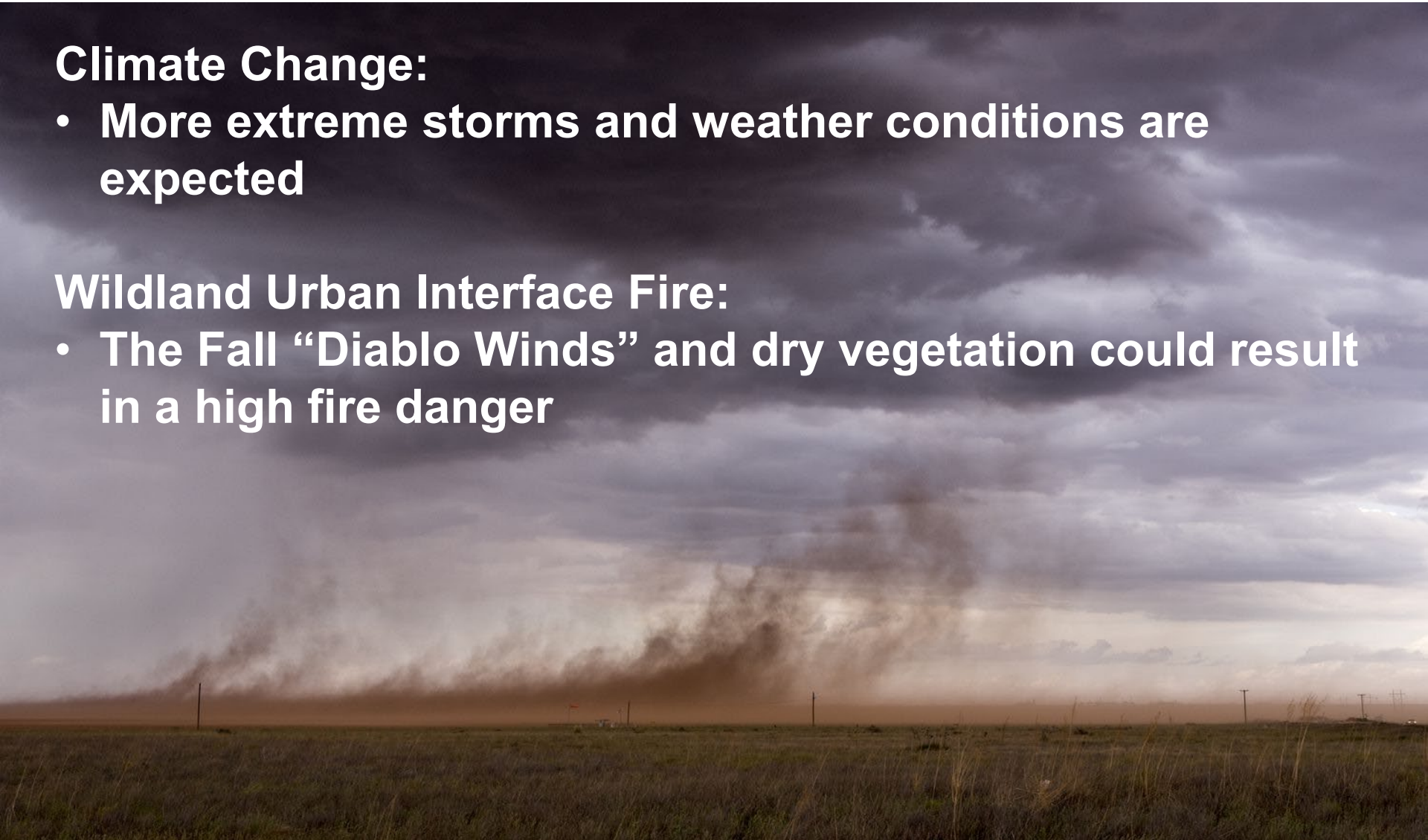


Climate Change:

- More extreme storms and weather conditions are expected

Wildland Urban Interface Fire:

- The Fall “Diablo Winds” and dry vegetation could result in a high fire danger



What is “high wind”?

- ***Sustained wind*** of 40 mph or more, lasting for 1 hour or more
or
- ***Wind gust*** (usually 20-30 seconds) of 58 mph or higher



Vulnerabilities

Direct

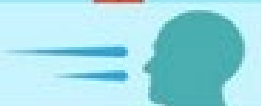
- Trees
- Utility lines
- Heavy objects
- High-profile vehicles and RVs

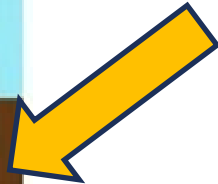
Indirect

- People



Beaufort Wind Scale

< 1 mph	Calm	Smoke rises vertically	
1-3 mph	Light air	Direction shown by smoke drift	
4-7 mph	Light breeze	Wind felt on face	
8-12 mph	Gentle breeze	Leaves and small twigs in constant motion	
13-18 mph	Moderate breeze	Raises dust and loose paper	
19-24 mph	Fresh breeze	Small trees and leaves begin to sway	
25-31 mph	Strong breeze	Large branches in motion	
32-38 mph	High wind, moderate gale, near gale	Whole trees in motion	
39-46 mph	Gale, fresh gale	Twigs break off trees	
47-54 mph	Strong/severe gale	Slight structural damage	
55-63 mph	Storm, whole gale	Trees uprooted, considerable structural damage	
64-72 mph	Violent storm	Widespread damage	
>73 mph	Hurricane force	Devastation	



What can you do about high winds?

Keep Trees Maintained



City trees

Call 311

Email

trees@berkeleyca.gov

Private trees

Trim, prune and talk to
arborist

Before a wind event...



**Secure outdoor
items**

**Be ready for
power outages**



During high winds...

Stay inside if you can

Stay away from trees

**If you see a downed
power line, call 9-1-1**



Credit: Berkeleyside, Benji Friedman, March 2023 at Berkeley Marina

During high winds...



If you see a downed power line, stay away and call 9-1-1

Recap & Next Steps



Recap

- **Creek flooding** and **storm drain issues** cause most flooding in Berkeley
- Infrastructure improvements can reduce risks
- Residents can protect their neighborhoods and homes
- **High winds** can create dangerous situations – get ready and then stay out of the way if you can!



Next Steps Today!

- Mitigation plan:
 - Share your top mitigation actions and other ideas
 - Full draft plan available in 2024
 - Mitigation@BerkeleyCA.gov
- Learn more at today's event!
 - Adopt a storm drain
 - Learn how to sandbag and if it will protect your property



Tsunami



Agenda

- Tsunami Information
 - What is a tsunami?
 - Where is it in Berkeley?
 - What could be affected by a tsunami?
- Mitigation Strategy Actions
- Community Readiness Steps

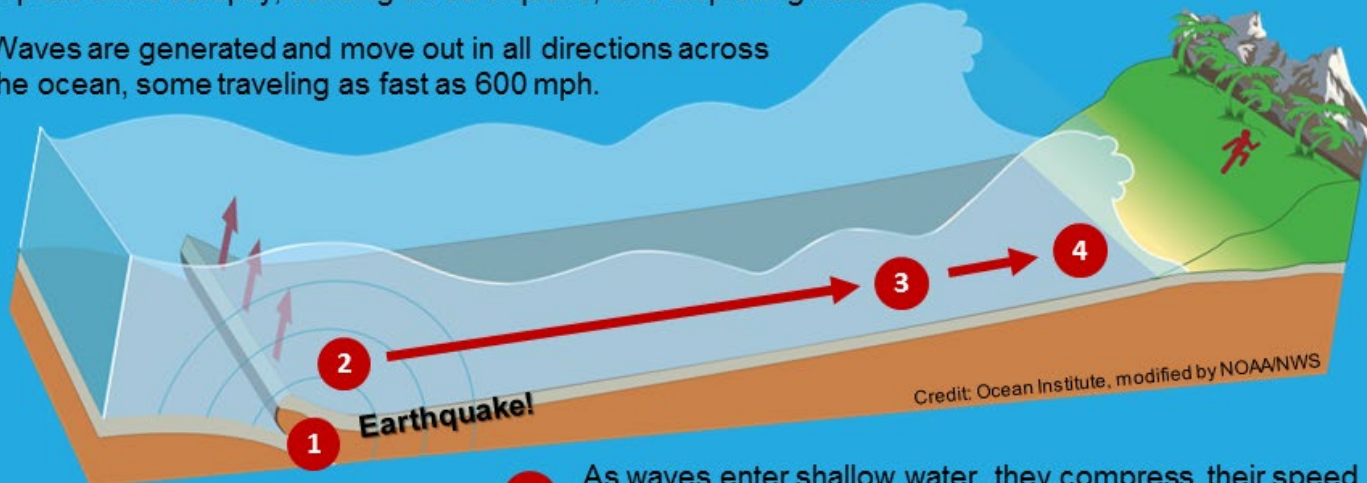
What is a Tsunami?

What is a Tsunami?

How a Tsunami Works

Most tsunamis are caused by large earthquakes below or near the ocean floor.

- 1 A plate shifts abruptly, causing an earthquake, and displacing water.
- 2 Waves are generated and move out in all directions across the ocean, some traveling as fast as 600 mph.

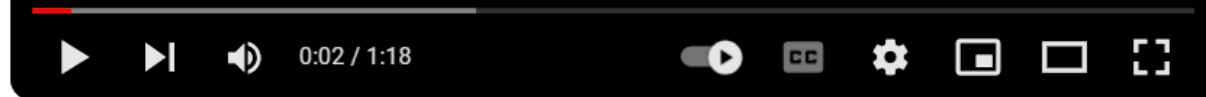


weather.gov/tsunamisafety

- 3 As waves enter shallow water, they compress, their speed slows, and they build in height.
- 4 The wave height increases, and associated currents intensify, becoming a threat to life and property.

Berkeley, California Marina Friday March 11, 2011

Tsunami surge enters harbor



Berkeley Marina Tsunami



Yachtblackgold
1 subscriber

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👍 11



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https://www.youtube.com/watch?v=r_Z07BOolmc



Tonga tsunami surge into the Berkeley Marina



Berkeleyside
739 subscribers

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👍 5



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⬇️ Download



https://www.youtube.com/watch?v=hdANpkJ_Xzc&t=17s



Tsunami Wrecks Marina in Santa Cruz California



WDEF News 12
9.93K subscribers

Subscribe

 348



 Share

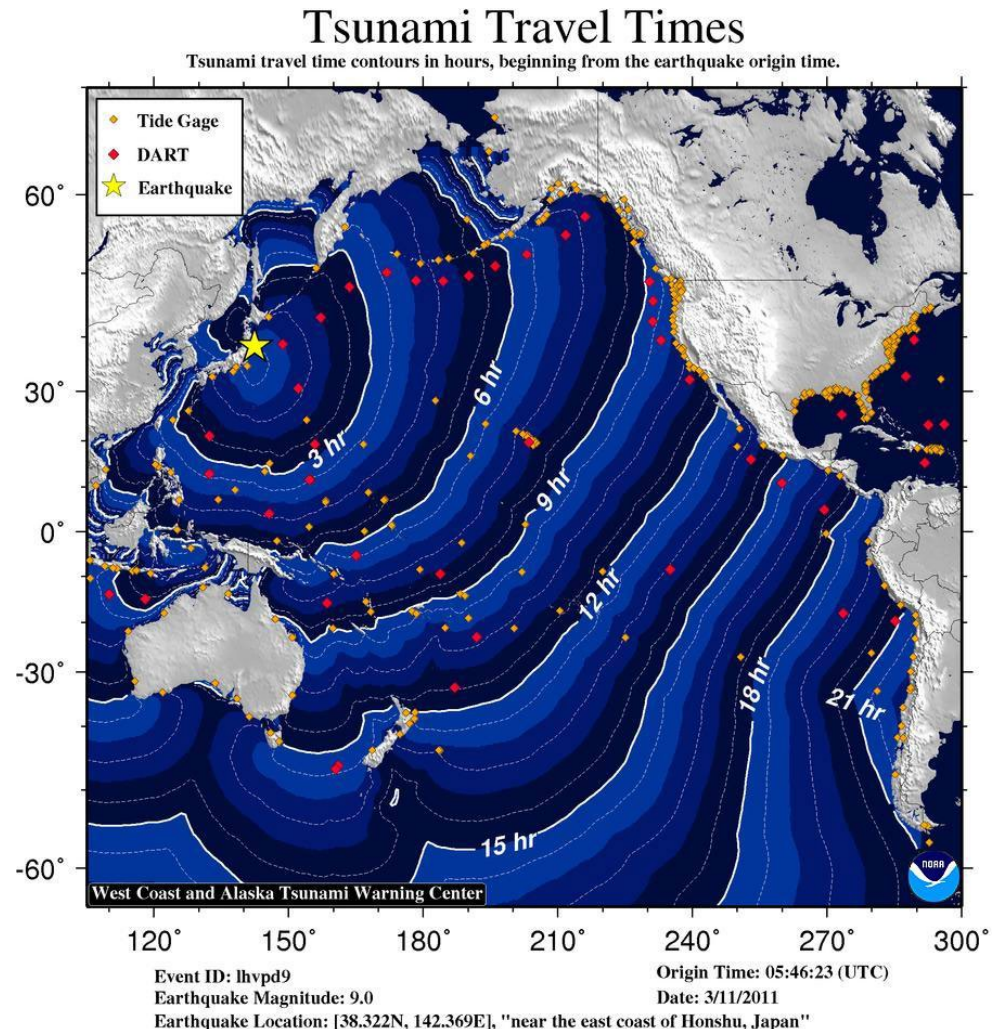
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<https://www.youtube.com/watch?v=C0Afa4pjWg4>

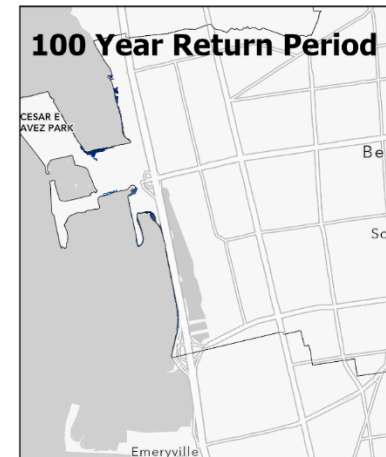
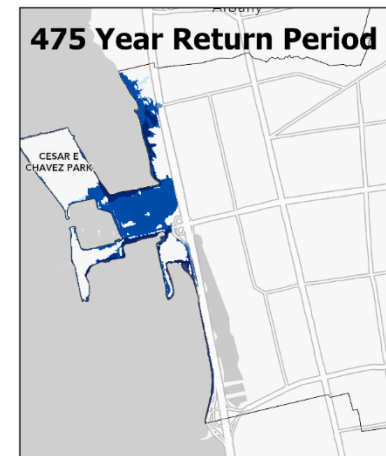
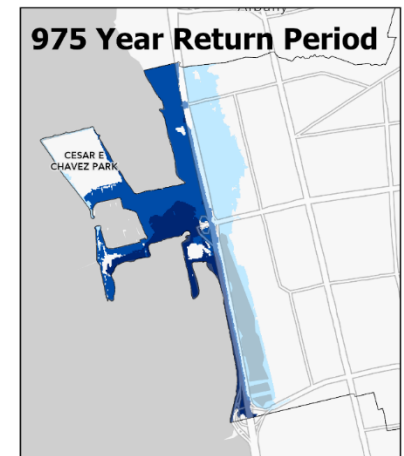
What is a Tsunami?

- Tsunamis affecting the Bay Area can result from **offshore earthquakes within the Bay Area, or from very distant events.**
- Tsunamis impacting the Bay Area are usually generated by faults in Washington and Alaska.



Where is it in Berkeley?

Tsunamis would mostly impact the areas of Berkeley near the Bay. From the coast to about sixth street is considered the tsunami zone. The area that we watch the most is the marina and the maritime community.



Amplitude in Meters

≤ 3.4

≤ 3.73

≤ 4.05



0.1 0.25 0.5 Miles

State of California, 2023. Probabilistic Tsunami Hazard Analysis Raster Data – Version 1, California Geological Survey and AECOM Technical Services; dated 2023.

California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Draft 2024 Mitigation Strategy Tsunami Actions

Mitigate the tsunami hazard at the Berkeley Marina

Mitigation Strategy Actions

- Continue to repair and replace damaged finger docks.
 - Complete the demolition and replacement of D&E docks.
 - Consider reconstruction or repairs to J L M N and O docks as funding becomes available.



A look back: A broken dock in the marina after the March 11, 2011, tsunami entered the bay. Credit: [Betsy Dorsett](#)

Mitigation Strategy Actions

- Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to **document and explore additional tsunami hazard mitigation measures for Berkeley's maritime communities.**



FEMA



Cal OES
GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

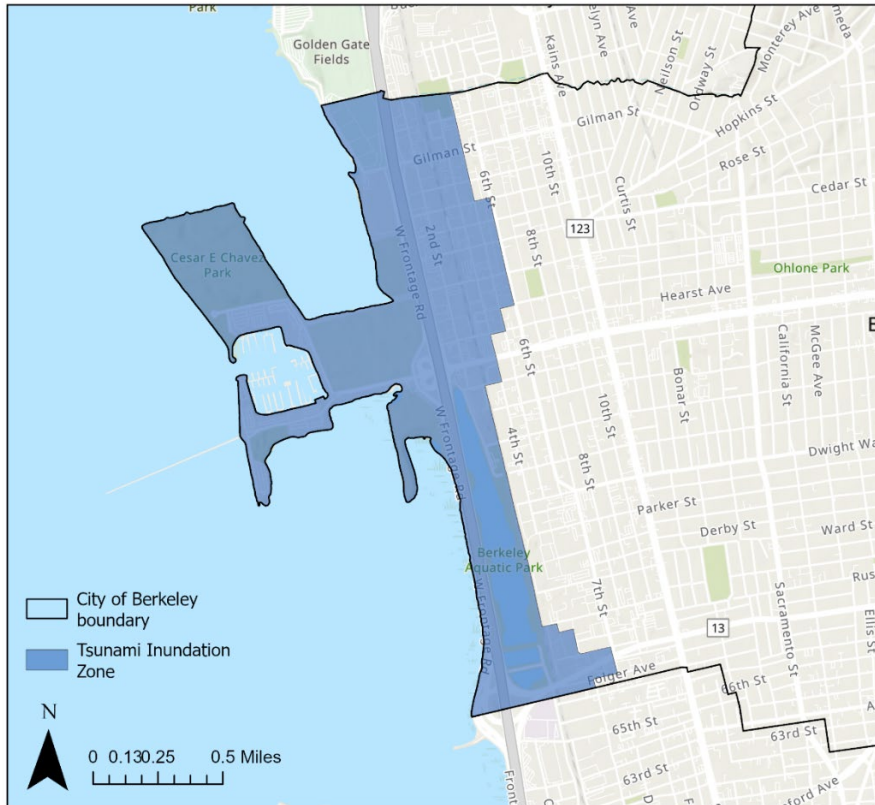


California
Department of
Conservation

Community Readiness Steps

Community Readiness Steps

Tsunami Alerts		
Alert Name	Actions	Potential Hazards
 WARNING	Get to high ground or inland IMMEDIATELY Follow tsunami evacuation signage	DANGER! TSUNAMI IMMINENT! Flooding/powerful currents Wave heights > 3 ft. or unknown
 ADVISORY	Stay out of the water and away from the shore	STRONG CURRENTS AND DANGEROUS WAVES in or very near coastal water Wave heights of 1 - 3 ft.
 WATCH	Be prepared to take action Stay tuned to local radio/TV/ NOAA "alert" weather radios	TSUNAMI IS POSSIBLE Alert level may change once more information is known
 INFORMATION STATEMENT	No action needed	NO TSUNAMI IMPACT EXPECTED Alert level may change once more information is known
THREAT Message: Intended to alert international partners only. Not applicable to U.S. coasts		
THE NATIONAL TSUNAMI WARNING CENTER ISSUES OFFICIAL TSUNAMI ALERTS. CHECK TSUNAMI.GOV OR WEATHER.GOV WEBSITES FOR TSUNAMI ALERT DETAILS.		



Credits: Tsunami Hazard Area Map, Alameda County; produced by the California Geological Survey and the California Governor's Office of Emergency Services; 2021, mapped at multiple scales.

California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, Esri, NASA, NGA, USGS, FEMA

Community Readiness Steps

- Understand Berkeley's tsunami inundation area to **identify whether you might find yourself in the tsunami inundation zone**

Community Readiness Steps



Know the Roar



Sound Effects 

Pricing FAQ SFXHD [Login/Register](#)  

Sound

Tsunami - beach - distant, approaching, and crashing



Tsunami - beach - distant, approaching, and crashing.

1:23









Crash

Tsunami

nature

ocean

sea

sound design

wave

https://www.soundsnap.com/tsunami_beach_distant_approaching_and_crashing_0

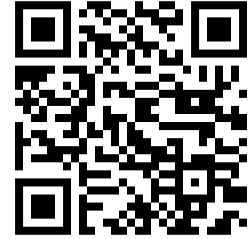
Community Readiness Steps

- Bookmark and get familiar with **Berkeley's Emergency Map**





Community Readiness Steps



- **Personal Preparedness**

- Sign up for **AC Alert**
- Visit Berkeley Ready Table afterward if you are not already signed up



Community Readiness Steps

- **Personal Preparedness**
 - Get familiar with the emergency tones from **Berkeley's Outdoor Warning System**.
 - [Test Message](#)
 - [Tsunami Advisory](#)



Community Readiness Steps

- If you live in the tsunami inundation zone, **make your household evacuation plan for tsunami**, including:
 - Where will you go – east, out of the tsunami zone
 - How will you get there, using which routes
 - Who can help if you need it
 - What will you pack

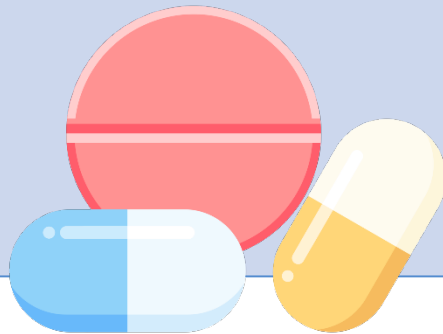


My household will pack...



Distant Source Tsunami

- Items to be safe and comfortable while you are away
- Medications, prescriptions, and medical devices
- Computers, electronics & chargers
- Irreplaceable items (family treasures, art, photo albums)
- Other Valuables



Near Source Tsunami

- **Go-bag (backpack)** with basic items:
 - Flashlight/headlamp
 - Area map, marked with driving/ walking evacuation routes
 - Printed list of phone numbers and email addresses for important contacts
 - Battery-powered radio and extra batteries
 - Prescriptions or critical medications
 - Extra eyeglasses or contact lenses
 - Extra set of keys
 - Cell phone charger
 - Copies of important documents
 - Toiletries and change of clothing
 - Hand sanitizer
- **As you leave, grab:** Wallet, cell phone

Maritime Community



Keep Your Boat Tsunami Ready!

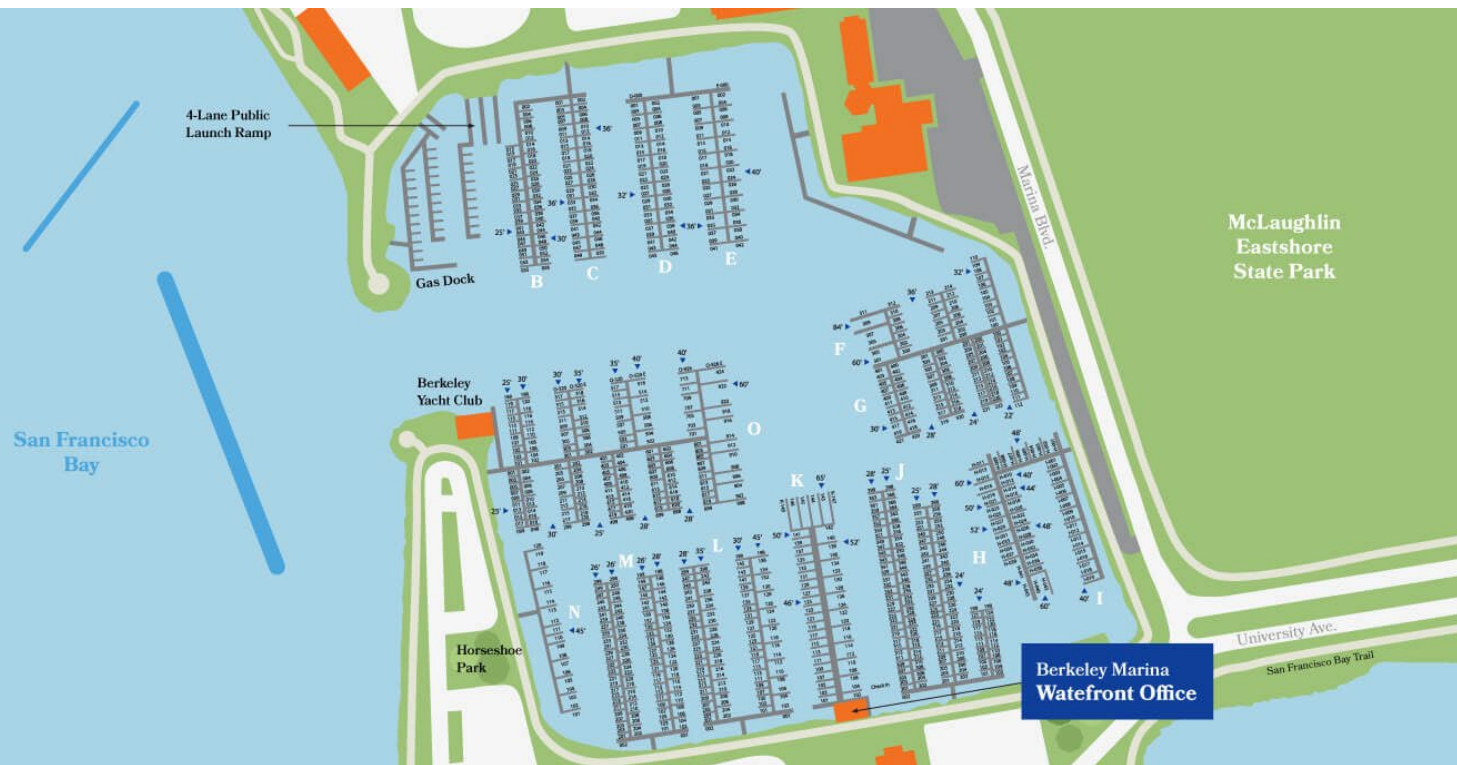
Make sure your boat is secured and ready. Keep in mind that the City will shut down the dock 1 hour before the tsunami's anticipated arrival time.

- Secure your boat to the dock and tie down any loose gear.
- Check your dock line condition and replace any worn dock lines.
- Remove as much loose boating gear onboard as possible, especially electronics and important documents. Any gear that will remain on your boat should be secured.
- Turn off and disconnect shore power cords, water supply hoses and propane or other gas valves.
- Secure and lock all hatches and port holes. Check for leaks, and seal them as necessary.

Maritime Community

The City of Berkeley will evacuate docks and shut them down within 1 hour of a tsunami's estimated arrival.

Berkeley Marina CALIFORNIA



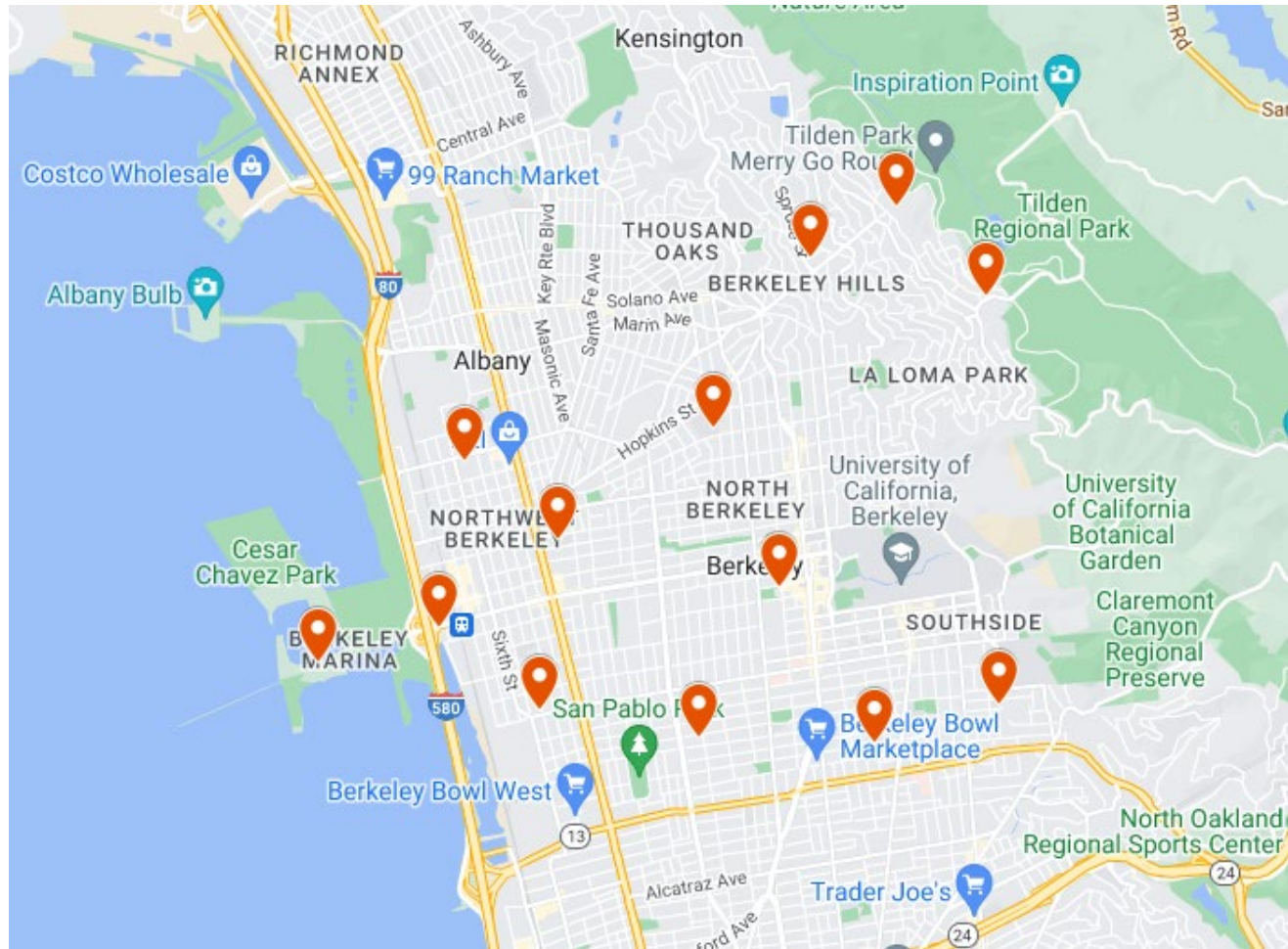
WHAT IS COVERED BY *Boat Insurance?*



Activity: Household Tsunami Evacuation Planning

Next Steps

Outdoor Warning System Locations



List of people that were contacted to help draft the plan

City Staff

- Daniel Akagi, Supervising Civil Engineer, Public Works Department
- Joy Brown, Operations Manager, Public Works Department
- Jamie Cooney, Hazardous Materials Specialist, Planning Department
- Sean Crothers, Waterfront Supervisor, Parks, Recreation, and Waterfront Division
- Thomas Dodge, Forestry Technician, Parks, Recreation, and Waterfront Division
- Ali Endress, Waterfront Manager, Parks, Recreation, and Waterfront Division
- Makinde Falade, GIS Coordinator, Information Technology Department
- Lam Inthavong, Hazardous Materials Manager, Planning Department
- Leticia Jauregui, Solid Waste and Recycling Manager, Public Works Department
- Elmar Kapfer, Supervising Civil Engineer, Public Works Department
- David Lopez, Building Official, Building and Safety Division
- Jenny McNulty, Resilient buildings Program Manager, Building and Safety Division
- Rebecca Milliken, Sustainability Outreach Specialist, Office of Energy and Sustainable Development
- Hamid Mostowfi, Supervising Traffic Engineer, Public Works Department
- Srinivas Muktevi, Supervising Civil Engineer, Public Works Department
- Ron Nevels, Supervising Civil Engineer, Public Works Department
- Alene Pearson, Deputy Director of Planning and Development, Planning Department
- Ruth Raisner, Health Services Program Specialist, Public Health Emergency Preparedness and Immunization Program
- Billi Romain, Manager, Office of Energy and Sustainable Development
- Marna Schwartz, Sustainability Coordinator, Office of Energy and Sustainable Development
- Alisa Shen, Principal Planner, Planning Department
- Katharine Sullivan, COVID-19 Response Coordinator, Health, Housing, and Community Services
- Ron Torres, Division Manager, Environmental Health
- Katie Van Dyke, Chief Resilience Officer, Office of Energy and Sustainable Development

External Hazard Experts

- Jackie Bott, Engineering Geologist, California Geological Survey
- Sarah Church, Sustainability Project Manager, County of Alameda
- Brian Garcia, Warning Coordination Meteorologist, National Weather Service
- Eric Geist, Research Geophysicist, United States Geological Survey
- Nick Graehl, Engineering Geologist, California Geological Survey
- Anne Wein, Operations Research Analyst, United States Geological Survey
- Rick Wilson, Senior Engineering Geologist, California Geological Survey

Community Partners

- Ed Roberts Campus
- Berkeley Youth Alternatives
- McGee Baptist Church

- La Peña
- YMCA Head Start Preschool
- Harriet Tubman Terrace Apartments
- Easy Does It
- Oregon Park Senior Apartments
- Ecology Center
- Berkeley Humane
- Multicultural Institute
- Berkeley Pathwanderers
- Berkeley City College
- Bay Area Rapid Transit
- City of Oakland
- Alameda County Sheriff's Office - Office of Homeland Security and Emergency Services
- Lawrence Berkeley National Lab
- Kinder Morgan Corporation
- East Bay Municipal Utility District
- Union Pacific Railroad
- UC Berkeley
- Bayer
- Caltrans
- City of Albany
- City of Emeryville
- Union Pacific Railroad
- East Bay Regional Parks District
- Kensington Fire
- PG&E

From: [Mitigation](#)
To: ["jfeil@oaklandca.gov"](mailto:jfeil@oaklandca.gov)
Subject: Berkeley Mitigation Plan - Invitation to Participate
Date: Thursday, September 7, 2023 10:26:00 AM

Dear Jessica,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. It's really nice to meet you! It would be awesome to connect more as Emergency Managers in East Bay when you have the time.

I am reaching out because we're beginning the process to update our [2024 Local Hazard Mitigation Plan](#). As our lovely neighbor, we're reaching out for any insights or ideas you might want to share as we embark on the planning process:

1. Any key vulnerabilities or concerns you have related to natural hazards that impact Berkeley and Oakland. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
2. What actions do you recommend the City take to reduce disaster risk? Any potential mitigation actions between our two jurisdictions?
3. Do you want to highlight any work you all have done to reduce risk that is also relevant to Berkeley?
4. Is there anything you want to share or make sure we're also looking into?

I know you must have a million things on your to do list, so thank you in advance for taking the time to read this and consider offering feedback. If you can, **please provide your feedback before September 18.** I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again! And hope to meet you soon!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services
e | j.albrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["pheess@acgov.org"](mailto:pheess@acgov.org)
Subject: Berkeley Mitigation Plan - Invitation to Participate
Date: Thursday, September 7, 2023 10:28:00 AM

Dear Paul,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. It's really nice to meet you! It would be awesome to connect more as Emergency Managers in East Bay when you have the time.

I am reaching out because we're beginning the process to update our [2024 Local Hazard Mitigation Plan](#). Since you have the county-wide perspective, we're reaching out for any insights or ideas you might want to share as we embark on the planning process:

1. Any key vulnerabilities or concerns you have related to natural hazards that impact Berkeley and Alameda County in general. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
2. What actions do you recommend the City take to reduce disaster risk? Any potential mitigation actions you want to note between jurisdictions or areas for potential collaboration?
3. Do you want to highlight any work you all have done to reduce risk that is also relevant to Berkeley?
4. Is there anything you want to share or make sure we're also looking into?

I know you must have a million things on your to do list, so thank you in advance for taking the time to read this and consider offering feedback. If you can, **please provide your feedback before September 18.** I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again! And hope to meet you soon!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services
e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["jvalenzuela@kensingtonfire.org"](mailto:jvalenzuela@kensingtonfire.org); ["mmayorga@kensingtonfire.org"](mailto:mmayorga@kensingtonfire.org)
Subject: Berkeley Mitigation Plan - Invitation to Participate
Date: Thursday, September 7, 2023 10:35:00 AM

Dear Mary and Johnny,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. It's really nice to meet you! It would be awesome to connect more as Emergency Managers in East Bay when you have the time.

I am reaching out because we're beginning the process to update our [2024 Local Hazard Mitigation Plan](#). As our lovely neighbor, we're reaching out for any insights or ideas you might want to share as we embark on the planning process:

1. Any key vulnerabilities or concerns you have related to natural hazards that impact Berkeley and Kensington. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
2. What actions do you recommend the City take to reduce disaster risk? Any potential mitigation actions between our two jurisdictions?
3. Do you want to highlight any work you all have done to reduce risk that is also relevant to Berkeley?
4. Is there anything you want to share or make sure we're also looking into?

I know you must have a million things on your to do list, so thank you in advance for taking the time to read this and consider offering feedback. If you can, **please provide your feedback before September 18.** I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again! And hope to meet you soon!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services
e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["jelephant@emeryville.org"](mailto:jelephant@emeryville.org)
Subject: Berkeley Mitigation Plan - Invitation to Participate
Date: Thursday, September 7, 2023 10:39:00 AM

Dear Lori

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. It's really nice to meet you! It would be awesome to connect more as Emergency Managers in East Bay when you have the time.

I am reaching out because we're beginning the process to update our [2024 Local Hazard Mitigation Plan](#). As our lovely neighbor, we're reaching out for any insights or ideas you might want to share as we embark on the planning process:

1. Any key vulnerabilities or concerns you have related to natural hazards that impact Berkeley and Emeryville. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
2. What actions do you recommend the City take to reduce disaster risk? Any potential mitigation actions between our two jurisdictions?
3. Do you want to highlight any work you all have done to reduce risk that is also relevant to Berkeley?
4. Is there anything you want to share or make sure we're also looking into?

I know you must have a million things on your to do list, so thank you in advance for taking the time to read this and consider offering feedback. If you can, **please provide your feedback before September 18.** I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again! And hope to meet you soon!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services
e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["jenn.cogley@bayer.com"](mailto:jenn.cogley@bayer.com)
Subject: Berkeley Mitigation Plan - Invitation to Participate
Date: Thursday, September 7, 2023 10:01:00 AM

Dear Jenn,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our 2024 Local Hazard Mitigation Plan.

The City of Berkeley is currently updating its [2024 Local Hazard Mitigation Plan](#). The LHMP is a public document that addresses Berkeley's natural hazards and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key partner to the City of Berkeley, you are invited to participate in the plan development process.

We're interested in hearing from you:

1. Description of your main functions and any disaster related work your organization does
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk in Berkeley does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to inform the community about your concerns and all your hard work to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback before September 18. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,

Jamie

Jamie Albrecht

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Albrecht, Jamie](#)
To: ["Wittenbergd@kindermorgan.com"](mailto:Wittenbergd@kindermorgan.com)
Subject: FW: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, September 6, 2023 5:41:00 PM

Not sure if this is the right email address. Learned your name from Scott's out of office.

From: Albrecht, Jamie
Sent: Wednesday, September 6, 2023 5:38 PM
To: manleys@kindermorgan.com
Subject: FW: Berkeley Mitigation Plan – Invitation to Participate

Forwarding this to you per Nicole's out of office! Please do let me know if I should send to someone else.

Thank you,
Jamie

From: Mitigation
Sent: Friday, September 1, 2023 10:53 AM
To: nicole_stewart@kindermorgan.com
Subject: Berkeley Mitigation Plan – Invitation to Participate

Dear Nicole,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our 2024 Local Hazard Mitigation Plan.

The City of Berkeley is currently updating its [2024 Local Hazard Mitigation Plan](#). The LHMP is a public document that addresses Berkeley's natural hazards and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key partner to the City of Berkeley, you are invited to participate in the plan development process.

We're interested in hearing from you:

1. Description of your main functions and any disaster related work your organization does
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk in Berkeley does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to inform the community about your concerns and

all your hard work to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,

Jamie

Jamie Albrecht

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Albrecht, Jamie](#)
To: [James Nunez](#)
Cc: [Mitigation](#); [August Harless](#); [Ian Servin](#)
Subject: RE: Berkeley Mitigation Plan – Invitation to Participate
Date: Friday, September 8, 2023 1:06:00 PM

Yes, of course – take a few extra days! Thank you so much for taking the time to provide us with your insights. Super appreciate it.

Jamie Albrecht

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: James Nunez <jnunez@lbl.gov>
Sent: Thursday, September 7, 2023 8:10 PM
To: Albrecht, Jamie <JAlbrecht@berkeleyca.gov>
Cc: Mitigation <Mitigation@berkeleyca.gov>; August Harless <AHarless@lbl.gov>; Ian Servin <iservin@lbl.gov>
Subject: Re: Berkeley Mitigation Plan – Invitation to Participate

WARNING: This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Hi Jamie,

Apologies for the late reply. Several of us have been out of the office and scattered to the wind for training! It's been great to meet you and I hope you're getting settled on the team.

I'm putting two of my best and brightest on this effort. I've cc'd Ian and August on this email. Would it be possible to get a few extra days to work on this past the 13th? We are happy to support your effort and would like a little more time to give you quality input.

V/r,

James

James Nunez

Department Head, Emergency Services

[Security & Emergency Services Division](#)

Lawrence Berkeley National Laboratory

510.833.3989 (m) **acta non verba**

On Fri, Sep 1, 2023 at 11:51 AM Albrecht, Jamie <JAlbrecht@berkeleyca.gov> wrote:

Dear James,

Hope you're having a good week and that you have a relaxing long weekend ahead of you! It's been nice to get to know you a little bit on our bi-monthly calls. I am looking forward to continuing to work together.

I am reaching out because I am leading the City's effort to update the [2024 Local Hazard Mitigation Plan](#). One thing we always do in our plan development stage is to reach out the City partners and offer them an opportunity to add to the Plan. Here's what we're hoping to capture:

1. Short description of the Lab and the work you all do related to disasters/emergency management
2. What concerns or vulnerabilities related to natural hazards do you have for the Lab that you think are worth mentioning in our Plan? In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you think the City should take to reduce risk? Are there future mitigation areas where you would like to see the Lab and the City work together?
4. What work in mitigating disaster risk does the Lab want to highlight or share from the last five years?
5. Anything else related to disaster mitigation that you want to include on behalf of the Lab, please let me know

I am hoping this is information you might already have and hopefully this won't be too much work for you! I just want to make sure I am including you all and doing so with accurate and updated information. If you could send it to me before September 13, that would be much appreciated. I can send a few reminders along the way, too.

I so appreciate your help with this! Let me know if you have any questions or would rather jump on the phone and chat through it.

Warmly,
Jamie

Jamie Albrecht

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: [Trevor Jacobson](#); [Bruce Curtis](#)
Cc: [Mitigation](#)
Subject: RE: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, September 6, 2023 5:38:00 PM
Attachments: [image002.png](#)

Thanks so much!!

From: Trevor Jacobson <trevor@easydoesitservices.org>
Sent: Tuesday, September 5, 2023 10:27 AM
To: Albrecht, Jamie <JAlbrecht@berkeleyca.gov>; Bruce Curtis <bruce@easydoesitservices.org>
Cc: Mitigation <Mitigation@berkeleyca.gov>
Subject: RE: Berkeley Mitigation Plan – Invitation to Participate

WARNING: This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Hey Jamie,

Thanks, and likewise! I appreciate the opportunity to contribute to the 2024 Local Hazard Mitigation Plan. I'll be sure to send our feedback by the 12th.

Thank again,



Trevor Jacobson (he/him/his)
Outreach Coordinator

Phone (510) 438-1647 Fax (510) 845-2115
Web easydoesitservices.org Email trevor@easydoesitservices.org
PO Box 3365 Berkeley, CA 94703-2480
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From: Albrecht, Jamie <JAlbrecht@berkeleyca.gov>
Sent: Wednesday, August 30, 2023 1:51 PM
To: Trevor Jacobson <trevor@easydoesitservices.org>; Bruce Curtis <bruce@easydoesitservices.org>
Cc: Mitigation <Mitigation@berkeleyca.gov>
Subject: Berkeley Mitigation Plan – Invitation to Participate

Hi Trevor and Bruce,

I hope that you both have been doing well! It's been nice to get to know you both a little bit more through the luncheon and the recent meetings. I wanted to reach out about something a bit different that I am currently working on, which is updating our [2024 Local Hazard Mitigation Plan](#). The linked website has the 2019 Plan.

The Local Hazard Mitigation Plan is a big, public document with strict requirements provided by the Federal Emergency Management Agency that addresses Berkeley's natural hazards, like earthquakes, extreme heat, and wildfires. It also establishes a 5-year mitigation strategy to better protect the community in the next disaster, focused on actions that reduce risk before a disaster happens, like retrofitting buildings. As a key part of the Berkeley Community and partner to the City, I hope you will be considering contributing to the plan development process by sharing the following:

1. Your role in the Berkeley community, and any functions you have before, during, or after a disaster
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well as all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["atheile@ebparks.org"](mailto:atheile@ebparks.org)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Friday, September 1, 2023 11:29:00 AM

Dear Aileen,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community (I personally benefit so much from our regional parks, so thank you thank you!). Second, I'd like to invite you to contribute to our 2024 Local Hazard Mitigation Plan.

The City of Berkeley is currently updating its [2024 Local Hazard Mitigation Plan](#). The LHMP is a public document that addresses Berkeley's natural hazards and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key partner to the City of Berkeley, you are invited to participate in the plan development process.

We like to include the following information from key partners in our plan:

1. Description of your main functions and any disaster related work you do
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are including sections on the following hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. Any actions you recommend the City take to reduce disaster risk? Or actions you want to or are currently working on with the City on to reduce risk? (I know you're collaborating quite a bit with our Parks, Recreation, and Waterfront Department on some exciting grant opportunities, so we will definitely be highlight those, but feel free to share anything you want related to that work!)
4. What work in reducing disaster risk in Berkeley does PG&E want to highlight or share from the last five years?

We hope you will take this as a great opportunity to inform the community about your concerns and all your hard work to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers

Emergency Services Coordinator
City of Berkeley Office of Emergency Services
e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["mblagg@bart.gov"](mailto:mblagg@bart.gov)
Subject: Berkeley Mitigation Plan – Invitation to Participate - BART
Date: Friday, September 1, 2023 10:52:00 AM

Dear Marla,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our 2024 Local Hazard Mitigation Plan.

The City of Berkeley is currently updating its [2024 Local Hazard Mitigation Plan](#). The LHMP is a public document that addresses Berkeley's natural hazards and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key partner to the City of Berkeley, you are invited to participate in the plan development process.

We're interested in hearing from you:

1. Description of your main functions and any disaster related work your agency does
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk in Berkeley does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to inform the community about your concerns and all your hard work to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,

Jamie

Jamie Albrecht

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["sslaughter@peralta.edu"](mailto:sslaughter@peralta.edu)
Subject: Berkeley Mitigation Plan – Invitation to Participate - Berkeley City College
Date: Friday, September 1, 2023 10:42:00 AM

Dear Shirley,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our 2024 Local Hazard Mitigation Plan.

The City of Berkeley is currently updating its [2024 Local Hazard Mitigation Plan](#). The LHMP is a public document that addresses Berkeley's natural hazards and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key partner to the City of Berkeley, you are invited to participate in the plan development process.

We're interested in hearing from you:

1. Description of your main functions and any disaster related work you do
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to inform the community about your concerns and all your hard work to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,

Jamie

Jamie Albrecht

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["kwilliams@byaonline.org"](mailto:kwilliams@byaonline.org)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Friday, September 1, 2023 10:37:00 AM

Dear Kevin,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. We've been on some emails together, but haven't had a chance to really meet yet. First, I want to thank you for all that you do to serve the Berkeley community. Second, I wanted to share with you a project that I am working on and hope you will consider offering your insights!

The City of Berkeley is currently updating its [2024 Local Hazard Mitigation Plan](#). The LHMP is a public document that addresses Berkeley's natural hazards and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key partner to the City of Berkeley, you are invited to participate in the plan development process.

I'd love to include the following information from you:

1. Your role in the Berkeley community, and any functions you have before, during, or after a disaster
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator

City of Berkeley Office of Emergency Services
e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: [Jane Andersen](#)
Cc: [Mitigation](#)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, August 30, 2023 2:02:00 PM

Hi Jane,

It's been too long! I hope you've been well since we last spoke. It would be great to catch up soon, if you have the time! You might remember from when we met that I described my major project being the 2024 update to the Local Hazard Mitigation Plan. It's been taking up so much of my time that I am sorry I haven't been more in touch.

Anyways, I am reaching out because it's always been super important to the Plan to include updates from key City partners. I'd love to include the following from the Pathwanderers, if you wouldn't mind sharing:

1. Brief description of the organization and what you do
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What mitigation actions or successes does your organization want to highlight from the last five years?

We hope you will take this as a great opportunity to inform the community about your concerns and all your hard work to keep Berkeley safe. **If you could please provide your feedback before September 12, I would super appreciate it.** I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services
e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["deborah@ecologycenter.org"](mailto:deborah@ecologycenter.org)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, August 30, 2023 1:56:00 PM

Dear Debbie,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our [2024 Local Hazard Mitigation Plan](#).

The Plan is a public document that addresses Berkeley's natural hazards, like earthquakes, extreme heat, and wildfires, and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key part of the Berkeley Community and partner to the City, I hope you will consider contributing to the plan development process.

We'd love to include the following information from you:

1. Your role in the Berkeley community, and any functions you have before, during, or after a disaster
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator

City of Berkeley Office of Emergency Services
e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["jzerwekh@berkeleyhumane.org"](mailto:jzerwekh@berkeleyhumane.org)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, August 30, 2023 1:53:00 PM

Dear Jeffery,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our [2024 Local Hazard Mitigation Plan](#).

The Plan is a public document that addresses Berkeley's natural hazards, like earthquakes, extreme heat, and wildfires, and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key part of the Berkeley Community and partner to the City, I hope you will consider contributing to the plan development process.

We'd love to include the following information from you:

1. Your role in the Berkeley community, and any functions you have before, during, or after a disaster
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["ajafasah@gmail.com"](mailto:ajafasah@gmail.com)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, August 30, 2023 1:52:00 PM

Dear Aja,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our [2024 Local Hazard Mitigation Plan](#).

The Plan is a public document that addresses Berkeley's natural hazards, like earthquakes, extreme heat, and wildfires, and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key part of the Berkeley Community and partner to the City, I hope you will consider contributing to the plan development process.

We'd love to include the following information from you:

1. Your role in the Berkeley community, and any functions you have before, during, or after a disaster
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["htmgr@amcllc.net"](mailto:htmgr@amcllc.net)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, August 30, 2023 1:41:00 PM

Dear Salvador,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our [2024 Local Hazard Mitigation Plan](#).

The Plan is a public document that addresses Berkeley's natural hazards, like earthquakes, extreme heat, and wildfires, and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key part of the Berkeley Community and partner to the City, I hope you will consider contributing to the plan development process.

We'd love to include the following information from you:

1. Your role in the Berkeley community, and any functions you have before, during, or after a disaster
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["lbranford@ymcaeastbay.org"](mailto:lbranford@ymcaeastbay.org)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, August 30, 2023 1:40:00 PM

Dear Liz,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our [2024 Local Hazard Mitigation Plan](#).

The Plan is a public document that addresses Berkeley's natural hazards, like earthquakes, extreme heat, and wildfires, and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key part of the Berkeley Community and partner to the City, I hope you will consider contributing to the plan development process.

We'd love to include the following information from you:

1. Your role in the Berkeley community, and any functions you have before, during, or after a disaster
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What work in reducing disaster risk does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["frostiesmith73@gmail.com"](mailto:frostiesmith73@gmail.com)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, August 30, 2023 1:38:00 PM

Dear Pastor Mike,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our [2024 Local Hazard Mitigation Plan](#).

The Plan is a public document that addresses Berkeley's natural hazards, like earthquakes, extreme heat, and wildfires, and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key part of the Berkeley Community and partner to the City, I hope you will consider contributing to the plan development process.

We'd love to include the following information from you:

1. Your role in Berkeley community, and any functions you have before, during, or after a disaster
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What actions or successes in reducing disaster risk does your organization want to share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["jgriffith@edrobertscampus.org"](mailto:jgriffith@edrobertscampus.org)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Wednesday, August 30, 2023 1:36:00 PM

Dear Josh,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley. First, I want to thank you for all that you do to serve the Berkeley community. Second, I'd like to invite you to contribute to our [2024 Local Hazard Mitigation Plan](#).

The Plan is a public document that addresses Berkeley's natural hazards, like earthquakes, extreme heat, and wildfires, and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key part of the Berkeley Community and partner to the City, I hope you will consider contributing to the plan development process.

We'd love to include the following information from you:

1. Your role in Berkeley community, and any functions you have before, during, or after a disaster
2. Any key vulnerabilities or concerns you have related to natural hazards in Berkeley. In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you recommend the City take to reduce disaster risk?
4. What actions or successes in reducing disaster risk does your organization want to share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers
Emergency Services Coordinator
City of Berkeley Office of Emergency Services
e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Mitigation](#)
To: ["natalia@lapena.org"](mailto:natalia@lapena.org)
Subject: Berkeley Mitigation Plan – Invitation to Participate
Date: Friday, September 1, 2023 11:59:00 AM

Dear Natalia,

My name is Jamie Albrecht, and I am an Emergency Services Coordinator with the City of Berkeley's Office of Emergency Services. I believe we've been on some emails together, but haven't had a chance to really meet yet. I have had the chance to meet some of your amazing staff, however!

First, I want to thank you for all that you do to serve the Berkeley community. Second, I wanted to share with you a project that I am working on and hope you will consider offering your insights!

The City of Berkeley is currently updating its [2024 Local Hazard Mitigation Plan](#). The LHMP is a public document that addresses Berkeley's natural hazards and establishes a 5-year mitigation strategy to better protect the community in the next disaster. As a key partner to the City of Berkeley, I wanted to invite you to participate in the plan development process.

We're hoping to include the following information from community partners in the Plan:

1. Your role in the Berkeley community, and any functions you have/take on related to disasters
2. What vulnerabilities or concerns do you have for Berkeley related to natural hazards? In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you want the City to take to reduce disaster risk?
4. What work in reducing disaster risk does your organization want to highlight or share from the last five years?

We hope you will take this as a great opportunity to share your concerns as well all that you do to keep Berkeley safe. With this information, we can take better and more informed actions as City and as a Berkeley community.

Please provide your feedback by replying to this email before September 12. I will follow up a few times between now and then to provide a reminder. Please let me know if you have any questions or want to hop on a call.

Thank you again for your help with this Plan and for all that you do for Berkeley!

Warmly,
Jamie

Jamie Albrecht
she/her/hers

Emergency Services Coordinator
City of Berkeley Office of Emergency Services
e | jalbrecht@cityofberkeley.info p | (510) 981-5577

From: [Albrecht, Jamie](#)
To: "Seamus Wilmot"
Subject: RE: Berkeley Mitigation Plan – Invitation to Participate
Date: Friday, September 1, 2023 3:46:00 PM

Appreciate you! Have a great weekend!

Jamie Albrecht

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | j.albrecht@cityofberkeley.info p | (510) 981-5577

From: Seamus Wilmot <swilmot@berkeley.edu>
Sent: Friday, September 1, 2023 1:13 PM
To: Albrecht, Jamie <JAlbrecht@berkeleyca.gov>
Subject: Re: Berkeley Mitigation Plan – Invitation to Participate

WARNING: This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Thanks Jamie,

I will get something back to you before the 13th.

Have a great weekend,

Thanks,
Seamus

Seamus Wilmot

Assistant Vice Chancellor and

Executive Director Business Operations

UC Berkeley

swilmot@berkeley.edu

(510) 643-7700

**1995 University Ave, Ste 325
Berkeley, CA 94704-5746**

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<https://mailservices.berkeley.edu/>

<https://oem.berkeley.edu/>

On Fri, Sep 1, 2023 at 11:48 AM Albrecht, Jamie <JAlbrecht@berkeleyca.gov> wrote:

Dear Seamus,

Hope you're having a good week and that you have a relaxing long weekend ahead of you! It's been nice to get to know you a little bit on our bi-monthly calls. I am looking forward to continuing to work together.

I am reaching out because I am leading the City's effort to update the [2024 Local Hazard Mitigation Plan](#). One thing we always do in our plan development stage is to reach out the City partners and offer them an opportunity to add to the Plan. Here's what we're hoping to capture:

1. Short description of UC Berkeley and the work you all do before, during, and after a disaster
2. What concerns or vulnerabilities related to natural hazards do you have for UC Berkeley that you think are worth mentioning in our Plan? In the 2024 update to the LHMP, we are considering the following natural hazards: earthquake, wildfire, tsunami, landslide, poor air quality, extreme heat, utility disruption, sea level rise, high wind events, and flooding.
3. What actions do you think the City should take to reduce risk? Are there areas where you would like to see UC and the City work on together?
4. What work in reducing disaster risk does UC want to highlight or share from the last five years?
5. Anything else related to disaster mitigation that you want to include, please let me know

I am hoping this is information you might already have and hopefully this won't be too much work for you! I just want to make sure I am including you all and doing so with accurate and updated information. If you could send it to me before September 13, that would be much appreciated. I can send a few reminders along the way, too.

I so appreciate your help with this! Let me know if you have any questions or would rather jump on the phone and chat through it.

Warmly,
Jamie

Jamie Albrecht

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | jalbrecht@cityofberkeley.info p | (510) 981-5577



DISASTER AND FIRE SAFETY COMMISSION REGULAR MEETING

**September 27, 2023
7:00 PM**

Fire Department Division of Training Classroom – 997 Cedar Street

Present: Mike Wilson, Andy Katz, Weldon Bradstreet, Shirley Dean, Robert Kinosian, Theo Gordon, Greg Murphy, Harrison Raine
Absent: Todd Darling
Staff: Keith May, Leah Greenbaum, Sarah Lana
Public: 9 attendees

AGENDA

Preliminary Matters Call to Order

Meeting called to order at 7:06 pm

Approval of the Agenda

Motion to approve minutes: G. Murphy

Second: T. Gordon

Vote: 5 Ayes: M. Wilson, A. Katz, W. Bradstreet, S. Dean, R. Kinosian, T. Gordon, G. Murphy, H. Raine; 0 Noes; 1 Absent: T. Darling; 0 Abstain

Raine arrived at 7:09 pm

Public Comment on Non-Agenda Matters

Public comment: 1

1. Chairperson's Report
2. Fire Department Staff Report*

Consent Items

3. Minutes of August 2, 2023*
From: Commission Secretary
Recommendation: Approve the draft minutes of the August 2, 2023 Regular Meeting.

Motion to approve minutes: S. Dean
Second: G. Murphy
Vote: 5 Ayes: M. Wilson, A. Katz, W. Bradstreet, S. Dean, R. Kinosian, T. Gordon, G. Murphy, H. Raine; 0 Noes; 1 Absent: T. Darling; 0 Abstain
4. Minutes of September 6, 2023*
From: Commission Secretary
Recommendation: Approve the draft minutes of the September 6, 2023 Special Meeting.

Motion to approve minutes: S. Dean
Second: T. Gordon
Vote: 5 Ayes: M. Wilson, A. Katz, W. Bradstreet, S. Dean, R. Kinosian, T. Gordon, G. Murphy, H. Raine; 0 Noes; 1 Absent: T. Darling; 0 Abstain

Action Items

5. Request that the Commission forward the Janice Thomas' August 27, 2023 letter "RE: State Fire Marshal's Recommendation For Panoramic Hill" to City Council, UC Berkeley President, and the UC President and Board * (Dean)
Public comments: 2

After discussion, Dean pulled this item from the action calendar and will draft a letter of support for the Commission to consider at the next meeting.

At the meeting, Ms. Thomas distributed printed materials to commissioners. Those materials were added to the online agenda packet after the meeting.

Discussion Items

6. Staff presentation on 2024 Local Hazard Mitigation Plan update process* (Staff)
Public comments: 3

7. Discussion on impact of increased density due to new developments along Shattuck/Adeline (Darling)

Chair moved this item to next meeting.

8. Discussion on biolabs and other large facilities, hazardous materials contained therein, and potential emergency response impacts and challenges (Dean)

Dean pulled item and requested Commission consider it as an action item at the next meeting. Dean will draft attachment for consideration at the next meeting.

9. Discussion to write a Commendation to Chief Sprague for the Master Facilities Plan (Dean)

Dean pulled item and requested Commission consider it as an action item at the next meeting. Dean will draft attachment for consideration at the next meeting.

10. Update on the City's progress of evaluating and regulating non-ductile concrete structures* (Murphy)

This item was not discussed at the meeting, but Commissioner Murphy offered a written report.

Work Group Reports

- Plan & Budget Oversight
- Home Hardening
- Wildland Urban Interface
- Safe Passages
- Community Outreach

No workgroup report outs—pushed to next meeting due to time.

11. Future Agenda Items and Next Steps

- Discussion regarding concerns about the recent State Housing and Community Development ruling which would increase density in Fire Zones 2 and 3 (Dean)
- Discussion on impact of increased density due to new developments along Shattuck/Adeline (Darling)

- Request that the Commission forward the Janice Thomas' August 27, 2023 letter "RE: State Fire Marshal's Recommendation For Panoramic Hill" to City Council, UC Berkeley President, and the UC President, City of Oakland, and Board of Forestry with a letter of support from the Commission (Dean)
- Discussion on biolabs and other large facilities, hazardous materials contained therein, and potential emergency response impacts and challenges (Dean)
- Discussion to write a Commendation to Chief Sprague for the Master Facilities Plan (Dean)

Adjournment

Meeting adjourned at 9:05pm

Motion to adjourn: G. Murphy

Second: S. Dean

Vote: 5 Ayes: M. Wilson, A. Katz, W. Bradstreet, S. Dean, R. Kinoshian, T. Gordon, G. Murphy, H. Raine. 0 Noes; 1 Absent: T. Darling; 0 Abstain

This meeting will be conducted in accordance with the Brown Act, Government Code Section 54953. Any member of the public may attend this meeting. Questions regarding this matter may be addressed to Keith May, kmay@berkeleyca.gov 510-981-5508.

Communications to Berkeley boards, commissions or committees are public record and will become part of the City's electronic records, which are accessible through the City's website. Please note: E-mail addresses, names, addresses, and other contact information are not required but, if included in any communication to a City board, commission, or committee, will become part of the public record. If you do not want your e-mail address or any other contact information to be made public, you may deliver communications via U.S. Postal Service or in person to the secretary of the relevant board, commission, or committee. If you do not want your contact information included in the public record, please do not include that information in your communication. Please contact the secretary to the relevant board, commission, or committee for further information.

Any writings or documents provided to a majority of the commission regarding any item on this agenda will be made available for public inspection at Berkeley Fire Department located at 2100 Martin Luther King Jr. Way Berkeley, CA.



COMMUNICATION ACCESS INFORMATION:

This meeting is being held in a wheelchair-accessible location. To request a disability-related accommodation(s) to participate in the meeting, including auxiliary aids or services, please contact the Disability Services specialist at 981-6418 (V) or 981-6347 (TDD) at least three business days before the meeting date. Please refrain from wearing scented products to this meeting.

I hereby certify that the agenda for this regular/special meeting of the Berkeley City's Disaster and Fire Safety Commission was posted at the front of the Division of Training, 997 Cedar Street, as well as on the City's website, three days prior to the scheduled Commission meeting.

Internal
Internal

SECRETARY SIGNATURE

Keith May

10/26/2023

Internal

Local Hazard Mitigation Plan (LHMP) Update Process

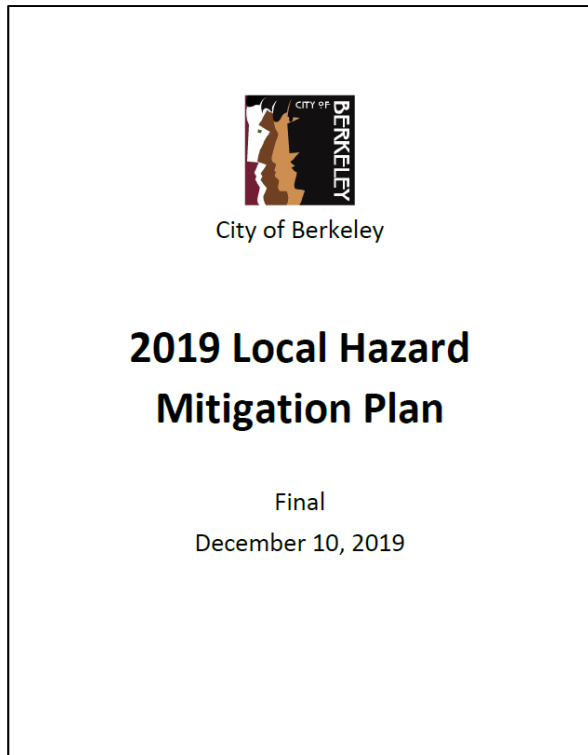
Disaster and Fire Safety Commission

September 27, 2023

Agenda

- Local Hazard Mitigation Plan (LHMP) Elements
- 2024 Updates
- DFSC Role in 2024 Plan Update Process
- Community Outreach Plan
- Plan Review and Approvals Process

Local Hazard Mitigation Plan



- Appendix to City's General Plan
- Adopted 2004, 2014, 2019
- Required by the Federal Emergency Management Agency every 5 years to **remain eligible for post-disaster recovery money and hazard mitigation funds**
- Collects and presents:
 - City's funded activities
 - Proposed activities that require additional funding

Mitigation + Preparedness = Readiness

- Mitigation: Reduce or eliminate disaster impacts
- Preparedness: Increase emergency response capability



Mitigation + Preparedness = Readiness

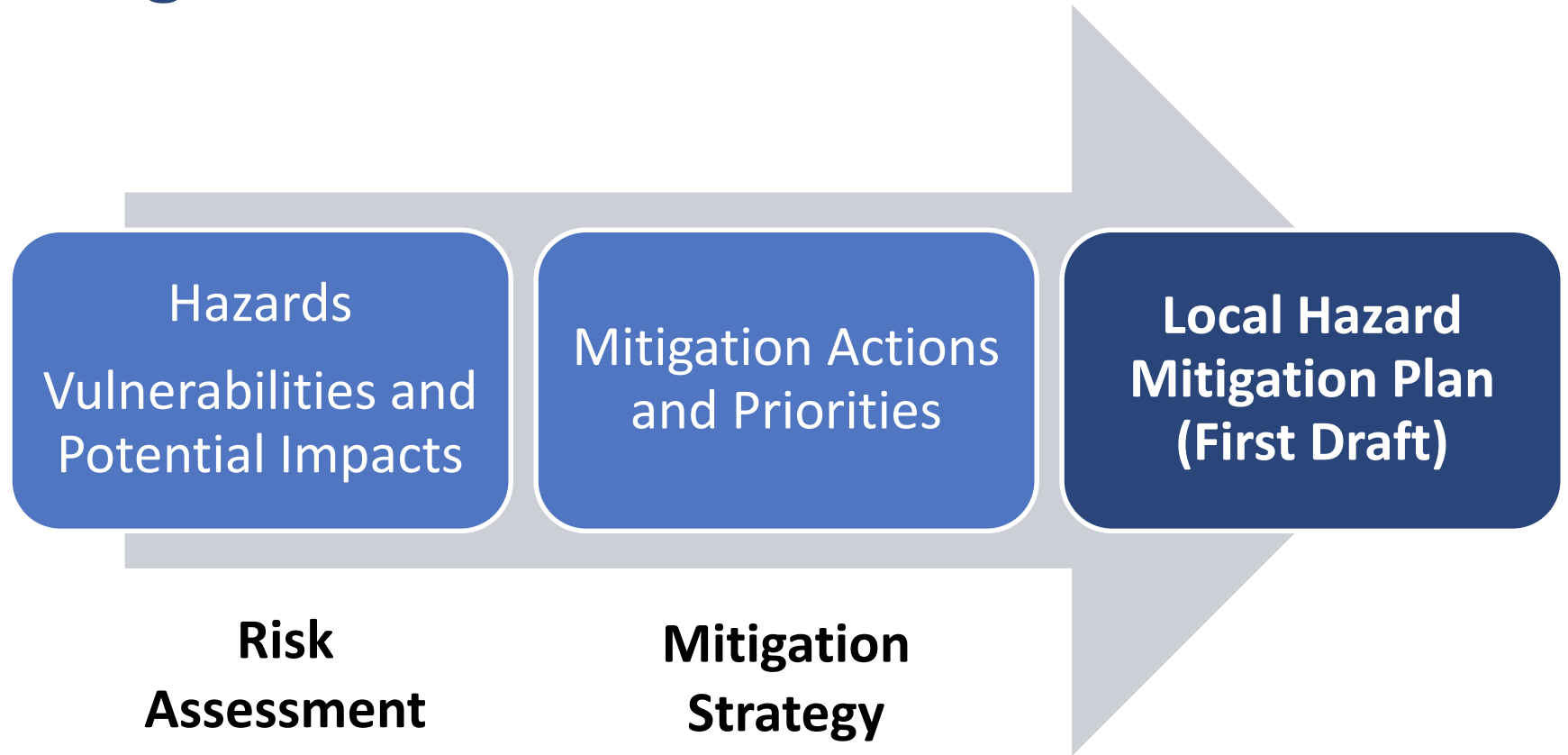
Mitigation:

- Strengthening structures
- Making land use decisions that will minimize damage
- Vegetation management and home hardening in fire-risk areas
- Strapping down water heaters

Preparedness:

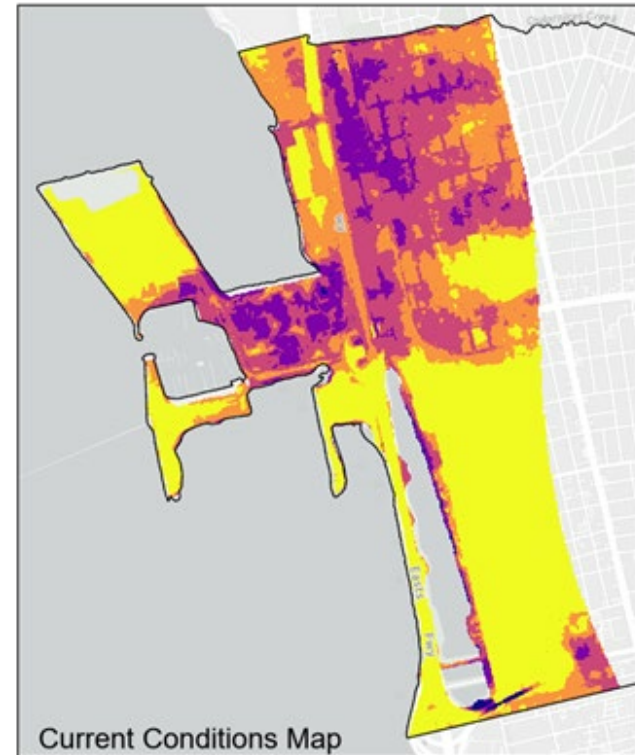
- Purchasing equipment to use in emergency response
- Conducting disaster response drills
- Storing disaster supplies

Mitigation Plan Elements



2024 Risk Assessment: Key Updates

- Updated hazard science
- New mapping and analysis
- Integrated climate change and environmental justice concerns throughout
- 5 new hazards of concern



Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community Pathways
Climate Institute, San Francisco Estuary Institute



Risk Assessment: Hazards of concern

2019	2024
Earthquake	Earthquake
Wildland-Urban Interface Fire	Wildland-Urban Interface Fire
Landslide	Landslide
Flood	Flood
Tsunami	Tsunami
Climate change	Climate change *
Extreme heat	Extreme heat
Hazardous materials release	Hazardous materials release
	Sea level rise and Shallow Groundwater Rise
	Poor Air Quality
	Wind
	Utility Disruption
	Infectious Disease

*2024: climate change will be integrated into every hazard and in the plan's overarching framing

2024 Mitigation Strategy: Key Updates

- Progress on 2019 actions
- New actions
- Re-prioritize actions



New in 2024: Evacuation Analysis

- Included to meet new State requirements
 - SB 99: Residential developments with 1 way out
 - AB 747: Evacuation routes, capacities, safety, viability
 - AB 1409: Evacuation locations
- Will include **preliminary analysis** from Evacuation Time Study

DFSC Roles & Responsibilities

- “Advise the City Council on all matters affecting fire safety and/or disaster resilience within Berkeley”
- Timeline: Winter 2023 through Fall 2024
- Host 2 public meetings (along with Planning Commission)
 - **Meeting 1:** First Draft LHMP (Dec 2023 or Jan 2024)
 - Action (optional): Commission feedback on Mitigation Strategy
 - **Meeting 2:** Final Draft (est. Oct 2024)
 - Action: Recommend Final Draft Plan adoption by Council

DFSC Engagement



Community Outreach Plan

- Post Plan to website; physical copies at City Hall
- Staff presentations at DFSC and Planning Commission
- Accessible, hazard-specific education
 - Community meetings
 - Online videos
- Receive feedback
 - In-person meetings
 - Online (feedback collection tool; Mitigation@BerkeleyCA.gov)
 - Postal mail/comment drop-off at Public Safety Building

LHMP Review and Approvals Process





Planning Commission

FINAL MINUTES OF THE REGULAR PLANNING COMMISSION MEETING

October 4, 2023

The meeting was called to order at 5:33 p.m.

Location: North Berkeley Senior Center, 1901 Hearst Avenue, Berkeley, CA 94709

1. ROLL CALL:

Commissioners Present: Blaine Merker, Jeff Vincent, John E. Moore, Christina Oatfield, Emily Marthinsen, Elisa Mikiten, Alfred Twu, Savlan Hauser, and Barnali Ghosh.

Commissioner Absent: None.

Staff Present: Secretary Alisa Shen, Clerk Zoe Covello, Grace Wu, Justin Horner, Sarah Lana, and Eleanor Hollander.

2. LAND ACKNOWLEDGEMENT.

Commissioner Ghosh shared that Indigenous Peoples Day Powwow and Indian Market will be held at Civic Center Park on Saturday, October 7th from 10am to 6pm.

The City of Berkeley recognizes that the community we live in was built on the territory of xučyun (Huchiun (Hooch-yoon)), the ancestral and unceded land of the Chochenyo (Chochen-yo)-speaking Ohlone (Oh-low-nee) people, the ancestors and descendants of the sovereign Verona Band of Alameda County. This land was and continues to be of great importance to all of the Ohlone Tribes and descendants of the Verona Band. As we begin our meeting tonight, we acknowledge and honor the original inhabitants of Berkeley, the documented 5,000-year history of a vibrant community at the West Berkeley Shellmound, and the Ohlone people who continue to reside in the East Bay. We recognize that Berkeley's residents have and continue to benefit from the use and occupation of this uncanceled stolen land since the City of Berkeley's incorporation in 1878. As stewards of the laws regulating the City of Berkeley, it is not only vital that we recognize the history of this land, but also recognize that the Ohlone people are present members of Berkeley and other East Bay communities today. The City of Berkeley will continue to build relationships with the Lisjan Tribe and to create meaningful actions that uphold the intention of this land acknowledgement.

3. ORDER OF AGENDA: No changes.

4. PUBLIC COMMENT PERIOD: 0.

5. PLANNING STAFF REPORT:

- On Tuesday, October 3rd, City Council adopted the first reading of the City's new ADU ordinance.
- The City of Berkeley and North Berkeley Housing Partners held a North Berkeley BART Community Meeting and Open House on September 11th
 - City presented draft Objective Design Standards (ODS) and the North Berkeley Housing Partners presented a preliminary development concept
 - Staff is intending to bring this item to the Planning Commission in a special meeting on October 18th
- A public draft of the Waterfront Specific Plan is available for review and comments are currently being accepted - <https://berkeleyca.gov/your-government/our-work/capital-projects/waterfront-specific-plan>
 - A City Council worksession is planned to be held on Thursday, November 2nd
- On Tuesday November 14th, the Southside Zoning amendments going to City Council for a first reading

Information Items: None.

Communications:

- General.

Late Communications: *See agenda for links.*

- Supplemental Packet One.

6. CHAIR REPORT:

- Chair Vincent shared that there was a celebration of life for Gene Poschman published in Berkeleyside recently. Mr. Poschman served as the Chair of the Planning Commission when Chair Vincent started, as well as on the Zoning Adjustments Board and many other commissions.

7. COMMITTEE REPORT: Reports by Commission committees or liaisons. In addition to the items below, additional matters may be reported at the meeting.

- None.

8. APPROVAL OF MINUTES:

Motion/Second/Carried (Twu/Vincent) to approve the Planning Commission Meeting Minutes from September 6, 2023.

Ayes: Merker, Vincent, Moore, Oatfield, Mikiten, Marthinsen, Twu, Hauser. Noes: None. Abstain: Ghosh. Absent: None. (8-0-1-0)

9. OTHER PLANNING RELATED EVENTS:

- Chair Vincent shared that PC may agendaize changing the start time of the Planning Commission at either the 10/18 or 11/1 meeting.

AGENDA ITEMS

10. Discussion: Local Hazard Mitigation Plan Presentation

Manager of OES Sarah Lana presented on the Local Hazard Mitigation Plan.

Public Comments: 0

11. Action: Public Hearing: Berkeley Business Amendments

Associate planner Justin Horner presented the proposed zoning ordinance amendments. Public comment was taken, draft amendments were discussed, and a recommendation to City Council was made.

Motion/Second/Carried (Vincent/Ghosh) to close the public hearing at 6:43pm.

Ayes: Merker, Vincent, Moore, Oatfield, Mikiten, Marthinsen, Twu, Hauser, Ghosh. Noes: None. Abstain: None. Absent: None. (9-0-0-0)

Public Comments: 2

Motion/Second/Carried (Mikiten/Moore) to recommend staff's proposed amendments with the modification to match the "Health and Fitness Facility, 7,500 sf or larger" row in Table 23.204-1 with the permits required for "Group Instruction 3,000 sf or larger" row for each district at 7:25pm

Ayes: Merker, Vincent, Moore, Oatfield, Mikiten, Marthinsen, Twu, Hauser, Ghosh. Noes: None. Abstain: None. Absent: None. (9-0-0-0)

Motion/Second/Carried (Oatfield/Mikiten) to adjourn the meeting at 7:39pm.

Ayes: Merker, Vincent, Moore, Oatfield, Mikiten, Marthinsen, Twu, Hauser, Ghosh. Noes: None. Abstain: None. Absent: None. (9-0-0-0)

Members in the public in attendance: 3

Public Speakers: 2

Length of the meeting: 2 hr 6 minutes

A handwritten signature in black ink, appearing to read 'Alisa Shen', positioned above a horizontal line.

Alisa Shen

Planning Commission Secretary

Local Hazard Mitigation Plan (LHMP) Update Process

Planning Commission

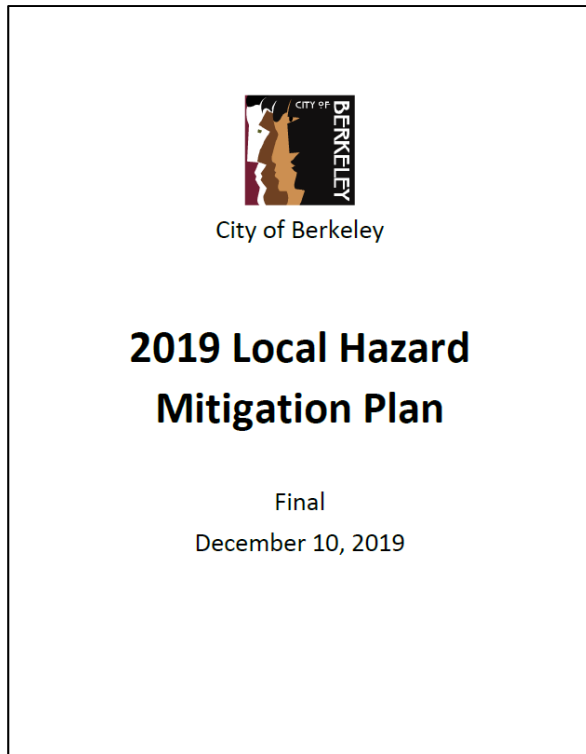
October 4, 2023



Agenda

- Local Hazard Mitigation Plan & Safety Element
- Berkeley Hazards and Mitigation
- Mitigation Plan Elements
- Planning Commission Role & Engagement
- Community Outreach Plan
- Approvals Process

Local Hazard Mitigation Plan



- Appendix to General Plan
- Collects and presents:
 - Updated hazard information
 - Mitigation activities – planned/funded and other proposals that require additional funding
- Adopted 2004, 2014, 2019
- Update required by December 2024 to maintain eligibility for post-disaster recovery money and hazard mitigation funding

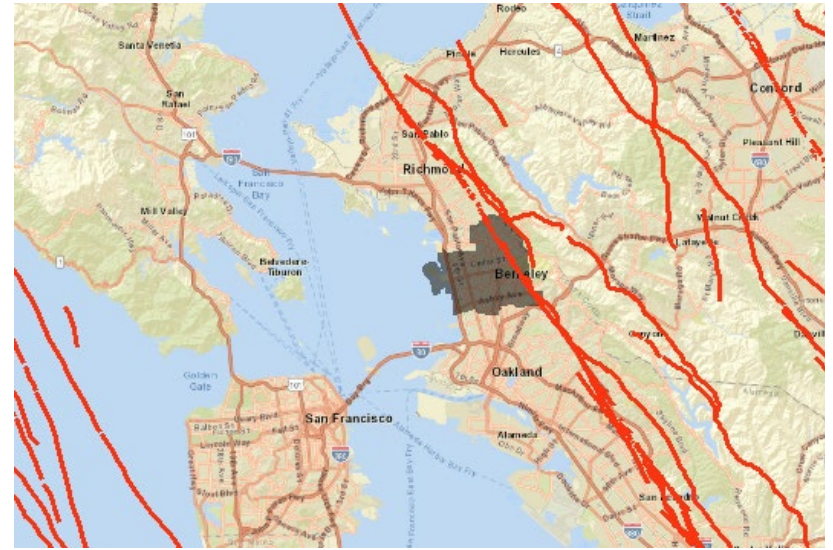


LHMP & General Plan Safety Element

2024 Local Hazard Mitigation Plan	Safety Element Update
Identify latest hazard information	Identify hazard information consistent with LHMP
Compile City's mitigation efforts into a 5-year mitigation strategy	Establish citywide goals, policies, actions: <ul style="list-style-type: none"> • Reduce risk from hazards • Address climate adaptation, resilience and equity
Provide analysis to meet new State evacuation planning requirements	Integrate evacuation analysis into Citywide goals, policies and actions
Updated every 5 years	Updated every 8 years

Hazards in Berkeley

- Earthquake
- Wildland-Urban Interface Fire
- Landslide
- Flood
- Tsunami
- Extreme Heat
- Hazardous Materials Release
- Sea Level Rise/Shallow Groundwater Rise
- Poor Air Quality
- Wind
- Utility Disruption
- Infectious Disease



Readiness = Mitigation + Preparedness

- Mitigation: Reduce or eliminate disaster impacts
- Preparedness: Increase emergency response capability





Readiness = Mitigation + Preparedness

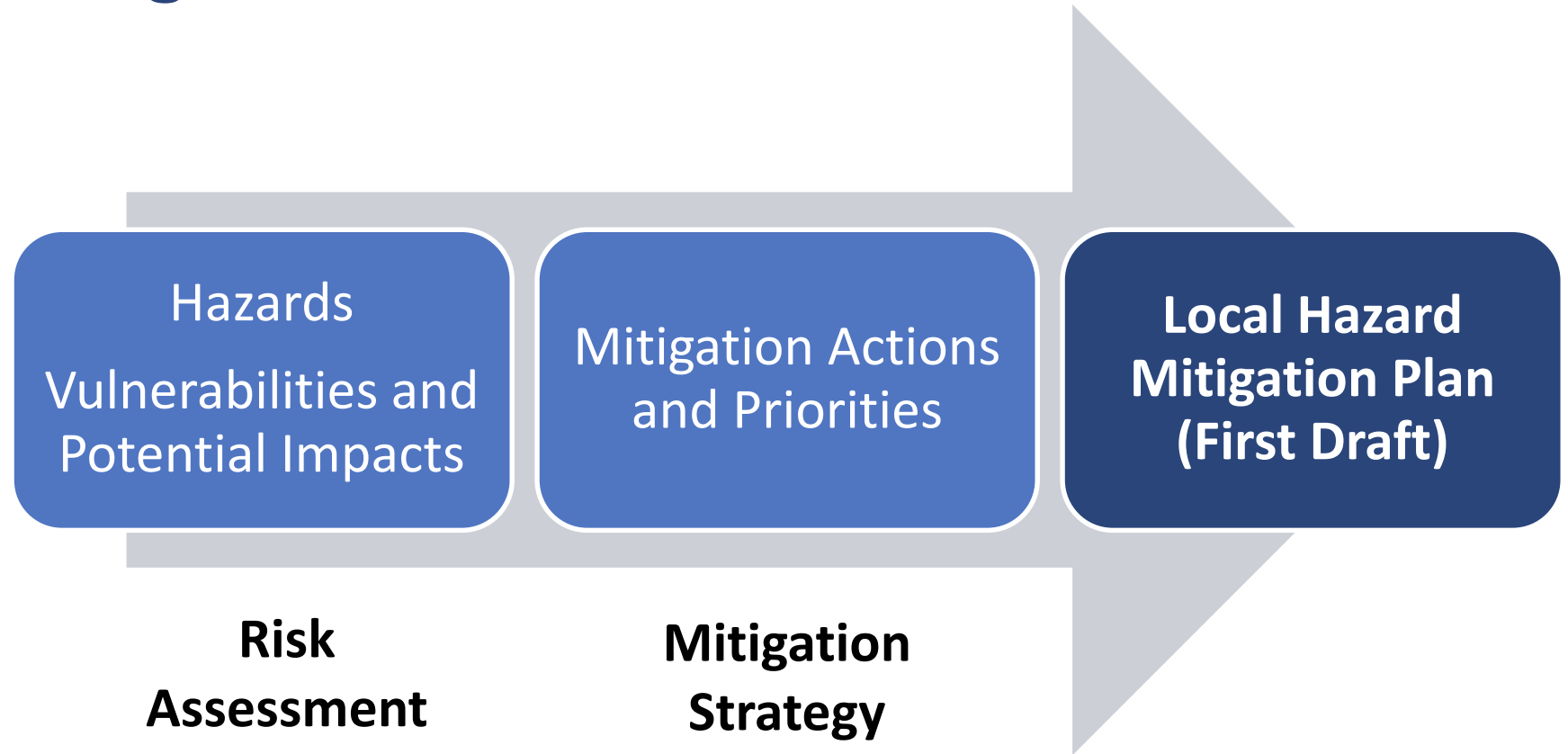
Mitigation:

- Strengthening structures
- Making land use decisions that will minimize damage
- Reducing vegetation in high-fire areas
- Strapping down water heaters

Preparedness:

- Purchasing equipment to use in emergency response
- Conducting disaster response drills
- Storage of disaster supplies

Mitigation Plan Elements





New in 2024: Evacuation Analysis

- Included to meet new State requirements
 - SB 99: Residential developments with 1 way out
 - AB 747: Evacuation routes, capacities, safety, viability
 - AB 1409: Evacuation locations
- Will include **preliminary analysis** from Evacuation Time Study



Planning Commission Role

- Timeline: Winter 2023 through Fall 2024
- Planning Commission Focus
 - Ensure consistency with the General Plan and process
 - Specific review of land use planning actions in Mitigation Strategy
- Host 2 public meetings (along with Disaster & Fire Safety Commission)
 - **Meeting 1:** First Draft LHMP (Dec 2023 or Jan 2024)
 - Action (optional): Commission feedback on Mitigation Strategy
 - **Meeting 2:** Final Draft (est. Oct 2024) ***First Public Hearing***
 - Action: Recommend Final Draft Plan adoption by Council

Planning Commission Engagement





Community Outreach Plan

- Post Plan to website; physical copies at City Hall
- Staff presentations at DFSC and Planning Commission
- Accessible, hazard-specific education
 - Community meetings
 - Online videos
- Receive feedback
 - In-person meetings
 - Online (feedback collection tool; Mitigation@BerkeleyCA.gov)
 - Postal mail/comment drop-off at Public Safety Building

LHMP Review and Approvals Process





Planning Commission

**FINAL MINUTES OF THE REGULAR PLANNING COMMISSION MEETING
June 5, 2024**

The meeting was called to order at 6:02 p.m.

Location: North Berkeley Senior Center, 1901 Hearst Avenue, Berkeley, CA 94709

- **ROLL CALL:**

Commissioners Present: Blaine Merker, Jeff Vincent, Christina Oatfield, Elisa Mikiten, Emily Marthinsen, Alfred Twu, Savlan Hauser, and Barnali Ghosh

Commissioner Absent: Chip Moore

Staff Present: Secretary Justin Horner, Clerk Brian Garvey, Zoe Covello, Ashley James, Jamie Albrecht, and Alisa Shen.

- **LAND ACKNOWLEDGEMENT.**

The City of Berkeley recognizes that the community we live in was built on the territory of xučyun (Huchiun (Hooch-yoon)), the ancestral and unceded land of the Chochenyo (Chochen-yo)-speaking Ohlone (Oh-low-nee) people, the ancestors and descendants of the sovereign Verona Band of Alameda County. This land was and continues to be of great importance to all of the Ohlone Tribes and descendants of the Verona Band. As we begin our meeting tonight, we acknowledge and honor the original inhabitants of Berkeley, the documented 5,000-year history of a vibrant community at the West Berkeley Shellmound, and the Ohlone people who continue to reside in the East Bay. We recognize that Berkeley's residents have and continue to benefit from the use and occupation of this uncanceled stolen land since the City of Berkeley's incorporation in 1878. As stewards of the laws regulating the City of Berkeley, it is not only vital that we recognize the history of this land, but also recognize that the Ohlone people are present members of Berkeley and other East Bay communities today. The City of Berkeley will continue to build relationships with the Lisjan Tribe and to create meaningful actions that uphold the intention of this land acknowledgement.

- **ORDER OF AGENDA:** No changes.
- **PUBLIC COMMENT PERIOD: 1**
- **PLANNING STAFF REPORT:**

- City Council approved contract for consultant team for College Ave, Shattuck Ave, and Solano Ave corridors upzoning. Project should start in summer 2024. Goal is to be done by end of 2026.
- Demolition Ordinance is scheduled for June 25 City Council Meeting.
- Two items for next meeting on July 17th: Public Hearing on Keep Innovation in Berkeley and Public Hearing on Technical Edits to Zoning Ordinance package.
- Reminder: June 26th Special Meeting is cancelled.

Information Items:

- Community Health Assessment (CHA) and Community Health Improvement Plan (CHIP)

Communications:

- General

Late Communications:

- None.

CHAIR REPORT:

- None.

- **COMMITTEE REPORT:** Reports by Commission committees or liaisons. In addition to the items below, additional matters may be reported at the meeting.

- None.

8. APPROVAL OF MINUTES:

Motion/Second/Carried (Merker/Hauser) to approve the Planning Commission Meeting Minutes from May 1, 2024.

Ayes: Merker, Vincent, Oatfield, Mikiten, Marthinsen, Twu, and Hauser.

Noes: None. Abstain: Ghosh. Absent: Moore (7-0-1-1)

9. OTHER PLANNING RELATED EVENTS:

- None.

AGENDA ITEMS

10. Discussion: Draft Local Hazard Mitigation Plan

Emergency Services Coordinator Jamie Albrecht presented on the draft Local Hazard Mitigation Plan (LHMP). The Commissioners took public comment, asked questions, and provided feedback on the proposed Plan.

Public Comments: 1

11. Discussion: General Plan Update: Disaster Preparedness & Safety, Environmental Justice, and Climate Metrics

Senior Planner Ashley James presented on the status of the general plan update. The Commissioners asked questions and provided feedback on the proposed updates.

Public Comments: 0

Motion/Second/Carried (Mikiten/Ghosh) to adjourn the meeting at 7:22 pm.

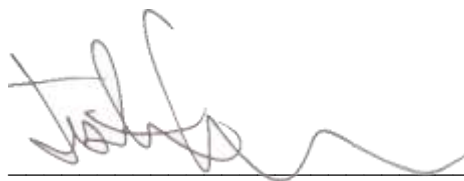
Ayes: Merker, Vincent, Oatfield, Mikiten, Marthinsen, Twu, Hauser, and Ghosh.

Noes: None. Abstain: None. Absent: Moore (8-0-0-1)

Members in the public in attendance: 3

Public Speakers: 2

Length of the meeting: 1 hr 20 min



Justin Horner, Planning Commission Secretary

2024 Local Hazard Mitigation Plan (LHMP)

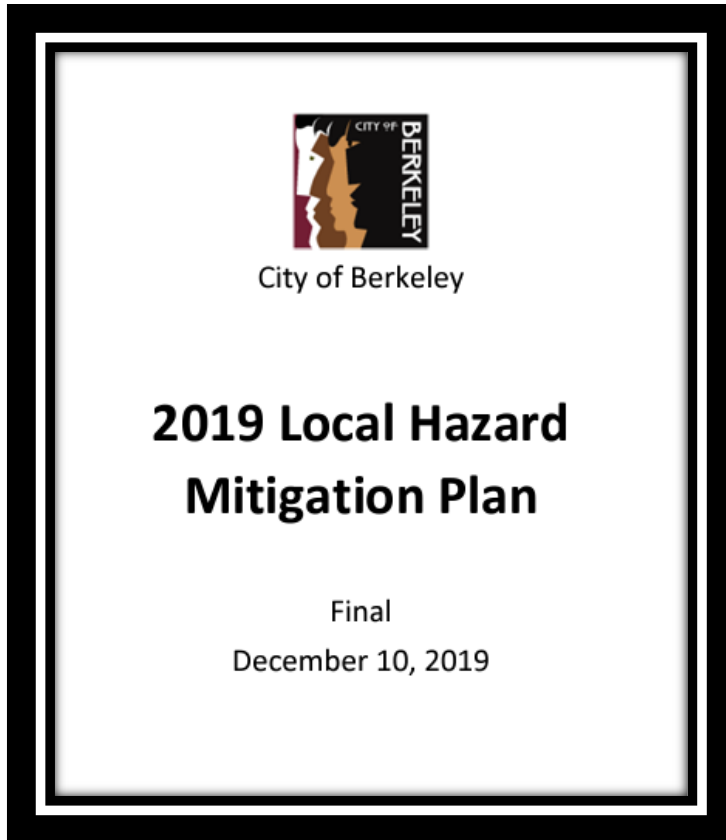
First Draft Plan

Planning Commission
June 5, 2024

Agenda

- Local Hazard Mitigation Plan (LHMP) Overview
- What is Hazard Mitigation?
- Plan Changes Since 2019
- First Draft Plan: Risk Assessment and Mitigation Strategy Updates
- Public Outreach
- Next Steps

Local Hazard Mitigation Plan



- Appendix to City's General Plan
- Adopted in 2004, 2014, and 2019
- Financial incentives (pre- and post-disaster)
- Public Review for First Draft: May 24 to July 31
- Key Plan Elements
 - B: Risk Assessment
 - C: Mitigation Strategy

What is Hazard Mitigation?

Hazard mitigation breaks the cycle of damage, by taking action now to reduce impacts later.

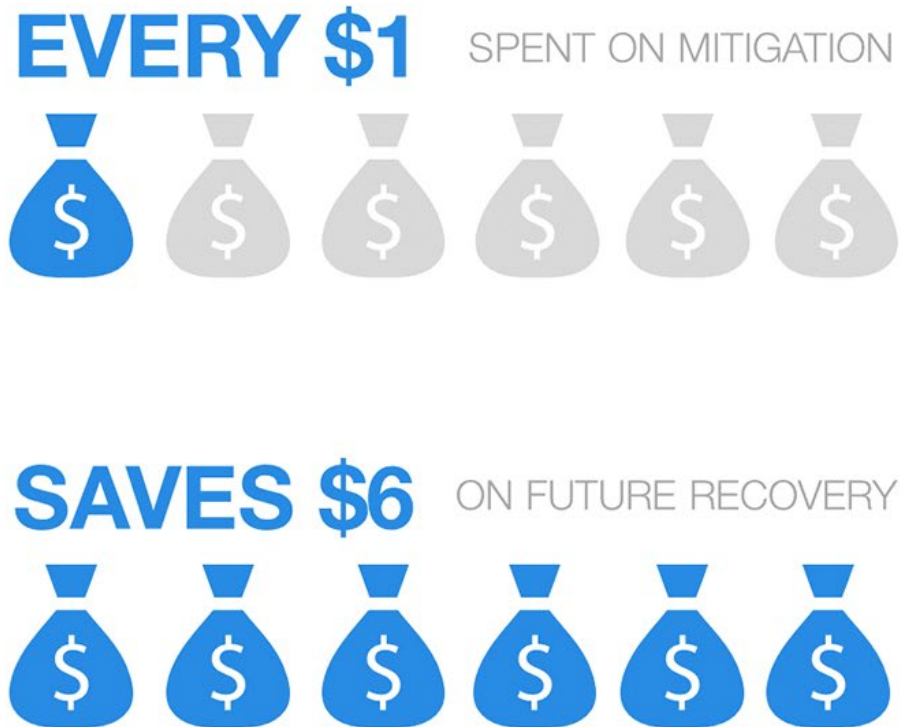


Image Credit: Boston.gov

Examples of mitigation activities

- Home hardening (like in top photo)
- Strengthening structures (like earthquake retrofits)
- Making land use decisions that will minimize damage
- Reducing vegetation in high-fire areas (like in bottom photo)
- Strapping down water heaters



Major Plan Changes Since 2019

New Hazards Included in the Plan

- High Wind
- Poor Air Quality
- Infectious Disease
- Utility Interruption
- Sea Level Rise

Individual and Household Actions

- Previous versions: Heavy focus on City government actions
- 2024 LHMP: And what can you do?
- Example: Earthquake
 - City: Retrofitting municipal buildings, facilitating grants
 - Household: bolting down furniture



First Draft Plan: Risk Assessment and Strategy Updates

Risk Assessment Summary

Hazard	Likelihood	Severity of Impact
Earthquake	Likely	Catastrophic
Wildland-Urban Interface Fire	Likely	Catastrophic
Extreme Heat	Likely	Moderate to Catastrophic
Poor Air Quality	Likely	Minor
High Wind	Likely	Minor
Rainfall-Triggered Landslide	Likely	Minor to Catastrophic
Tsunami	Possible	Minor to Catastrophic
Sea Level Rise	Likely	Minor to Major
Floods	Likely	Minor
Utility Interruption	Likely	Minor to Major
Hazardous Materials Release	Likely	Minor to Catastrophic
Infectious Disease	Likely	Minor to Catastrophic

Mitigation Strategy Summary

- 33 Actions
- Focus:
 - Current work with funding secured
 - Improvements to buildings, infrastructure, and wildfire mitigation (aligning with the Community Wildfire Protection Plan)
- New actions
 - Mitigating poor air quality, infectious disease, high winds, and utility interruption
 - New WUI fire mitigation measures
 - Action to improve the way we communicate hazard information to marginalized populations
 - Climate Equity Collaborative work to engage community partners in resilience work
 - Evacuation Time Study

Land Use Planning Actions

- Maintaining City participation in National Flood Insurance Program
- Ensuring new and existing developments and infrastructure are protected from floods due to sea level rise through the permitting process for new development and conditions
- Use development standards to ensure new development does not contribute to an increase in flood potential
- Streamline the rebuilding process: Give priority to project applications that would rebuild to current standards following disasters.
- Complete implementation of the Evacuation and Response Time Study to identify necessary roadway safety improvements, along with prioritized roadways, to facilitate safe evacuation during emergency scenarios.
 - Land Use Planning is involved by providing guidance on current and potential development that might impact evacuation
 - The results of this Study will be included in the update to the Safety Element

Public Outreach

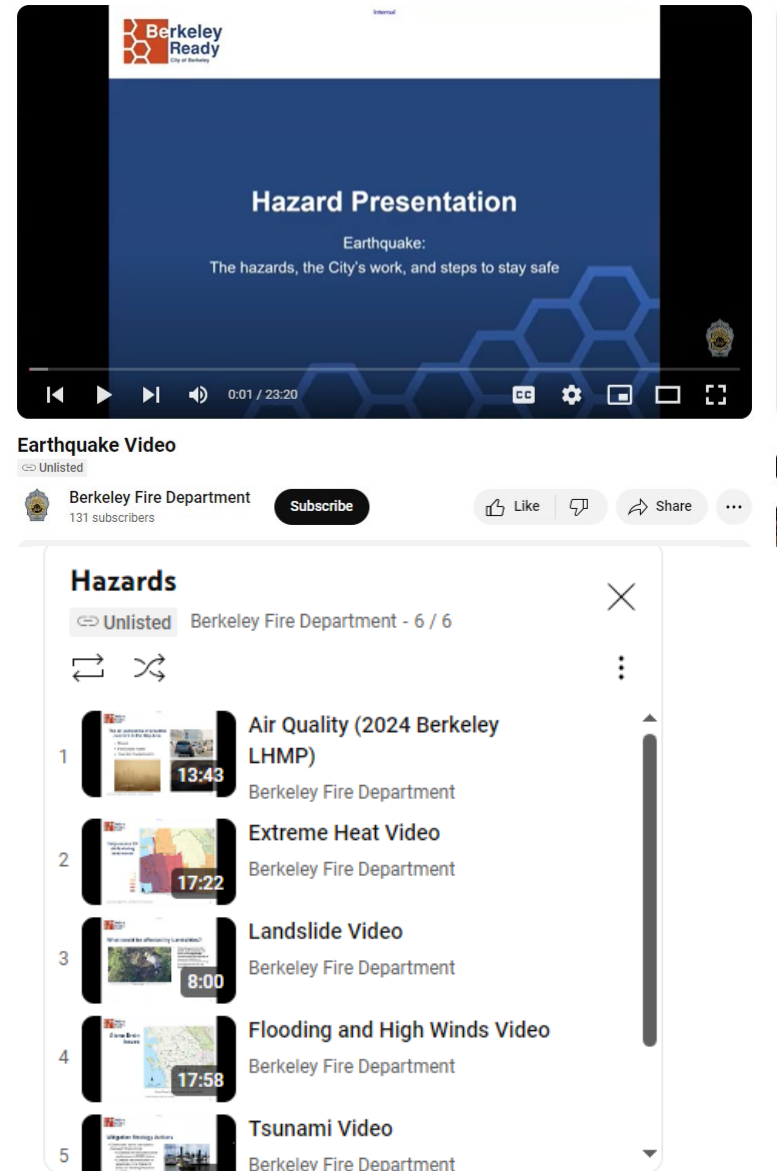
Engagement Methods

- In-person outreach at various events during the drafting stage, including National Night Out and Solano Stroll
- Two in-person workshops during the drafting stage, including a Winter Weather Workshop and a Tsunami Workshop at the Marina
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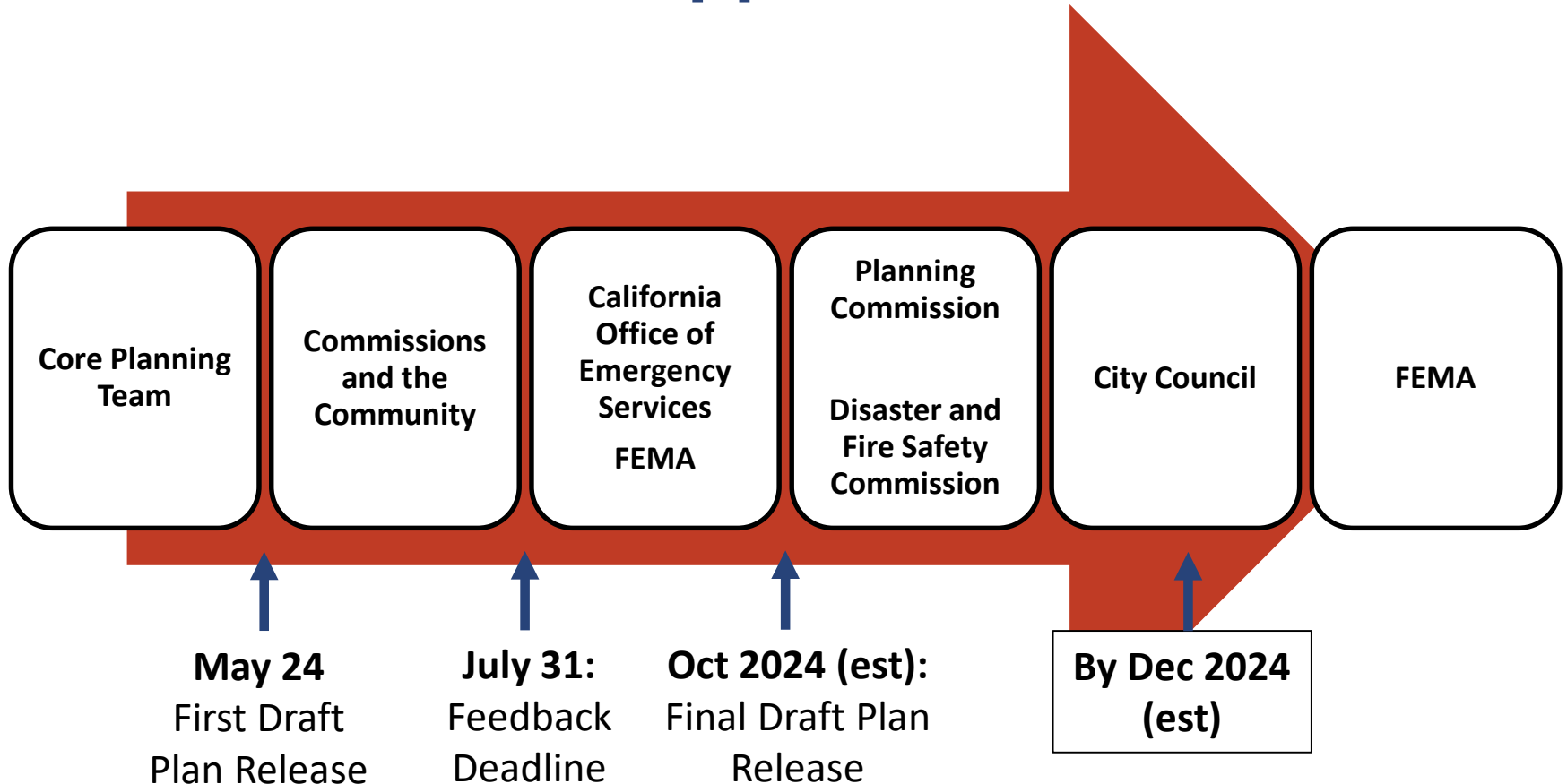
Videos

- LHMP is written to satisfy FEMA requirements, making it long and dense.
- We don't want to just check the box!
 - We want community members to be able to engage with this material, so we made hazard videos.
- You can watch at your leisure and focus on the hazards you're most worried about.
- Videos are designed as both an alternative and a supplement to in-person meetings.
- These videos will remain available even after the LHMP process, continuing to support our outreach about hazards.



Next Steps

Plan Review and Approval Process



Next Steps

- First Draft 2024 LHMP at www.BerkeleyCa.gov/Mitigation
- Commission and community feedback deadline: July 31, 2024
- Submit written feedback:
 - To Mitigation@berkeleyca.gov
 - Via postal mail to the Fire Department
 - Via business hours drop off at the Fire Department
 - 2100 Martin Luther King Jr. Way, 2nd Floor

DISASTER AND FIRE SAFETY COMMISSION

REGULAR MEETING

June 26, 2024

7:00 PM

Fire Department Division of Training Classroom – 997 Cedar Street

Mayor's Appointee- Andy Katz

District 1 – Michael Wilson
District 2 – Weldon Bradstreet
District 3 – Todd Darling
District 4 – Robert Kinosian

District 5 – Shirley Dean
District 6 – Greg Murphy
District 7 – Harrison Raine
District 8 – Theo Gordon

AGENDA

Preliminary Matters

Call to Order

Meeting called to order at 7:00 PM

*Present: Wilson, Bradstreet, Dean, Murphy, Gordon, Katz [arrived 7:02pm],
Kinosian [arrived 7:03pm], Darling [arrived 7:06pm]*

Absent: Raine

Approval of the Agenda

Motion to approve: Murphy

Second: Dean

Vote: Ayes: Wilson, Bradstreet, Dean, Murphy, Gordon

Nays: 0

Abstain: 0

Agenda Approved

Public Comment on Non-Agenda Matters

4 Public speakers

1. Chairperson's Report

Chair noted rising COVID rates and reminded fellow Commissioners that if they feel ill they should stay home. If a Commissioner's item is agendaized at a meeting for which they must stay home sick, the Chair is committed to ensuring that the item will be set as item #4 at the following meeting.

2. Fire Department Staff Report*

REGULAR AGENDA MATTERS *All Regular agenda Matters are for discussion and possible action.*

3. Action: Minutes of May 22, 2024
Recommendation: Approve the draft minutes of the May 22, 2024 regular meeting.
Written Material: May 22, 2024 Draft Minutes
Presentation: N/A
Motion to approve: Dean
Second: Wilson
Vote: Ayes: Wilson, Bradstreet, Dean, Murphy, Gordon, Katz, Kinoshian, Darling
Nays: 0
Abstain: 0

4. Action: Support Of The Grizzly Peak Mitigation Project (Gordon)
Recommendation: Recommendation To Support Vegetation Management in Fire Zones
Written Material: Council Report and Resolution
Presentation: N/A

1 Public Speaker

Motion to approve the recommendation: Katz
Second: Wilson
Vote: Ayes: Wilson, Bradstreet, Dean, Murphy, Gordon, Katz, Kinoshian, Darling
Nays: 0
Abstain: 0

5. Discussion: Local Hazard Mitigation Plan Update (Staff)
Recommendation: N/A
Written Material: First Draft 2024 Local Hazard Mitigation Plan available at <https://BerkeleyCA.gov/Mitigation>
Presentation: First Draft 2024 LHMP PowerPoint Presentation

3 Public Speakers

Extended meeting to 9:15pm by unanimous consent.

- 6. Action:** Ad-Hoc LHMP Workgroup (Bradstreet)
Recommendation: Create ad-hoc Workgroup to document proposed DFSC feedback on First Draft LHMP for action at August 7 2024 meeting
Written Material: N/A
Presentation: N/A

0 Public Speakers

Motion to approve the recommendation: Bradstreet

Second: Murphy

Vote: Ayes: Wilson, Bradstreet, Dean, Murphy, Gordon, Katz, Kinonian, Darling

Nays: 0

Abstain: 0

7. Work Group Reports

Receive reporting on recent activities by the following work groups:

- Plan & Budget Oversight
- Home Hardening
- Wildland Urban Interface
- Safe Passages
- Community Outreach

8. Future Agenda Items and Next Steps

- a. Fulfill by emailing Commission Secretary and Chair

Adjournment

Motion to approve: Bradstreet

Second: Kinonian

Vote: Ayes: Wilson, Bradstreet, Dean, Murphy, Gordon, Katz, Kinonian, Darling

Nays: 0

Abstain: 0

Meeting adjourned 9:14 pm

This meeting will be conducted in accordance with the Brown Act, Government Code Section 54953. Any member of the public may attend this meeting. Questions regarding this matter may be addressed to Keith May, kmay@berkeleyca.gov 510-981-5508.

Communications to Berkeley boards, commissions or committees are public record and will become part of the City's electronic records, which are accessible through the City's website. Please note: E-mail addresses, names, addresses, and other contact information are not required but, if included in any communication to a City board, commission, or committee, will become part of the public record. If you do not want your e-mail address or any other contact information to be made public, you may deliver

communications via U.S. Postal Service or in person to the secretary of the relevant board, commission, or committee. If you do not want your contact information included in the public record, please do not include that information in your communication. Please contact the secretary to the relevant board, commission, or committee for further information.

Any writings or documents provided to a majority of the commission regarding any item on this agenda will be made available for public inspection at Berkeley Fire Department located at 2100 Martin Luther King Jr. Way Berkeley, CA.

COMMUNICATION ACCESS INFORMATION:

This meeting is being held in a wheelchair-accessible location. To request a disability-related accommodation(s) to participate in the meeting, including auxiliary aids or services, please contact the Disability Services specialist at 981-6418 (V) or 981-6347 (TDD) at least three business days before the meeting date. Please refrain from wearing scented products to this meeting.

~~~~~  
I hereby certify that the agenda for this regular/special meeting of the Berkeley City's Disaster and Fire Safety Commission was posted at the front of the Division of Training, 997 Cedar Street, as well as on the City's website, three days prior to the scheduled Commission meeting.

SECRETARY SIGNATURE

*Keith May*      8/12/2024

# 2024 Local Hazard Mitigation Plan (LHMP)

## First Draft Plan

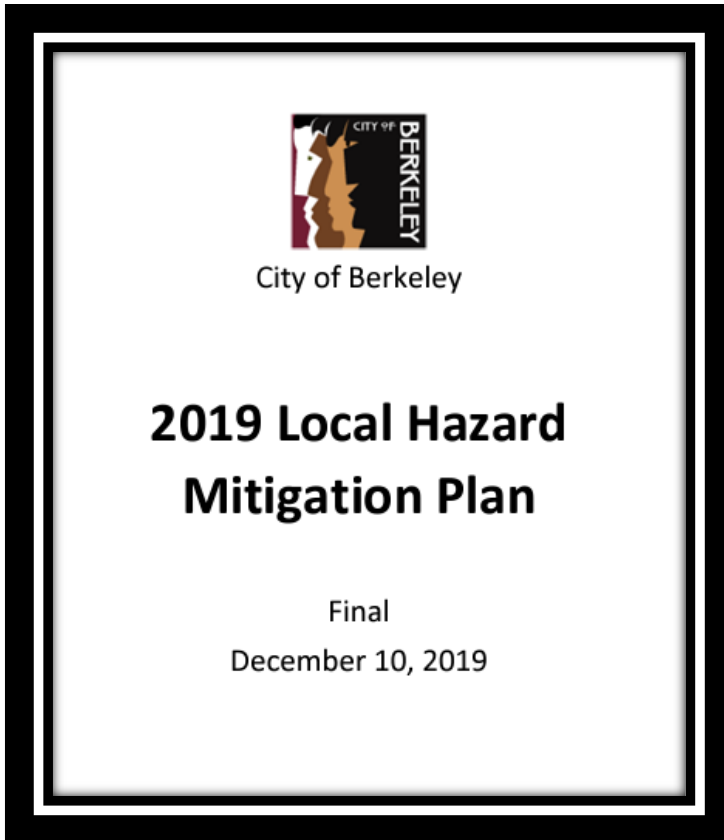
Disaster and Fire Safety Commission  
June 26, 2024

# Agenda

- Local Hazard Mitigation Plan (LHMP) Overview
- What is Hazard Mitigation?
- Plan Changes Since 2019
- First Draft Plan: Risk Assessment and Mitigation Strategy Updates
- Public Outreach
- Next Steps



# Local Hazard Mitigation Plan



- Appendix to City's General Plan
- Adopted in 2004, 2014, and 2019
- Financial incentives (pre- and post-disaster)
- Public Review for First Draft: May 24 to July 31
- Key Plan Elements
  - B: Risk Assessment
  - C: Mitigation Strategy

# What is Hazard Mitigation?

**Hazard mitigation breaks the cycle of damage, by taking action now to reduce impacts later.**



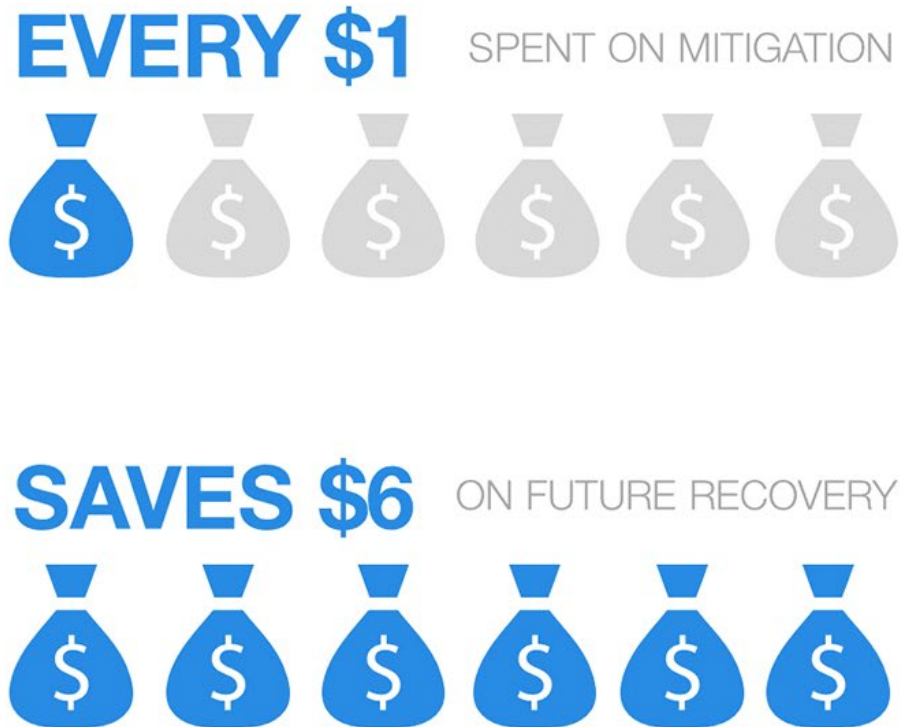


*Image Credit: Boston.gov*

# Examples of mitigation activities

- Home hardening (like in top photo)
- Strengthening structures (like earthquake retrofits)
- Making land use decisions that will minimize damage
- Reducing vegetation in high-fire areas (like in bottom photo)
- Strapping down water heaters



# Major Plan Changes Since 2019



# New Hazards Included in the Plan

- High Wind
- Poor Air Quality
- Infectious Disease
- Utility Interruption
- Sea Level Rise

# Individual and Household Actions

- Previous versions: Heavy focus on City government actions
- 2024 LHMP: And what can you do?
- Example: Earthquake
  - City: Retrofitting municipal buildings, facilitating grants
  - Household: bolting down furniture



# **First Draft Plan: Risk Assessment and Strategy Updates**



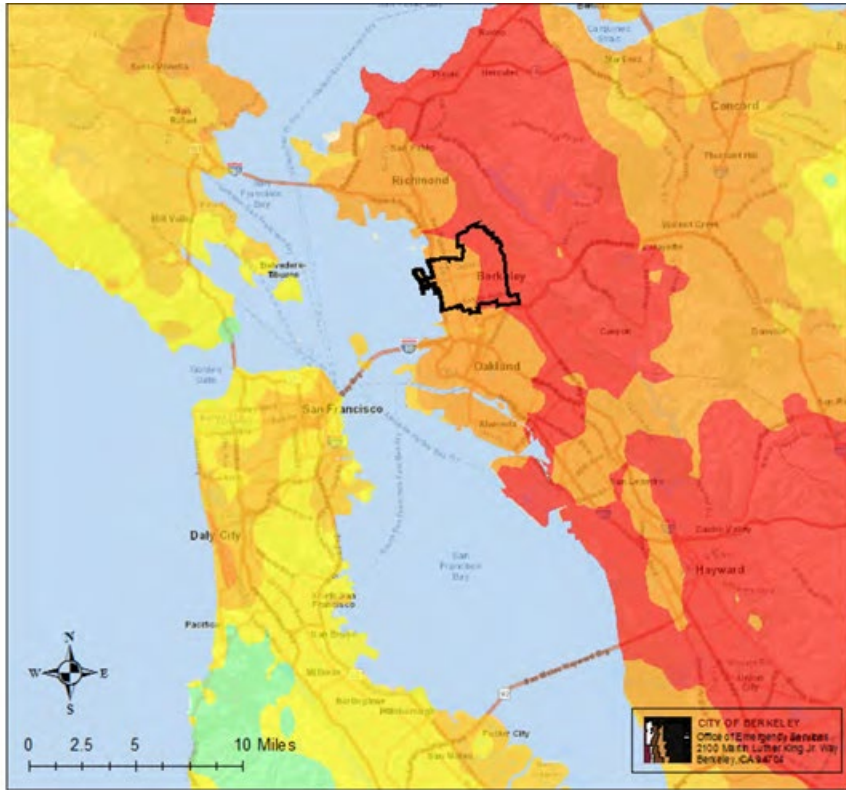
# Risk Assessment Summary

| Hazard                        | Likelihood | Severity of Impact       |
|-------------------------------|------------|--------------------------|
| Earthquake                    | Likely     | Catastrophic             |
| Wildland-Urban Interface Fire | Likely     | Catastrophic             |
| Extreme Heat                  | Likely     | Moderate to Catastrophic |
| Poor Air Quality              | Likely     | Minor                    |
| High Wind                     | Likely     | Minor                    |
| Rainfall-Triggered Landslide  | Likely     | Minor to Catastrophic    |
| Tsunami                       | Possible   | Minor to Catastrophic    |
| Sea Level Rise                | Likely     | Minor to Major           |
| Floods                        | Likely     | Minor                    |
| Utility Interruption          | Likely     | Minor to Major           |
| Hazardous Materials Release   | Likely     | Minor to Catastrophic    |
| Infectious Disease            | Likely     | Minor to Catastrophic    |

# Mitigation Strategy Summary

- 33 Actions
- Focus:
  - Current work with funding secured
  - Improvements to buildings, infrastructure, and wildfire mitigation (aligning with the Community Wildfire Protection Plan)
  - New actions or activities related to new hazards
  - Upcoming Environmental Justice and Safety Element updates

# Earthquake



## Mitigation Actions

### City buildings

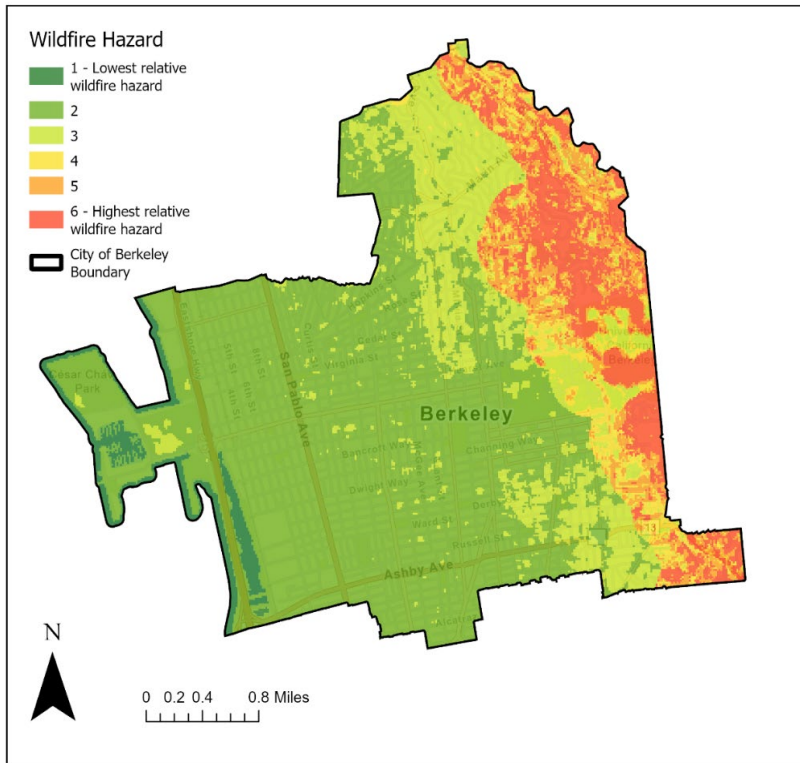
- Building assessments
- Strengthen and replace in prioritized order

### Privately owned buildings

- Soft Story Retrofit Program
- Retrofit Grants Program
- Concrete Retrofit Ordinance Research
- URM Ordinance



# Wildland-Urban Interface Fire



Sources: 2020 Alameda and Contra Costa County Wildfire Risk to Structures and Wildfire Hazard Maps for Fire Prevention Planning, East Bay Regional Parks, et al.  
California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

## Mitigation Actions

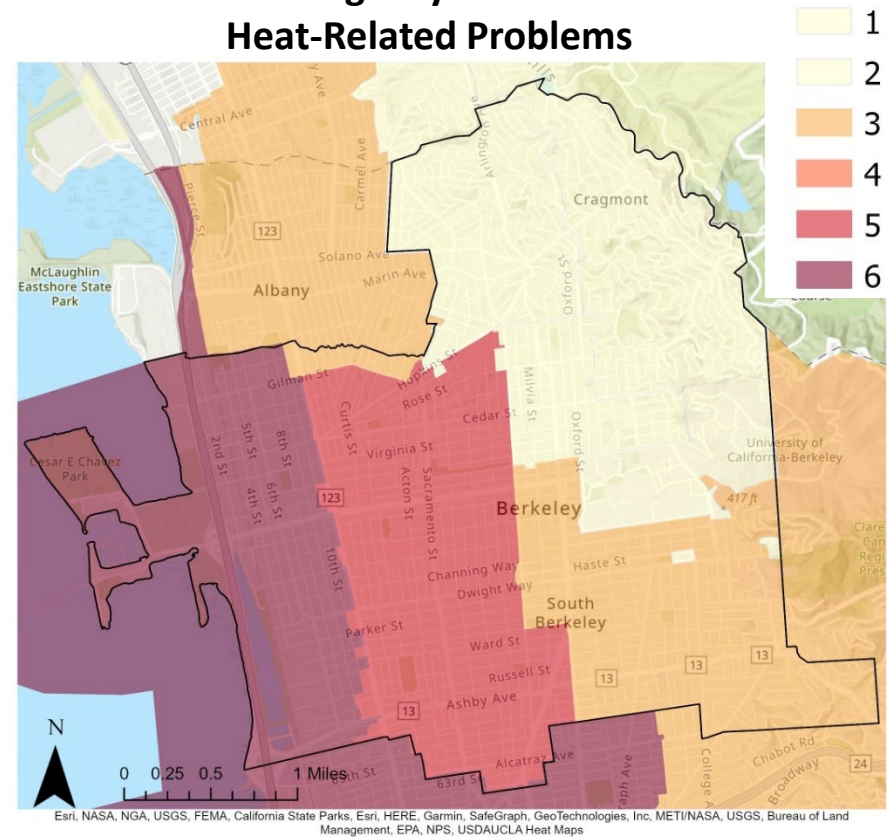
- Coordinate regional mitigation strategies
- Improve responder access and community evacuation in Fire Zones 2 and 3 through road maintenance and parking restrictions
- Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3
- Mitigate risk to Berkeley's overnight camps
- Reduce fire risk through:
  - fire code and updates and enforcement
  - vegetation management
  - residential assistance program
  - utility undergrounding
  - Implementing actions in the Community Wildfire Protection Plan

# Extreme Heat

## Mitigation Actions

- Expanding Urban Forestry team and their activities
- Encouraging passive and energy-efficient strategies to cool down buildings
- Continuing to seek out funding to use cool paving materials on streets when feasible to reduce urban heat island impacts
- Implementing transportation projects and programs to reduce emissions

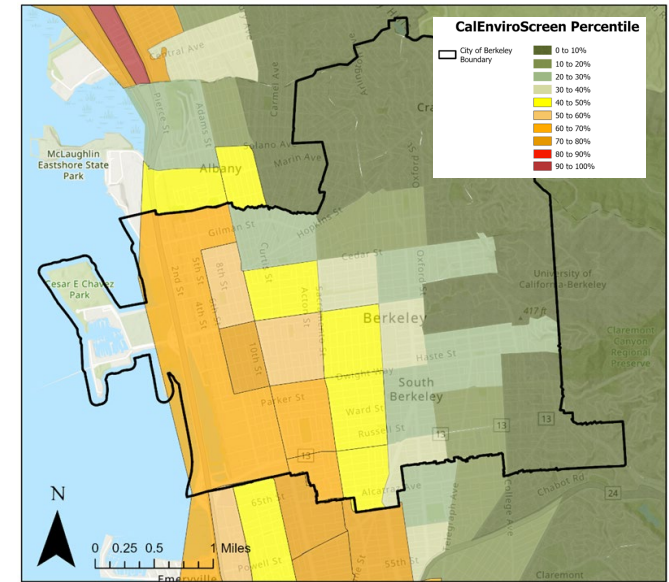
## Excess Emergency Room Visits for Heat-Related Problems



# Poor Air Quality

## Mitigation Actions

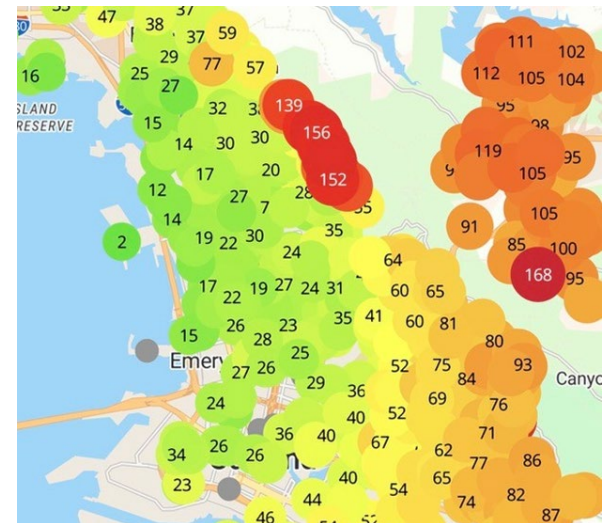
- Expanding Urban Forestry team and their activities
- Implementing transportation projects and programs to reduce emissions



Credits: CalEnviroScreen 4.0, October 2021

Esri, NASA, NGA, USGS, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

## Regular day poor air quality



## Poor air quality from fires



# High Wind

## Mitigation Actions

- Expanding Urban Forestry team and their activities
- Reduce fire risk through utility undergrounding.

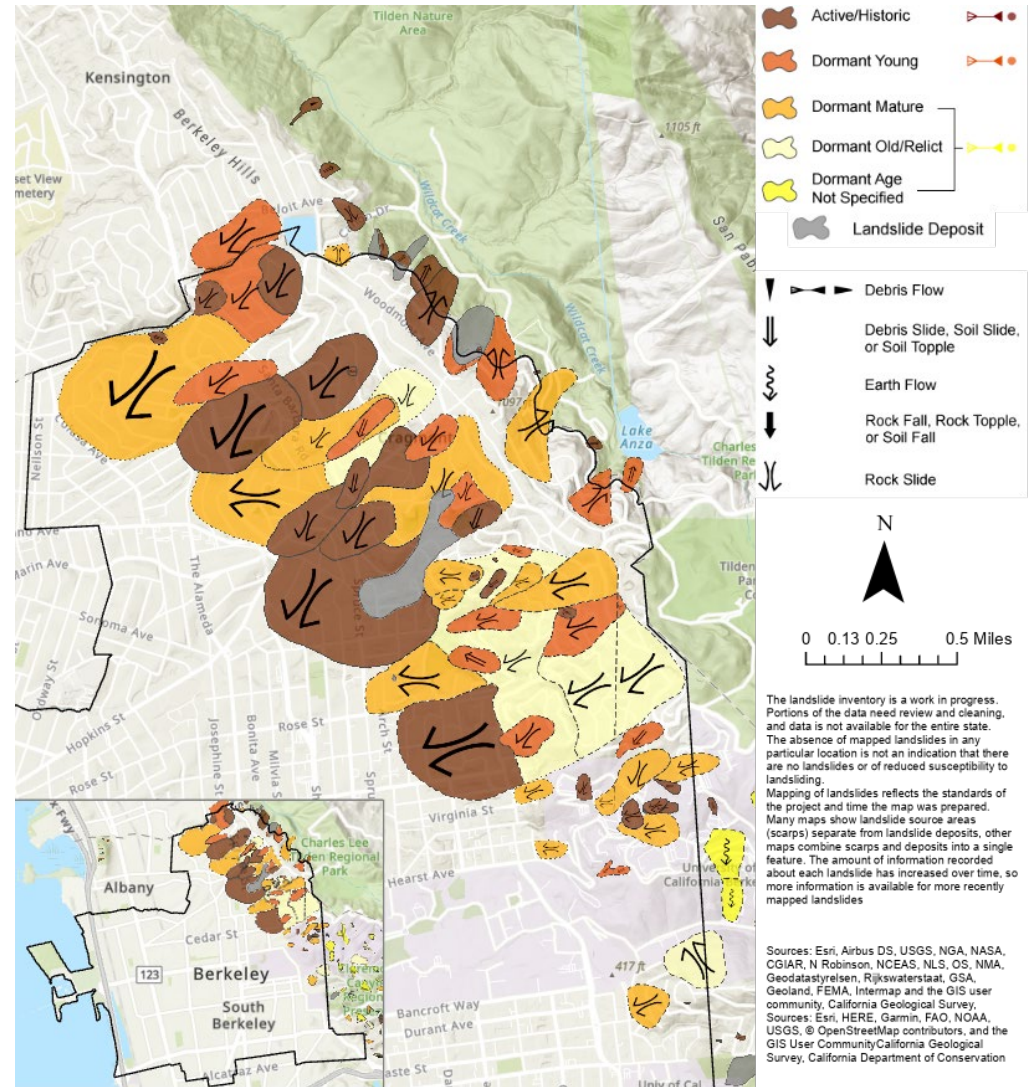


**Photo credits: Berkeleyside** (Benji Friedman, Ximena Natera, Berkeleyside/CatchLight)

# Landslide

## Mitigation Actions

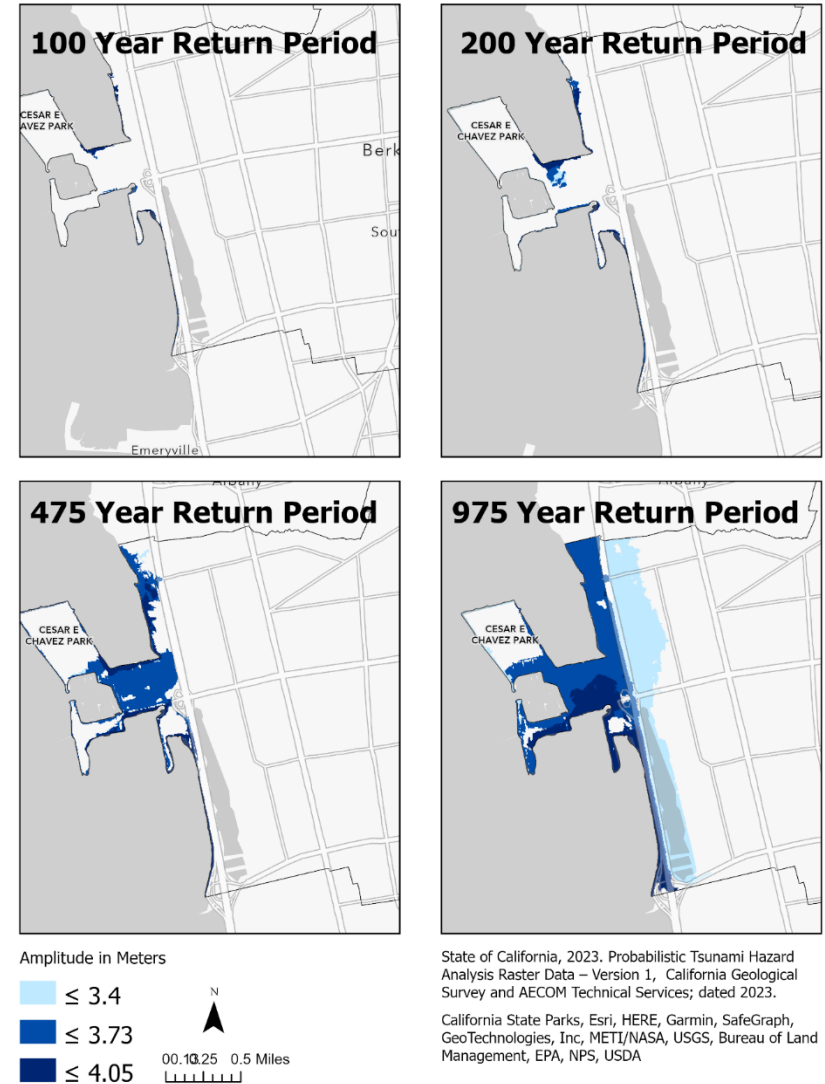
- **Collect, analyze and share information** with the Berkeley community about Berkeley hazards and associated risk reduction techniques.
  - Track changes in hazard risk using the best-available information and tools.
  - Collect and share up-to-date hazard maps identifying areas subject to heightened risk from hazards.



# Tsunami

## Mitigation Actions

- Continue to replace and repaired damaged finger docks
- Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to **document and explore additional tsunami hazard mitigation measures for Berkeley's maritime communities.**

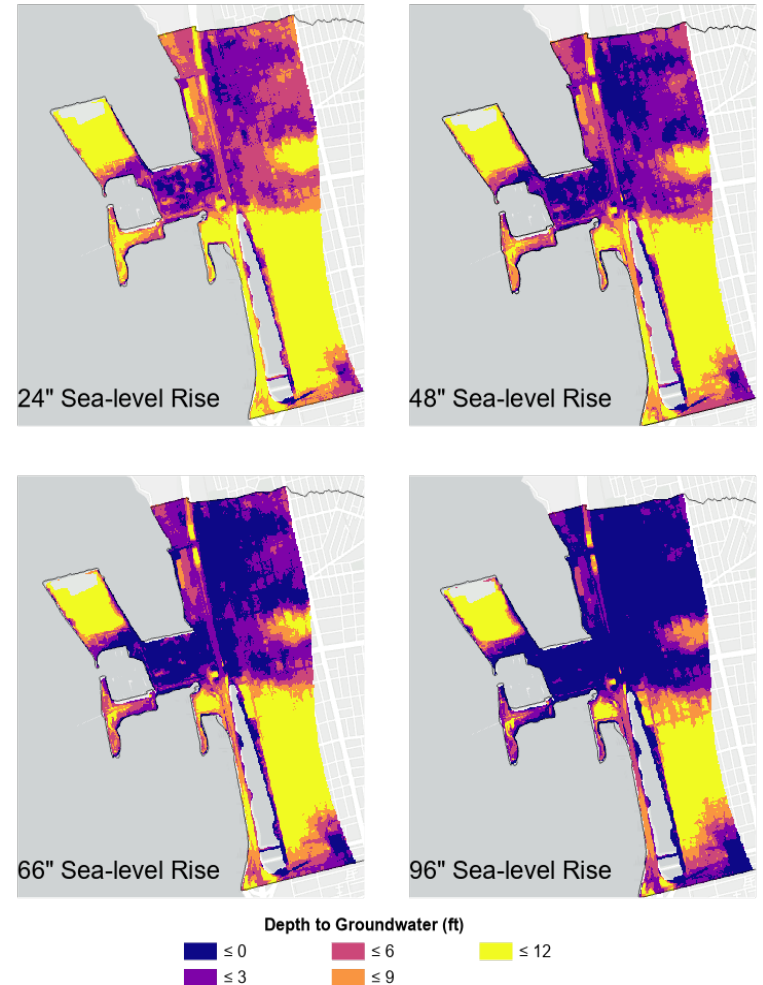




# Sea Level Rise

## Mitigation Actions

- Mitigate the impacts of sea level rise in Berkeley.
  - Continue to ensure new and existing public and private developments and infrastructure are protected from floods due to sea-level rise through the permitting process for new development and conditions.
  - Identify funding and nature based solutions to adapt to sea level rise at Berkeley Waterfront areas at risk of future inundation

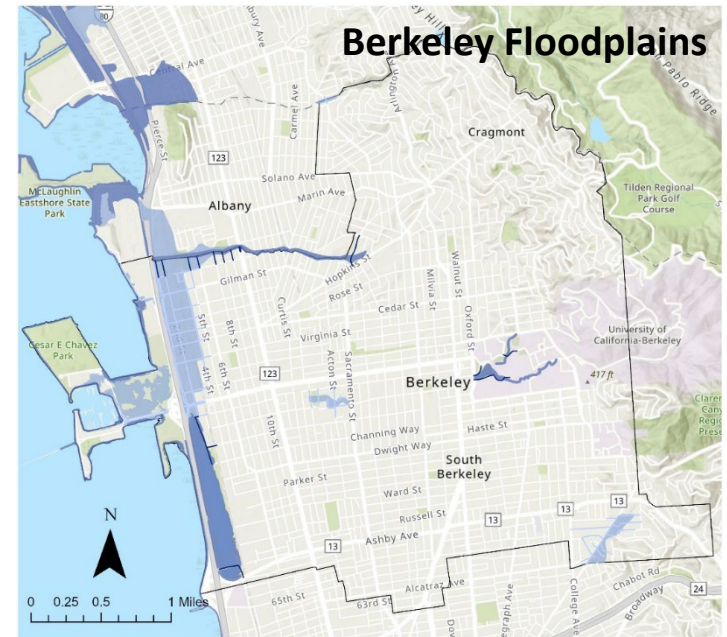
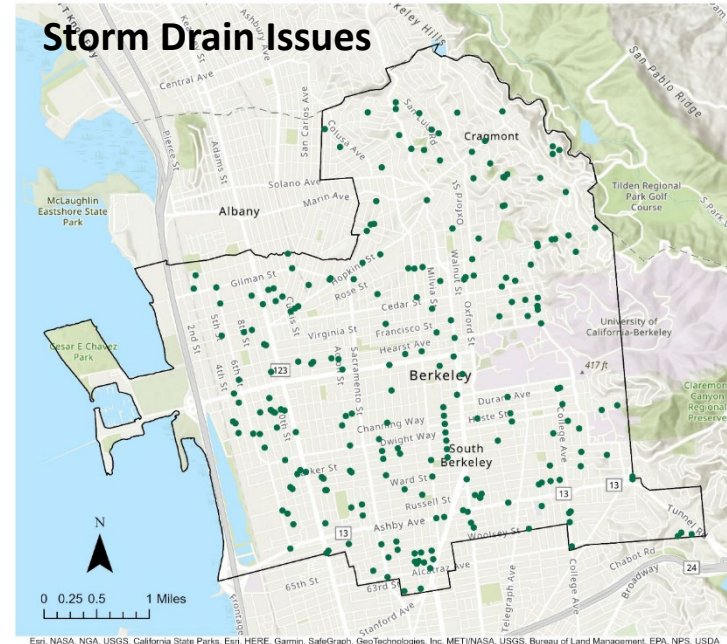


Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Pathways Climate Institute, San Francisco Estuary Institute

# Flood

## Mitigation Actions

- Maintain City participation in the National Flood Insurance Program
- Use development standards to ensure that new development does not contribute to an increase in flood potential
- Complete a Stormwater Master Plan for all City stormwater infrastructure
- Renovate the tide tubes that remove storm water from Berkeley Aquatic Park and Potter Street to the Bay
- Design public improvements such as streets, parks, and plaza for retention and infiltration of stormwater by diverting urban runoff to bio-filtration systems



# Utility Interruption

## **Mitigation Actions**

- Urge PG&E to perform utility undergrounding in Berkeley's Very High Fire Hazard Severity Zone (VHFHSZ) to mitigate wildfire risk and limit evacuation and ingress obstruction.
- Coordinate undergrounding efforts with the State of CA Public Utilities Commission, and elected officials.
- Provide key hazard information and best practices to Berkeley's business and arts community through established networks, for example by exploring opportunities for local business to share best practices and resources during utility interruptions.
- Identify potential actions to mitigate energy assurance vulnerabilities at critical City facilities during planning/conceptual design of both retrofits and new construction.
- Provide guidance to help the City consider opportunities to design, finance and implement clean energy assurance strategies (e.g., photovoltaic-supplemented generation, energy efficiency activities, and/or mobile charging stations).
- Work with partners to identify additional non-City critical facilities and develop strategies to provide clean backup power at these sites.
- Create new formats and user friendly guidance to educate the public, especially underserved populations, on Berkeley hazards.



# Public Outreach

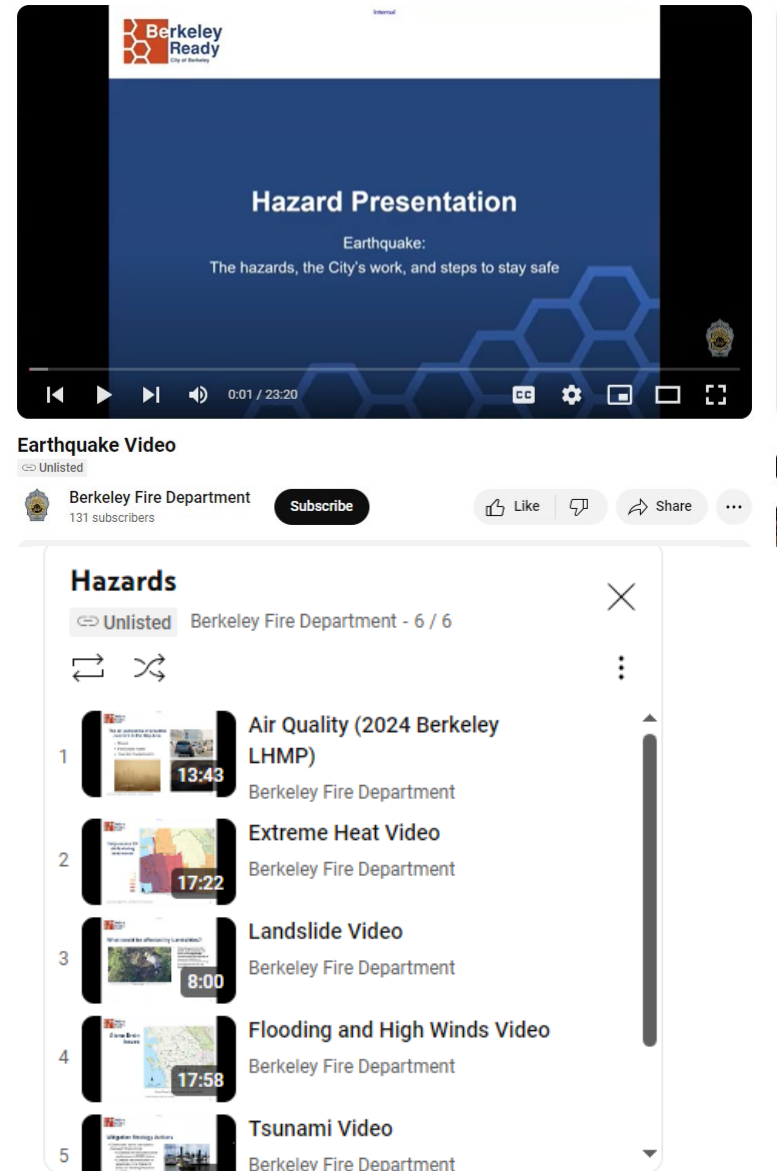
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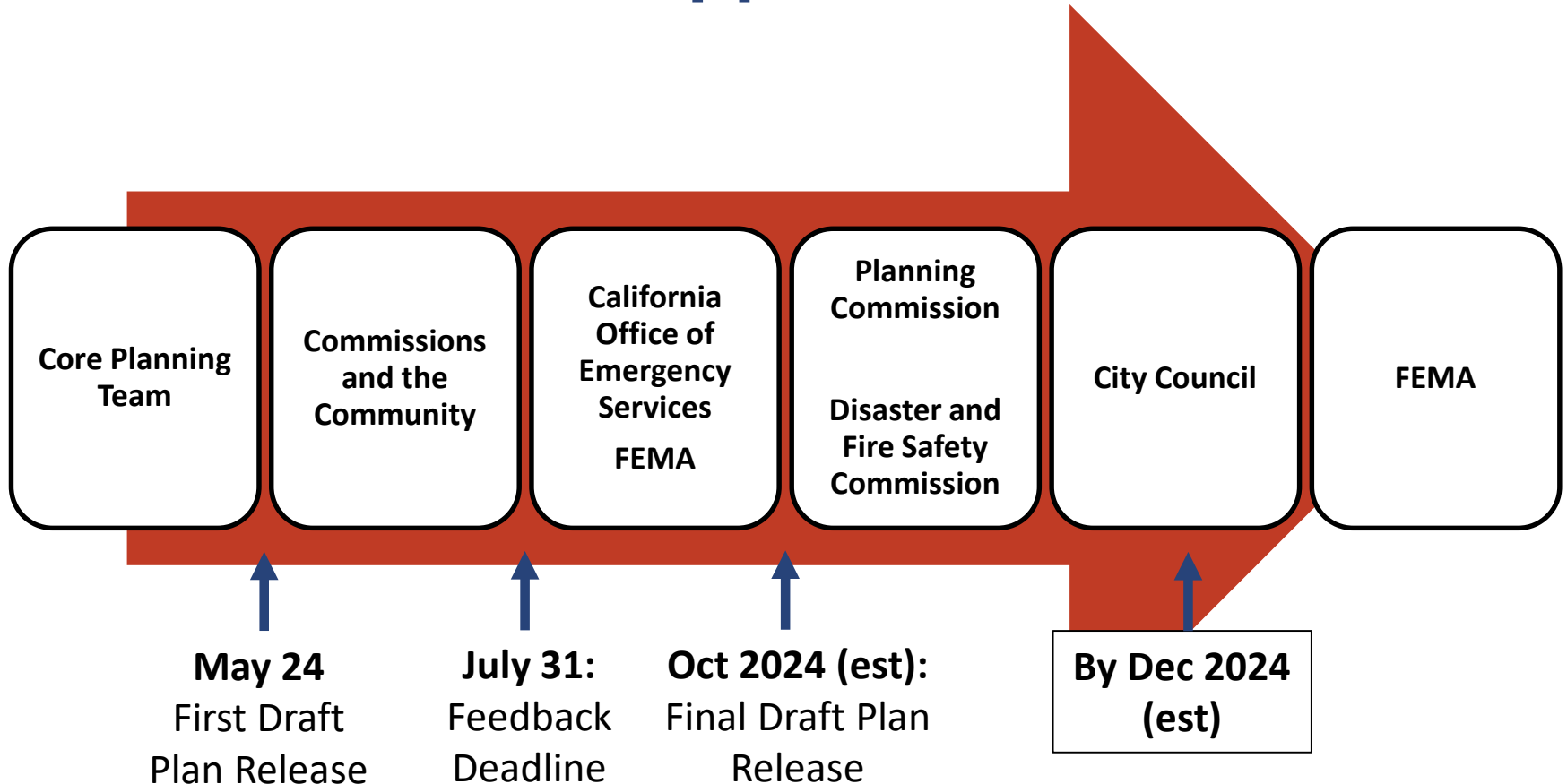
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# Next Steps

# Plan Review and Approval Process



## Next Steps

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## **BERKELEY CITY COUNCIL PUBLIC SAFETY COMMITTEE REGULAR MEETING MINUTES**

**Monday, July 15, 2024  
10:30 AM**

2180 Milvia Street, 6<sup>th</sup> Floor, Berkeley, CA 94704 – Redwood Room

Committee Members:

Councilmembers Terry Taplin, Ben Bartlett, and Igor Tregub  
Alternate: Councilmember Mark Humbert

This meeting will be conducted in a hybrid model with both in-person attendance and virtual participation. If you are feeling sick, please do not attend the meeting in person.

Remote participation by the public is available through Zoom. To access the meeting remotely using the internet: Join from a PC, Mac, iPad, iPhone, or Android device: Use URL - <https://cityofberkeley-info.zoomgov.com/j/1608671032>. To request to speak, use the “raise hand” icon on the screen. To join by phone: Dial **1-669-254-5252 or 1-833-568-8864 (Toll Free)** and Enter Meeting ID: **160 867 1032**. If you wish to comment during the public comment portion of the agenda, press \*9 and wait to be recognized by the Chair. Please be mindful that the meeting will be recorded.

To submit a written communication for the Committee’s consideration and inclusion in the public record, email [policycommittee@berkeleyca.gov](mailto:policycommittee@berkeleyca.gov).

Written communications submitted by mail or e-mail to the Public Safety Policy Committee by 5:00 p.m. the Friday before the Committee meeting will be distributed to the members of the Committee in advance of the meeting and retained as part of the official record.

Pursuant to the City Council Rules of Procedure and State Law, the presiding officer may remove, or cause the removal of, an individual for disrupting the meeting. Prior to removing an individual, the presiding officer shall warn the individual that their behavior is disrupting the meeting and that their failure to cease their behavior may result in their removal. The presiding officer may then remove the individual if they do not promptly cease their disruptive behavior. “Disrupting” means engaging in behavior during a meeting of a legislative body that actually disrupts, disturbs, impedes, or renders infeasible the orderly conduct of the meeting and includes, but is not limited to, a failure to comply with reasonable and lawful regulations adopted by a legislative body, or engaging in behavior that constitutes use of force or a true threat of force.

# MINUTES

**Roll Call** 10:34 a.m.

**Present:** Taplin, Tregub

**Absent:** Bartlett

Councilmember Bartlett present at 10:37 a.m.

**Public Comment on Non-Agenda Matters – None.**

## **Election of Chairperson**

**Action:** M/S/C (Tregub/Taplin) to elect Councilmember Taplin as Chairperson of the Public Safety Policy Committee.

**Vote:** Ayes – Taplin, Tregub; Noes – None; Abstain – None; Absent – Bartlett.

## **Minutes for Approval**

*Draft minutes for the Committee's consideration and approval.*

### **1. Minutes - September 18, 2023**

**Action:** M/S/C (Taplin/Tregub) to approve the September 18, 2023 minutes.

**Vote:** Ayes – Taplin, Tregub; Noes – None; Abstain – None; Absent – Bartlett.

## **Committee Action Items**

*The public may comment on each item listed on the agenda for action as the item is taken up. The Chair will determine the number of persons interested in speaking on each item. Up to ten (10) speakers may speak for two minutes. If there are more than ten persons interested in speaking, the Chair may limit the public comment for all speakers to one minute per speaker. Speakers are permitted to yield their time to one other speaker, however no one speaker shall have more than four minutes.*

*Following review and discussion of the items listed below, the Committee may continue an item to a future committee meeting, or refer the item to the City Council.*

### **2. First Draft 2024 Local Hazard Mitigation Plan**

**From:** Office of Emergency Services

**Recommendation:** Discussion on the first draft 2024 Local Hazard Mitigation Plan.

**Financial Implications:** See report

Contact: Jamie Albrecht, Emergency Services Coordinator, (510) 981-5514

**Action:** 0 speakers. Presentation made and discussion held. Item continued to a future meeting.

## Committee Action Items

### 3a. Recommendation Regarding Panoramic Hill Secondary Evacuation

**From:** Disaster and Fire Safety Commission

**Referred:** April 25, 2024

**Due:** October 8, 2024

**Recommendation:** Adopt a Resolution approving the development of a plan that includes a feasibility study and identification of funding sources for the construction of an emergency secondary egress road on Panoramic Hill. Such a plan could include discussions between the City of Berkeley, the City of Oakland, UC Berkeley, East Bay Regional Parks District and Alameda County and should also provide for continued contact with the Disaster and Fire Safety Commission (DFSC) as well as other related Berkeley Commissions as the Council determines.

**Financial Implications:** See report

Contact: Keith May, Commission Secretary, (510) 981-3473

**Action:** See action for Item 3b.

### 3b. Companion Report: Recommendation Regarding Panoramic Hill Secondary Evacuation

**From:** Fire and Emergency Services

**Referred:** April 25, 2024

**Due:** October 8, 2024

**Recommendation:** Adopt a Resolution directing the Fire Department to reach out to other impacted landowners to determine interest in pursuing, and coordinate costs sharing to conduct a feasibility study to identify a safe secondary evacuation and access route for the access impaired Panoramic neighborhood. The results of the study should then be shared with the Public Safety Policy Committee.

**Financial Implications:** See report

Contact: David Sprague, Fire, (510) 981-3473

**Action:** 0 speakers. M/S/C (Taplin/Bartlett) to send item 3b. to Council with a positive recommendation for City Council to adopt a Resolution directing the Fire Department to reach out to other impacted landowners to determine interest in pursuing, and coordinate costs sharing to conduct a feasibility study to identify a safe secondary evacuation and access route for the access impaired Panoramic neighborhood.

**Vote:** All Ayes.



## Unscheduled Items

*These items are not scheduled for discussion or action at this meeting. The Committee may schedule these items to the Action Calendar of a future Committee meeting.*

**4. Resolution: Opposition to Police Brutality and Use of Force on Nonviolent Protesters**

**From: Councilmember Harrison (Author)**

**Referred: November 20, 2023**

**Due: September 12, 2024**

**Recommendation:** Adopt a Resolution reaffirming the City of Berkeley's opposition to and condemning police brutality towards nonviolent protesters and discouraging use of "less-lethal" weapons for crowd control.

**Financial Implications:** See report

Contact: Kate Harrison, Councilmember, District 4, (510) 981-7140

## Items for Future Agendas

- Discuss results of feasibility study regarding Panoramic Hill Secondary Evacuation.

## Adjournment

Adjourned at 11:41 a.m.

I hereby certify that the foregoing is a true and correct record of the Public Safety Committee meeting held on July 15, 2024.

---

Wendy Sorensen, Assistant City Clerk

## Communications

*Communications submitted to City Council Policy Committees are on file in the City Clerk Department at 2180 Milvia Street, 1st Floor, Berkeley, CA, and are available upon request by contacting the City Clerk Department at (510) 981-6908 or [policycommittee@berkeleyca.gov](mailto:policycommittee@berkeleyca.gov).*

# 2024 Local Hazard Mitigation Plan (LHMP)

## First Draft Plan

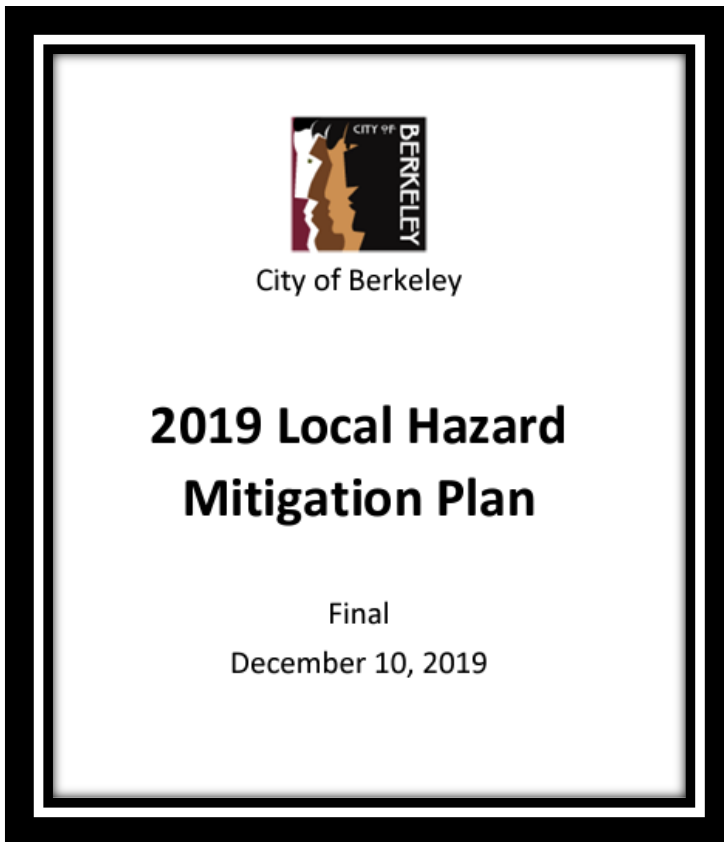
Public Safety Committee  
July 15, 2024

# Agenda

- Local Hazard Mitigation Plan (LHMP) Overview
- What is Hazard Mitigation?
- Plan Changes Since 2019
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# Local Hazard Mitigation Plan



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- Financial incentives (pre- and post-disaster)
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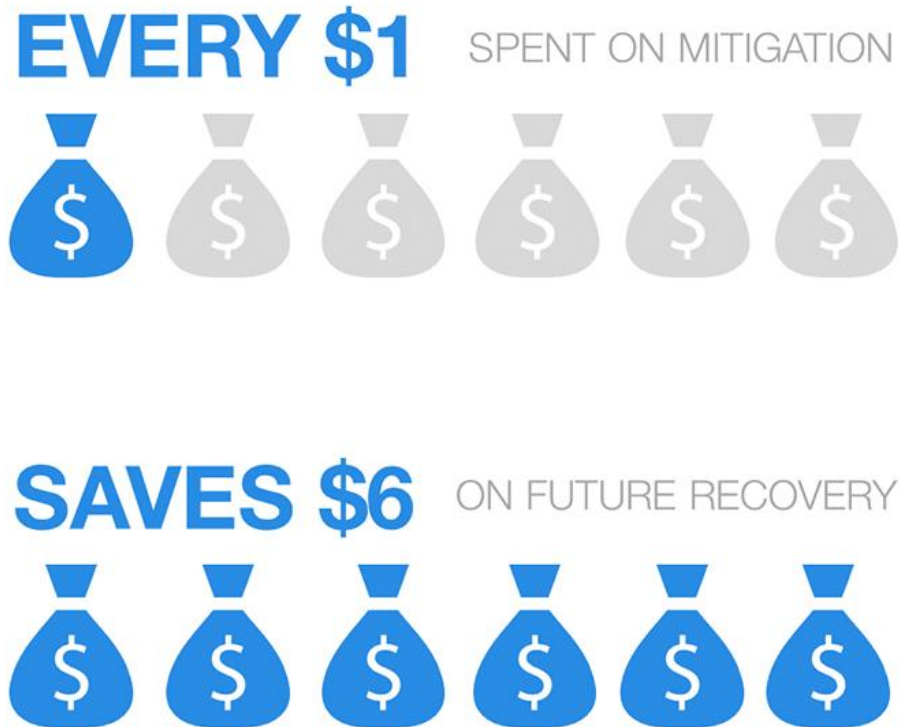


*Image Credit: Boston.gov*

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- Making land use decisions that will minimize damage
- Reducing vegetation in high-fire areas (like in bottom photo)
- Strapping down water heaters



# **First Draft Plan: Risk Assessment and Strategy Updates**



# Risk Assessment Summary

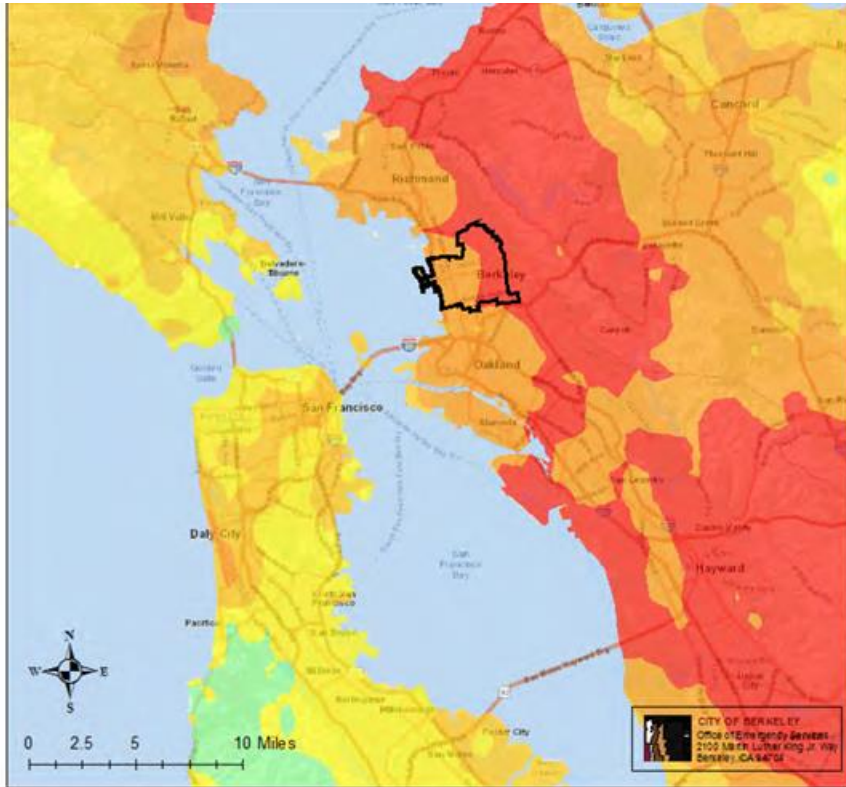
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| Infectious Disease*           | Likely     | Minor to Catastrophic    |

\*New Hazard in 2024 Plan

# Mitigation Strategy Summary

- 33 Actions
- Focus:
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  - Improvements to buildings, infrastructure, and wildfire mitigation (aligning with the Community Wildfire Protection Plan)
  - New actions or activities related to new hazards
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# Earthquake



Source: USGS, HayWired Scenario, August 2017.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

## Mitigation Actions

### City buildings

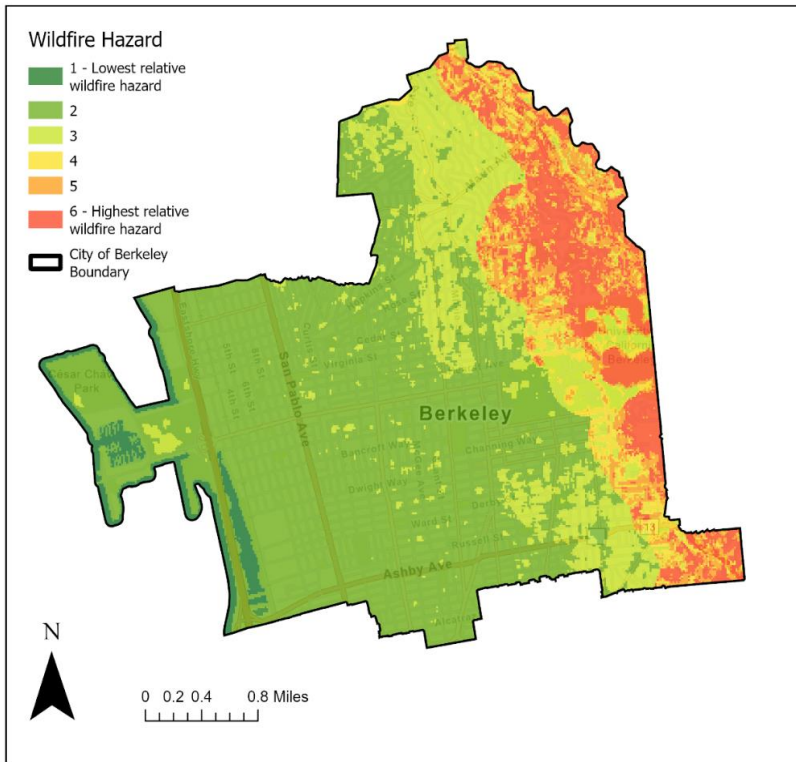
- Building assessments
- Strengthen and replace in prioritized order

### Privately owned buildings

- Soft Story Retrofit Program
- Retrofit Grants Program
- Concrete Retrofit Ordinance Research
- URM Ordinance



# Wildland-Urban Interface Fire



Sources: 2020 Alameda and Contra Costa County Wildfire Risk to Structures and Wildfire Hazard Maps for Fire Prevention Planning, East Bay Regional Parks, et al. California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

## Mitigation Actions

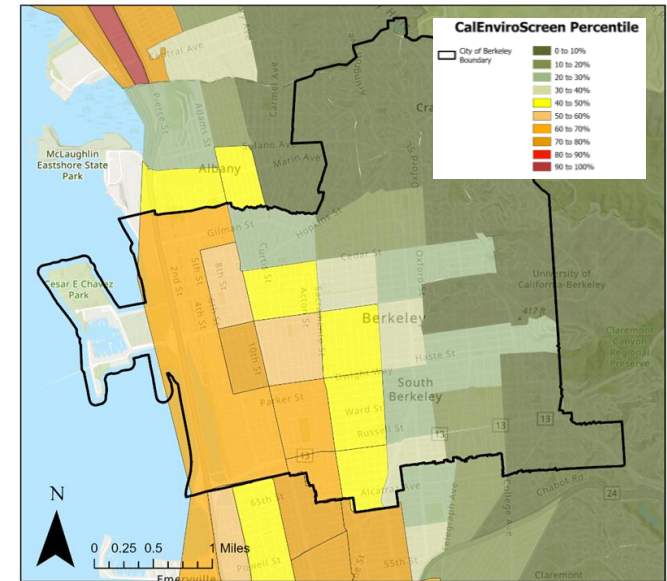
- Coordinate regional mitigation strategies
- Improve responder access and community evacuation in Fire Zones 2 and 3 through road maintenance and parking restrictions
- Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3
- Mitigate risk to Berkeley's overnight camps
- Reduce fire risk through:
  - fire code and updates and enforcement
  - vegetation management
  - residential assistance program
  - utility undergrounding
  - Implementing actions in the Community Wildfire Protection Plan



# Poor Air Quality

## Mitigation Actions

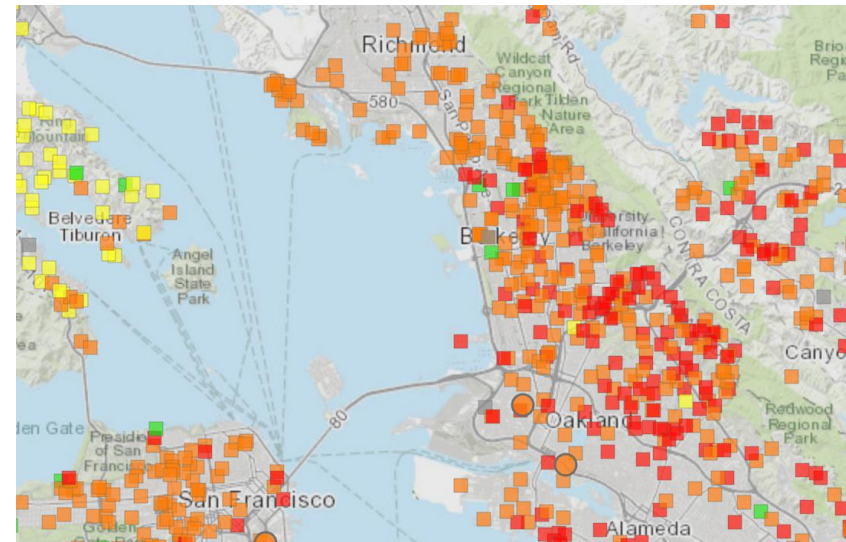
- Expanding Urban Forestry team and their activities
- Implementing transportation projects and programs to reduce emissions



Credits: CalEnviroScreen 4.0, October 2021

Esri, NASA, NGA, USGS, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

## Regular day poor air quality



## Poor air quality from fires



# Community Engagement

# Individual and Household Actions

- Previous versions: What can City government do?
- 2024 LHMP: And what can you do in your household?
- Example: Earthquake
  - City: Retrofitting municipal buildings, facilitating grants
  - Household: bolting down furniture



# Engagement Methods

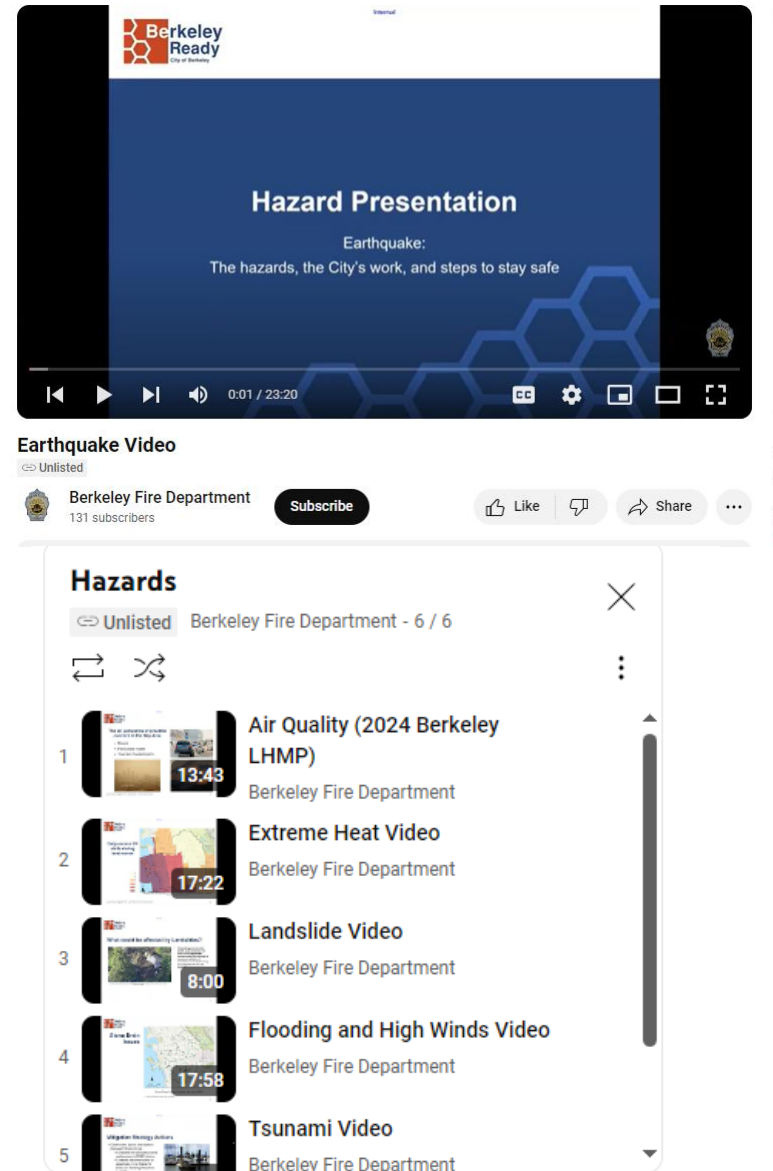
- In-person outreach at various events during the drafting stage, including National Night Out and Solano Stroll
- Two in-person workshops during the drafting stage, including a Winter Weather Workshop and a Tsunami Workshop at the Marina
- Two in-person workshops after First Draft is released
  - June 3 5:30pm – 730pm at Central Library
  - July 20 10am – 12pm at South Berkeley Library
- Detailed hazard videos posted to YouTube
- Presentations to the Planning and Disaster and Fire Safety Commissions, memos to all other Commissions
- Community members are invited to send in feedback via email or in person at the Fire Department





# Videos

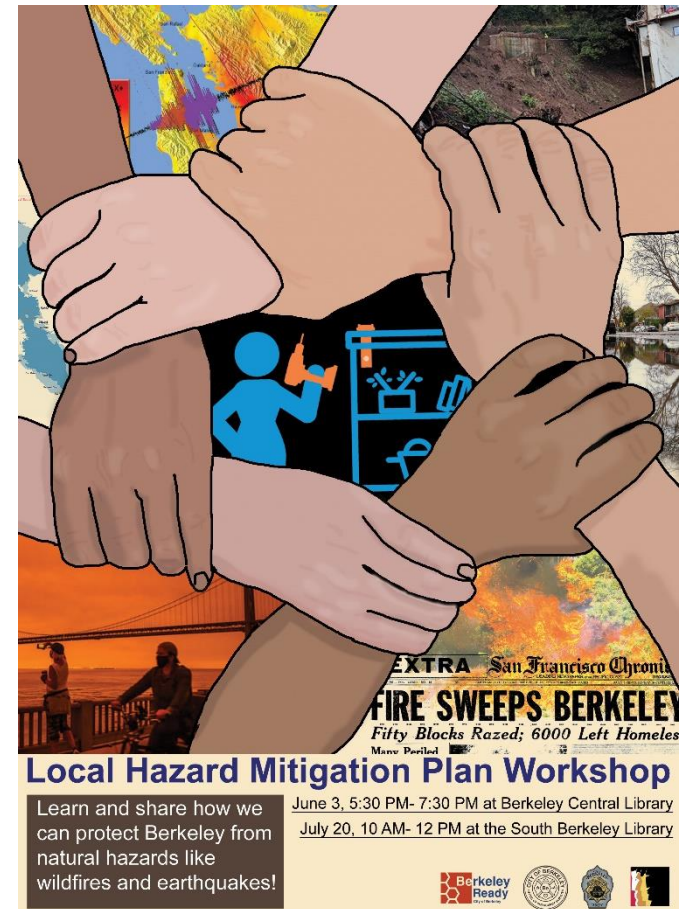
- LHMP is written to satisfy FEMA requirements, making it long and dense.
- We don't want to just check the box!
  - We want community members to be able to engage with this material, so we made hazard videos.
- You can watch at your leisure and focus on the hazards you're most worried about.
- Videos are designed as both an alternative and a supplement to in-person meetings.
- These videos will remain available even after the LHMP process, continuing to support our outreach about hazards.



# Next Steps

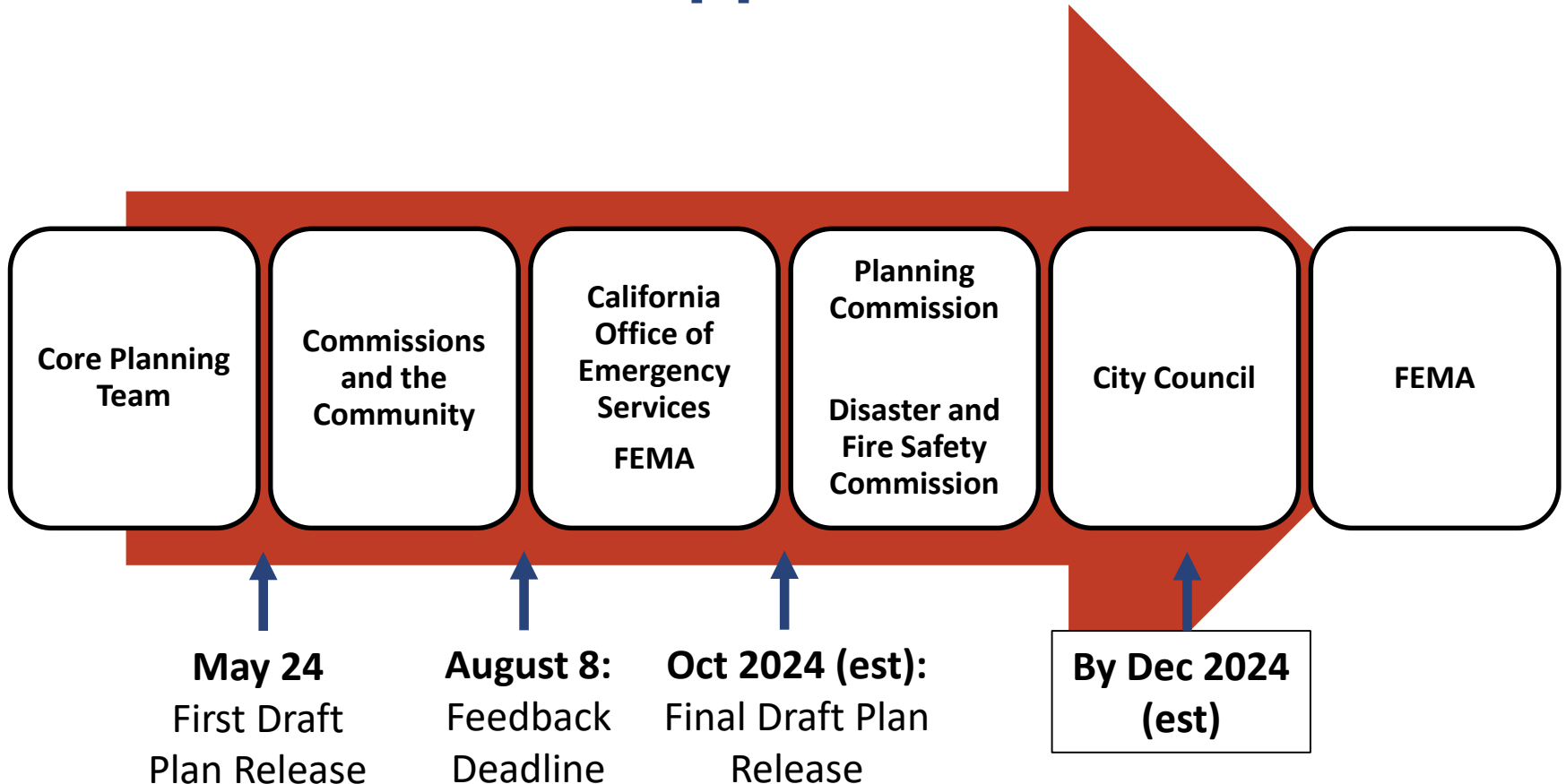
# Please help us engage the community

- Public Review Workshop
  - Sat 7/20 10a-12p Tarea Hall Pittman  
South Berkeley Branch
- Hazard videos and Plan  
[berkeleyca.gov/mitigation](https://berkeleyca.gov/mitigation)
- Feedback to  
[mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov)





# Plan Review and Approvals Process



## Next Steps

- First Draft 2024 LHMP at [www.BerkeleyCa.gov/Mitigation](http://www.BerkeleyCa.gov/Mitigation)
- Commission and community feedback deadline: August 8, 2024
- Submit written feedback:
  - To [Mitigation@berkeleyca.gov](mailto:Mitigation@berkeleyca.gov)
  - Via postal mail to the Fire Department
  - Via business hours drop off at the Fire Department



# Local Hazard Mitigation Plan Update

*Share your ideas for actions the City of Berkeley and its residents can take to reduce risks from natural hazards, such as earthquakes and wildfires.*

Help inform the City of Berkeley's updated First Draft 2024 Local Hazard Mitigation Plan. The Plan outlines the hazards that can occur in Berkeley and what actions the City is taking to reduce risk. It also lists actions that you can take to reduce personal risk and help our collective mitigation efforts.

The First Draft 2024 Local Hazard Mitigation Plan is available for review and comment until August 8. The Plan Elements are linked below:

- [Executive Summary](#) (updated on 06/04/2024 to fix page numbers)
- [Element A Planning Process](#)
- [Element B Risk Assessment](#) (updated on 06/04/2024 to correct Berkeley Fire Zone map and to fix page numbers)
- [Element C Mitigation Strategy](#)
- [Element D Plan Maintenance](#)
- [Element E Plan Update](#)
- Element F Plan Adoption (only for Final Draft Plan)
- [Element G Community Education](#)
- Appendix
  - [Status of 2019 Actions Spreadsheet](#)
  - [2024 Mitigation Strategy Actions Spreadsheet](#)
  - [2024 Community Actions Spreadsheet](#)

Help us by engaging with the first draft of the Plan, learning about the natural hazards that can occur in Berkeley, like earthquakes and wildfires, and commenting on the lists of actions to reduce our risks.

To learn more about the hazards that can occur in Berkeley, [watch our videos](#).

To be involved in the planning process:



- Attend one of our community presentations, which will be posted under ‘upcoming events’ at the bottom of this page
- Email [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov) with your comments by August 8
- Attend the [Planning Commission](#) meeting on June 5
- Attend the [Disaster and Fire Safety Commission](#) meeting on June 26

## PROJECT OVERVIEW

All local governments are required to update their Local Hazard Mitigation Plans every five years. This update provides an opportunity to assess any changes to the hazards Berkeley faces and to recommend projects to reduce risk.

Natural hazards, like earthquakes and wildfires, can cause loss of life and damage property and infrastructure. Mitigation is an investment in future safety and sustainability. By taking actions to reduce risk now, we can reduce losses later.

Having an updated Local Hazard Mitigation Plan increases community safety by providing a roadmap of actionable projects to reduce risks. An updated Plan also ensures the City is eligible for state and federal disaster assistance and mitigation grants, like the ones that fund our [seismic retrofit programs](#).

## PROJECT TIMELINE

The 2024 Local Hazard Mitigation Plan effort began in April 2023 and is estimated to be complete in December 2024.

- First Draft Released (May 2024)
- Public Comment Period (May 24 – August 8, 2024)
  - *The Public Comment period was extended from July 31 as of June 26.*
- California Office of Emergency Services and Federal Emergency Management Agency Approval (August – October 2024)
- Public Hearing at Planning Commission to Recommend Adoption of Plan (October 2024)
- Adoption of Final Plan (December 2024)

## RESOURCES

- [2019 Local Hazard Mitigation Plan \(LHMP\)](#)

- [2014 LHMP](#)
- Hazard Videos:
  - [Earthquake](#)
  - [Wildland-Urban interface Fire](#)
  - [Air Quality](#)
  - [Extreme Heat](#)
  - [Landslide](#)
  - [Flooding and High Winds](#)
  - [Tsunami](#)
  - [Utility Disruption](#)

## PAST EVENTS

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### Local Hazard Mitigation Plan Public Review Workshop

June 3, 2024 | 1 Documents



## News



Sign up for AC Alert for official emergency information



Register your neighborhood event for National Night Out by July 21



High temperatures predicted; make a plan to stay cool



Safely celebrate July 4th—Avoid fireworks and certain hillside roads

## **FIRE DEPARTMENT**

**Email:** [fire@berkeleyca.gov](mailto:fire@berkeleyca.gov)

**Phone:** (510) 981-3473, TDD: (510) 981-6903



Create a resilient, safe, connected, and prepared City

**[VIEW OUR STRATEGIC PLAN](#)**

**CITY OF BERKELEY** 2180 Milvia St, Berkeley, CA 94704

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SERVICES. RESOURCES. COMMUNITY.

## News from the City of Berkeley

### **Help shape plan to protect our community from natural hazards**

*Give input on and learn how the City and Berkeleyans can best reduce risks from natural hazards such as earthquakes and wildfires. Join us for in-person workshops on June 3 or July 20.*



Attend an upcoming workshop to give feedback on a draft plan for how Berkeley can prepare for wildfires, earthquakes, and other natural hazards.

The plan, known as a Local Hazard Mitigation Plan, identifies the hazards Berkeley faces and prioritizes City and community-member actions to reduce risks, which are increasing in severity and likelihood due to climate

N

News &amp; Updates from the City of Berkeley &lt;updates@news.berkeley&gt;

Courtesy Copy: Berkeley Ready June Updates

✓ Albrecht, Jamie; ✓ Lana, Sarah; ✓ Fang, David; ✓ Chakko, Matthai; ✓ Lee, Seung; ✓ Willis, Kimberly; ✓ Dailey, Dafina; ✓ Yocum, He  
✓ May, Keith

! If there are problems with how this message is displayed, click here to view it in a web browser.

This is a courtesy copy of an email bulletin sent by Jamie Albrecht.

This bulletin was sent to the following groups of people:

Subscribers of Berkeley Ready Updates (3778 recipients)

May 10, 2024

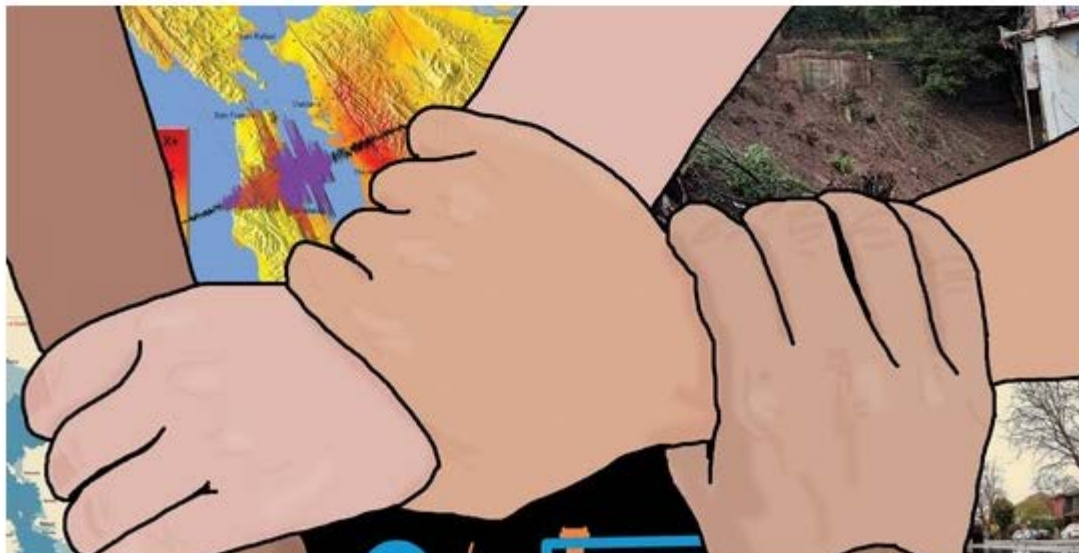
[View this message as a webpage](#)



Office of Emergency Services

## Berkeley Ready News & Updates

### Engage with our Local Hazard Mitigation Plan





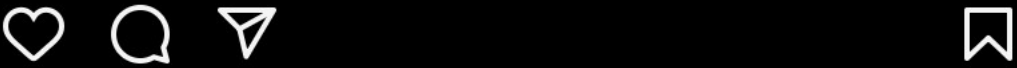
Post



berkeleyfiredept · [Follow](#)



**Local Hazard Mitigation Plan Workshop**  
June 3, 5:30 to 7:30 PM at the Berkeley Central Library



10 likes

**berkeleyfiredept** Join us for a hands-on workshop to engage with the First Draft 2024 Local Hazard Mitigation Plan. This workshop is an opportunity to learn about the various natural hazards, such as wildfires and earthquakes, that can occur in Berkeley, and to understand the





## Berkeley to host pair of disaster readiness workshops

Officials will review the city's local hazard mitigation plan, one at 5:30 tonight at the Berkeley Public Library and again in July.

By Alex N. Gecan June 3, 2024

## Berkeley landlines may be preserved; regulators to discuss in June

AT&T wants to abandon much of its landline telephone network, but some residents in the hills say that's their only reliable means of communication. Regulators will take up the matter June 20.

By Alex N. Gecan  
May 31, 2024



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K-8 Campus 1310 University Ave.  
[www.theberkeleyschool.org](http://www.theberkeleyschool.org)



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in Berkeley.*





City of Berkeley

MAY 29, 2024 6:00 AM · 4

## DISASTER PREPAREDNESS

# Help Berkeley prepare for natural hazards and disasters

The Local Hazard Mitigation Plan identifies hazards Berkeley faces and prioritizes actions that reduce risks. Find out how to get involved.



Attend an upcoming workshop to give feedback on a draft plan for how Berkeley can prepare for wildfires, earthquakes and other natural hazards.

The plan, known as a Local Hazard Mitigation Plan, identifies the hazards Berkeley faces and prioritizes city and community actions to reduce risks — which are increasing in severity and likelihood due to climate change.

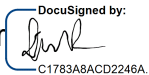
There are three ways you can help shape the plan:



Office of the City Manager

May 31, 2024

To: Commission Secretaries

From: Dee Williams-Ridley, City Manager 

Subject: 2024 Update to the Local Hazard Mitigation Plan;  
Public Comment Process

The First Draft of the City's 2024 Local Hazard Mitigation Plan (LHMP) update has been released on the City's website ([www.BerkeleyCA.gov/Mitigation](http://www.BerkeleyCA.gov/Mitigation)). The document's Executive Summary and Actions are attached to this letter.

As a Commission Secretary, please:

- Include the attached material as an Information Item in your next Commission meeting packet
- If your Commission wishes to provide feedback on the plan, please send comments to [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov) by July 31.

#### Plan Content

The LHMP identifies natural hazards in Berkeley and outlines a five-year strategy to further protect Berkeley's people, buildings, infrastructure, and environment from those hazards. The City began updating the LHMP in early 2023. This update effort will allow Berkeley to apply for federal mitigation grant programs and State funding, and is anticipated to be complete at the end of 2024.

The content of the LHMP is dictated by State and federal requirements and focuses on City actions to reduce risks. In an effort to make the LHMP more relevant and accessible to community members, staff created a new section called "Berkeley Household Risk Reduction" to offer clear steps people can take to mitigate risks in their own households. Staff also wants to acknowledge all the work community members do to contribute to collective risk reduction in Berkeley by taking these actions.

#### Commission Review

All City Commissions are welcome to review the First Draft Plan. Commissions interested in providing feedback must submit it to [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov) by July



Page 2

May 31, 2024

Re: 2024 Update to the Local Hazard Mitigation Plan; Public Comment Process

31, 2024. Staff will review the feedback and incorporate appropriate edits into the Final Draft Plan.

Staff will present on the First Draft Plan at the Planning Commission's June 5 meeting and the Disaster and Fire Safety Commission's June 26 meeting.

### Community Review

The First Draft Plan has been posted for review and comment on the City website ([www.BerkeleyCA.gov/Mitigation](http://www.BerkeleyCA.gov/Mitigation)). Staff recognize that it is difficult to engage with long documents, such as the LHMP. In an effort to support community review of the materials, the website also has detailed videos about each hazard included in the LHMP. The videos describe each hazard, its impacts, actions the City is taking to reduce risk, and recommend actions that community members can take to reduce risk in their own lives.

Members of the public are invited to provide written feedback on the document until July 31, 2024.

Written feedback can be submitted:

- a) Via email to [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov)
- b) Via postal mail to:  
Fire Department – Office of Emergency Services  
Attn: Mitigation Plan  
2100 Martin Luther King, Jr. Way, 2<sup>nd</sup> Floor  
Berkeley, CA 94704
- c) In-person during business hours to the Fire Department – Office of Emergency Services at the address above.
- d) In-person at Public Review Workshops:
  - a. Monday, June 3, 5:30 pm to 7:30 pm at the Central Library, in The Commons
  - b. Saturday, July 20, 10 am to 12pm at the Tarea Hall Pittman South Branch Library

Following the public review process for the First Draft Plan, staff will review community member feedback and will incorporate appropriate edits into the Final Draft Plan. Staff will concurrently develop an outline of edits made based on Commission and community feedback.

The Final Draft Plan will undergo review first by the State of California Office of Emergency Services, and then the Federal Emergency Management Agency (FEMA). Staff will make changes to the plan as required by these State and federal bodies.

### Adoption

In winter 2024 (est.), staff will post the Final Draft Plan, including any State and federal edits, to the City website. At that time, staff will present the Final Draft Plan to the

Page 3

May 31, 2024

Re: 2024 Update to the Local Hazard Mitigation Plan; Public Comment Process

Disaster and Fire Safety Commission and the Planning Commission, requesting their recommendations to the Council on the plan. The Planning Commission meeting will also serve as the First Public Hearing for the plan. Staff anticipates bringing the Final Draft Plan to the City Council for review and adoption in December 2024.

Commission Secretaries will serve as their Commissions' point of contact for this project. Please contact Jamie Albrecht, Emergency Services Coordinator (<mailto:jalbrecht@berkeleyca.gov>x5514), with questions.

Attachment: 2024 Local Hazard Mitigation Plan: First Draft Executive Summary and Actions

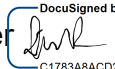
cc: David Sprague, Fire Chief  
LaTanya Bellow, Deputy City Manager  
Anne Cardwell, Deputy City Manager  
Jenny Wong, City Auditor  
Farimah Brown, City Attorney  
Mark Numainville, City Clerk  
Matthai Chakko, Assistant to the City Manager



Office of the City Manager

May 31, 2024

To: Honorable Mayor and Members of the City Council

From: Dee Williams-Ridley, City Manager   
DocuSigned by:  
C1783A8ACD2246A...

Re: 2024 Update to the Local Hazard Mitigation Plan; Public Comment Process

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The content of the LHMP is dictated by State and federal requirements and focuses on City actions to reduce risks. In an effort to make the LHMP more relevant and accessible to community members, staff created a new section called "Berkeley Household Risk Reduction" designed to offer clear steps people can take to mitigate risks in their own households. Staff also wants to acknowledge all the work community members do to contribute to collective risk reduction in Berkeley by taking these actions.

#### Community Review

The First Draft Plan has been posted for review and comment on the City website ([www.BerkeleyCA.gov/Mitigation](http://www.BerkeleyCA.gov/Mitigation)). Staff recognize that it is difficult to engage with long documents, such as the LHMP. In an effort to support community review of the materials, the website also has detailed videos about each hazard included in the LHMP. The videos describe each hazard, its impacts, actions the City is taking to reduce risk, and recommend actions that community members can take to reduce risk in their own lives.

Members of the public are invited to provide written feedback on the document until July 31, 2024.



Page 2

May 31, 2024

Re: 2024 Update to the Local Hazard Mitigation Plan; Public Comment Process

Written feedback can be submitted:

- a) Via email to [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov)
- b) Via postal mail to:  
Fire Department – Office of Emergency Services  
Attn: Mitigation Plan  
2100 Martin Luther King, Jr. Way, 2<sup>nd</sup> Floor  
Berkeley, CA 94704
- c) In-person during business hours to the Fire Department – Office of Emergency Services at the address above.
- d) In-person at Public Review Workshops:
  - a. Monday, June 3, 5:30 pm to 7:30 pm at the Central Library, in The Commons
  - b. Saturday, July 20, 10 am to 12pm at the Tarea Hall Pittman South Branch Library

Members of the public are invited to provide written feedback on the document until July 31, 2024.

#### Commission Review

All Commissions have been requested to include the First Draft Plan as an Information Item in an upcoming meeting, and to provide written feedback before July 31, 2024. Staff will present the Plan's proposed mitigation strategy at the June 5 meeting of the Planning Commission and the June 26 meeting of the Disaster and Fire Safety Commission. Following the public comment period for the First Draft Plan, staff will review and incorporate appropriate feedback from Commissions and community members into the Final Draft Plan.

#### Final Draft Plan

The Final Draft Plan will undergo review first by the State of California Office of Emergency Services and then the Federal Emergency Management Agency (FEMA). Staff will make changes to the plan as required by these State and federal bodies.

Once approved by these bodies, staff will present the Final Draft Plan to the Planning Commission. This meeting will be the first Public Hearing for the Final Draft Plan. At this meeting, staff will request the Commission's recommendation to Council on the Final Draft Plan. Because the LHMP will be an amendment to the City's General Plan, the Planning Commission must make a recommendation to Council on the Final Draft Plan.

Staff will also present the Final Draft Plan to the Disaster and Fire Safety Commission. Because the Disaster and Fire Safety Commission closely monitors the City's preparedness and mitigation efforts, staff will request that the Commission make a recommendation to Council on the Final Draft Plan at this meeting.

Staff anticipates bringing the Final Draft Plan to City Council for review and adoption in

Page 3

May 31, 2024

Re: 2024 Update to the Local Hazard Mitigation Plan; Public Comment Process

December 2024.

The First Draft Plan's Executive Summary and Actions are attached. Please let me know if you have any questions.

Attachments:

1. 2024 First Draft Local Hazard Mitigation Plan: Executive Summary and Actions

cc:

David Sprague, Fire Chief  
LaTanya Bellow, Deputy City Manager  
Anne Cardwell, Deputy City Manager  
Jenny Wong, City Auditor  
Farimah Brown, City Attorney  
Mark Numainville, City Clerk  
Matthai Chakko, Assistant to the City Manager

**From:** [Mitigation](#)  
**To:** [Mitigation](#)  
**Bcc:** [jmamit@aol.com](mailto:jmamit@aol.com); [sslaughter@peralta.edu](mailto:sslaughter@peralta.edu); [mblagg@bart.gov](mailto:mblagg@bart.gov); [jfeil@oaklandca.gov](mailto:jfeil@oaklandca.gov); [phess@acgov.org](mailto:phess@acgov.org); [manleys@kindermorgan.com](mailto:manleys@kindermorgan.com); [david.cook@ebmud.com](mailto:david.cook@ebmud.com); [swilmot@berkeley.edu](mailto:swilmot@berkeley.edu); ["JBoito@albanyca.org"](mailto:JBoito@albanyca.org); [jenn.cogley@bayer.com](mailto:jenn.cogley@bayer.com); [caltrans\\_d4@dot.ca.gov](mailto:caltrans_d4@dot.ca.gov); [mmayorga@kensingtonfire.org](mailto:mmayorga@kensingtonfire.org); [Barry.Stallard@pge.com](mailto:Barry.Stallard@pge.com); [aharte@berkeley.edu](mailto:aharte@berkeley.edu); [ejunkins1@berkeley.edu](mailto:ejunkins1@berkeley.edu); [smithe@sutterhealth.org](mailto:smithe@sutterhealth.org); [atheile@ebparks.org](mailto:atheile@ebparks.org)  
**Subject:** Draft 2024 Local Hazard Mitigation Plan Posted for Public Comment  
**Date:** Tuesday, June 4, 2024 12:27:00 PM

---

Dear Berkeley Community Partner,

The City of Berkeley is updating its Local Hazard Mitigation Plan, and the First Draft has been posted for public review at <http://www.berkeleyca.gov/mitigation>. The Mitigation Plan identifies Berkeley's natural hazards of concern and outlines a five-year strategy to further protect Berkeley's people, buildings, infrastructure and environment from these hazards.

We invite you to engage with the Plan, by either:

- Attending our public review workshop on [July 20](#)
- Watching our [detailed videos on Berkeley's natural hazards](#)
- Emailing your comments to [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov)
- Providing feedback in-person or via mail to the Berkeley Fire Department (2100 Martin Luther King Jr. Way)
- Attending our presentations at the [Planning Commission](#) on June 5 or [Disaster and Fire Safety Commission](#) on June 26

You're invited to provide written feedback on the First Draft Plan until July 31, 2024.

Thank you for considering and all the work that you do.

Warmly,  
City of Berkeley, Office of Emergency Services  
Mitigation Planning Team



**From:** [Mitigation](#)  
**To:** [Mitigation](#)  
**Bcc:** [info@downtownberkeley.com](mailto:info@downtownberkeley.com); [mail@telegraphberkeley.org](mailto:mail@telegraphberkeley.org); [info@shoptheelmwood.com](mailto:info@shoptheelmwood.com); [info@northshattuck.org](mailto:info@northshattuck.org); [liz@shotgunplayers.org](mailto:liz@shotgunplayers.org); [info@solanoavenue.org](mailto:info@solanoavenue.org); [gilmardistrict@gmail.com](mailto:gilmardistrict@gmail.com); [contact@westberkeleydesignloop.org](mailto:contact@westberkeleydesignloop.org); [uaaberkeley@yahoo.com](mailto:uaaberkeley@yahoo.com)  
**Subject:** Draft 2024 Local Hazard Mitigation Plan Posted for Public Comment  
**Date:** Thursday, May 30, 2024 4:18:00 PM

---

Dear Berkeley Commercial District,

The City of Berkeley is updating its Local Hazard Mitigation Plan, and the First Draft has been posted for public review at <http://www.berkeleyca.gov/mitigation>. The Mitigation Plan identifies Berkeley's natural hazards of concern and outlines a five-year strategy to further protect Berkeley's people, buildings, infrastructure and environment from these hazards. Businesses are a key piece in our collective disaster resilience, serving the Berkeley community everyday as go to places for everything we need, including most importantly social connection!

We invite you to engage with the Plan, by either:

- Attending one of our public review workshops on [June 3](#) or [July 20](#)
- Watching our [detailed videos on Berkeley's natural hazards](#)
- Emailing your comments to [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov)
- Providing feedback in-person or via mail to the Berkeley Fire Department (2100 Martin Luther King Jr. Way)
- Attending our presentations at the [Planning Commission](#) on June 5 or [Disaster and Fire Safety Commission](#) on June 26

Members of the public are invited to provide written feedback on the First Draft Plan until July 31, 2021. Thank you so much for considering and for your dedication to the Berkeley community.

In service,  
Jamie Albrecht

**From:** [Mitigation](#)  
**Bcc:** ["jgriffith@edrobertscampus.org"](#); ["kwilliams@byaonline.org"](#); ["frostiesmith73@gmail.com"](#); ["natalia@lapena.org"](#); ["lbranford@ymcaeastbay.org"](#); ["Trevor Jacobson"](#); [deborah@ecologycenter.org](#); [izerwekh@berkeleyhumane.org](#); [rosefalanga@gmail.com](#); [mirna@mionline.org](#); [RevCarrie@bfuu.org](#); [office@netivotshalom.org](#); [office@cbiberkeley.org](#); [operations@bethelberkeley.org](#); [spberkeley05@gmail.com](#); [ryoko.osa@gmail.com](#); [berkeleyhigashi@gmail.com](#); [thechairman1@comcast.net](#); [berkeleymtzn@sbcglobal.net](#); [noah.guynn@gmail.com](#); [walzer@usa.net](#); [berkeleylions@yahoo.com](#); [jwenk69@gmail.com](#); [nielsen.dennis.a@gmail.com](#); [arch1132@gmail.com](#); [rbermack@gmail.com](#); [karen@sawbirds.com](#); [dleveen@earthlink.net](#); [susansilber07@gmail.com](#); [karlreeh@gmail.com](#); [coolcarole4@gmail.com](#); [rjfinger@gmail.com](#); [nancy94705@gmail.com](#); [mbrayz@gmail.com](#); [thelous.email@gmail.com](#); [kathyhoare@sbcglobal.net](#); [stasha13@comcast.net](#); [berkgal22@gmail.com](#); [naj.dnomyar@gmail.com](#); [Petra.Liljestrand@gmail.com](#); [daniel.leaverton@gmail.com](#); [ginosegre@gmail.com](#); [coxbanbury@gmail.com](#); [bcfilms@me.com](#); [hfortich@gmail.com](#); [richard@richardschwartz.info](#); [barrie@rokeachphoto.com](#); [nazreenkadir@gmail.com](#); [psamis@gmail.com](#); [heathero75gwhs@gmail.com](#); [mariceashe@gmail.com](#); [marisa@steponeschool.org](#); [lizbarry4@yahoo.com](#); [vargasgabr@gmail.com](#); [me@dietlind.net](#); [Ben.s.ringler@gmail.com](#); [stephporras@yahoo.com](#); [laib.christa@gmail.com](#); [kodanih@comcast.net](#); [paperfortress@gmail.com](#); [helend@berkeley.edu](#); [elissa.s.lee@berkeley.edu](#); [damonguthrie@gmail.com](#); [janefischberg2@gmail.com](#); [audrey12@comcast.net](#); [ronkyle@lmi.net](#); [msmensik@me.com](#)  
**Subject:** Draft 2024 Local Hazard Mitigation Plan Posted for Public Comment  
**Date:** Wednesday, May 29, 2024 4:16:00 PM

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Dear Berkeley Community Partner,

The City of Berkeley is updating its Local Hazard Mitigation Plan, and the First Draft has been posted for public review at <http://www.berkeleyca.gov/mitigation>. Thanks to so many of you who contributed previously to the plan with your words but also to all of you for contributing with your actions every day. It is the work that you do, in service to the community, connecting people to each other and resources that is truly the best thing we can do to reduce our disaster risks.

The Mitigation Plan identifies Berkeley's natural hazards of concern and outlines a five-year strategy to further protect Berkeley's people, buildings, infrastructure and environment from these hazards.

We invite you to engage with the Plan, by either:

- Attending one of our public review workshops on [June 3](#) or [July 20](#)
- Watching our [detailed videos on Berkeley's natural hazards](#)
- Emailing your comments to [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov)
- Providing feedback in-person or via mail to the Berkeley Fire Department (2100 Martin Luther King Jr. Way)
- Attending our presentations at the [Planning Commission](#) on June 5 or [Disaster and Fire Safety Commission on June 26](#)

Members of the public are invited to provide written feedback on the First Draft Plan until July 31, 2021. Thank you so much for considering and for your dedication to the Berkeley community.

In service,  
Jamie Albrecht

---

**Jamie Albrecht**  
she/her/hers

Emergency Services Coordinator  
City of Berkeley Office of Emergency Services  
e | [jalbrecht@cityofberkeley.info](mailto:jalbrecht@cityofberkeley.info) p | (510) 981-5514



**From:** [Albrecht, Jamie](#)  
**To:** [Mitigation](#)  
**Bcc:** [bampta@gmail.com](mailto:bampta@gmail.com); [info@emerson elementary.org](mailto:info@emerson elementary.org); [ptapresident@cragmont.org](mailto:ptapresident@cragmont.org); [info@johnmuirelementray.org](mailto:info@johnmuirelementray.org); [communications@mxpta.org](mailto:communications@mxpta.org); [pta@oxford elementary.org](mailto:pta@oxford elementary.org); [ruthactypta.berkeley@gmail.com](mailto:ruthactypta.berkeley@gmail.com); [president@washington.berkeleypta.org](mailto:president@washington.berkeleypta.org); [president4willard@gmail.com](mailto:president4willard@gmail.com); [ptsaberkeleyhigh@gmail.com](mailto:ptsaberkeleyhigh@gmail.com); [bis@berkeley.net](mailto:bis@berkeley.net)  
**Subject:** Draft 2024 Local Hazard Mitigation Plan Posted for Public Comment  
**Date:** Thursday, May 30, 2024 4:38:00 PM

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Dear Berkeley Parent Teacher Association,

The City of Berkeley is updating its Local Hazard Mitigation Plan, and the First Draft has been posted for public review at <http://www.berkeleyca.gov/mitigation>. The Mitigation Plan identifies Berkeley's natural hazards of concern and outlines a five-year strategy to further protect Berkeley's people, buildings, infrastructure and environment from these hazards. Schools are a key part of our collective disaster resilience – from the buildings they occupy to the services they provide to the connections they create. We are interested in hearing from you and how we can help you feel ready for the natural hazards in Berkeley.

We invite you to engage with the Plan, by either:

- Attending one of our public review workshops on [June 3](#) or [July 20](#)
- Watching our [detailed videos on Berkeley's natural hazards](#)
- Emailing your comments to [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov)
- Providing feedback in-person or via mail to the Berkeley Fire Department (2100 Martin Luther King Jr. Way)
- Attending our presentations at the [Planning Commission](#) on June 5 or [Disaster and Fire Safety Commission](#) on June 26

Members of the public are invited to provide written feedback on the First Draft Plan until July 31, 2021. If engaging with the Plan feels like too much, we understand that. If you're interested in connecting more in general with the Office of Emergency Services, please email me at [jalbrecht@berkeleyca.gov](mailto:jalbrecht@berkeleyca.gov) – I am very interested in connecting with schools, learning what you all need, and seeing how we can work together.

Thank you so much for considering and for your dedication to the Berkeley community.

In service,  
Jamie Albrecht

**From:** [Elsine Green](#)  
**To:** [Mitigation](#)  
**Subject:** Re: Mitigation of Fires Hillside Berkeley  
**Date:** Wednesday, June 5, 2024 2:40:17 PM

---

Thank you.  
Sent from my iPhone

> On Jun 4, 2024, at 2:19 PM, Mitigation <Mitigation@berkeleyca.gov> wrote:  
>  
> Hi Elsine,  
>  
> Thank you for your message! The City of Berkeley hasn't used goats for fire fuel mitigation work.  
>  
> UC Berkeley and the Lawrence Berkeley National Lab have used goats in the past. I believe the area that you're asking about is UC Berkeley property so this question would be best for them.  
>  
> It is tricky to use goats. Many people are upset about them -- they tend to eat everything, not just the stuff you want them, too!  
>  
> I hope this is helpful!  
>  
> Thanks,  
> Jamie  
>  
> \_\_\_\_\_  
>  
> Jamie Albrecht  
> she/her/hers  
> Emergency Services Coordinator  
> City of Berkeley Office of Emergency Services  
> e | [jalbrecht@cityofberkeley.info](mailto:jalbrecht@cityofberkeley.info) p | (510) 981-5514  
>  
> -----Original Message-----  
> From: Elsine Green <[emkg99@icloud.com](mailto:emkg99@icloud.com)>  
> Sent: Wednesday, May 29, 2024 5:18 PM  
> To: Mitigation <Mitigation@berkeleyca.gov>  
> Subject: Mitigation of Fires Hillside Berkeley  
>  
> WARNING: This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.  
>  
> 29 May 24  
>  
> Until the last couple of years goats were used to remove the hillside grass, weeds , all potential fuel for fires. The goats did an excellent job. Now, whoever is cutting down the potential fire fuel has brush from approximately 5'' to 12'' of dry brush. This can easily be seen from east side of Sports Lane, next to the swimming pool. The children's annual camp program is expected to start soon.  
> Why don't you use the goat service anymore?  
>  
> Concerned citizens  
>  
>  
> Sent from my iPhone





**From:** [rachel bradley](#)  
**To:** [Mitigation](#)  
**Subject:** Re: Public meetings re plan  
**Date:** Tuesday, June 4, 2024 5:50:32 PM

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Thanks Jamie.

I have a couple of thoughts about WUI Fires (since I live in the Berkeley hills north of campus).

The first is the importance of protecting evacuation routes for residents (and incoming fire trucks) by restricting parking on the narrow roads in the hills to make sure two cars can pass. This is essential to keep residents safe. It should be enforced at all times by citations, and especially on high fire risk days, when cars in violation should be towed. This is just the most basic common sense, based on how people have died in previous fires. People act like they have the right to park as many giant vehicles as they want on the public street in front of their house, but this should not trump public safety. They may have to park elsewhere, or use their driveways or garages. It's time to get serious about this in my opinion, and I know many neighbors agree.

The second thing is the importance of having homeowners clear dead and dangerous vegetation on their properties. This needs to be taken more seriously, and quick clean up required (or else the city should clean and charge homeowners). I have called to report dangerous conditions on neighborhood properties, and it usually takes many calls over many weeks to get any results. Given the high risk of fire, this should be a priority.

Thanks for taking my comments into consideration.

---

**From:** Mitigation <Mitigation@berkeleyca.gov>  
**Sent:** Tuesday, June 4, 2024 2:02 PM  
**To:** rachel bradley <rachelbradleywood@hotmail.com>  
**Subject:** RE: Public meetings re plan

Hi Rachel,

Hope you're doing well! I am attaching a PDF of our poster boards. Please feel free to send me any feedback you have!

Thank you again for your interest,  
Jamie

---

**Jamie Albrecht**

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | [jalbrecht@cityofberkeley.info](mailto:jalbrecht@cityofberkeley.info) p | (510) 981-5514

---

**From:** rachel bradley <rachelbradleywood@hotmail.com>

**Sent:** Thursday, May 30, 2024 4:01 PM

**To:** Mitigation <Mitigation@berkeleyca.gov>

**Subject:** Re: Public meetings re plan

Thanks, I would love to see the posters

On May 30, 2024, at 3:52 PM, Mitigation <[Mitigation@berkeleyca.gov](mailto:Mitigation@berkeleyca.gov)> wrote:

Hello Rachel,

Thanks so much for following up! We don't currently have an online meeting scheduled. However, our YouTube videos are a good run down of the Plan and we welcome comments to this email address. I can also send you the posters that we're showing at our in person meetings and welcome your comments that way!

Warmly,

Jamie

---

**From:** rachel bradley <[rachelbradleywood@hotmail.com](mailto:rachelbradleywood@hotmail.com)>

**Sent:** Tuesday, May 28, 2024 5:34 PM

**To:** Mitigation <[Mitigation@berkeleyca.gov](mailto:Mitigation@berkeleyca.gov)>

**Subject:** Public meetings re plan

**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Will either of these meetings be available to join online?

Sent from [Mail](#) for Windows

**From:** [Sabina McMurtry](#)  
**To:** [Mitigation](#)  
**Subject:** Re: suggestions  
**Date:** Sunday, June 2, 2024 10:07:25 AM

---

And thank you for your response, Jamie.

I'm glad to hear the trees are, rightly, included in the mitigation plan. One additional comment about the maintenance of the street trees, and city work in general, is that I hope you are building in evaluation of work that is done, with recourse to improving any work that is not done well.

Sabina

On Thursday, May 30, 2024 at 03:57:46 PM PDT, Mitigation <mitigation@berkeleyca.gov> wrote:

Thanks for responding! Totally understand that – unfortunately federal requirements ensure that this Plan is very long! We're always looking for ways to make it more approachable, but it's difficult. We have made the [YouTube videos](#) with this in mind but they take time to watch too.

Appreciate your comment about the trees! We have an action in our Mitigation Plan to expand our Forestry Unit so that we can do more maintenance and planting. So hopefully this will improve soon – it is definitely on our radar.

Thanks so much for writing in,  
Jamie

---

**From:** Sabina McMurtry <sabinamcmurtry@yahoo.com>

**Sent:** Wednesday, May 29, 2024 8:04 PM

**To:** Mitigation <Mitigation@berkeleyca.gov>

**Subject:** suggestions

**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Hello

I am a 50 year resident of Berkeley, a homeowner in South Berkeley.

I do not have the bandwidth to read your incredibly long proposals, but I would like to suggest an area of attention if it is not already included:

Many of our street trees are in abysmal condition and they present a variety of hazards to people and property.

During natural disasters which may include heavy rain and winds, wildfires and earthquakes they can be the source of danger and damage. As an example, I will discuss the camphor trees on my block, the 2200 block of Stuart St.

Many of them have been pruned by the city to avoid problems with power lines. Pruning in this manner only leaves them extremely lopsided, prone to toppling in high winds and heavy rains. A number of the trees on my block have huge dead limbs, and when the city has pruned some of these limbs (leaving other hazardous ones), again they have dealt with one problem and caused others, more lopsided trees with potential to fall. We even have one camphor tree where the entire crown is dead, but the city ignores it. I have been in touch with the Dept. of Forestry about this, been added to waiting lists and seen the city come out and do a very minor and unbalanced job of pruning. And this is just one block. Our street trees are important and valuable to us in so many ways - but the city must maintain them and plant additional ones as the old ones die. Here is something the city can do that is an integral part of disaster mitigation and which does not involve figuring out new ways to deal with difficult problems. The answers are obvious, but not put into effect. I understand that there is limited money for the Forestry Dept., but perhaps some funds for disaster mitigation could be correctly added to to street tree maintenance to mitigate these hazards.

Sabina McMurtry



**From:** [Mitigation](#)  
**To:** [Shela Ray](#); [Mitigation](#)  
**Subject:** RE: Video quality (or lack)  
**Date:** Thursday, June 27, 2024 4:41:23 PM

---

Hi Shela,

Thanks so much for sending another note! I appreciate it. I am excited to hear about your work in the peer ambassador program. It's such an exciting program and I am grateful for your work in this space, including watching our videos and providing feedback.

It's helpful to hear what made the other videos better! As I continue to build our outreach programs and materials, I will definitely keep this in mind. If you have other ideas for how we can better reach people and provide actionable materials, I am here to listen!

Warmly,

Jamie

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**Jamie Albrecht**

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | [jalbrecht@cityofberkeley.info](mailto:jalbrecht@cityofberkeley.info) p | (510) 981-5514

**From:** Shela Ray <[sray.spacework@gmail.com](mailto:sray.spacework@gmail.com)>

**Sent:** Tuesday, June 18, 2024 3:24 PM

**To:** Mitigation <[Mitigation@berkeleyca.gov](mailto:Mitigation@berkeleyca.gov)>

**Subject:** Re: Video quality (or lack)

Hi Jamie Albrecht,

Thanks for getting back to me.

I'm sorry if I came across as harshly critical! A little more explanation is that I have been working my way through many emergency preparedness videos as part of my final project for a six-month training program I am just completing through the Center for Independent Living - it's a peer ambassador training in emergency preparedness for disabled and older adults.

<https://thecil.org/emergency-preparedness/peer-ambassador-program/>

I decided to compile a list of resources on emergency preparedness focusing particularly on older adults, and have been reviewing many web sites - federal, state, Alameda Cty and City of Berkeley, including check lists, articles, and videos. I think videos are a great way to get things across, as most people I know getting very tangled up in online research.

I have watched some really good videos from City of Berkeley so far - "Making your household fire weather plan: a step by step guide" (2022, on the City of Berkeley YouTube channel), and "What you can do: four key steps to take control before a wildfire starts" (on the Berkeley Fire Dept You Tube Channel). They were narrated by different people, but were slower, gave a bit more time to absorb what was being said, and had a more conversational tone than the ones I was commenting on.

I've got myself on various lists now and am trying to keep up, but as mentioned, I was disappointed in those last two I watched from the recent email notification I got.

I understand that time and budgets can be limiting factors in producing communications. A lot of helpful things have been done so far. I do appreciate your efforts and wish the best to all of you who are involved in these efforts.

Shela Ray

On Mon, Jun 17, 2024 at 1:13 PM Mitigation <[Mitigation@berkeleyca.gov](mailto:Mitigation@berkeleyca.gov)> wrote:

Hi Shela,

Thank you for watching and for the feedback. We have your recommendations noted – we will continue to improve our materials as much as we can, given our limitations.

Appreciate it,

Jamie

---

**Jamie Albrecht**

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | [jalbrecht@cityofberkeley.info](mailto:jalbrecht@cityofberkeley.info) p | (510) 981-5514

---

**From:** Shela Ray <[sray.spacework@gmail.com](mailto:sray.spacework@gmail.com)>

**Sent:** Thursday, June 13, 2024 6:43 PM

**To:** Mitigation <[Mitigation@berkeleyca.gov](mailto:Mitigation@berkeleyca.gov)>

**Subject:** Video quality (or lack)

**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Hi,

I've tried watching the videos. The voice over is so bad, way too fast, lots of mistakes, flat, like someone bored and reading and not understanding that they are teaching, informing people for the first time, these very important points

You need to get someone who knows how to teach, how to communicate in this medium. I watched the Wildland Urban Interface and tried to go on with landslides but I just couldn't handle the rushed, flat presentation of info.

Thanks for trying, but it's really important information and needs a media specialist to help it get across in an engaging manner.

Shela Ray

**From:** [Marilyn Sagna](#)  
**To:** [Mitigation](#)  
**Subject:** Re: What I would like included in an equitable mitigation plan  
**Date:** Thursday, August 1, 2024 1:32:54 PM

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**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

P.S. I think a proactive psychosocial component could be a positive addition to this hazard mitigation plan. Especially if it is arched into a public health component.

Equity minded, holistic and inclusive!

On Thu, Aug 1, 2024 at 1:24 PM Marilyn Sagna <[marilynsagna19@gmail.com](mailto:marilynsagna19@gmail.com)> wrote:

I am regularly exposed to dangerous dusts with neighborhood hired yard maintenance blowers. If I'm here and able to shut all windows in a rapid manner, I can momentarily protect my indoor air space from dangerous conditions. This happens often: neighbors right, left and cross change days blowing these toxins, fungi, allergens and other pollutants (noise, fumes, unknowns...) into my home. The homeowners are not there to be exposed to what we and these workers are subjected to.

I would like to see language that protects renters who participate and take preventative safety measures that the city recommends. I have been threatened that I could lose my housing by my landlords for storing water. Many rentals are small carved spaces, without the space resources that home owners usually have at their discretion. How about language that guarantees renters space for emergency provision and gobags? How about vouchers for low income water, etc.? How about neighborhood caches?

Furthermore, as an unpaid home based caregiver I have no OSHA or any other protections from landlords that hire people or do work themselves, that seriously threaten health and safety. These types of workplace health and safety violations would not be tolerated on a protected worksite. Allowing neighbors to hire vulnerable persons and exposing neighbors to continual and cumulative health and safety violations is unconscionable and should be addressed. As a worrisome example: should lead in the soil really be at the discretion of landlords? How about fire extinguishers? How about being exposed to unlabeled environmental and human toxins and/or flammables in locations unknown and perhaps not safe? Can you imagine being threatened for wanting to live in a healthy and safe home?

I would like to see the economic environmental discrepancy dangers to be addressed. Please extend mitigation to the hazards above and many more that debilitate the health and safety of many in our community that are vulnerable sitting ducks to cumulative environmental dangers. Please merge within an equity platform where each and every person's health, inclusive of their voice, and community health are worthy goals. This plan needs to be inclusive for all that is missing here.

Thank you for your works and for listening to some of my concerns. If anyone cares to respond, I thank you as well.

--

*Marilyn*

--

*Marilyn*



**From:** [Elsine Green](#)  
**To:** [Mitigation](#)  
**Subject:** Mitigation of Fires Hillside Berkeley  
**Date:** Wednesday, May 29, 2024 5:18:19 PM

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WARNING: This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

29 May 24

Until the last couple of years goats were used to remove the hillside grass, weeds , all potential fuel for fires. The goats did an excellent job. Now, whoever is cutting down the potential fire fuel has brush from approximately 5'' to 12'' of dry brush. This can easily be seen from east side of Sports Lane, next to the swimming pool. The children's annual camp program is expected to start soon.  
Why don't you use the goat service anymore?

Concerned citizens

Sent from my iPhone

**From:** [kelly hammargren](#)  
**To:** [Mitigation](#)  
**Subject:** LHMP Comments -  
**Date:** Thursday, August 8, 2024 10:22:53 PM

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**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

The Local Hazard Mitigation Plan Update (LHMP) is very well done and as comprehensive as it is, listed here are a few additions that need to be addressed regardless of the required LHMP Update timeline.

1) Berkeley should be aggressively moving toward Passive Houses and using Passive House Principles in multi-unit buildings. This would increase living and working comfort and reduce energy load on the grid.

<https://www.phius.org/passive-building/what-passive-building/passive-building-principles>

In the Strategy Action chart #49 encourage passive and energy efficient strategies are listed as is the word "ongoing." Since I have attended every public meeting on new project approvals for nearly 10 years, I can tell you this is not happening.

2) Passive house principles locate operable windows for the best exposure to cooling breezes. Currently new construction is designed with no consideration to cooling breezes.

3) The Zoning Adjustment Board (ZAB) and Design Review Committee (DRC) focus on the exterior design not the interior. There is no current regulation/ordinance in Berkeley that requires operable windows in bedrooms which means that multi-unit buildings have been approved with multiple bedrooms with no windows. In the situation where there is an extreme heat event and a power failure these rooms and units become a heat trap / a death trap.

4) The Zoning Ordinances before the City Council establish setbacks between buildings without consideration to air current, air circulation. This will be increasingly important as the climate continues to warm and heat events become more frequent. Lining San Pablo with wall to wall taller buildings will impact air flow, increase heat island effect and create micro climates of sustained heat.

5) Tree canopy is listed as a mitigation in heat events under 51, however, the problem is Berkeley's Urban Forestry selections are small trees in inadequate spaces instead native trees with large canopies as on California between Dwight and Allston. The city is being filled through the forestry program with none native trees that do not support local habitat and ecosystems besides being inadequate to provide shading in heat events.

6) Permeable paving is not listed as a mitigation to stormwater in 53. Permeable paving can easily be incorporated into street design as was done on the north side of Channing between MLK Jr Way and Milvia. It has also been used on the north side of San Pablo Park. Permeable paving is not the same as bioswales. Permeable paving could be used throughout the city instead of hardscape, impermeable concrete, or asphalt in driveways, sidewalks, etc.

5) A large gas pipeline runs up Allston through neighborhoods, past the high school (with over 3000 students) and by city hall. There is no reporting on inspections and status. A leak and explosion of this gas pipeline like what happened in 2010 in San Bruno at Milvia and Allston during a work day and school day has the potential to wipe out much of city government and the high school student body. Not only does there need to be reporting by PG&E, but in addition electrification needs to be accelerated to remove this kind of hazard.

6) Just like there are notifications of asbestos in buildings, there needs to be notifications to renters when units being considered for renting and to occupants of rented units that are in fire zones, hillside slide areas, within proximity to the Hayward fault and when rental housing is in soft story buildings at risk of collapse.

kelly hammargren

**From:** [John Light](#)  
**To:** [Mitigation](#)  
**Subject:** Hazards mitigation  
**Date:** Thursday, July 25, 2024 2:58:05 PM

---

WARNING: This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

How about removing those dangerous concrete bike lane dividers that people keep smashing into with their cars?  
Sent from my iPhone



**From:** [Burns, Anne M](#)  
**To:** [Mitigation](#)  
**Subject:** General DRC Comments on First Draft Local Hazard Mitigation Plan (LHMP)  
**Date:** Wednesday, July 31, 2024 3:11:32 PM

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[Internal](#)

The City's First Draft Local Hazard Mitigation Plan (LHMP) was included in the Design Review Committee (DRC) July 18, 2024 Agenda as a general communication item. There were some general comments on this draft at the meeting. We have included these general comments below, as well as in the DRC's summary on-line under their July 18<sup>th</sup> Meeting Summary. Thank you. – Anne Burns, Design Review Committee Secretary

- General DRC Comments on the City's First Draft Local Hazard Mitigation Plan (LHMP): Good draft, but continue to work on:
  - Fire egress for tall buildings once outside the building;
  - Heat wave mitigations;
  - New building design for livability with climate changes. One example of this would be requiring windows in all bedrooms;
  - Shelter-in-place safety precautions; and
  - Bird safety measures.

**From:** [Lana, Sarah](#)  
**To:** [Mitigation](#)  
**Subject:** FW: Fire Chief Sprague - Evacuation Routes  
**Date:** Tuesday, June 4, 2024 9:13:50 AM

---

Internal

**From:** Bernard Marszalek <[ztangi@lmi.net](mailto:ztangi@lmi.net)>  
**Sent:** Sunday, June 02, 2024 12:44 PM  
**To:** Berkeley Fire Department <[FireMailbox@berkeleyca.gov](mailto:FireMailbox@berkeleyca.gov)>  
**Subject:** Fire Chief Sprague - Evacuation Routes

**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Greetings Fire Chief Sprague,

I have been reading the City of Berkeley Local Hazard Mitigation Plan (Draft) and discovered that the only mention of Evacuation Routes refers to Fire Zone 2 & 3.\* Though I failed to find a map of Fire Zones on the City of Berkeley website, I presume that these are hill district zones. I recall that the City of Berkeley was past due establishing safe routes and that a consulting group was hired to complete a study.

I would like to make a comment on the Draft that would request that that information be added to the section on Evacuation Routes. (See below)

Could you please provide that information to me?

Thank you,

-b.

\* **map** - <https://berkeleyca.gov/sites/default/files/documents/Berkeley-Emergency-Access-Evacuation-Routes-06-2011.pdf>

Also, my summary of the draft's section on evacuation routes in Fire Zones 2 & 3:

Document re **Local Hazard Mitigation Plan 2024 - Update**

"Share your ideas for actions the City of Berkeley and its residents can take to reduce risks from natural hazards, such as earthquakes and wildfires."

<https://berkeleyca.gov/safety-health/disaster-preparedness/local-hazard-mitigation-plan-update>

Several things to note:

1. "For the first time, the plan identifies poor air quality, high wind, sea level rise, utility interruption, and infectious disease as hazards of concern."
2. "Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3. Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions."

There is no map provided to locate Fire Zone 2 and 3. Searching on the Berkeley City website proved fruitless. I presume that these are hill districts where narrow

streets prevail.

I scanned the entire LHMP Update and found nothing more about Evacuation Routes. Since at the first signs of a disaster, and even before some residents are immediately affected, people will practice preventive measures and seek safety. **If there are no plans for Evacuation Routes in a Mitigation Plan how do we prevent traffic chaos during a disaster?**

For example, an Evacuation Plan would include preferable arteries to safety. The arterial roads might be designated as all lanes One Way West.

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Berkeley Public Eye You Tube channel --> [https://youtu.be/rjqB62h\\_vlQ?si=skjKW71MEruz1zY6](https://youtu.be/rjqB62h_vlQ?si=skjKW71MEruz1zY6)

--

Bernard Marszalek • 510-693-5760 • Berkeley, CA 94703



**From:** [Albrecht, Jamie](#)  
**To:** [Mitigation](#)  
**Subject:** FW: Are there earthquake hardening resources for Berkeley residents? If so, please share?  
**Date:** Thursday, June 13, 2024 2:13:07 PM

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Internal

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**Jamie Albrecht**

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | [jalbrecht@cityofberkeley.info](mailto:jalbrecht@cityofberkeley.info) p | (510) 981-5514

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**From:** Gregory, Thomas <TGregory@berkeleyca.gov>

**Sent:** Tuesday, June 11, 2024 1:21 PM

**To:** Sheela Gunn <sgunn@thecil.org>; Albrecht, Jamie <JAlbrecht@berkeleyca.gov>

**Cc:** Emma Martin <emartin@thecil.org>; Henry Maeko <hmaeko@thecil.org>; Lana, Sarah <slana@berkeleyca.gov>

**Subject:** Re: Are there earthquake hardening resources for Berkeley residents? If so, please share?

Hi Sheela,

I'm not aware of any such resource (be it City-sponsored or County-sponsored, or be it available to all or just available to folks with low-incomes).

Just last week, Berkeley's Commission on Disability was discussing how useful it would be if such a resource were available to Berkeleyans as part of (or a supplement to) the City's Local Hazard Mitigation Plan.

If you discover any good news on this front, please share...I will do the same.

Best,

**Thomas Gregory / ADA Program Coordinator**

City of Berkeley, Public Works Department

1947 Center Street, 4<sup>th</sup> Floor

Berkeley, CA 94704

(510) 981-6418

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**From:** Sheela Gunn <[sgunn@thecil.org](mailto:sgunn@thecil.org)>

**Sent:** Tuesday, June 11, 2024 1:11 PM

**To:** Albrecht, Jamie <[JAlbrecht@berkeleyca.gov](mailto:JAlbrecht@berkeleyca.gov)>; Gregory, Thomas <[TGregory@berkeleyca.gov](mailto:TGregory@berkeleyca.gov)>

**Cc:** Emma Martin <[emartin@thecil.org](mailto:emartin@thecil.org)>; Henry Maeko <[hmaeko@thecil.org](mailto:hmaeko@thecil.org)>

**Subject:** Are there earthquake hardening resources for Berkeley residents? If so, please share?

WARNING: This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Hi, Folks,

I've just gotten an inquiry about getting shelves and other tall furniture secured. Are there such resources in Berkeley? I'm assuming low income. It also occurs to me to check for county resources, and would appreciate any info you have on that front, else I'll ask my 211 contact.

Thanks,  
Sheela Gunn, (ze, zeir, zeirs)  
Emergency Preparedness Coordinator  
Center for Independent Living (CIL),  
Berkeley, CA  
[sgunn@thecil.org](mailto:sgunn@thecil.org)  
510-422-5068 (Textable, too!)  
[www.thecil.org/emergency-preparedness/](http://www.thecil.org/emergency-preparedness/)

Our main web site is:

[www.thecil.org](http://www.thecil.org)

\*\*\*\*\*

See below for a list of some good emergency preparedness resources.

\*New Resource! \* Listos - Disaster Readiness

<<https://www.listoscalifornia.org/disaster-readiness/>>

\*New Resource! \* Alameda County's Disability-Specific page re Emerg. Prep.

<<https://www.acgov.org/ready/disability.htm>>

\* The Access and Functional Needs (AFN) Library at Cal OES. Everything you might want to know about people with disabilities, older adults, and other folks with Access and Functional Needs (AFN), \*including\* what that phrase means.

<https://www.caloes.ca.gov/office-of-the-director/policy-administration/access-functional-needs/afn-library/>

\* The Cal OES Listos resource hub that also features pamphlets about several kinds of emergencies/disasters in many languages. Different from the Readiness page listed above.

<https://www.listoscalifornia.org/resources/>

You may share any of these resources. :)

**From:** [Steve Koppman](#)  
**To:** [Mitigation](#)  
**Subject:** Fw: Air Pollution Mitigation, Citizen Comment  
**Date:** Thursday, August 8, 2024 4:15:03 PM  
**Attachments:** [denahbooksteinCommentonCityofBerkeleyMitigation824.doc](#)

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**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

From: Denah S. Bookstein

This is in response to the City of Berkeley's 2024 Air Pollution Mitigation report, part of Berkeley's Local Hazard Mitigation Plan:

I recently watched with interest your video alerting Berkeley citizens to the presence and dangers of airborne pollutants and their toxic effect on the health of our community. The video emphasizes that the health threats of air contaminants fall mainly on seniors and pregnant and nursing women, two groups many of whose members lack the financial resources to protect themselves, at the same time those most likely to be outside walking.

I have lived in Berkeley since 1987, first on the east side of the city and, since 2005, on the far west side. I have experienced an extreme difference in air quality in the two locations and the lack of attention the City has given to this problem. On the far west side of the city, there is constant infiltration of our homes and bodies by dangerous particulate matter. We sweep it up and wash it off our faces every night. My house dust is dark grey. My lungs feel constricted and only when I make it to the Marina can I breathe deeply.

Berkeley's proposals for dealing with these problems are, to me, inadequate. The city proposes planting trees, providing more convenient parking spaces and encouraging residents to walk and use bikes, scooters and EV cars.

It seems the City government is trying to delegate responsibility for dealing with these toxic problems to the general citizenry while failing to take concerted City actions.

Must we wear a mask every day for the rest of our lives?  
Install and maintain expensive air filtration systems?  
Buy a very costly electric car?  
Consult a 'Spare the Air' website to find out just how bad our air is on any given day?

Can we really expect our senior population to get around Berkeley on bicycles and scooters in increasing traffic, trying to be safe as cars and cyclists alike fail to stop at stop signs and red lights, or even use their signals, drivers and pedestrians often lost on their phones?

The City wants to encourage walking to reduce auto pollution. But uneven sidewalks, broken surface streets and poor lighting are endemic in Berkeley and hardly invite anyone, let alone older residents, to walk outside. I



myself have fallen twice on city streets and many seniors I know have fallen similarly with resulting sprains, bruising and broken bones.

I'm aware the City has planted some trees on the southwest side of Berkeley and has bought electric buses. However, our City must do much better than this.

An important line of attack would be building highway barriers to shield residents from the roads' harmful air pollution. There is no barrier at all along 580/80 through Berkeley. In other cities along the 80 and 580 corridor, there are trees, berms, plantings and walls absorbing a significant amount of the particulate matter along the roadway. In Berkeley, there is basically nothing. Increased traffic including trucks (and freight trains) along the 580/80 make this a worsening problem.

Apartment building developers also have had a continuously deleterious effect on how our City looks and how it feels to walk down a street. On Berkeley's streets, buildings are being built to the last permitted inch, forcing pedestrians ever closer to truck and car exhaust containing these particulates.

Imagine walking in the new shoreline park at the end of University Avenue, and not breathing in the toxic particulate-filled air of 580/80.

Imagine trees and bushes planted along the highway, train way and City commercial/major streets, providing an environment friendly to people and birds besides pigeons and seagulls. Imagine tree-lined streets providing cooling protection from the heat, cleaning the air and uplifting our spirits.

Imagine shady, spacious, accessible streets working to make life healthier and happier.

Thank you for your attention.

Denah S. Bookstein

2430 Fifth St., Studio L  
Berkeley, CA 94710  
District Two

**From:** [Friends of Five Creeks](#)  
**To:** [Mitigation](#)  
**Cc:** [May, Keith](#); [Miller, Roger](#); [Moore, Sarah M.](#); [Amiri, Wahid](#); [ccouncil@berkeleyca.gov](mailto:ccouncil@berkeleyca.gov)  
**Subject:** Friends of Five Creeks comments on Local Hazards Mitigation Plan, May 24, 2024 draft  
**Date:** Thursday, August 8, 2024 3:24:55 PM

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**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

To: Comments on draft Local Hazards Mitigation Plan

cc: Berkeley Commissions on Disaster and Fire Safety; Transportation and Infrastructure; Parks, Recreation, and Waterfront; and Environment and Climate; Mayor and Council

Friends of Five Creek appreciates the opportunity to comment on Berkeley's Local Hazards Mitigation Plan, May 2024 draft.

We are a 28-year-old, all-volunteer group working for creeks, watersheds, and local nature from Berkeley to Richmond. We have dealt with risks of erosion and flooding on local creeks for many years and seen the collapse of aging culverts. As climate changes, we are increasingly concerned with the likely effects of sea-level rise and groundwater infiltration, as well as increased probability of deluges.

### **This plan is an excellent start. Ongoing improvements and collaborations will be vital.**

The plan's focus and highest level of detail are on wildfire and earthquake. **Development in other areas will be needed.** The examples below regarding collaboration come from our water-related interests. We believe they apply to other areas as well, with many potential win-wins. For example, without claiming expertise, increased subsidies for heat pumps might benefit low-income residents, reduce greenhouse-gas emissions, lessen air pollution, and reduce dangers from heat waves, leading to a high cost-benefit ratio.

#### **1. We are delighted that the plan builds in frequent opportunities for updates as well as ongoing input via a dedicated web site, to be reviewed by a specific commission.**

We have already recommended this model to another city! We look forward to its use in other Berkeley planning processes. (From the July 31 meeting of the Council Policy Committee on Facilities, Transportation, Infrastructure, and Sustainability (FITES), we believe that a similar web site will be used in developing the coming Stormwater Plan).

#### **2. Collaboration among departments and commissions will be essential to flesh out this plan.** Here are examples from F5C's areas of interest:

- In the area of sea-level rise, the draft recognizes that groundwater infiltration due to sea-level rise is a serious threat, with research new and ongoing. This should be developed in the coming stormwater plan, whose scope is being amended to incorporate these effects. The

Disaster and Fire Safety Commission should be aware of, and have input into, these aspects as they develop.

- Similarly, from the FITES meeting, we understand that the stormwater plan's scope is being expanded to include modeling of the increasing probability of deluges, as these will affect severity and length of flooding (p. B204). This should be collaboratively incorporated into the Local Hazards Mitigation Plan as soon as possible.
- The current draft refers only in passing to the effects of higher tides on flooding in West Berkeley, and tides' and storms' interplay with Aquatic Park, which serves as a safety outlet for the city's largest storm drains, Strawberry/University and Potter. These threats should be explored as part of the stormwater plan.
- The maps and comments in Section B are highly informative, but they also show data gaps. For example, the storm drain overflow map on B 195 shows locations of service calls -- but not which sites get preventive maintenance or repeat calls. The stormwater plan should remedy this, and thus strengthen this plan.

### **3. Planning should move rapidly toward exploring and advocating collaboration with agencies other than the city.**

For example, the East Bay Regional Park District is beginning plans for the North Basin Strip -- much of northwest Berkeley's waterfront -- in September. **Berkeley should be involved in this process, because decisions will affect flood potential in Northwest Berkeley.** In a simple example, "daylighting" the mouth of Schoolhouse Creek would decrease flood risk in residential areas east of the freeway (by, in effect, shortening the constricted "hose" that water needs to pass through).

Collaboration is important with tate Parks and East Bay Regional Park District for most of the waterfront, CalTrans and the railroad near the waterfront, and UC Berkeley, Albany, and El Cerrito for creeks, which are now recognized as being possible wildfire conduits as well [possible areas of floods and slides.

**The plan's collection of low-cost recommendations for preparedness looks valuable. We hope to find ways to publicize those dealing with flooding and urban runoff.** Perhaps there could be brainstorming for ways to remind people repeatedly, without too heavy a hand? Could nonprofits help? An interesting project for a student intern?

**These comments are not criticisms.** They look to the near future and the promise of frequent improvements to this plan.

Susan Schwartz, President

Friends of Five Creeks  
510 848 9358  
[f5creeks@gmail.com](mailto:f5creeks@gmail.com)  
[www.fivecreeks.org](http://www.fivecreeks.org)



**From:** [Michael Tompkins](#)  
**To:** [Mitigation](#)  
**Subject:** Earthquake Hazard Mitigation  
**Date:** Friday, July 26, 2024 10:46:31 AM

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WARNING: This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

In reading the description of earthquake hazards and mitigations I saw no mention of perhaps the most common and widespread hazards in our residential neighborhoods. Unreinforced fireplace chimneys on older homes are just columns of heavy masonry ready to crumble or fall in large chunks. Many of us who live in these homes have long since stopped using our fireplaces because of particulate pollution and BAAQMD and others are discouraging their use. I'm a senior on a fixed income and have no idea how to get my 25 foot tall chimney safely removed at an affordable price. There are no contractors answering to the description of chimney removal and no information that I can find on city websites on the subject. I hope this gets addressed.

Michael Tompkins  
1230 Monterey Avenue  
Berkeley

Sent from my iPad



Office of the City Manager

To: City of Berkeley Office of Emergency Services  
From: Disaster and Fire Safety Commission  
Submitted by: Weldon Bradstreet, Chair  
Subject: Commission Comments and Questions about the 2024 Local Hazard Mitigation Plan

The Disaster and Fire Safety Commission presents the following comments on the Local Hazard Mitigation Plan ("LHMP") The Commissioners are referring these comments to the OES for their consideration and inclusion, where appropriate, into the LHMP.

### **General Comments on the LHMP**

A key point we would like to raise in the hazard mitigation work is pointing out that Berkeley's continuing efforts to implement Vision Zero by installing protected bike lanes and pedestrian improvements represents a mitigation strategy for the Extreme Heat, Sea Level Rise and Air Pollution scenarios because it is the key ingredient in motivating people to ride or walk in Berkeley, rather than drive. Vehicle emissions are of course a key driver of carbon emissions and climate change.

Many other cities are ignoring this approach to creating a transportation mode shift, so Berkeley should get credit for this. We know from the City's transportation survey, cited in the attached, that over 70% of Berkeley residents have indicated that they would use a bike rather than a vehicle for most needs, but only about 10% do this because the streets are unsafe for cycling.

Creating a transportation infrastructure that's safe for cycling is essential to reducing vehicle emissions and the environment problems they produce, including extreme heat, sea level rise and air pollution events.

"Vapor Pressure Deficit" should be added to our metrics in determining when to warn residents of potential fire hazard. Vapor Pressure Deficit measures the dryness in the atmosphere that has the propensity to suck moisture out of all vegetation. A spike in the Vapor Pressure Deficit signals dangerous fire conditions. This index should be monitored.

The Planning Department should not announce zoning or planning changes without first consulting with the Fire Department and the Disaster and Fire Safety Commission, including changes in planning codes and ordinances. Berkeley is a densely populated town, one of the densest places in California. Increased density may play an important role in our emergency response capability, and thus impact the safety of our citizens.

City streets need to be considered when planning or approving multi-story developments. The spate of plans on the two lane section of Shattuck between Derby and the border with Oakland would seem to strain our ability to move people and equipment on that narrow stretch. There are numerous retail operations on this street - most importantly the Berkeley Bowl grocery store. What will be the impact if several multi-story buildings go up? A fire or earthquake in the late afternoon could be calamitous if fire trucks had to access these blocks.

In terms of climate resilience Berkeley needs to take measures to protect roof top solar panels, especially those attached to batteries. Right now, solar arrays have little or no value in the planning process. **Solar access must be prioritized in planning.** In power blackouts, these roof top arrays, attached to batteries could be our main source of power, apart from emergency generators attached to buildings. But, these arrays do not require any fuel.

Berkeley should research and adopt measures to establish "micro-grids" based on solar panels in neighborhoods. This could be vital to power medical equipment, cooling, communication, and water pumps.

With the increased impacts of climate change Berkeley should heed the UN scientists who have determined that any structure over five stories is not carbon neutral and cannot generate adequate power to keep itself going. The UN panel does say this will have an impact on urban density, but that it is more important that density.

With more intense storms, Berkeley needs to review its flood and water flow rules, ordinances and regulations. Right now, the Planning Department says that there are no rules regulating run-off from one property onto another. If true, this needs to be addressed, given that we have stronger storms, the water table is rising, and the sea level is rising. New or old developments may start to cause problems with how their water does or does not drain from their property. This is especially important along historic creeks, storm drains, hillsides, and new developments with excavations deeper than five feet.



## **Specific Commentary Based upon the 2024 Mitigation Strategy Actions Spreadsheet**

(listed by item number and action, with the recommendation, question, or commentary following at the end)

6. Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.

The Commission would like to know How many buildings are left to retrofit, how will we track completion? Why is there no timeline for the project?

7. Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures. The Commission would like to know What does 'continue' analysis mean? How many buildings still need to be analyzed?

8. Continue implementation of the Soft Story Retrofit Program, which mandates seismic retrofit of soft story buildings with 5+ residential units. The Commission asks: When will all MFRs be retrofitted? Why only 5+ units?

9. Continue to implement the Retrofit Grants Program, which helps Berkeley building owners increase safety and mitigate the risk of damage caused by earthquakes. The Commission asks: How are we tracking overall seismic safety of the housing stock?

10. Continue to monitor passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices. The Commission would like to see a more tangible goal for the next 5 years.

11. Coordinate regional wildfire mitigation strategies with key partners and stakeholders. The Commission would like to see continued monitoring of passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices.

12. Coordinate regional wildfire mitigation strategies with key partners and stakeholders - Coordinate regional efforts to mitigate wildfire risk in the Oakland - Berkeley hills through the Hills Emergency Forum. The Commission would like to know what the new mitigation measures are, and when will those be identified?

13. Coordinate with and encourage mitigation actions of key City partners. The Commission asks if we know what actions we want to see from other institutions?

14. Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions - Continue to enforce Fire Code requirement for fire fuel clearance on public roadways. Commission: By the end of this period, what percentage of roadways will be cleared of fuels?

15. Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking - With multiple agency partners, clear hazardous vegetation along 45 roadways in Fire Zone 2 protecting evacuation routes. The Commission asks: Have these 45 roadways be identified? Can we get periodic briefings of the progress?

16. Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking - Develop process to increase parking enforcement in fire-vulnerable areas during fire weather. The Commission asks: How is this moving forward? In the underserved communities section, I'd like to call out that FF raises money from underserved communities and disproportionately spends it in the wealthiest communities. So I'd like to call out that we need to spend the money responsibly and take into accounts the needs of the whole community, not just the loudest voices in the hills.

17. Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking - Maintain and improve roadways in Fire Zones 2 and 3. The Commission asks: Are there roadways that need improvement?

19. Maintain City participation in the National Flood Insurance Program. The Commission asks: Are there any FEMA guidelines that we're working on incorporating now?

21. Maintain City programs and projects to mitigate the impacts of infectious diseases in Berkeley. The Commission asks: Do we need to invest in stockpiles of these interventions so that we're ready?

24. Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3. The Commission asks: What percentage of paths are appropriately maintained? What percentage are we aiming for?

28. Mitigate hazards associated with natural gas usage, including disaster damage and energy service disruption, by minimizing need for energy use and moving toward use of electricity in lieu of natural gas. The Commission asks: Do we have a goal for number of buildings electrified? Do we know when a building disconnects from natural gas?

29. Reduce fire risk in existing development through fire code updates and enforcement - Continue to evaluate inspection procedures and adjust inspection cycle annually based on changing climatic conditions. The Commission asks: Are we meeting our goals for number of inspections?

30. Reduce fire risk in existing development through fire code updates and enforcement - Maintain Fire Department efforts to reduce fire risk through inspections through annual building inspections in all Fire Zones, including Multi-unit-residential building inspections. The Commission asks: Are we meeting our goals for number of inspections?

38. Reduce fire risk in existing development through vegetation management - Maintain Fire Fuel Abatement Program on Public Land with technical assistance from WUI Division. The Commission asks: Do we have goals for the abatement program?

39. Reduce fire risk in existing development through vegetation management - Continue to allocate UC Settlement Funding to do vegetation management projects on UC Berkeley properties. The Commission asks: are these projects defined?

40. Reduce fire risk in existing development through vegetation management - Maintain redesigned and expanded citywide fire fuel chipper program to provide curbside pickup, chipping, and disposal of vegetation material from residential properties. The Commission asks: What does it mean to provide access to all residents.

44. Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley. The Commission asks: Maintain redesigned and expanded citywide fire fuel chipper program to provide curbside pickup, chipping, and disposal of vegetation material from residential properties.

45. Reduce wildfire risk throughout Berkeley by implementing the Action Plan identified in the Community Wildfire Protection Plan (CWPP). The Commission asks: Do we intend to accomplish all action items in the CWPP during this cycle?

46. Research, identify, and implement infrastructure improvements to facilitate emergency evacuation. The Commission asks: Is the study going to come with action items that will be implemented? Or is this just to complete the study?

48. Strengthen or replace City buildings in the identified prioritized order as funding is available - West Berkeley Service Center, Old City Hall, Veterans Memorial Building . The Commission asks: What's the timeline for completing these buildings?

49. Strengthen or replace City buildings in the identified prioritized order as funding is available - Continue to seek funding to seismically strengthen or replace additional City buildings in a prioritized order. The Commission asks: Do we have a goal for additional buildings?

58. Implement energy assurance strategies at critical facilities - Identify potential actions to mitigate energy assurance vulnerabilities at critical City facilities during



planning/conceptual design of both retrofits and new construction. The Commission asks: What is the timeline for identifying these actions.

59. Implement energy assurance strategies at critical facilities - Provide guidance to help the City consider opportunities to design, finance and implement clean energy assurance strategies (e.g., photovoltaic-supplemented generation, energy efficiency activities, and/or mobile charging stations). The Commission asks: What is the timeline?

60. Implement energy assurance strategies at critical facilities -Work with partners to identify additional non-City critical facilities and develop strategies to provide clean backup power at these sites. The Commission asks: What is the timeline?

61. Implement existing City programs, plans, and projects designed to reduce emissions that contribute to poor air quality - Continue to implement the traffic safety capital construction projects identified and prioritized in the Berkeley Pedestrian Plan (2021), Berkeley Bicycle Plan (2017), Berkeley Vision Zero Action Plan (2020), and Berkeley Transit-First Implementation Plan; these projects are intended to encourage non-driving modes. The Commission would like to call out increased efforts to have the FD take a more pro-active role in implementing these plans. This should be in the purview of the new STP.

62. Implement existing City programs, plans, and projects designed to reduce emissions that contribute to poor air quality - Continue to implement the City's Electric Mobility Road Map which includes electric shared mobility (bikes and scooters) as well as electric and hybrid car-sharing, and the installation of public charging stations. The Commission would like to call out increased efforts to have the FD take a more pro-active role in implementing these plans. This should be in the purview of the new STP.

63. Implement existing City programs, plans, and projects designed to reduce emissions that contribute to poor air quality - Transportation program coordination with transit providers, Berkeley Unified School District (Safe Routes to Schools), Berkeley Police Department (Vision Zero), and others, to promote transit efficiency and traffic safety for non-driving modes. The Commission would like to call out increased efforts to have the FD take a more pro-active role in implementing these plans. This should be in the purview of the new STP.

64. Mitigate impacts of sea level rise - Continue to ensure new and existing public and private developments and infrastructure are protected from floods due to sea-level rise through the permitting process for new development and conditions. The Commission asks: Are these standards documented and enforced ministerially or are they at the discretion of ZAB/Plancom?

70. Reduce Berkeley's vulnerability to extreme heat events and associated hazards - Continue to seek out funding to use cool paving materials on streets when feasible to

reduce urban heat island impacts. The Commission asks: Is there a timeline for deploying these materials on X percent of city streets? Is there a tie-in to the two street improvement ballot initiatives?

72. Reduce Berkeley's vulnerability to extreme heat events and associated hazards - Encourage passive and energy-efficient strategies to cool buildings such as natural ventilation, shading, insulation, cool roofs, whole-house fans, and heat pump HVAC systems. The Commission asks: How is this being encouraged?

**From:** [Irene Rice](#)  
**To:** [Mitigation](#)  
**Subject:** Comments on Air Quality  
**Date:** Thursday, August 8, 2024 1:38:29 PM  
**Attachments:** [image.png](#)

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**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Thank you for the excellent mitigation planning by the Berkeley City Council; your exemplary ideas are well thought out. The inclusion of links for easy citizen access to find information on air quality is so important and thoughtful - Thank you!

I have only two comments regarding Air Quality.

As all three of the pollutants listed as affecting air quality included fossil fuel combustion, the mitigation plan might focus heavily on reducing fossil fuel combustion. It is noted that the City has addressed this in good ways. Consider any possible incentives that might encourage drivers (Taxis/Uber/Lyft) to purchase electric/hybrid vehicles. Possibly more good ideas could be gleaned from the three countries with high scores for reducing fossil fuel combustion emissions: <https://earth.org/countries-climate-policy/#:~:text=Denmark%2C%20Sweden%2C%20and%20Chile%20are%20leading%20countries%20in%20climate%20action.>

The mitigation plan for improving air quality states that the City will plant more trees. Please consider including the planting of **California Native** trees and shrubs. Expert advice on native plants is very available locally through the California Native Plant Society - East Bay Chapter (<https://ebcnps.org/>), the Tilden Regional Botanic Garden ([nativeplants.org](https://nativeplants.org/)), the Native Here Nursery ([nativeherenursery.org](https://nativeherenursery.org)) - to name only a few of our local dedicated organizations. For your reference, an excellent presentation on the importance of prioritizing native plants was introduced during Kathy Kramer's annual 'Bring Back the Natives' event - that of Author and Entomologist/Ecologist/Conservationist and professor at the University of Delaware, Douglas Tallamy: <https://www.youtube.com/watch?v=vARtLzygjN0&authuser=0>

Your ongoing and dedicated work is very appreciated; it is nice to see the City of Berkeley strive to be a climate change leader with intelligent and informed planning; promoting efforts that sustain the good health of the earth and its inhabitants!

Thank you,  
Irene Rice



[berkeleyfiresafecouncil.org](http://berkeleyfiresafecouncil.org)

[info@firesafeberkeley.org](mailto:info@firesafeberkeley.org)  
(415) 340-0152

June 28, 2024

Project Managers  
Local Hazard Mitigation Team  
City of Berkeley

Via [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov)

Re: 2024 First Draft Local Hazard Mitigation Plan (LHMP)

Dear LHMP Project Managers,

The Berkeley FireSafe Council (FireSafe Council) is pleased to provide comments on the 2024 First Draft Local Hazard Mitigation Plan (LHMP).

#### About the FireSafe Council

The FireSafe Council is a community not-for-profit 501(c)(3) organization with the primary mission of preventing the next catastrophic wildfire in Berkeley. Our principal focus since 2019 has been reducing hazardous vegetation in and around the city, focusing on the 100+ tons of eucalyptus debris in the understory of nine eucalyptus groves among the homes in the City's Fire Zone 2. We have developed a volunteer-led model, conducting 37 debris-clearing events to date involving over 50 residents and approximately 1,000 UC Berkeley student workdays. The City of Berkeley has supported this effort by providing Zero Waste green bins and Parks Department trucks to remove the debris to the City's green waste site at no charge.

The FireSafe Council estimates that we have removed 75 tons of highly flammable bark, branches, and leaves from the understory of six of the nine eucalyptus groves on private property, more than half of the accumulated fuel. These clean ups have been funded by community donations and grants. Although highly efficient, this model cannot be sustained by the FireSafe Council and, at the pace we have been able to work, the groves we cleared in 2021 will need to be cleaned up again before we complete the process. For this reason, the FireSafe Council strongly supported the City Council's recent resolution in support of using up to \$1 million of Measure FF funds to conduct a one-time, voluntary eucalyptus understory clean-up on select private properties within the city, with subsequent maintenance by the property owners. The one-time clean-up of eucalyptus debris by the City will also enable property access to Fire Department inspectors, an obstacle that has been particularly problematic for inspecting the eucalyptus groves.

In addition to the above direct action to remove fuel, we have supported Chief Sprague in his development and implementation of the city's residential inspection program, participated in essentially all the Disaster and Fire Safety Commission meetings, and taken numerous other steps to point out wildfire safety needs and to support public officials in pursuing wildfire safety.



Comments on Draft LHMP

**Discuss hazardous vegetation in Element B (Risk Assessment).** Element B mentions dense fuel loads as a compounding factor in the WUI risk, but while the section elaborates, for example, on existing structure density (which is not mitigatable), it does not elaborate on vegetative fuel loads (which the city is addressing, as noted, through various vegetation management programs). The vegetative fuel load – particularly hazardous, fire-prone vegetation such as eucalyptus, Monterey Pine, and juniper – should be characterized in terms of the WUI risk it presents.

As the FireSafe Council has documented, there are approximately 1,000 eucalyptus trees in northeast Berkeley, most of which are concentrated in 9 groves on private property. Should these tall groves ignite in a wind-driven canopy fire, embers and firebrands would ignite additional ground fires miles ahead of the leading edge of the fire. Including this information in Element B would provide some context for the statement in Element C, p. C-44, that “Since 2019, Berkeley has removed nearly 300 hazardous trees (mostly eucalyptus and Monterey Pine) from City parks, paths, and street rights-of-way” and the recently approved eucalyptus debris-clearing program that should be mentioned in Element C, as noted below.

Junipers and other fire-prone vegetation commonly seen adjacent to homes are more prone to ignite homes and other structures, particularly in structure-dense areas, leading to the “structure-to-structure ignition” discussed on pp. B-65 and B-66.

**Re-locate the Element B section on Berkeley Household Risk Reduction to Element C.** Element B is focused on risk assessment but includes a section on “Berkeley Household Risk Reduction” (p. B-87) that lists numerous steps that individual community members and households can take to reduce their fire risk. This section is better suited for Element C as part of the mitigation strategy.

Placing the household action section in Element C will also allow it to be paired with the City’s efforts to encourage or require individuals and households to act to reduce the community’s risk, and how the City is complementing those efforts. This will better describe “how the whole community can work together to mitigate Berkeley’s wildland-urban interface fire hazards” (p. B-87).

**Element C should state an intention to develop specific planning goals and metrics on several topics.** Element C:

“outlines Berkeley’s mitigation strategy, and how it connects to Berkeley’s disaster resilience vision. The strategy identifies and analyzes a comprehensive range of specific mitigation actions and activities being considered to reduce the effects of each hazard described in Element B: Risk Assessment. The Strategy is based on existing authorities, policies, programs, and resources, as well as Berkeley’s ability to expand on and improve these existing mitigation tools ...”

Thus, it is intended to include forward-looking actions as well as descriptions of current programs. However, the section mostly lists or describes existing programs with little to no discussion of what the goals of these programs are, when they will be accomplished,

and where funding or additional policies are needed. In short, it is missing a plan for how Berkeley intends to measurably reduce WUI fire risk. The document should reference the city’s intentions to develop such a plan.

We are pleased to see the statement on p. C-43 that the BFD's WUI Division is:

"working to develop a comprehensive WUI work plan that will provide strategic guidance for related work for the next five years. Plans are to expand existing programs and extend some services citywide, including fuel reduction on public lands and roadsides, private land incentives, debris bins, and citywide chipping services."

While we strongly support such planning, the stated intention to plan should be extended to include risk-reduction goals, timelines, funding, policy needs, and metrics.

Similarly, the LHMP should state an intention to develop a plan with goals and metrics to improve WUI evacuation routes through the Safe Passages and other programs, following the completion of the evacuation studies now underway (noted on pp. C-52 and C-53). The draft LHMP includes very little discussion of evacuation issues, and the Safe Passages program is not noted.

Related and more broadly, the LHMP should state an intention to develop a spending plan for Measure FF funds, with goals, timelines, funding, and metrics for WUI and other LHMP-related issues. The section on Measure FF (p. C-20) summarizes the measure and includes only backward-looking achievements without any forward-looking goals. For example, the long-range plan could include removal of all fire-prone vegetation in Fire Zones 2 & 3, with special emphasis on any hazardous vegetation near structures and all hazardous trees, primarily eucalyptus. The section should mention that the funding measure is indefinite, and that wildfire prevention and preparedness activities is one of three categories of allowed purposes for the use of Measure FF funds.

These items should be included in the list of action items.

**Element C should indicate the importance of land use planning in reducing exposure to wildfire risks.** The document notes the importance of planning and zoning in reducing Berkeley's vulnerability to landslide and flood hazards (Table 5, PDF-p. 61). The document should similarly note (in the text and the table) the importance of planning and zoning – as well as building codes and property transfer requirements – in reducing Berkeley's vulnerability to wildfire, e.g., by studying the wildfire risks associated with additional population and street parking in Berkeley's fire zone 2 and 3.

### **Specific additional suggestions.**

#### Executive Summary

- The compounding impact of climate change on WUI fire should be noted in the Executive Summary. The FireSafe Council supports the change in this updated LHMP to incorporate climate change into every hazard of concern, rather than addressing it as a separate item. The compounding impact of climate change on WUI fire is discussed in

Element B but is not mentioned in the WUI fire section of the Executive Summary, as it is in the "high wind" and "extreme heat" sections of Executive Summary.

Element B

- The architectural significance of Berkeley's Zone 2 should be noted in the "Natural, historical, and culture assets" section of Element B (p. B-82), in addition to the features in Zones 1 and 3. Many of the Berkeley Architectural Heritage Association's "41 Berkeley Walking Tours" are in Zone 2.
- Exhibit 11 (p. B-86) is difficult to understand. The y-axis should be redrawn to end at \$20 billion (so the trend lines are visible) and the increments relabeled as billions of dollars, rather than millions. Otherwise, it's easy to misread \$40,000 million as \$40 million, instead of \$40 billion, which we assume is what is intended.

Element C

- The statement (p. C-20) that the Disaster and Fire Safety Commission reviews and approves projects to receive Measure FF funding should be modified. The Commission can only recommend budgets and expenditures to Council and, to date, has not been able to do that due to lack of sufficient and timely information.
- To the list of vegetation management programs listed on p. C-43, add the new program to use Measure FF funds to conduct one-time, voluntary eucalyptus understory clean-ups on select private properties within the City, prioritized based on assessed wildfire risk. On May 7, 2024, the City Council adopted the supportive "Resolution to Mitigate Hazardous Eucalyptus Understory on Participating Properties," stating that "hazardous fuel mitigation is the safest and most effective method to reducing wildfire risk."
- In Table 4 on High Priority Actions, add the underlined text to this action item: "Coordinating regional wildfire mitigation strategies with key partners and stakeholders in adjacent municipal jurisdictions." Consider naming the regional partners in subsection C.1.m.

General

The document should be proofread for typos.

The FireSafe Council appreciates the opportunity to comment on the draft LHMP.

Sincerely,



Nancy Rader  
Member, Berkeley FireSafe Council Leadership Group  
On behalf of the Berkeley FireSafe Council

**From:** [David Halligan](#)  
**To:** [Mitigation](#)  
**Subject:** Berkeley Hazard Mitigation Plan  
**Date:** Wednesday, August 7, 2024 3:23:21 PM

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WARNING: This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Glad to see utility undergrounding as part of the plan, but it seems like the entire City would benefit from such, not just the high fire hazard area (basically the hills). While that might make sense as a priority, seems like ultimately undergrounding should be implemented City-wide.

Thanks for considering my comment.

Kind Regards,  
Dave Halligan  
2043 Berryman St.

Sent from my iPhone



**From:** [Mitigation](#)  
**To:** [Heather Christenson](#); [Mitigation](#)  
**Subject:** RE: LHMP and soft story rentals  
**Date:** Tuesday, June 4, 2024 12:37:43 PM

---

Hi Heather,

Thank you for your note. The Soft Story Retrofit program is managed by the Building and Safety Division of our Planning Department. You can reach them by emailing: [softstory@berkeleyca.gov](mailto:softstory@berkeleyca.gov). There is more information on this page of [our website](#), which does include the latest inventory of soft story buildings as of March 2024.

Some buildings are removed from the inventory for a variety of reasons, including if it does not have 5 or more dwelling units. Currently, the City ordinance only requires retrofits of soft story buildings with 5 or more units.

Please let know if you have any additional questions or you want to share additional comment/feedback.

Warmly,  
Jamie

---

**Jamie Albrecht**

she/her/hers

Emergency Services Coordinator

City of Berkeley Office of Emergency Services

e | [jalbrecht@cityofberkeley.info](mailto:jalbrecht@cityofberkeley.info) p | (510) 981-5514

---

**From:** Heather Christenson <h.christenson@yahoo.com>

**Sent:** Thursday, May 30, 2024 3:10 PM

**To:** Mitigation <Mitigation@berkeleyca.gov>

**Subject:** LHMP and soft story rentals

**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Hello,

I am a Berkeley resident and I hope to attend a community meeting on the Berkeley Local Hazard Mitigation Plan, thank you for the opportunity.

I have big concerns about my current soft story rental and do not see it reflected in your maps. It is cracking and sinking and the chimney is separating, even with just the small earthquakes we've had lately.

Can you please direct me to the correct city department to report a soft story rental house so that it is at least documented?

Thank you in advance,  
Heather Christenson

**From:** [Nancy Rader](#)  
**To:** [Lana, Sarah](#); ["Weldon Bradstreet"](#); [Mitigation](#)  
**Subject:** RE: Berkeley FireSafe Council Comments on 2024 First Draft LHMP  
**Date:** Friday, June 28, 2024 2:35:26 PM  
**Attachments:** [BFSC Comments on LHMP \(6-28-24\).pdf](#)

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And now, just to annoy everyone, here's a version with the formatting changed to fix the straddling signature block. Sorry for any inconvenience!

Nancy

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**From:** Lana, Sarah <[slana@berkeleyca.gov](mailto:slana@berkeleyca.gov)>  
**Sent:** Friday, June 28, 2024 12:10 PM  
**To:** Nancy Rader <[nraderhome@gmail.com](mailto:nraderhome@gmail.com)>; Weldon Bradstreet <[weldonbradstreet@yahoo.com](mailto:weldonbradstreet@yahoo.com)>  
**Cc:** Mitigation <[Mitigation@berkeleyca.gov](mailto:Mitigation@berkeleyca.gov)>  
**Subject:** RE: Berkeley FireSafe Council Comments on 2024 First Draft LHMP

Thank you, Nancy.

I am also copying in the [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov) address to make sure the comments are incorporated into the plan's official response record.

Best,

Sarah

---

**Sarah Lana, CEM<sup>®</sup>**

she/her/hers

Emergency Services Manager

City of Berkeley Office of Emergency Services

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**From:** Nancy Rader <[nraderhome@gmail.com](mailto:nraderhome@gmail.com)>  
**Sent:** Friday, June 28, 2024 9:16 AM  
**To:** Weldon Bradstreet <[weldonbradstreet@yahoo.com](mailto:weldonbradstreet@yahoo.com)>; Lana, Sarah <[slana@berkeleyca.gov](mailto:slana@berkeleyca.gov)>  
**Subject:** Berkeley FireSafe Council Comments on 2024 First Draft LHMP

**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

Hi Weldon & Sarah,

Wanted to share the Council's comments on the LHMP with the DFSC, attached.

Thanks,

Nancy

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**From:** Nancy Rader <[nraderhome@gmail.com](mailto:nraderhome@gmail.com)>  
**Sent:** Friday, June 28, 2024 9:09 AM  
**To:** [mitigation@berkeleyca.gov](mailto:mitigation@berkeleyca.gov)  
**Subject:** Berkeley FireSafe Council Comments on 2024 First Draft LHMP  
Please find attached the Berkeley FireSafe Council's Comments on the 2024 First Draft Local Hazard Mitigation Team.  
Nancy Rader  
Member, Leadership Team  
Berkeley FireSafe Council  
1198 Keith Avenue  
Berkeley, CA 94708  
(510) 919-6358 cell

**From:** [kelly hammargren](#)  
**To:** [Mitigation](#)  
**Subject:** LHMP Comments -  
**Date:** Thursday, August 8, 2024 10:22:53 PM

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**WARNING:** This is not a City of Berkeley email. Do not click links or attachments unless you trust the sender and know the content is safe.

The Local Hazard Mitigation Plan Update (LHMP) is very well done and as comprehensive as it is, listed here are a few additions that need to be addressed regardless of the required LHMP Update timeline.

1) Berkeley should be aggressively moving toward Passive Houses and using Passive House Principles in multi-unit buildings. This would increase living and working comfort and reduce energy load on the grid.

<https://www.phius.org/passive-building/what-passive-building/passive-building-principles>

In the Strategy Action chart #49 encourage passive and energy efficient strategies are listed as is the word "ongoing." Since I have attended every public meeting on new project approvals for nearly 10 years, I can tell you this is not happening.

2) Passive house principles locate operable windows for the best exposure to cooling breezes. Currently new construction is designed with no consideration to cooling breezes.

3) The Zoning Adjustment Board (ZAB) and Design Review Committee (DRC) focus on the exterior design not the interior. There is no current regulation/ordinance in Berkeley that requires operable windows in bedrooms which means that multi-unit buildings have been approved with multiple bedrooms with no windows. In the situation where there is an extreme heat event and a power failure these rooms and units become a heat trap / a death trap.

4) The Zoning Ordinances before the City Council establish setbacks between buildings without consideration to air current, air circulation. This will be increasingly important as the climate continues to warm and heat events become more frequent. Lining San Pablo with wall to wall taller buildings will impact air flow, increase heat island effect and create micro climates of sustained heat.

5) Tree canopy is listed as a mitigation in heat events under 51, however, the problem is Berkeley's Urban Forestry selections are small trees in inadequate spaces instead native trees with large canopies as on California between Dwight and Allston. The city is being filled through the forestry program with none native trees that do not support local habitat and ecosystems besides being inadequate to provide shading in heat events.

6) Permeable paving is not listed as a mitigation to stormwater in 53. Permeable paving can easily be incorporated into street design as was done on the north side of Channing between MLK Jr Way and Milvia. It has also been used on the north side of San Pablo Park. Permeable paving is not the same as bioswales. Permeable paving could be used throughout the city instead of hardscape, impermeable concrete, or asphalt in driveways, sidewalks, etc.

5) A large gas pipeline runs up Allston through neighborhoods, past the high school (with over 3000 students) and by city hall. There is no reporting on inspections and status. A leak and explosion of this gas pipeline like what happened in 2010 in San Bruno at Milvia and Allston during a work day and school day has the potential to wipe out much of city government and the high school student body. Not only does there need to be reporting by PG&E, but in addition electrification needs to be accelerated to remove this kind of hazard.

6) Just like there are notifications of asbestos in buildings, there needs to be notifications to renters when units being considered for renting and to occupants of rented units that are in fire zones, hillside slide areas, within proximity to the Hayward fault and when rental housing is in soft story buildings at risk of collapse.

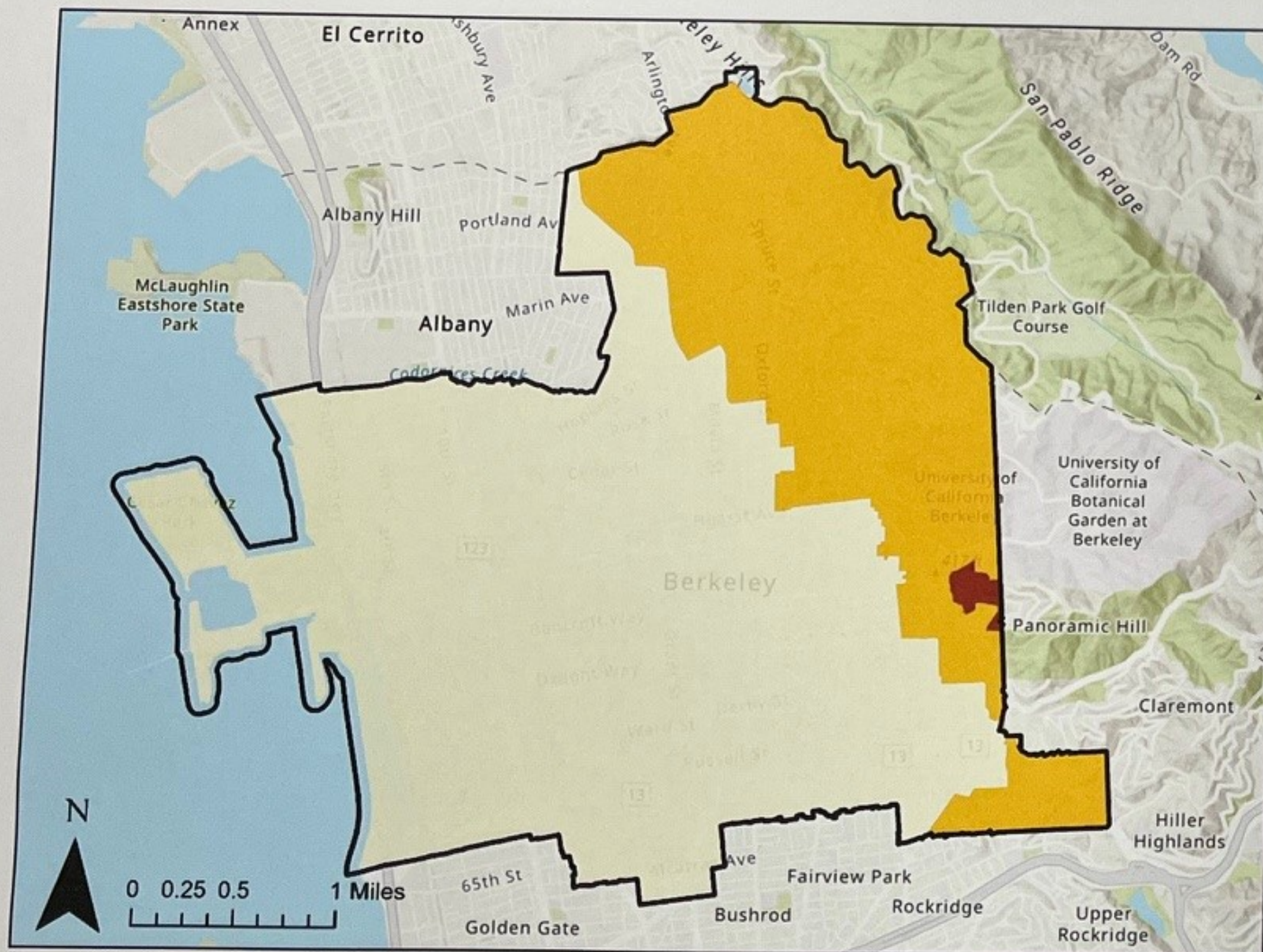
kelly hammargren



# Wildland Urban Interface (WUI) Fire

## Locations of WUI Fire:

Berkeley is most vulnerable to a wind-driven fire incident originating in an area adjacent to the City's eastern border. This map shows Berkeley Fire Zones.



## Legend

- City of Berkeley Boundary
- Berkeley Fire Zone 1
- Berkeley Fire Zone 2
- Berkeley Fire Zone 3

## PERSONAL ACTIONS TO MITIGATE RISK

### PLACE A DOT NEXT TO PERSONAL ACTIONS YOU'VE TAKEN

#### Residents in Fire Zones 2 and 3

1. Followed instructions on your home's Defensible Space Report.
  - a. Created defensible space around home
  - b. Hardened home by focusing on highest priority items:
    - i. Installed a fire resistive roof
    - ii. Cleared decks and covered porches
    - iii. Regularly clear tree debris
    - iv. Removed large rugs and combustible wood, wicker, or plastic furniture
    - v. Removed anything stored under the deck or stairs
    - vi. Included a five-foot noncombustible buffer around deck and stairs
    - vii. Installed non-combustible gutter guards
    - viii. Ensured the vents to your attic, basement, and crawlspace will block wind-blown embers.

#### All Berkeley Residents

1. Used the free Berkeley Chipper Day Program for curbside pickup, chipping, and disposal of vegetation material from my residential property.
2. Signed up for AC Alert and bookmarked with Berkeley's Emergency Map
3. Learned the test and emergency tones from Berkeley's Outdoor Warning System
4. Made my household fire weather plan.
5. Stayed out of the hills during extreme fire weather days.

**Questions or comments? Write them on a post it note!**



# Wildland Urban Interface (WUI) Fire

## About the Hazard:

WUI fires occur where the natural landscape and urban-built environment meet or intermix. Low humidity and high sustained winds create the most dangerous conditions for wildfire spread. While WUI fires can occur at any time of the year, they are especially dangerous in fall when the landscape and vegetation are dry, and strong, hot, dry offshore winds further desiccate vegetation and can push a fire down or up a slope with amazing speed.

Berkeley has a history of devastating WUI fires, including the 1923 Fire mapped below. The fire burned from Tilden all the way to Shattuck Avenue. The map also shows the fire at the municipal dump that very same day, likely the result of embercast. This highlights the potential impacts of WUI fires on the Berkeley flatlands.



## CITY ACTIONS TO MITIGATE RISK

PLACE A DOT NEXT TO THE CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Reduce fire risk in existing development through fire code updates and enforcement.
  - a. Continue YouthWorks Pilot program to staff expansion of Defensible Space Inspections in Fire Zones 2 and 3.
2. Reduce fire risk in existing development through vegetation management programs.
3. Pursue external funding to perform vegetation management on public and private property and to increase education and awareness of vegetation management standards.
4. Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.
  - a. With multiple agency partners, clear hazardous vegetation along 45 roadways in Fire Zone 2 protecting evacuation routes
  - b. Develop process to increase parking enforcement in fire-vulnerable areas during fire weather.
  - c. Continue to enforce Fire Code requirement for fire fuel clearance on public roadways.
5. Coordinate regional wildfire mitigation strategies with key partners and stakeholders.
6. Manage and promote pedestrian evacuation in Fire Zones 2 and 3
7. Reduce wildfire risk throughout Berkeley by implementing the Action Plan in the Community Wildfire Protection Plan.
8. Reduce fire risk through utility undergrounding.

Questions or comments? Write them on a post it note!





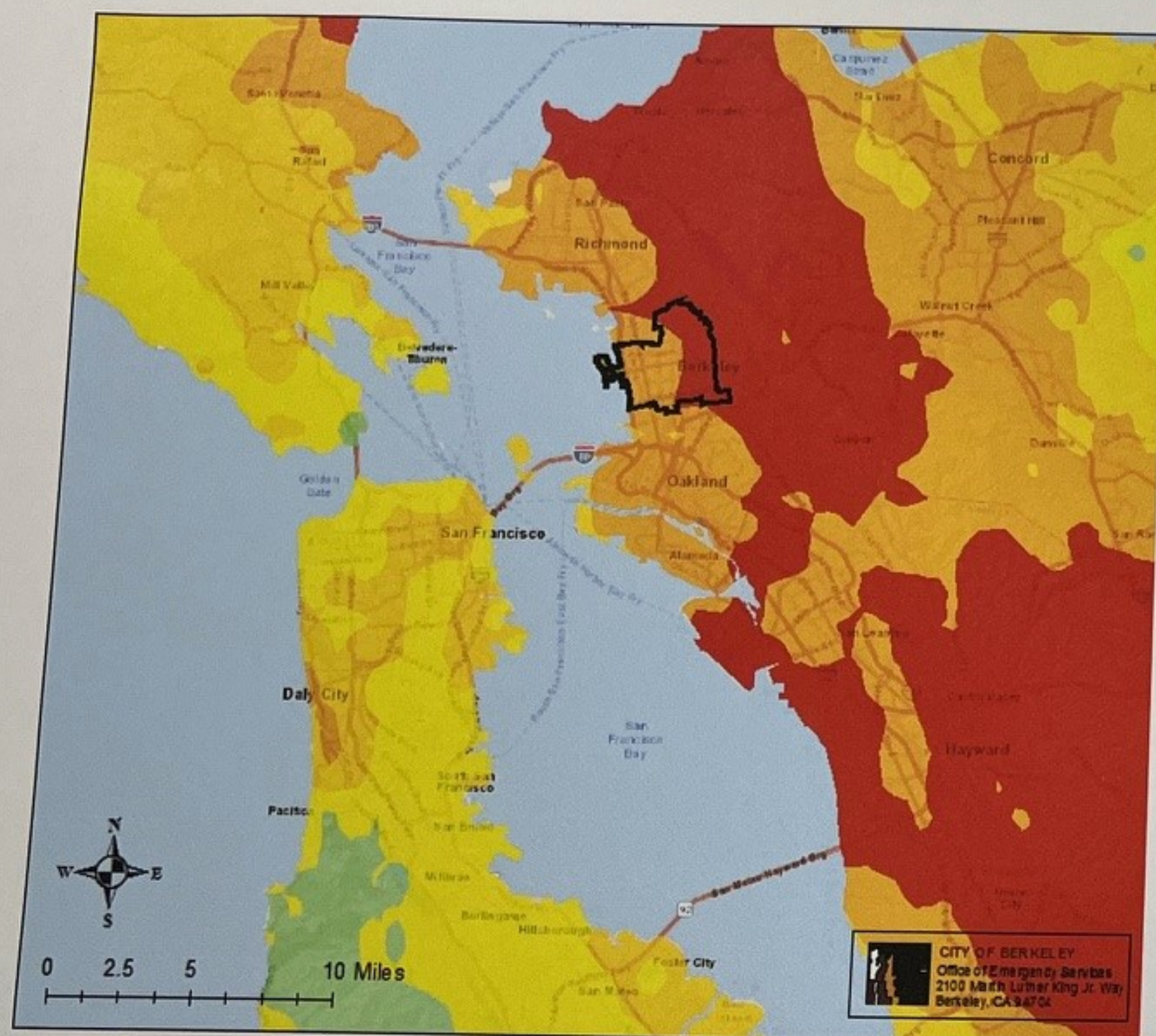
# EARTHQUAKES



## About the Hazard:

According to the USGS, there is a 72% probability of one or more 6.7+ magnitude earthquakes occurring from 2014 to 2043 in the San Francisco Bay Region.

This means that many Berkeley residents will likely experience a severe earthquake in their lifetime.



This map shows the shaking associated with a magnitude 7.0 earthquake on the Hayward Fault. The City of Berkeley outlined in black would experience severe and violent shaking, indicated by orange and red coloring respectively.

## CITY ACTIONS TO MITIGATE RISK

### PLACE A DOT NEXT TO THE CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Conducting ongoing building assessments for City facilities and structures
2. Strengthening and or replacing City buildings in prioritized order as funding becomes available
3. Offering the Soft Story Retrofit Program which reimburses eligible building owners up to 75%
4. Offering the Retrofit Grants Program to multi-family homes of 3+ units, non-residential buildings, hotels, and mixed-use buildings
5. Completing Concrete Retrofit Ordinance Research with a Team from the Earthquake Engineering Research Institute
6. Completing program to retrofit all non-complying Unreinforced Masonry Buildings (URM)

embed code for gen/earthquake for websites

How do we ensure safe routes/evac excenters before/after earthquake?

Community focused program to do in home EQ furniture bolting (Rena)

CIL John Benson - designing program - housing CIL has to accented - mechanical common sense

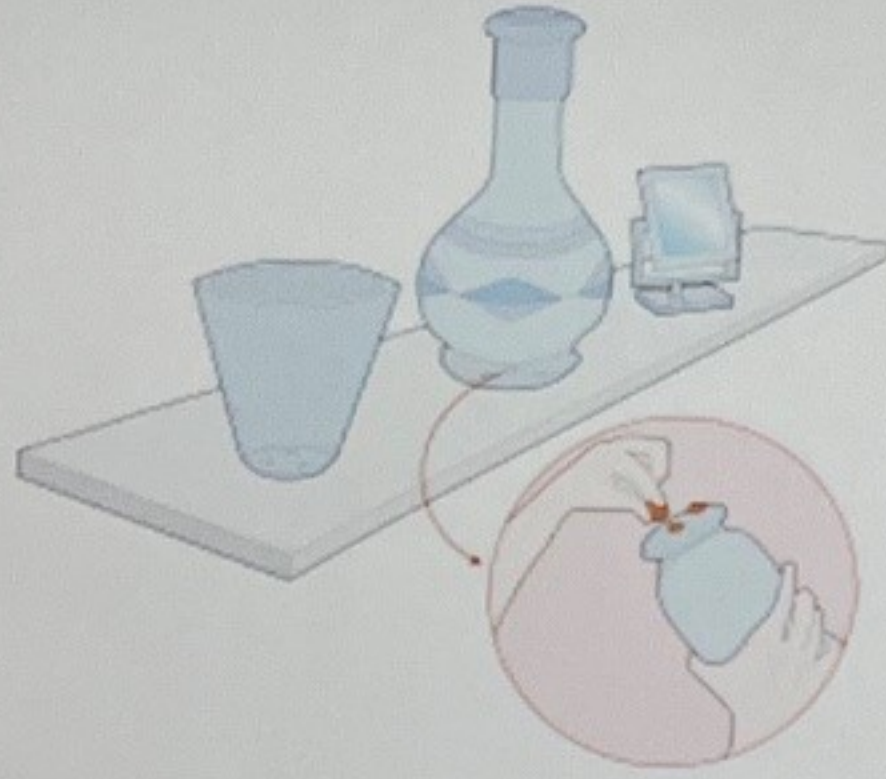
What other carrot-or stick incentives are available to help or even force private landlords to do appropriate retrofitting?

Questions or comments? Write them on a post





# EARTHQUAKES



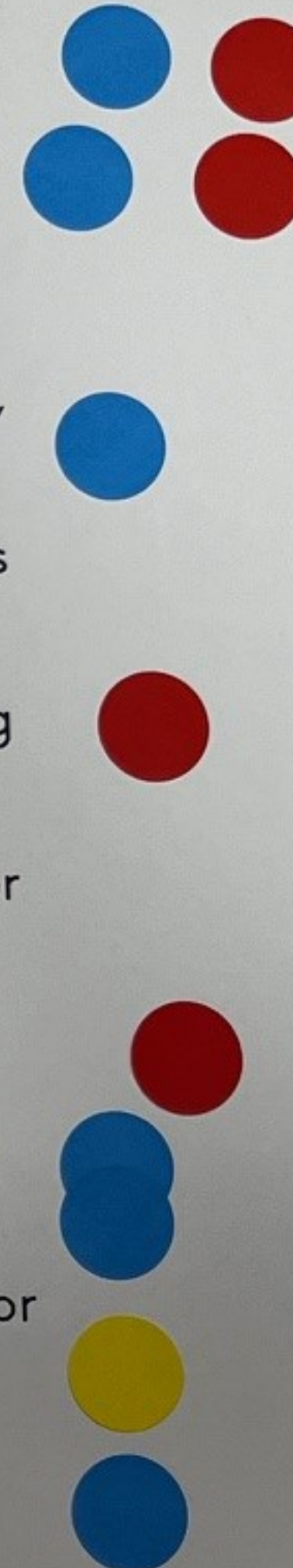
**Did you know that the most common cause of injuries during an earthquake is falling objects?**



## PERSONAL ACTIONS TO MITIGATE RISK

PLACE A DOT NEXT TO PERSONAL ACTIONS YOU'VE TAKEN.

1. Made living space more safe by storing heavy and breakable objects on low shelves.
2. Properly anchored bookshelves and heavy furniture
3. Moved beds away from windows
4. Moved or secured hanging objects over beds, sofas, or chairs
5. Used quake gel or putty to secure breakables in place
6. Had home assessed and retrofitted using available grants.
7. Talked to landlord about disaster preparedness and seismic safety of my rental.
8. Considered or bought earthquake insurance.
9. Stored water (1-2 gallons per day per person)
10. Practiced drop, cover, and hold on.
11. Learned how to turn off utilities at home or business.
12. Have taken free CERT Training.



**Questions or comments? Write them on a post it note!**





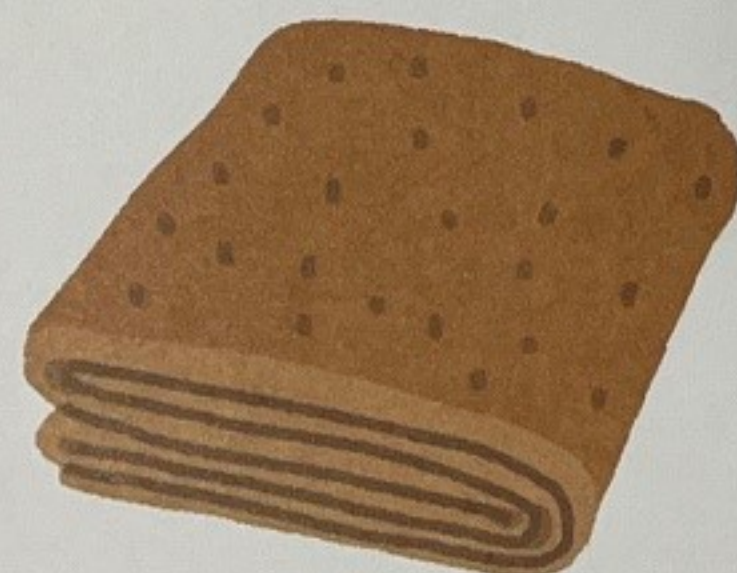
# Utility Disruption



## About the Hazard:

Utility interruption is any loss of a public service which includes but is not limited to electrical service, telecommunications, wastewater and potable water, and natural gas. Interruption can be planned and include a warning, such as with Power Safety Power Shutoffs that proactively turn off electricity to mitigate wildfire risk, or come a secondary impact of the other natural hazards included in this plan.

## What will you need if you have no power? Water? Communications?



## CITY ACTIONS TO MITIGATE RISK

### PLACE A DOT NEXT TO THE CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Identify and implement potential actions to mitigate energy assurance vulnerabilities at key City facilities
2. Consider opportunities to design, finance, and implement clean energy assurance strategies.
3. Provide key hazard information and best practices during utility disruptions to Berkeley's business and arts community

## PERSONAL ACTIONS TO MITIGATE RISK

### PLACE A DOT NEXT TO PERSONAL ACTIONS YOU'VE TAKEN

1. Made a plan to stay safe and comfortable during power outages
  - a. Determined emergency power needs to stay warm, keep food and medicine cool, and to operate medical devices.
  - b. Determined the power draw of these devices
  - c. Considered purchasing a power bank or generator
2. Made sure outage alerts reach me by calling PG&E 800-743-5000 and updating my contact information.
3. Stored 1-2 gallons of water per person per day for at least 3 days.
4. Made a plan for alternative bathroom options, like using a bucket when the toilet can't be flushed.
5. Established backup communication with my family.
6. Printed important documents or saved them to a thumb drive.

training and outreach for CRCs

Questions or comments? Write them on a post it note!



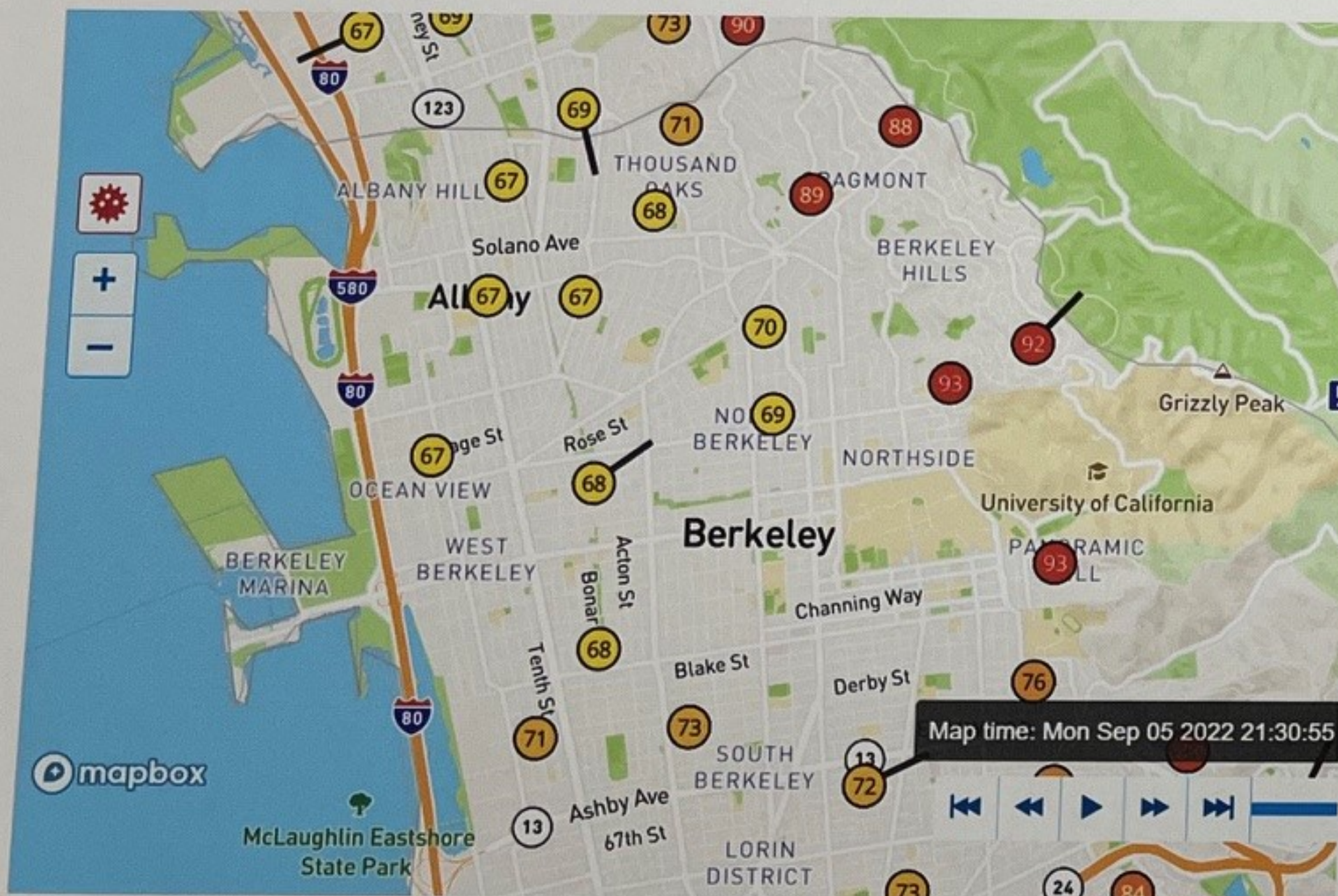


# Extreme Heat



## About the Hazard:

In Berkeley, an extreme heat day is a day above 88.3 degrees Fahrenheit. Extreme heat days can be further exacerbated by the urban heat island effect in which densely built cities experience higher temperatures due to a relative lack of vegetation, reduced air flow, and an abundance of hard, dark surfaces. However, the Berkeley hills often experiences higher temperatures than the rest of the city, due to a phenomenon known as thermal belting.



This map shows temperatures in Berkeley at 9:30 pm on September 5, 2021. Temperatures remain in the 90s in the Berkeley hills and in the 60s and 70s in the rest of Berkeley.

## CITY ACTIONS TO MITIGATE RISK

PLACE A DOT NEXT TO THE CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Encouraging passive and energy-efficient strategies to cool down buildings including natural ventilation, shading, insulation, green/cool roofs, whole-house fans, and heat pump HVAC systems.
2. Continuing to seek out funding to use cool paving materials on streets
3. Implementing programs and projects to reduce emissions.
4. Monitoring and supporting regional and state efforts to forecast the impact of climate change on temperatures and integrate extreme heat readiness into City operations.
5. Continue Urban Forestry Unit's tree maintenance and planting programs to increase canopy coverage for extreme heat events to provide shade and mitigate impacts from poor air quality.



Questions or comments? Write them on a post it note!

Investing in  
resilience helps  
for folks to  
access AC.





# Extreme Heat



## Heat Exhaustion

## Heat Stroke

### ACT FAST

- Move to a cooler area
- Loosen clothing
- Sip cool water
- Seek medical help if symptoms don't improve

Dizziness  
Thirst  
Heavy Sweating  
Nausea  
Weakness



Confusion  
Dizziness  
Becomes Unconscious

### ACT FAST

### CALL 911

- Move person to a cooler area
- Loosen clothing and remove extra layers
- Cool with water or ice

Heat exhaustion can lead to heat stroke.

Heat stroke can cause death or permanent disability if emergency treatment is not given.



Stay Cool, Stay Hydrated, Stay Informed!



Did you know that heat waves kill more people than any other type of severe weather in the US?



## PERSONAL ACTIONS TO MITIGATE RISK

PLACE A DOT NEXT TO PERSONAL ACTIONS YOU'VE TAKEN

1. Purchased or have supplies for extreme heat events, including ice, spray bottle, and personal fan. ☒
2. Implemented methods to keep your home cool without air conditioning, including using larger fans and blocking sunlight with blackout curtains, reflective film, or solar blankets. ☒
3. Made a plan for where and how you will get to a cooling center during extreme heat events, like libraries. ☒
4. Learned the signs and symptoms of heat stroke and exhaustion. ☒
5. Checked in on friends and neighbors. ☒
6. Prepared for power outages. ☒
7. On previous hot days, made sure to get plenty to drink, wear lightweight clothing, and schedule outdoor activities carefully. ☒

Questions or comments? Write them on a post it note!

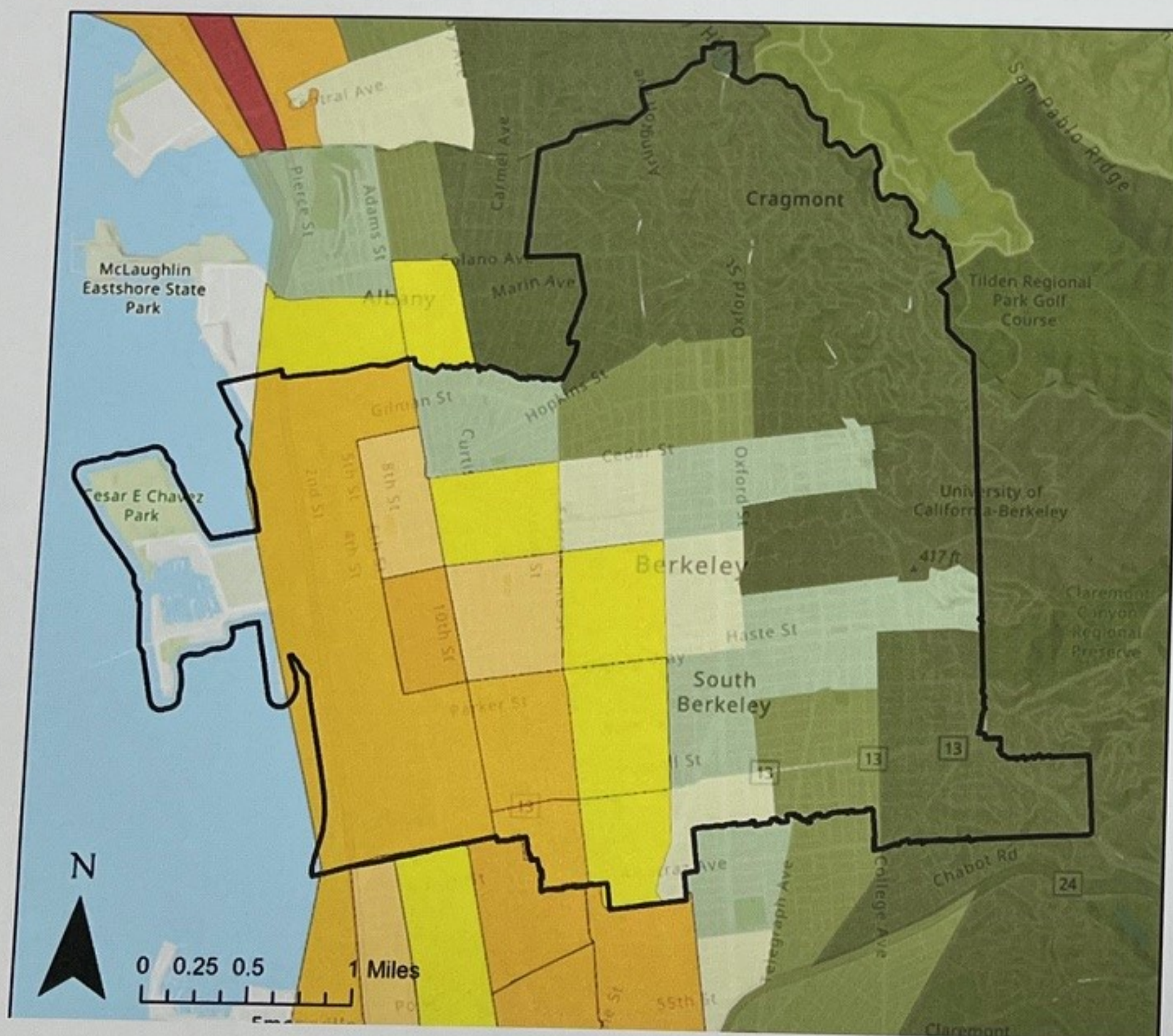




# Poor Air Quality

## About the Hazard:

Poor air quality is a major public health concern. Poor air quality can irritate the eyes, nose, and throat, cause shortness of breath, aggravate asthma and other respiratory conditions, and affect the heart and cardiovascular system. Poor air quality can last for a few hours or a few weeks, depending on its source. It can also be more of a chronic issue, especially in places near industries and highways for example.



This map shows the CalEnviroScreen Percentile for Berkeley. Higher percentiles shown in yellows and oranges in west and south Berkeley indicate higher pollution burden.

## CITY ACTIONS TO MITIGATE RISK

### PLACE A DOT NEXT TO THE CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Expanding Urban Forestry team and their activities
2. Implementing programs and projects to reduce emissions, such as electrifying transportation options and improving traffic safety.

## PERSONAL ACTIONS TO MITIGATE RISK

### PLACE A DOT NEXT TO ACTIONS YOU'VE TAKEN

1. Prepared home by replacing or sealing leaky windows and doors.
2. Bookmarked pages to see forecasts from AirNow.gov and real-time readings from Fire.AirNow.gov
3. On poor air quality days, stayed indoors with windows and doors closed and filtered the air.
4. Installed a MERV 13 rating or higher filter on HVAC system.
5. Purchased a certified portable air cleaner or constructed one with a box fan.

**Questions or comments? Write them on a post it note!**



# High Wind



## CITY ACTIONS TO MITIGATE RISK

PLACE A DOT NEXT TO THE CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Keep City trees maintained. These are trees located between the sidewalk and the street, in street medians, public parks, or on other properties owned by the City of Berkeley. Their maintenance is the responsibility of the forestry team of the City of Berkeley.

## PERSONAL ACTIONS TO MITIGATE RISK

PLACE A DOT NEXT TO PERSONAL ACTIONS YOU'VE TAKEN

1. Kept trees on my property maintained.
2. Have submitted a request for help with public trees that require attention by calling 311 or emailing [trees@berkeleyca.gov](mailto:trees@berkeleyca.gov).
3. Brought in any loose outdoor items, such as holiday decorations and chairs, or securely tied them down.
4. Kept a safe distance from trees and avoided driving on high wind days.
5. Called 9-1-1 about downed power lines.

work w/  
residents +  
businesses w/  
trees in danger  
or falling  
through training,  
mitigating for  
maintenance.

Questions or comments? Write them on a post it note!

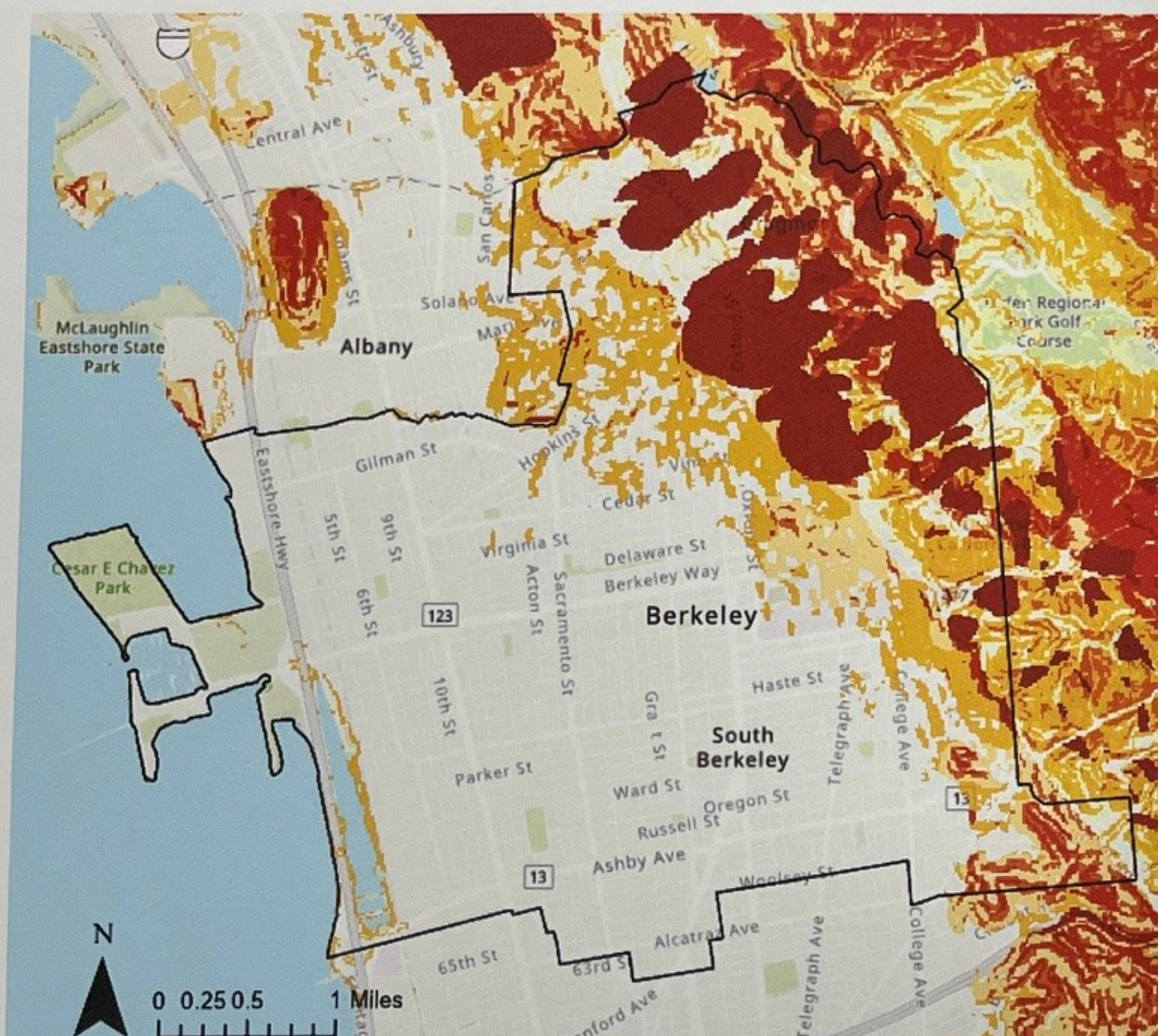




# LANDSLIDE

## About the Hazard:

A landslide is a movement of a mass of rock, debris, or earth down a slope. The most frequent and widespread damaging landslides are started by prolonged or heavy rainfall. In Berkeley, there are active and dormant landslides spread throughout locations in the Berkeley hills.



This map shows landslide susceptibility in Berkeley. The dark reds and oranges throughout the Berkeley hills indicate higher susceptibility (higher susceptibility is defined by higher slopes and weaker rocks).

## CITY ACTIONS TO MITIGATE RISK

### PLACE A DOT NEXT TO THE CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Collect, analyze and share information with the Berkeley community about landslide hazard and associated risk reduction techniques.
2. Track changes in landslide hazard risk using the best-available information and tools.
3. Collect and share up-to-date landslide hazard maps identifying areas subject to heightened risk from hazards.

## PERSONAL ACTIONS TO MITIGATE RISK

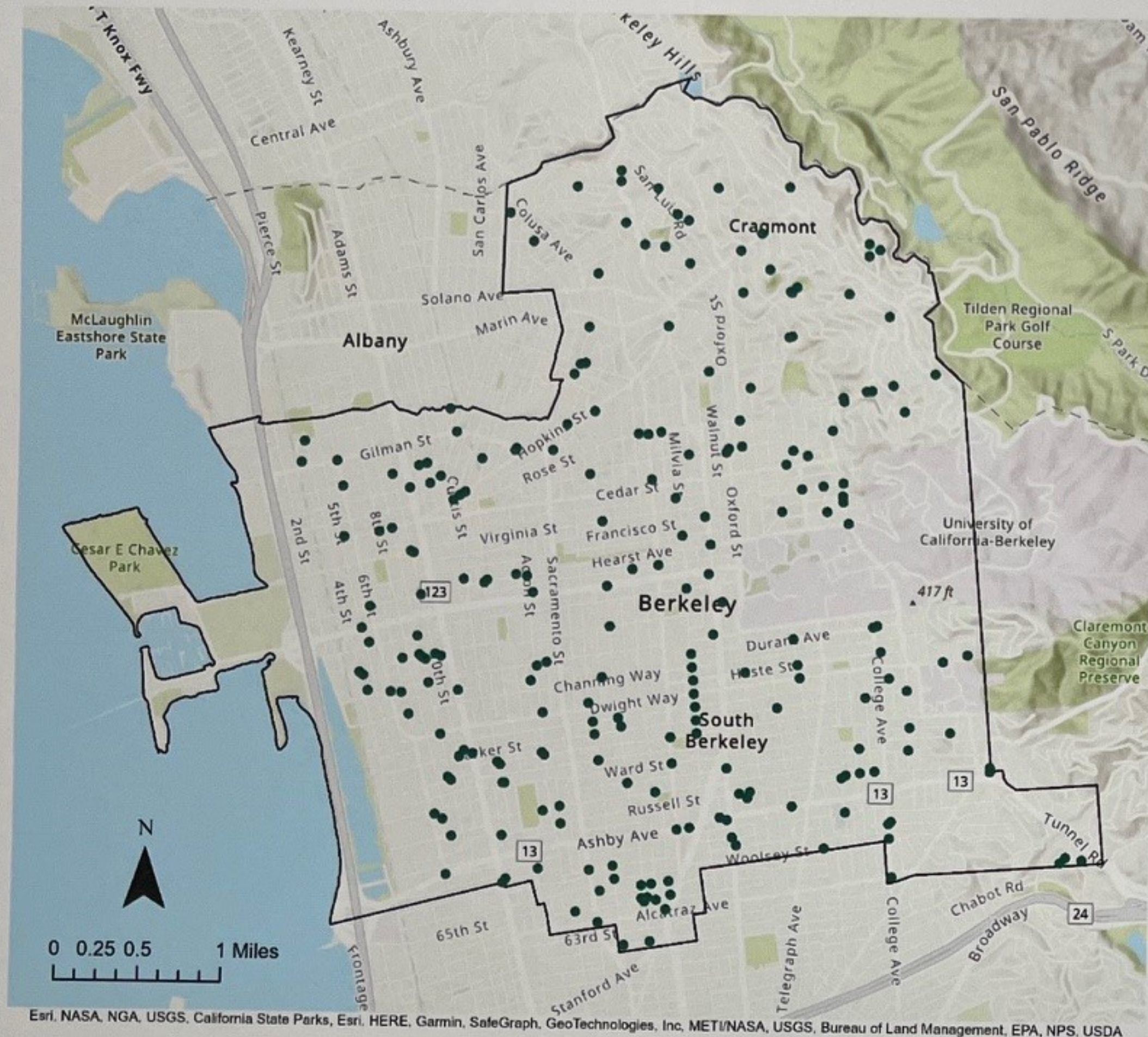
### PLACE A DOT NEXT TO PERSONAL ACTIONS YOU'VE TAKEN.

1. Learned if location of home or business is susceptible to landslides.
2. Had a gas company or professional install flexible pipe fittings to avoid leaks.
3. Planted appropriate vegetation to prevent erosion risk on hillsides and other susceptible areas
4. Consider "a difference in conditions" insurance policy, which can cover the gap in traditional homeowner's insurance.

**Questions or comments? Write them on a post it note!**



# FLOODING



Storm Drain System Issues, Jan-June 2023

During storms and flooding, community members call Berkeley's 3-1-1 service to report locations of storm drain backup or other locations where water is pooling. This map presents locations of community reports of these issues from January-June, 2023. This time period included two federally-declared storm emergencies.

## PERSONAL ACTIONS TO MITIGATE RISK

### PLACE A DOT NEXT TO PERSONAL ACTIONS YOU'VE TAKEN

1. Kept neighborhood sewer grates clean by "adopting a drain." ☐
2. Identified trouble spots around home where water accumulates and created a plan to manage them ☐
3. Considered flood insurance, since typical homeowners insurance policies do not cover flooding. ☐
4. Have learned how to fill sand bags and how to place them to reduce flooding problems ☐
5. Connected with neighbors to help with sand-bagging ☐
6. Moved important objects to higher shelves ☐
7. Learned not to walk, swim, or drive through flooded waters. ☐
8. Prepared for power outages and disruptions to the internet ☐
9. Learned proper methods for clean-up after a flood occurs ☐

**Questions or comments? Write them on a post it note!**

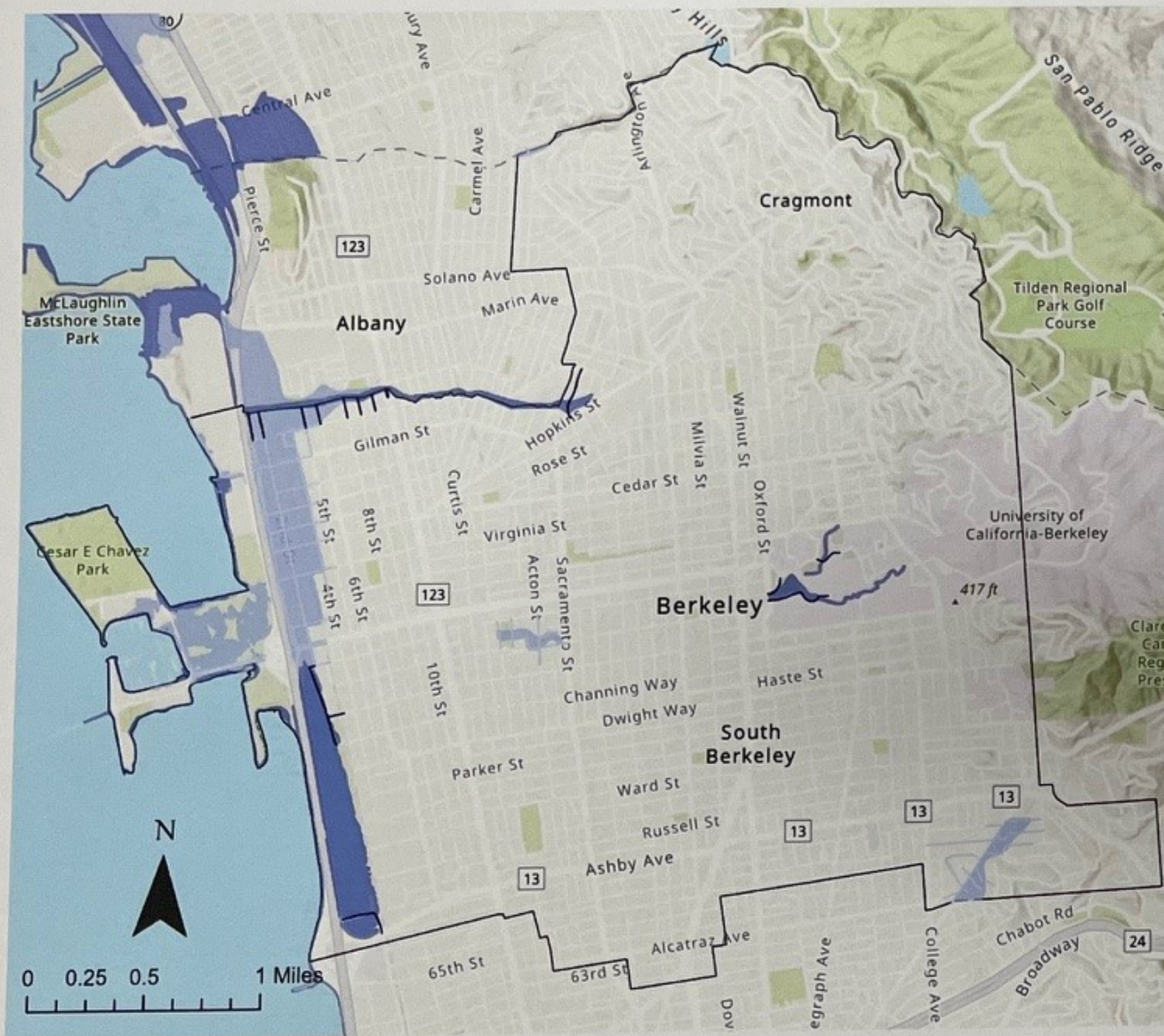


# FLOODING

## About the Hazard:

Floods occur when there is an overflow of water in areas that are normally dry. In Berkeley, three types of flooding typically occur: coastal flooding, creek flooding, and storm drain overflow.

This map shows where water will flood when creeks overflow.



## Flood Zone Map

Street Segment in 500-Year Floodplain

Street Segment in 100-Year Floodplain

### FEMA Floodplains

- 100 Year Floodplain
- 500 Year Floodplain

FEMA National Flood Hazard Layer  
Last updated for Alameda County: June 22, 2020

## CITY ACTIONS TO MITIGATE RISK

PLACE A DOT NEXT TO THE CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Maintain City participation in the National Flood Insurance Program.
2. Use development standards to ensure that new development does not contribute to an increase potential for flooding.
3. Complete a Stormwater Master Plan for all City stormwater infrastructure to identify system deficiencies.
4. Establish a capital Stormwater Improvement Plan and identify funding mechanisms.
5. Renovate the tide tubes that remove storm water from Berkeley Aquatic Park and Potter Street to the Bay.
6. Design stormwater improvements in streets, parks and plazas.



**Questions or comments? Write them on a post it note!**





# TSUNAMI

## About the Hazard:

A tsunami occurs in a body of water when a rapid displacement of water occurs (usually following an earthquake) that creates a surge of water. Tsunamis affecting Berkeley can result from offshore earthquakes near the Bay Area, or from very distant events. Tsunamis historically impacting Northern California were usually generated by earthquakes off the shore of Oregon, Washington and Alaska.



This map shows the Tsunami Inundation Zone in Berkeley. This is generally from sixth street west to the Bay. This doesn't represent a specific scenario but rather what is possible for all types of scenarios (including the worst case scenario).

## CITY ACTIONS TO MITIGATE RISK

### PLACE A DOT NEXT TO THE CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Continue to repair and replace damaged docks at Berkeley waterfront.
2. Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency on tsunami hazard mitigation measures for Berkeley's maritime communities.

## PERSONAL ACTIONS TO MITIGATE RISK

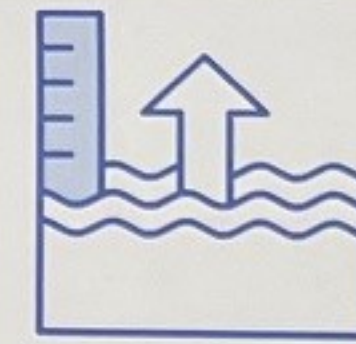
### PLACE A DOT NEXT TO PERSONAL ACTIONS YOU'VE TAKEN

1. Familiarized myself with Berkeley's tsunami inundation area (map to the left).
2. Learned indications of tsunami and what to do.
3. Signed up for AC Alert and Tsunami Zone.
4. Bookmarked Berkeley's Emergency Map.
5. Familiarized myself with Berkeley's Outdoor Warning System.
6. Created household evacuation plan for tsunami.
7. Considered flood insurance.

**Questions or comments? Write them on a post it note!**



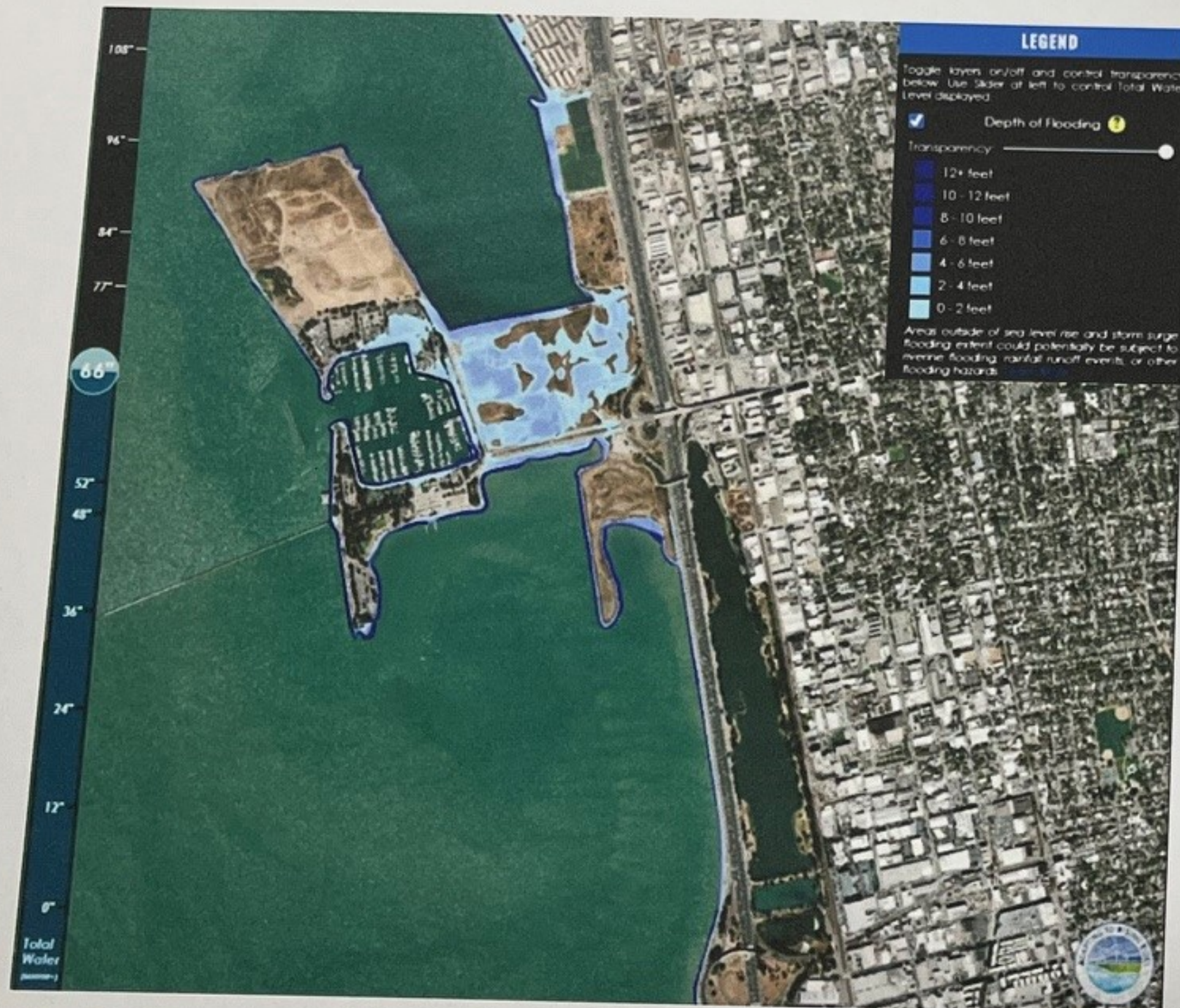
# SEA LEVEL RISE



## About the Hazard:

Sea level rise is an increase in the level of the world's oceans.

Warmer temperatures associated with climate change are causing global sea levels to rise. Damage from sea level rise may include increased infiltration rates into sewer systems, flooding of basements, and destroying underground infrastructure. Toxic materials may also move and release. Rising groundwater will also increase liquefaction hazards in response to earthquakes.



This map shows the Berkeley shoreline areas prone to permanent inundation due to 2 feet of sea level rise (a very likely scenario by 2100).

## CITY ACTIONS TO MITIGATE RISK

PLACE A DOT NEXT TO CITY ACTIONS YOU THINK ARE MOST IMPORTANT

1. Continue to ensure new and existing public and private developments and infrastructure are protected from flooding due to sea-level rise through the permitting process.
2. Identify funding and nature based solutions to adapt to sea level rise at Berkeley Waterfront areas at risk of future inundation.
3. Conduct a groundwater study on impacts of groundwater rise combined with sea level rise.

## PERSONAL ACTIONS TO MITIGATE RISK

PLACE A DOT NEXT TO ACTIONS YOU'VE TAKEN

1. Considered raising living spaces during a major home renovation or construction project.
2. Taken steps to reduce carbon emissions.

Questions or comments? Write them on a post it note!



# Other Ideas

What level of coordination  
between Cal/City  
for student populations  
(94704 area code)  
will campus be  
sanctuary?

Hazardous materials  
spilling during disasters  
(earthquake, flooding,  
etc.)  
Encourage people to  
dispose before  
disaster

OES pres'n  
at Commission  
on Disability  
→ best CBOs  
to engage with  
→ emergency  
planning  
priorities

Dispose hazardous  
materials  
- dispose days  
Safe from eq  
High wind  
fire

Electrical and  
removed gas  
line + Meter

ARCS map (online)  
so people can  
zoom in  
EI Center →  
real time location

Other inspections?  
Fire Zone 1  
more than fire.  
Reducing  
insurance

Watch Duty  
ape



















# Hazard Presentation

Air Quality:

The hazards, the City's work, and steps to stay safe



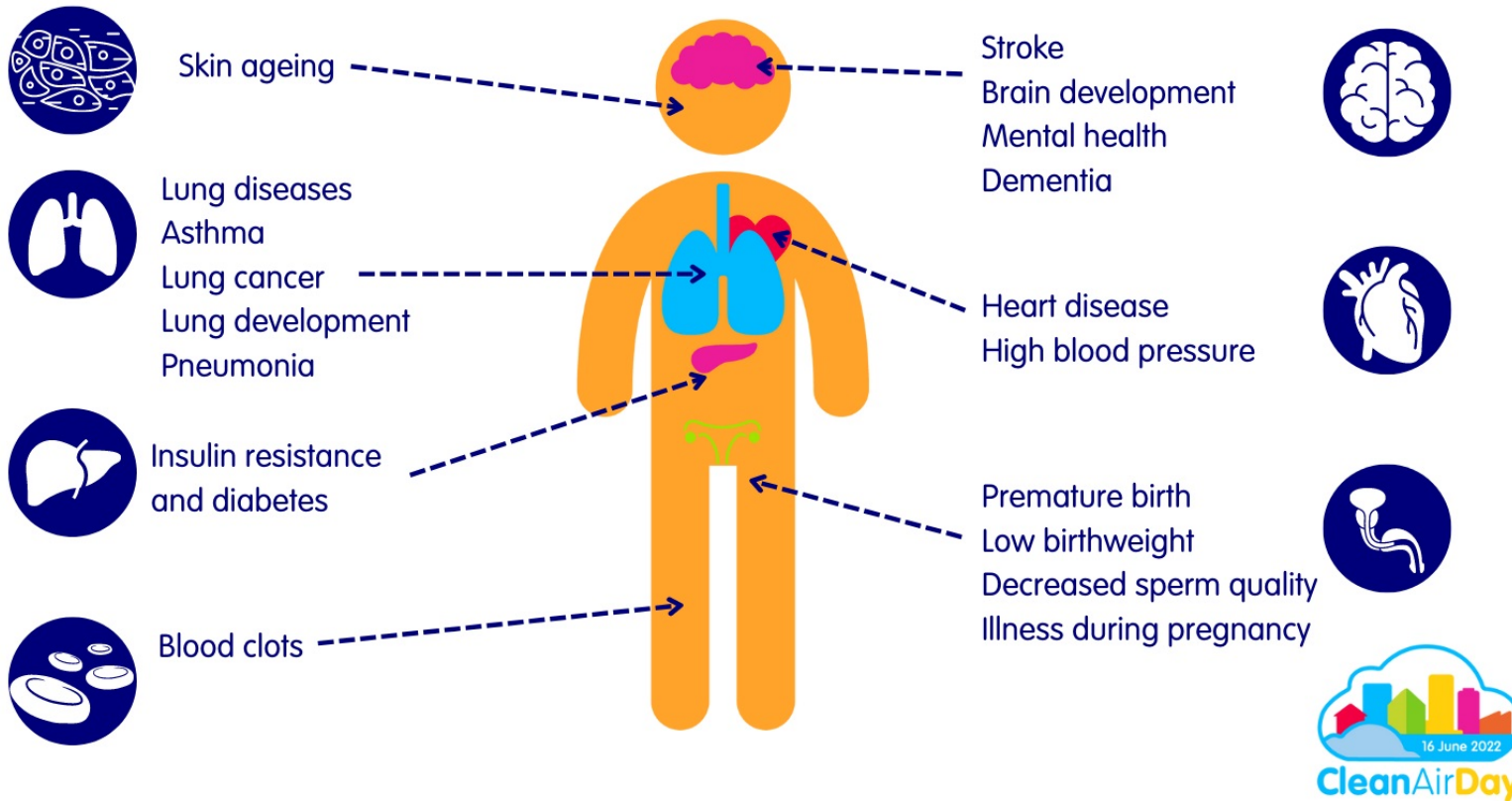
# Air Quality

# The air pollutants of greatest concern in the Bay Area

- Ozone
- Particulate matter
- Toxic Air Contaminants



## The health harms of air pollution

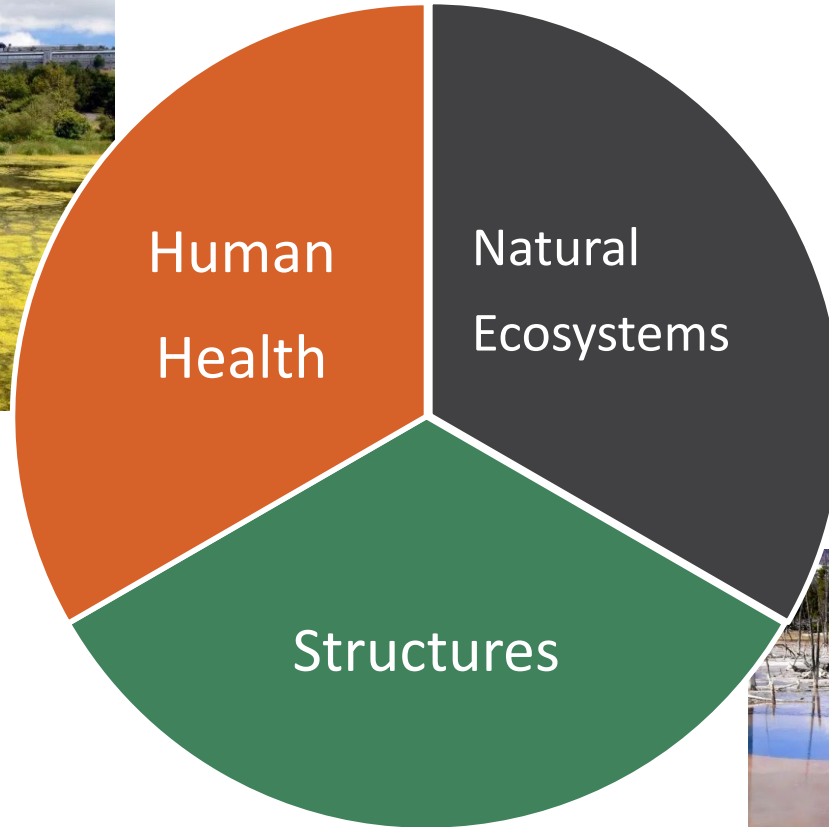




# Impacts of Poor Air Quality



Eutrophication



Acid Rain

# Human Interaction with Poor Air Quality

## Indoors:

- Leaky windows and doors
- Gas appliances
- Wood burning fireplace
- Smoking



## Outdoors:

- Motor vehicles, planes, trains
- Industrial facilities
- Wildfire smoke



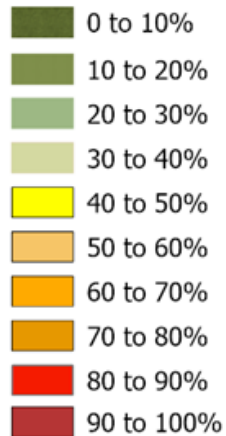
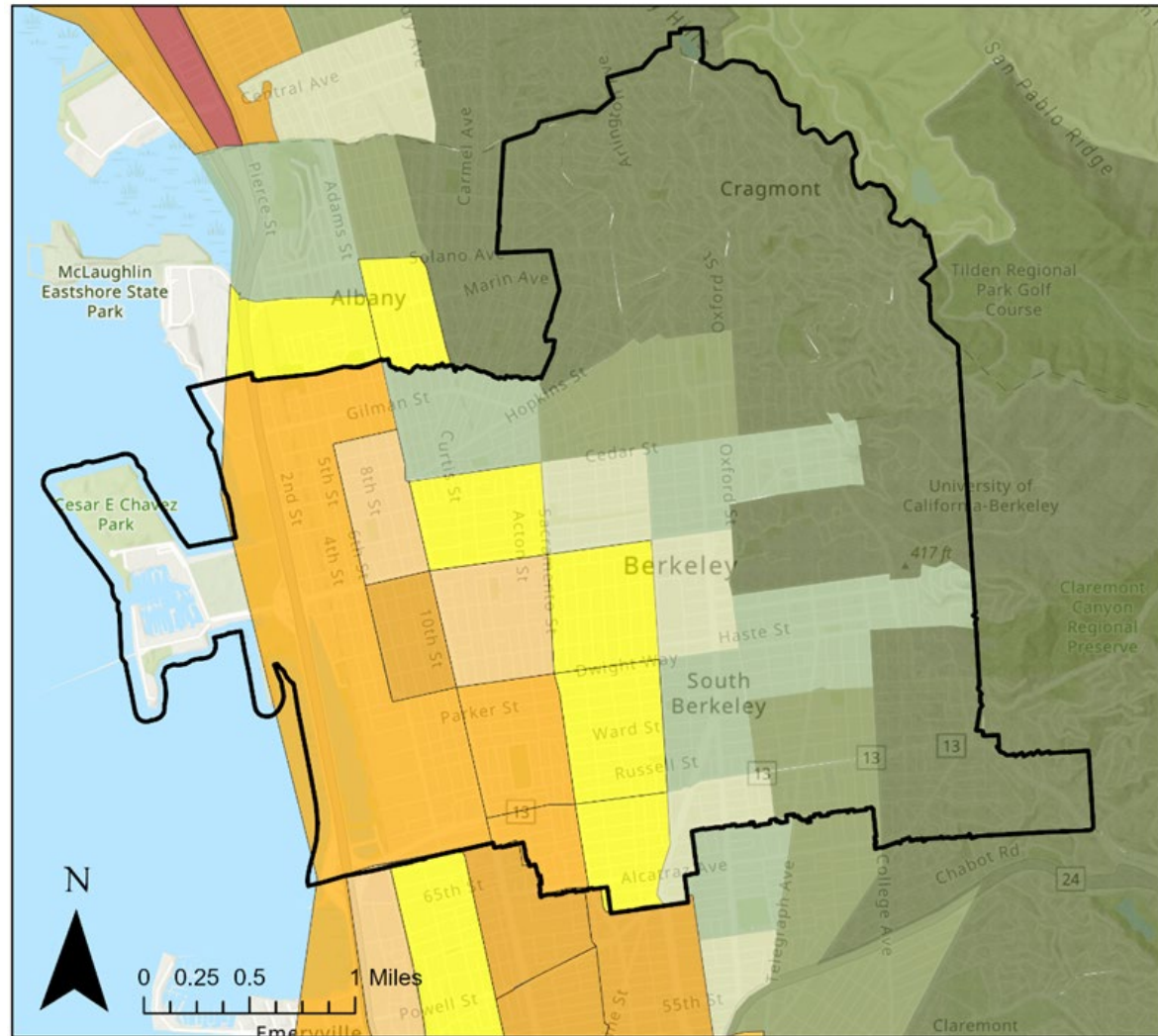


# Air Pollution in Berkeley

**\*regular days\***

## CalEnviroScreen Percentile

City of Berkeley Boundary

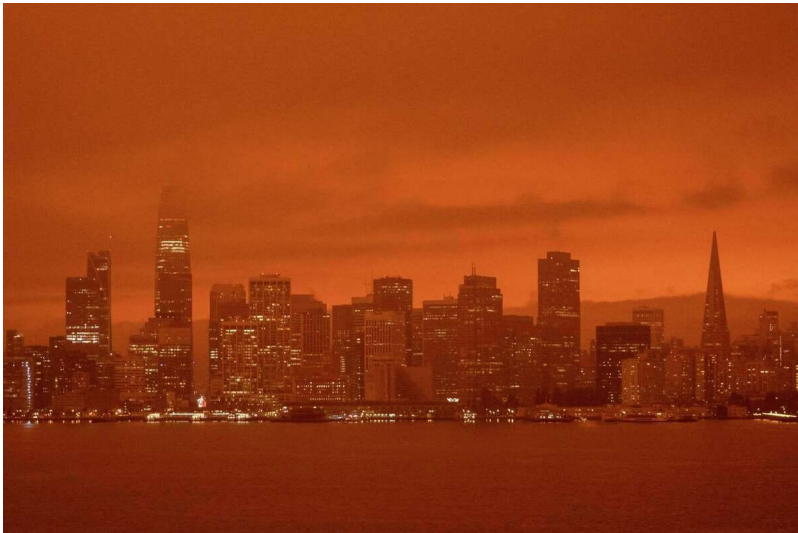


Credits: CalEnviroScreen 4.0, October 2021

Esri, NASA, NGA, USGS, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

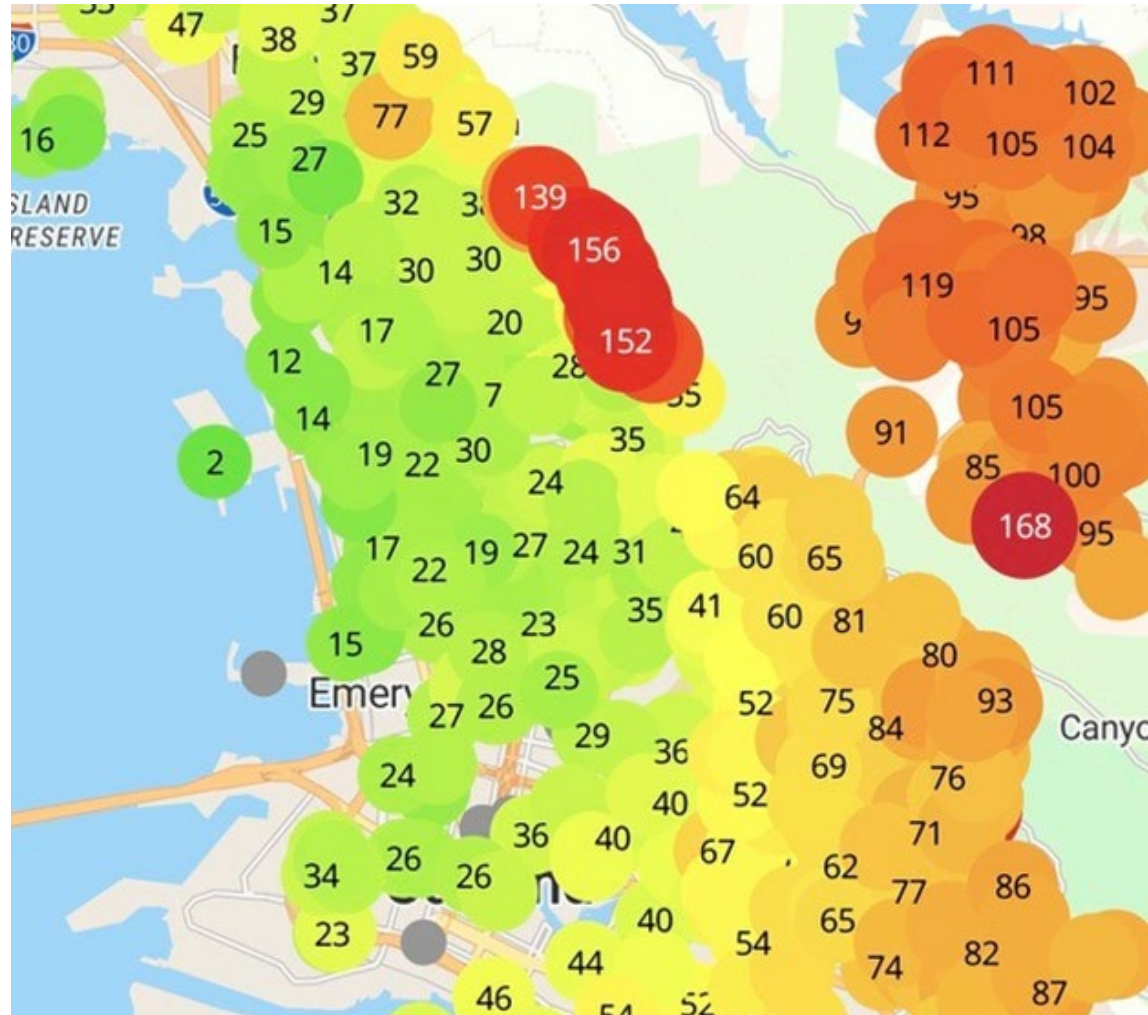


**Human activity** accelerates the effects of climate change, such as *longer, hotter, and drier fire seasons*, which increases risk of severe wildfires and **exposure to smoke**.



# Example, September 2021

- In Berkeley Hills AQI >150



# Air Quality Index

|         |                                |                                                                                                    |
|---------|--------------------------------|----------------------------------------------------------------------------------------------------|
| 0-50    | Good                           | Enjoy your usual outdoor activities.                                                               |
| 51-100  | Moderate                       | Extremely sensitive children and adults should refrain from strenuous outdoor activities.          |
| 101-150 | Unhealthy for Sensitive Groups | Sensitive children and adults should limit prolonged outdoor activity.                             |
| 151-200 | Unhealthy                      | Sensitive groups should avoid outdoor exposure and others should limit prolonged outdoor activity. |
| 201-300 | Very Unhealthy                 | Sensitive groups should stay indoors and others should avoid outdoor activity.                     |
| 301-500 | Hazardous                      | Everyone should avoid all outdoor exertion.                                                        |



## • Spare the Air

<https://www.sparetheair.org/understanding-air-quality/air-quality-forecast>



# **2024 Draft Mitigation Plan: Air Quality Strategy**

# Expanding Urban Forestry team and their activities

- *Parks, Recreation, and Waterfront Department*
  - Tree planting projects and increase of vegetation coverage



Photo Credit: Berkeleyside



Photo Credit: The City of Berkeley

# Implementing programs and projects to reduce emissions

- *Public Works: Transportation Division*
  - Electric and hybrid car/bike/scooter-sharing, installation of public charging stations, and managing public parking

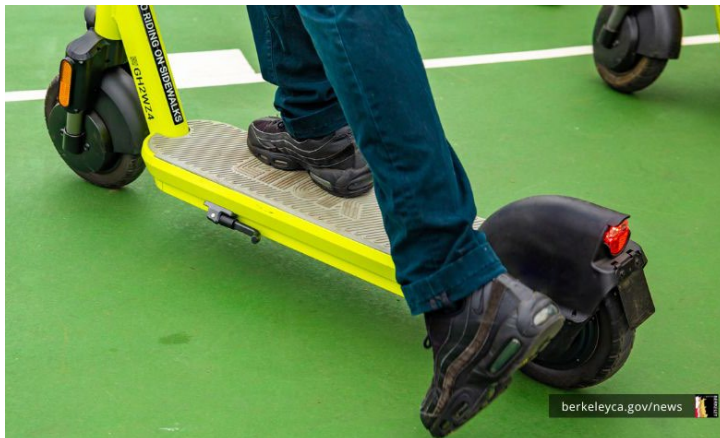


Photo Credit: City of Berkeley



Photo Credit: City of Berkeley



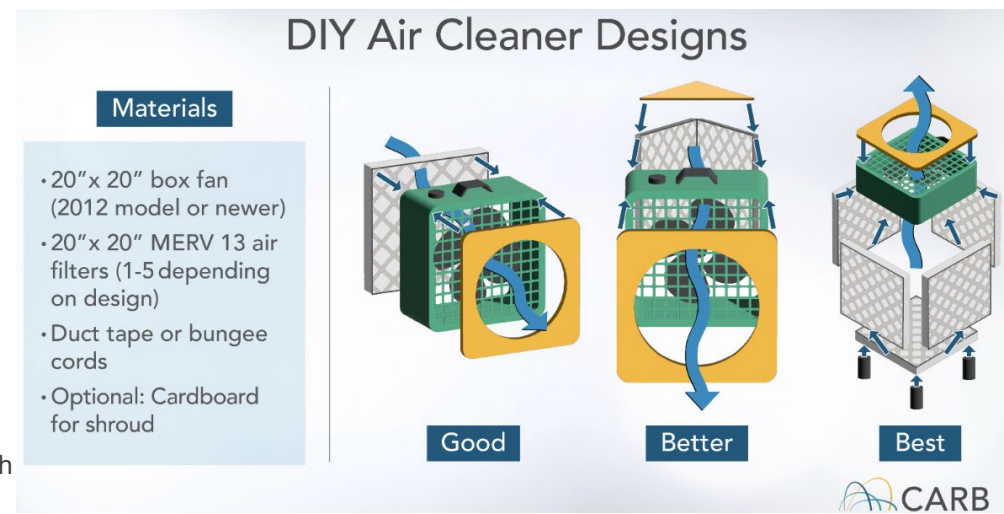
# What can you do about poor air quality?



## Prepare Your Home:

- Replace or seal leaky windows and doors
  - See *California Weatherization Assistance Program*
- Purchase equipment to clean the air inside your home
  - HVAC system filters
  - Portable Air Cleaners
  - See the list of *California Certified Air Cleaners*:  
<https://ww2.arb.ca.gov/list-carb-certified-air-cleaning-devices>

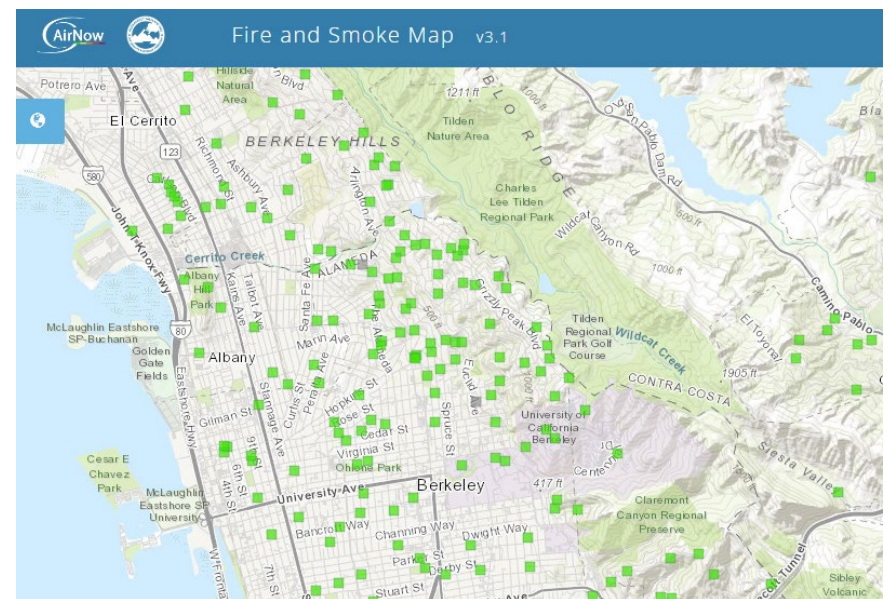
- If necessary, construct an air cleaner with a box fan





## Stay Updated:

- Be familiar with the **Air Quality Index (AQI)**
- Bookmark sites with key air quality information
  - Forecasts: ***AirNow.gov***
  - Real-time readings: ***Fire.AirNow.gov***





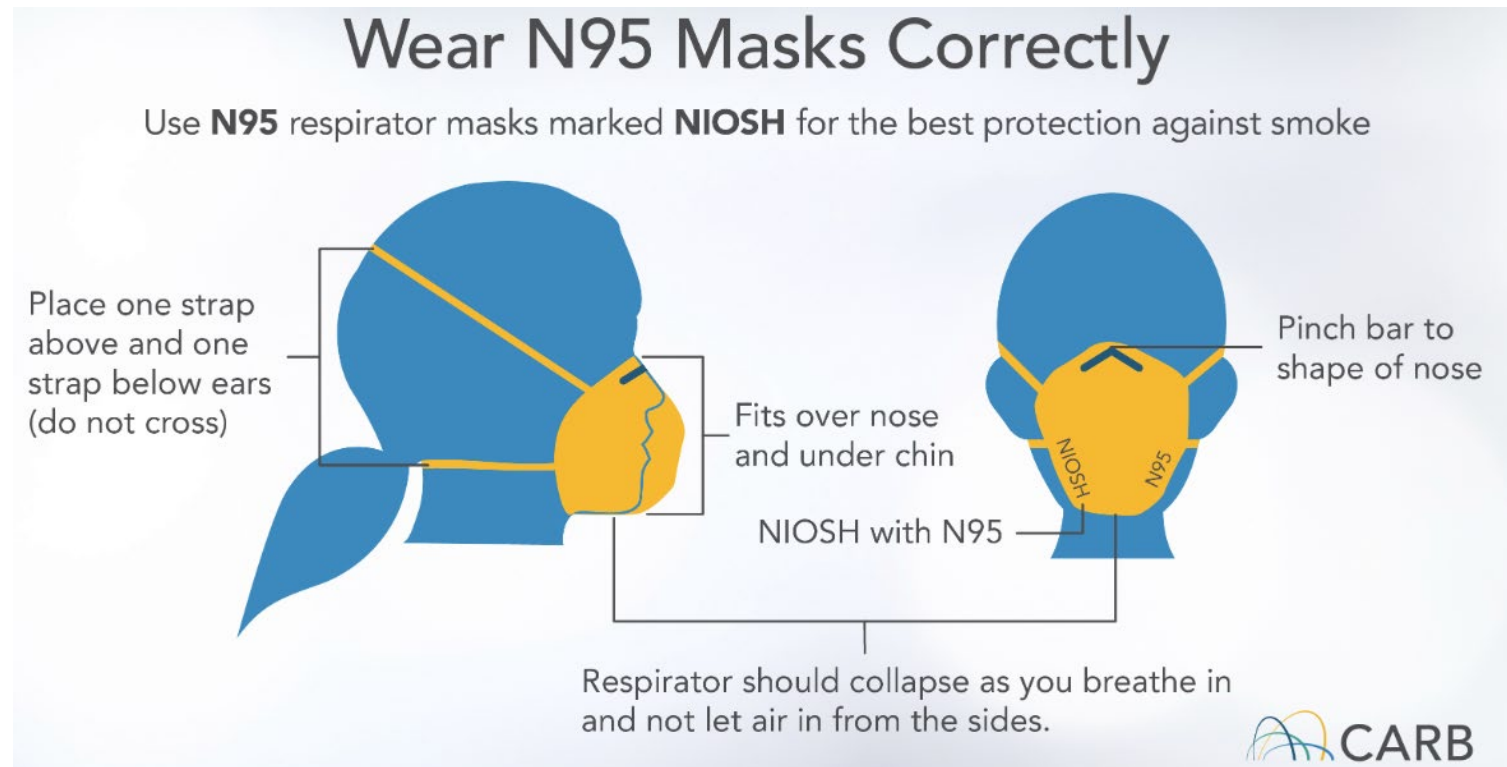
## Poor Air Quality Events:

- Stay indoors with windows and doors closed
- See *Smoke Ready California*: [ww2.arb.ca.gov/smokereadyca](http://ww2.arb.ca.gov/smokereadyca)



## Poor Air Quality Events:

- Learn how to wear a mask, preferably N95 respirator mask
- Look out for signs that you or those around you need cleaner air



# Next Steps





## Next Steps Today!

- Mitigation plan:
  - Share your top mitigation actions and other ideas
  - Full draft plan available in 2024
  - [Mitigation@BerkeleyCA.gov](mailto:Mitigation@BerkeleyCA.gov)

# Stay Connected and Informed!

Key sources of information and instructions  
during an emergency

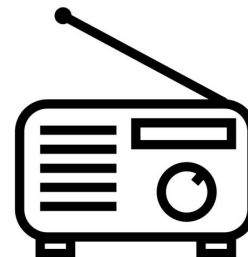




# Welcome!



Be prepared to use *different sources* to find information in an emergency







# AC Alert

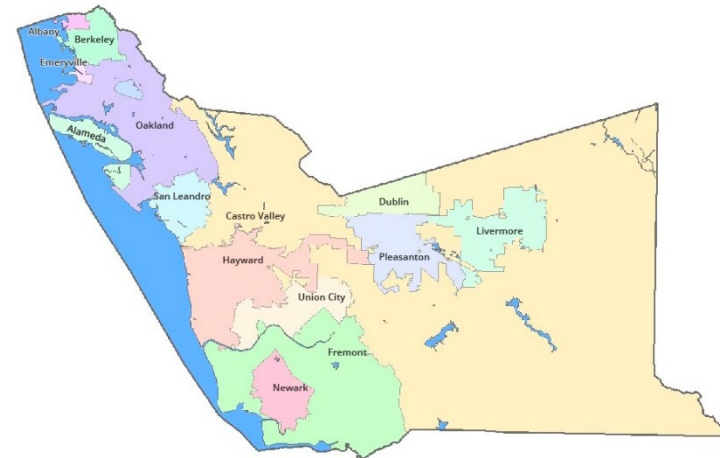
- **A Mass Notification System (Alameda County):**

- Voice alerts to phones
- SMS text messages
- Email
- TTY/TDD



- An Opt-in System

- Sign up for AC Alert today!





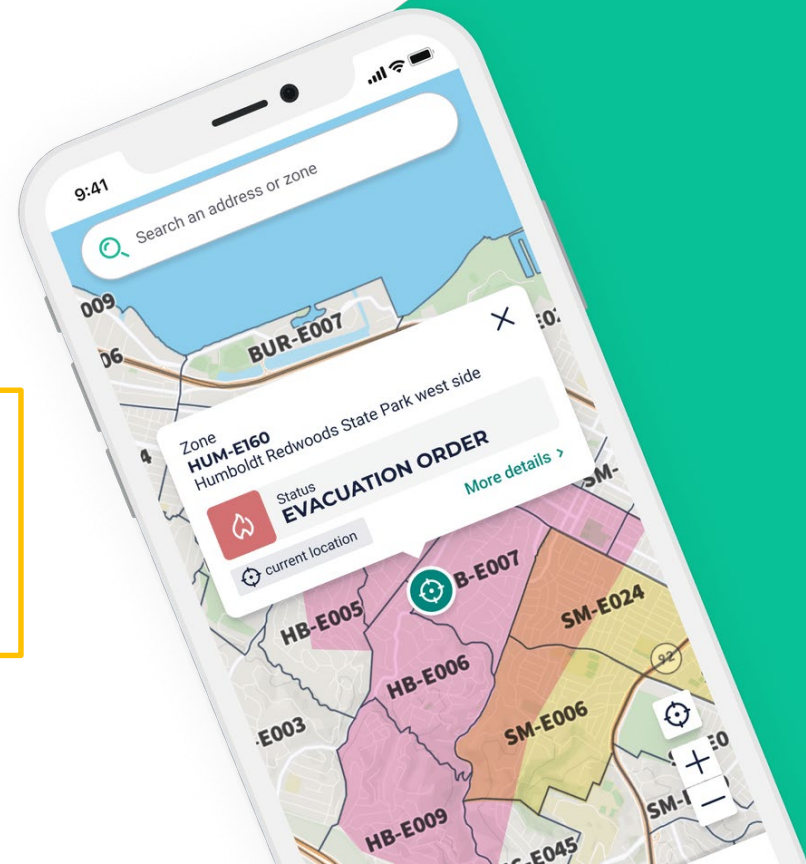
# Berkeley Emergency Map

During an emergency, review *Berkeley's Real-Time Emergency Map* to find emergency information, like evacuation orders or open shelters.



Let's check out the browser version together: [protect.genasys.com](https://protect.genasys.com)

 **genasys Protect**





# Outdoor Warning System

15 locations across Berkeley



Let's get familiar with the  
OWS emergency tones!





## Berkeley Siren Locations



### Phase I Siren Locations

-  Berkeley Marina
-  Animal Care Services
-  Fire Station 7
-  City Hall
-  Zaytuna College (Upper Campus)



### Phase II Siren Locations

-  Sylvia Mendez Elementary
-  Emerson Elementary
-  Cragmont Elementary
-  Oxford Elementary
-  Berkeley Adult School
-  Martin Luther King Jr. Middle School

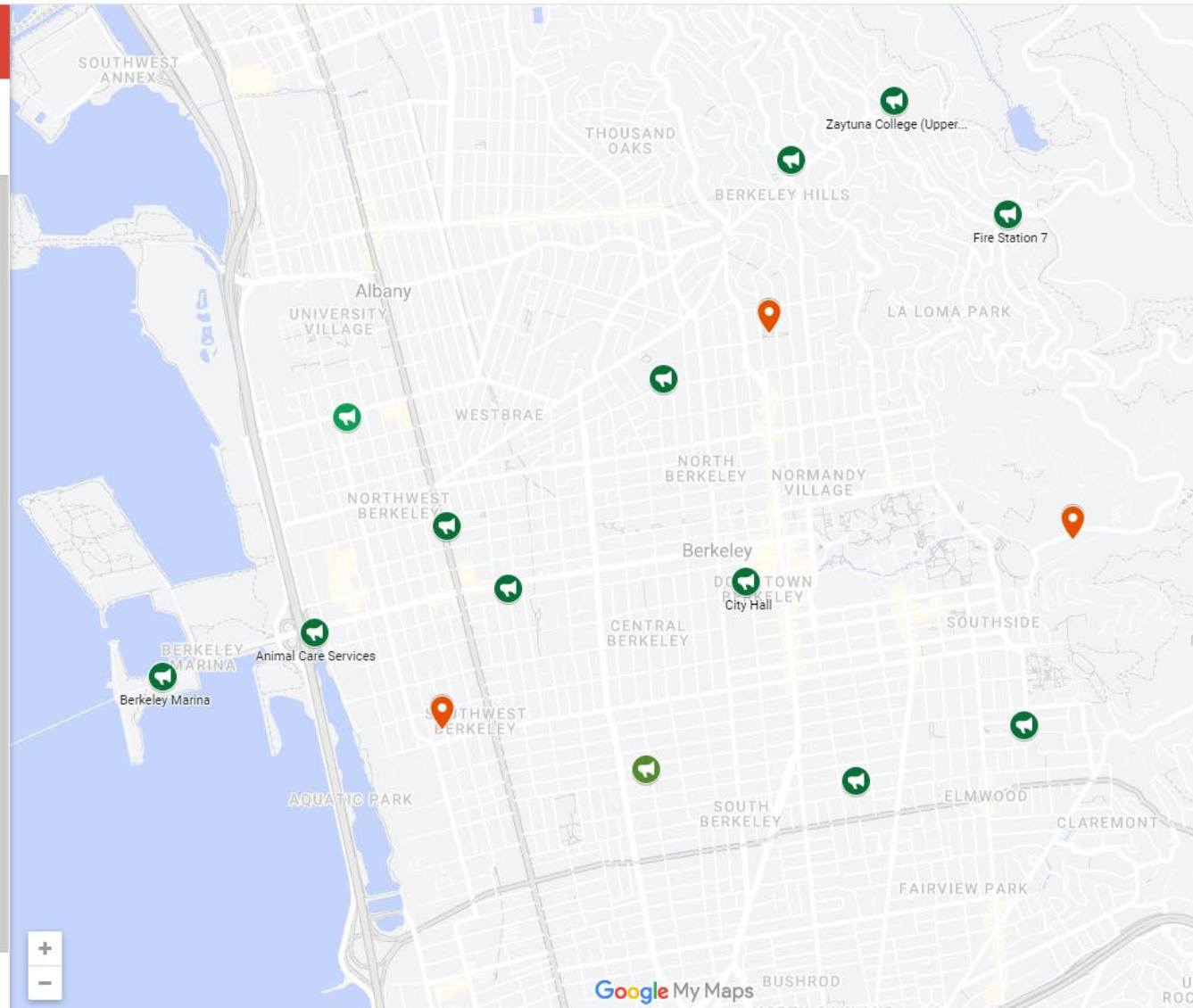


### Phase III Siren Locations (late 2023/2024)

-  Strawberry Canyon Recreation Center
-  Fire Station #1
-  Longfellow Middle School
-  BUSD Transportation
-  Live Oak Park



### Other Sirens Systems



# Radio - 1610 AM

- Run by the City of Berkeley
- Plays:
  - recorded messages
  - emergency information
  - instructions
- Or use **KPFB – 89.3 FM**





# Nixle

- Get information from Berkeley Police Department through BFD primary communication tool, which includes urgent and non-urgent communication
  - Email
  - Advisories
  - Text messages







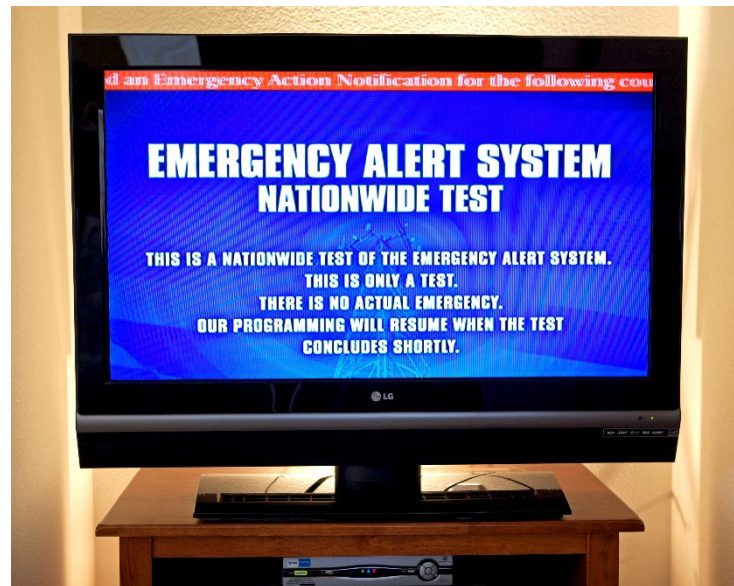
# Wireless Emergency Alerts (WEA)

- Short emergency text government agencies send to smartphones to alert about critical threat requiring public's attention, such as shelter-in place or evacuation order
- You cannot sign up to receive WEA
  - DO NOT rely only on WEA
  - For more detailed instructions sign up for AC Alert



# Television

All television channels will broadcast messages sent by Alameda County through the Emergency Alert System. Local news networks may also carry specific information and instructions from authorities.



# Emergency Alert System (EAS)

A national public warning system that enables the President or other authorities to address the American public via television and radio broadcast during a national emergency or to deliver important information.

In Berkeley, EAS radio stations:

- KCBS - 740 AM
- KQED - 88.5 FM
- KSOL - 98.9 FM (Spanish)







# UC Berkeley Recommendation

- Access UCB OEM Website - <https://oem.berkeley.edu/>



**Berkeley**  
UNIVERSITY OF CALIFORNIA



# WarnME (UC Berkeley)

- A warning system for *UC Berkeley students, staff, and faculty*
- By default, all UC Berkeley email addresses are enrolled in WarnME to receive emergency notifications, community advisories, and timely warnings from UCPD.
- Register your mobile number to receive crucial life safety SMS alerts.

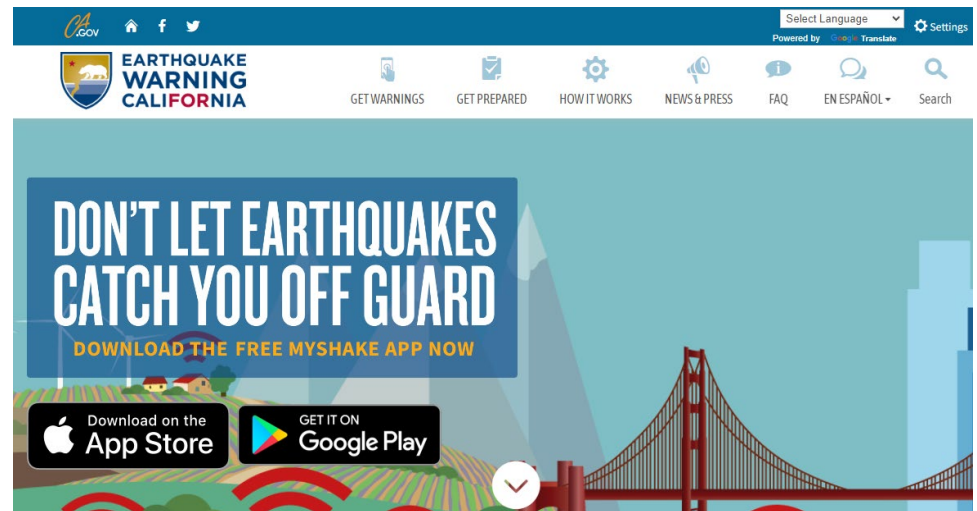


**Berkeley**  
UNIVERSITY OF CALIFORNIA



# Earthquake Warning for California

- The first earthquake early warning system
- Learn more at <https://earthquake.ca.gov>
- Install the ***MyShake App*** receive alerts before earthquake shaking starts







# Hazard Presentation

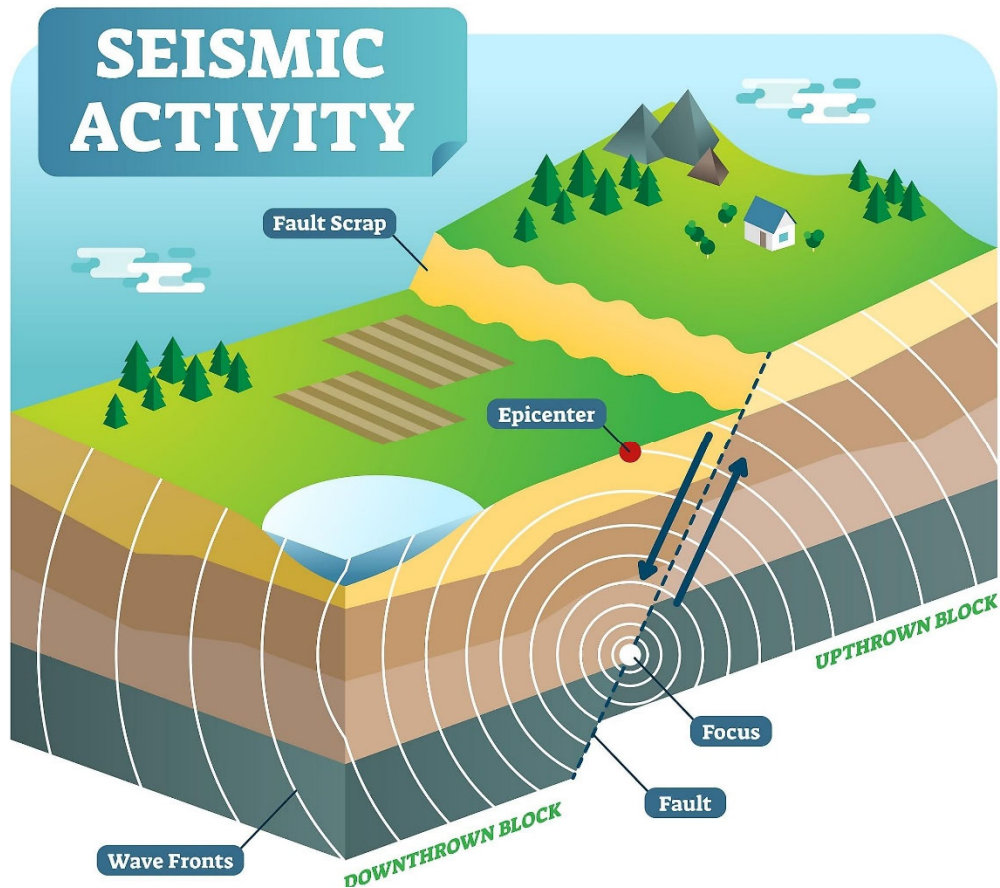
Earthquake:

The hazards, the City's work, and steps to stay safe





# Earthquake

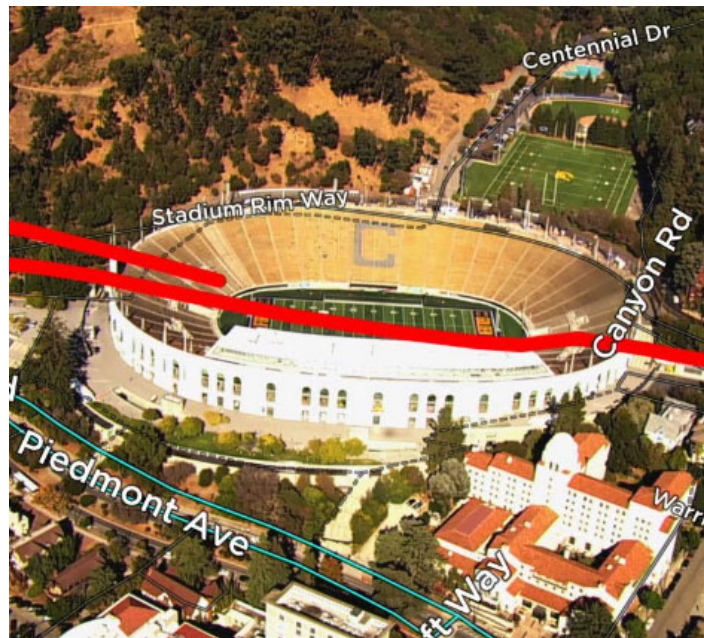


# What is an earthquake?



# Regional Faults

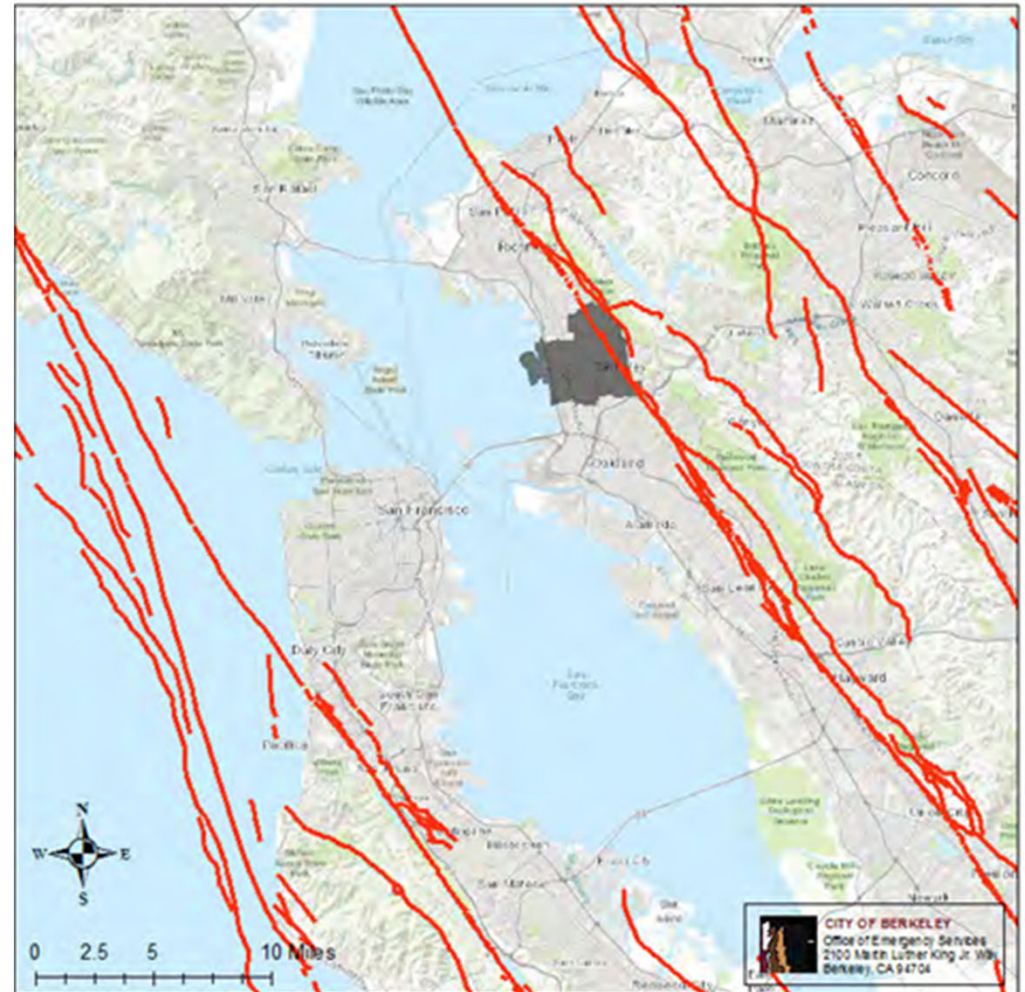
The Hayward Fault at UC Berkeley Stadium



Local Hazard Mitigation Plan ▪ 2024 Draft ▪ Community Outreach

Internal

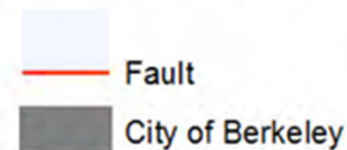
Map 1. *Regional faults and their location with respect to Berkeley*



Source: In 2012, USGS mapped multiple faults in the region that can produce damaging shaking in the region.

(Shapefiles and description from ABAG website)

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, ©







**Fault Rupture**



**Liquefaction**



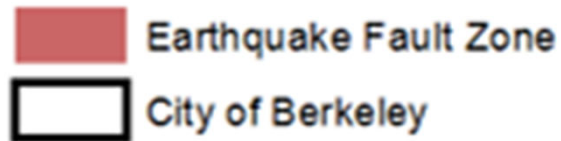
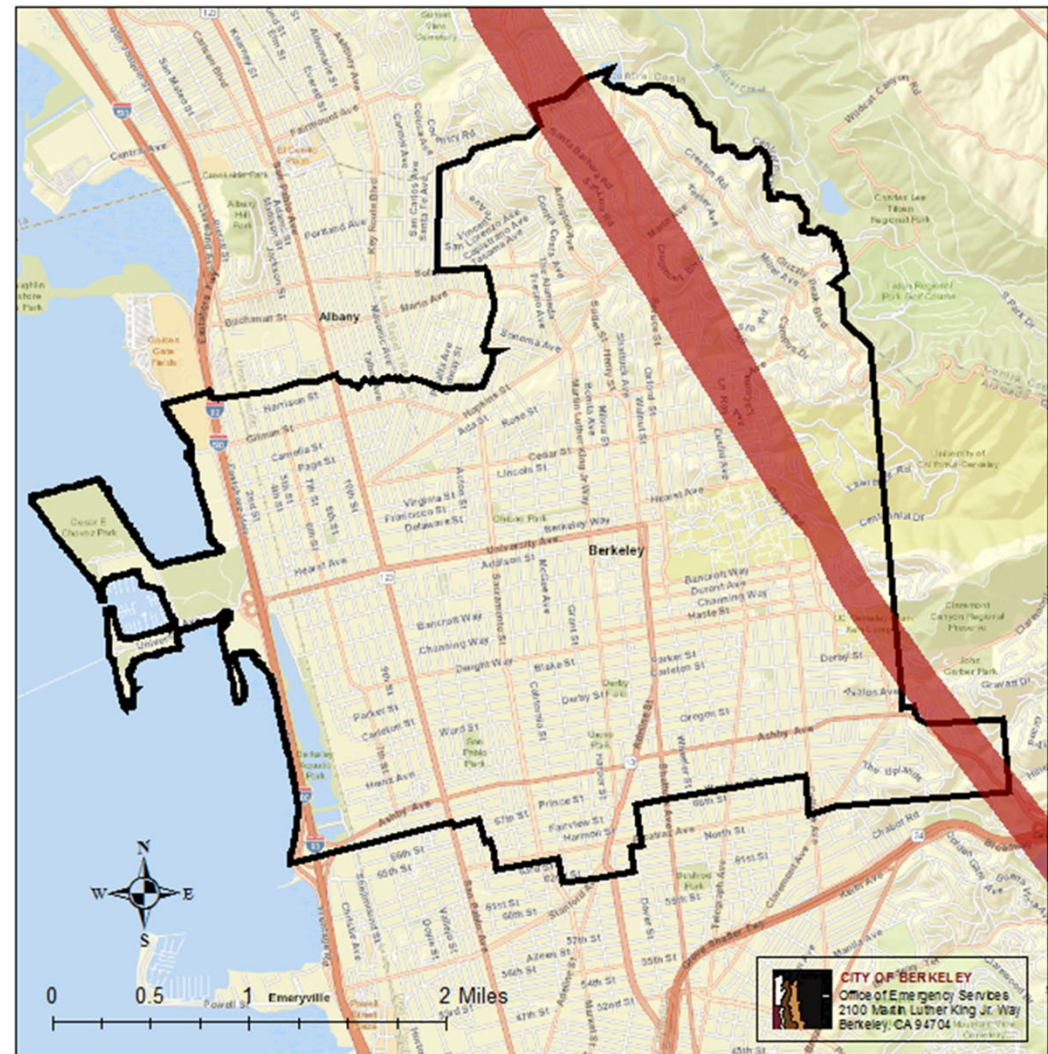
**Landslide**





# Fault Rupture

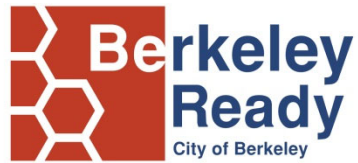
## Fault Planning Zone



Source: California Geological Survey, Earthquake Fault Planning Zone.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

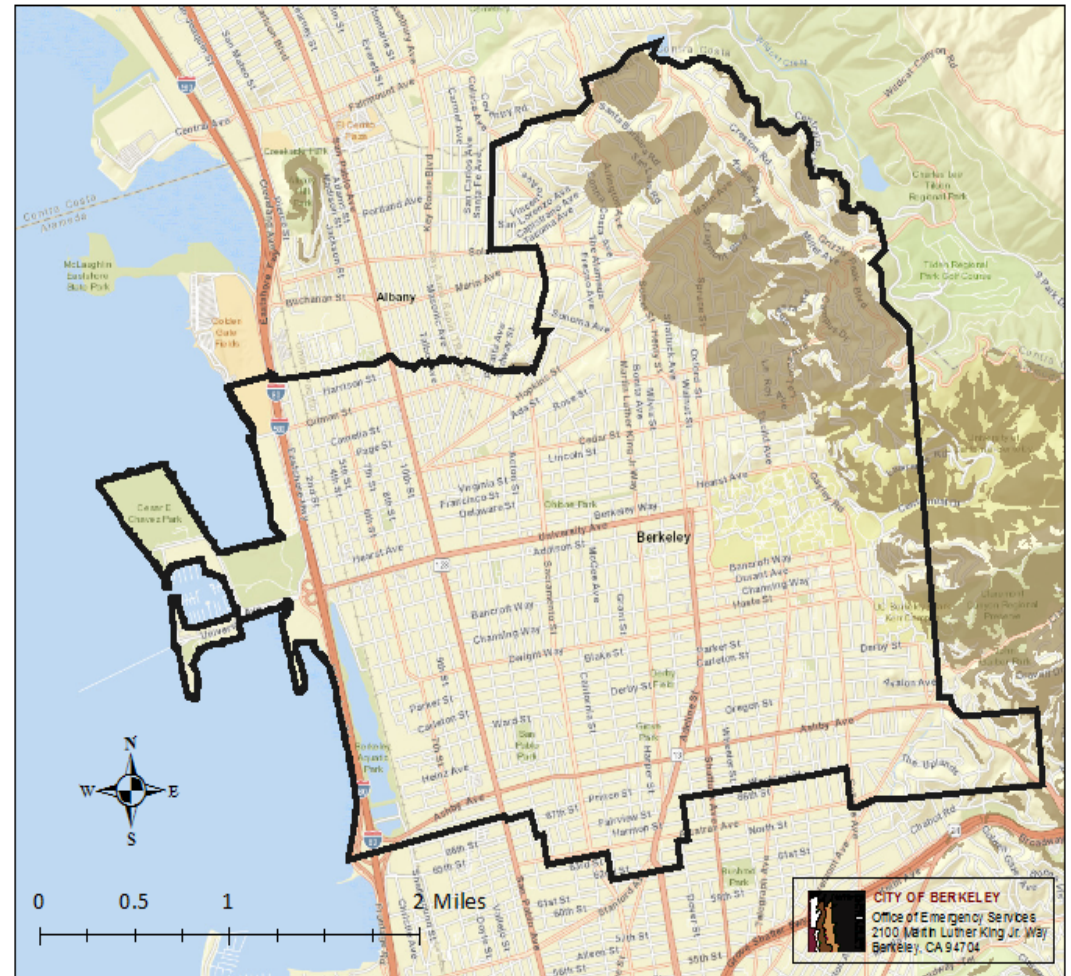




# Seismically-Triggered Landslide

## Landslide Planning Zone

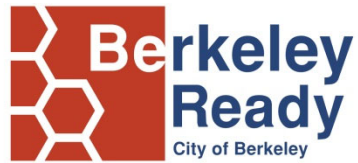
-  City of Berkeley
-  Earthquake-Induced Landslide Planning Zone



Source: California Geological Society, Earthquake-Induced Landslide Planning Zone.

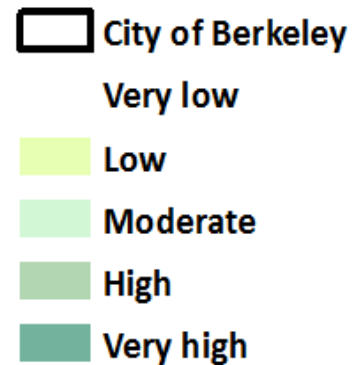
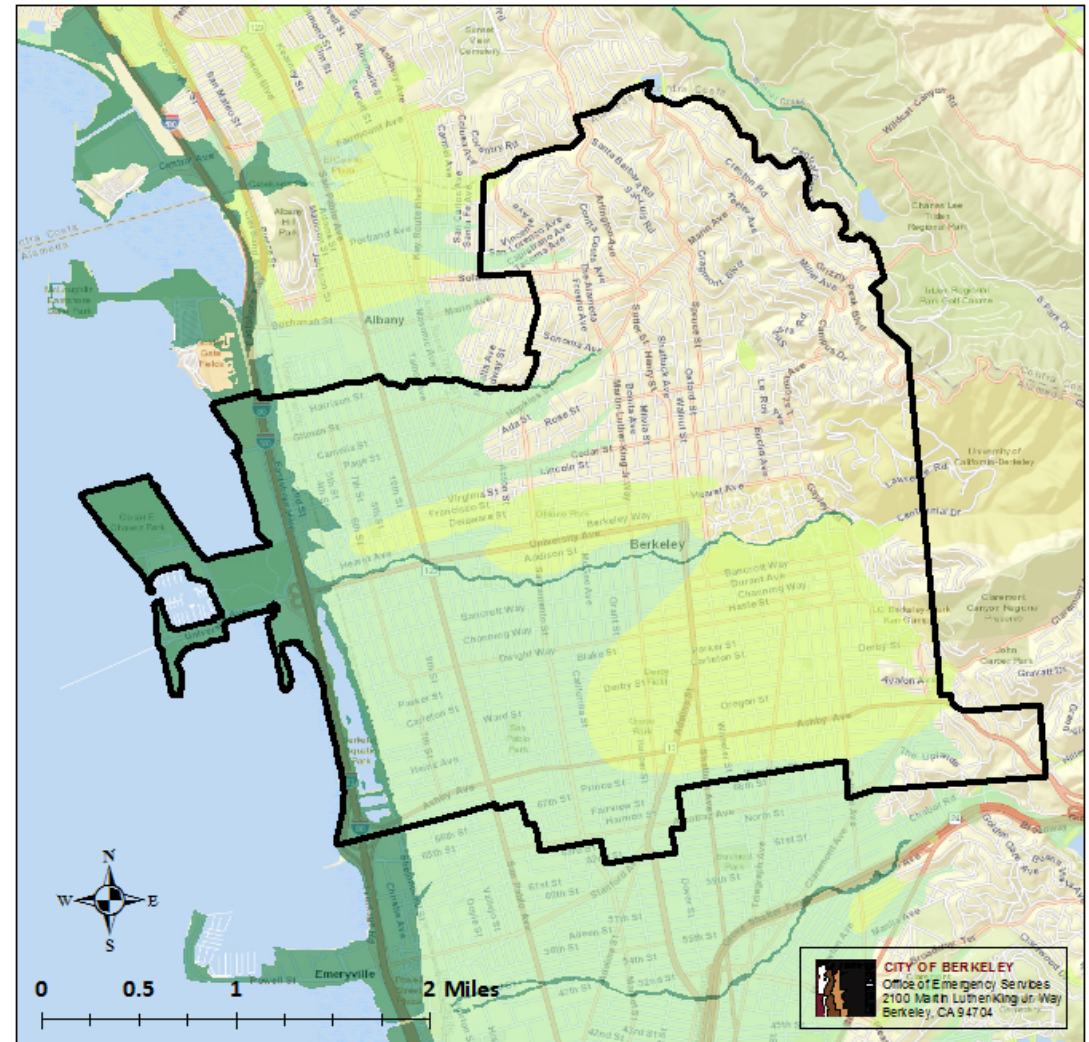
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community





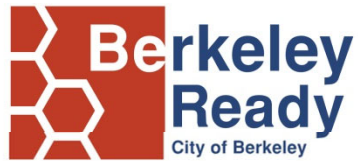
# Liquefaction

## Level of Susceptibility to Liquefaction in Berkeley



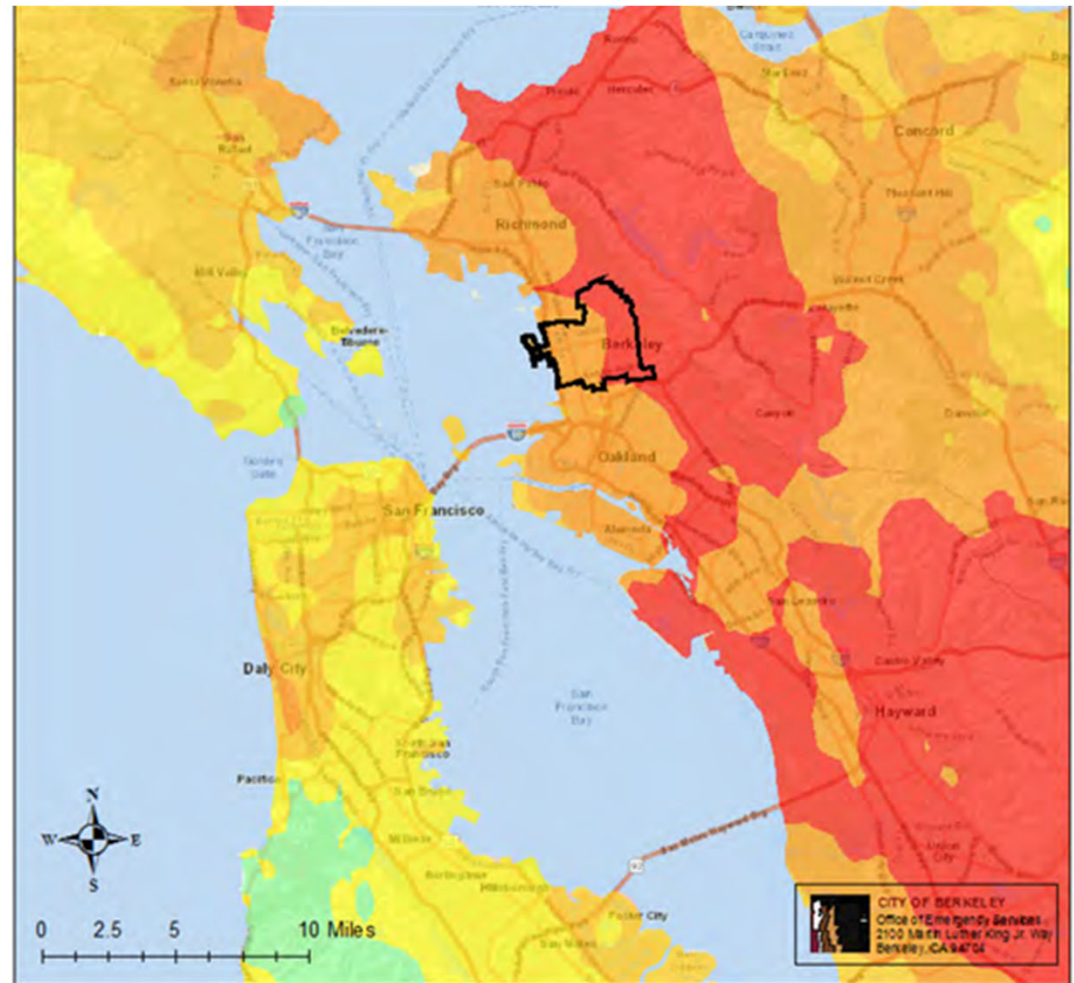
Source: USGS, 2006.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community



# Modified Mercalli Intensity (Shaking) for HayWired Earthquake Scenario

\*hypothetical magnitude (M) 7.0\*



Source: USGS, HayWired Scenario, August 2017.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community





# Modified Mercalli Intensity (MMI)

| MMI  | Shaking     | Description and damage                                                                                                                                                                                                                                         |
|------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I    | Not felt    | Not felt except by a very few under especially favorable conditions.                                                                                                                                                                                           |
| II   | Weak        | Felt only by a few persons at rest, especially on upper floors of buildings.                                                                                                                                                                                   |
| III  | Weak        | Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.                  |
| IV   | Light       | Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.                               |
| V    | Moderate    | Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.                                                                                                                                    |
| VI   | Strong      | Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.                                                                                                                                                    |
| VII  | Very strong | Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.                                                  |
| VIII | Severe      | Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. |
| IX   | Violent     | Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shift off foundations.                                                       |
| X+   | Extreme     | Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.                                                                                                                                         |



# Earthquake Hazard: Vulnerabilities

## What we will *NOT* see in Berkeley

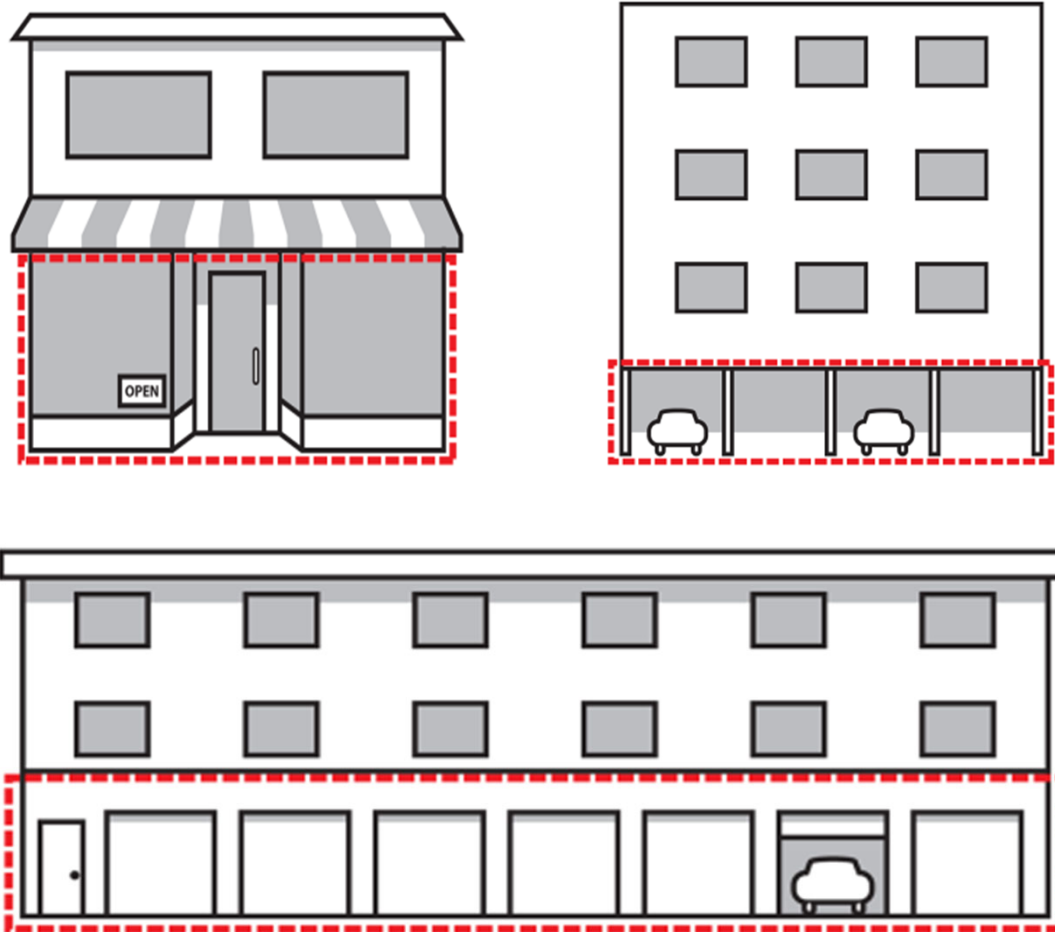


Photo Credit: USA Today



# Vulnerable Structures

## Soft, Weak or Open Front (SWOF)



SWOF buildings have *large openings on ground floor*, such as storefront windows, car openings.

# Vulnerable Structures

## Soft, Weak or Open Front (SWOF)



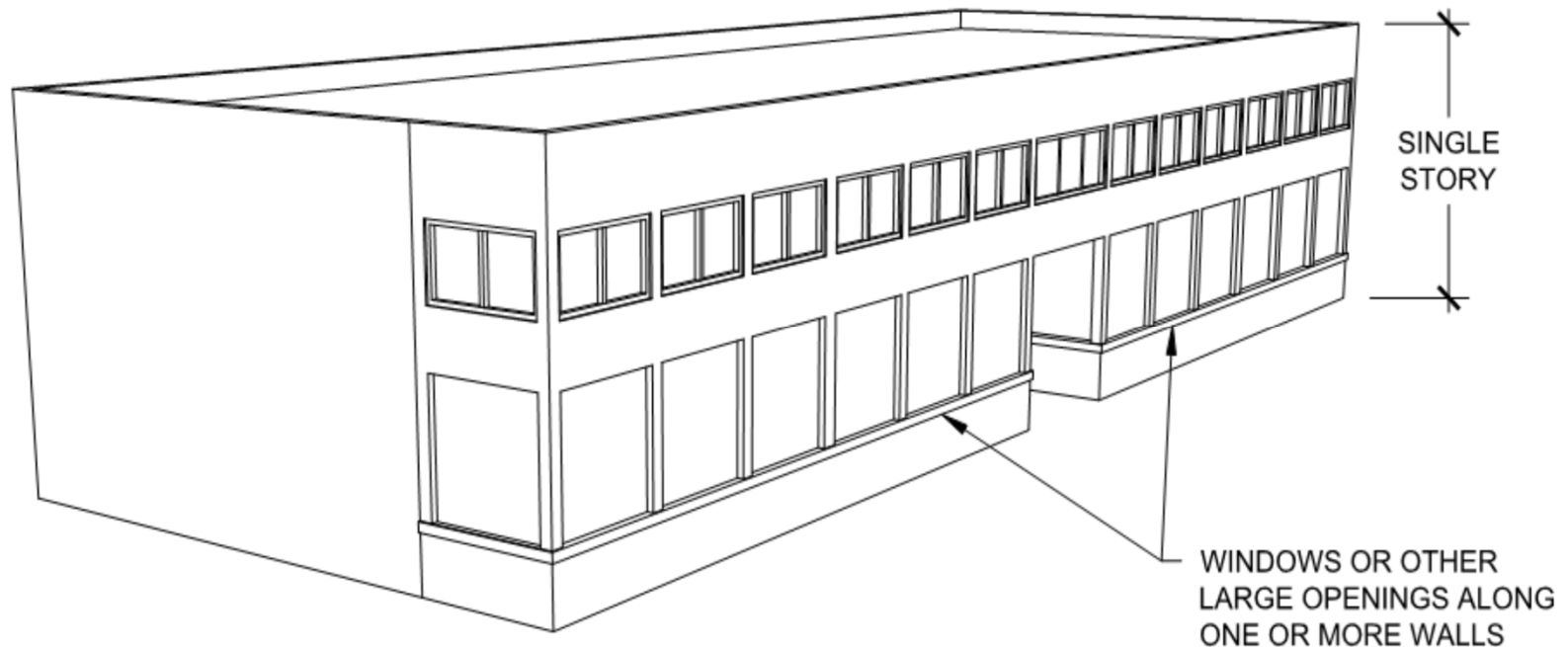
Example: A wood frame multi-unit residential building with soft, weak or open front soft story condition at first story due to garage openings.



# Vulnerable Structures

## Soft, Weak or Open Front (SWOF)

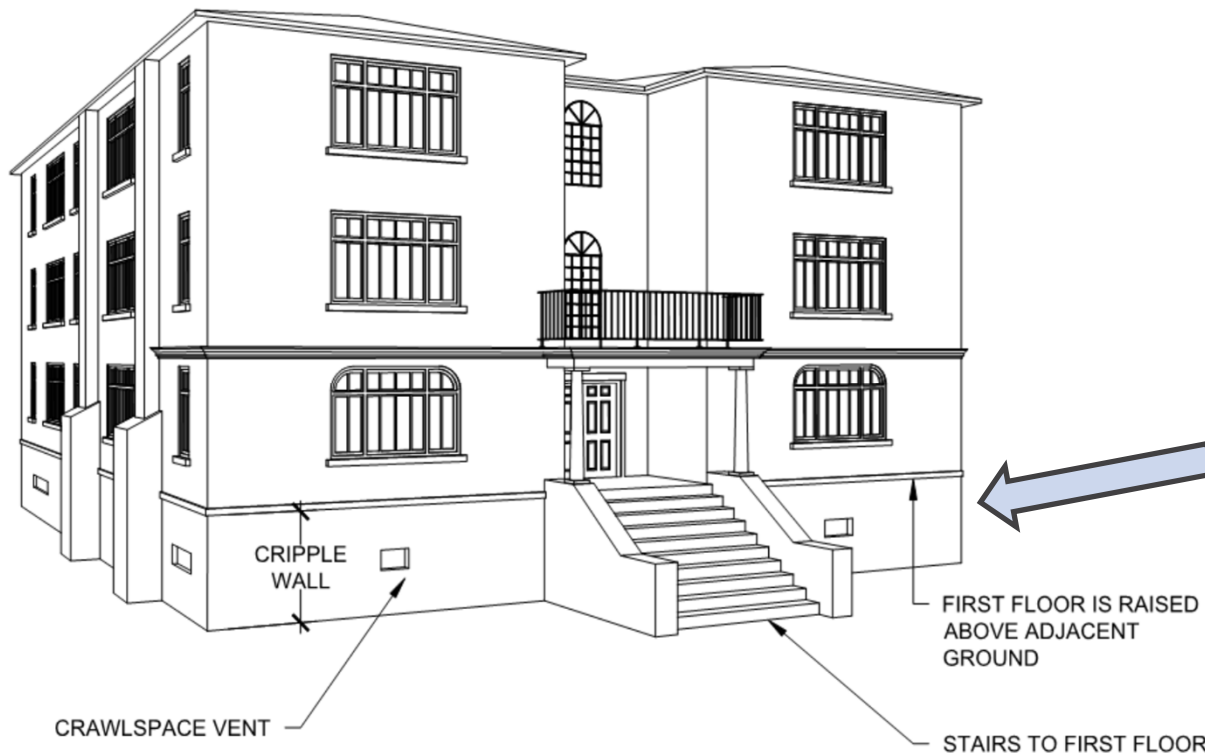
Example: One-story, open-front building with windows or other large openings along one or more walls





# Vulnerable Structures

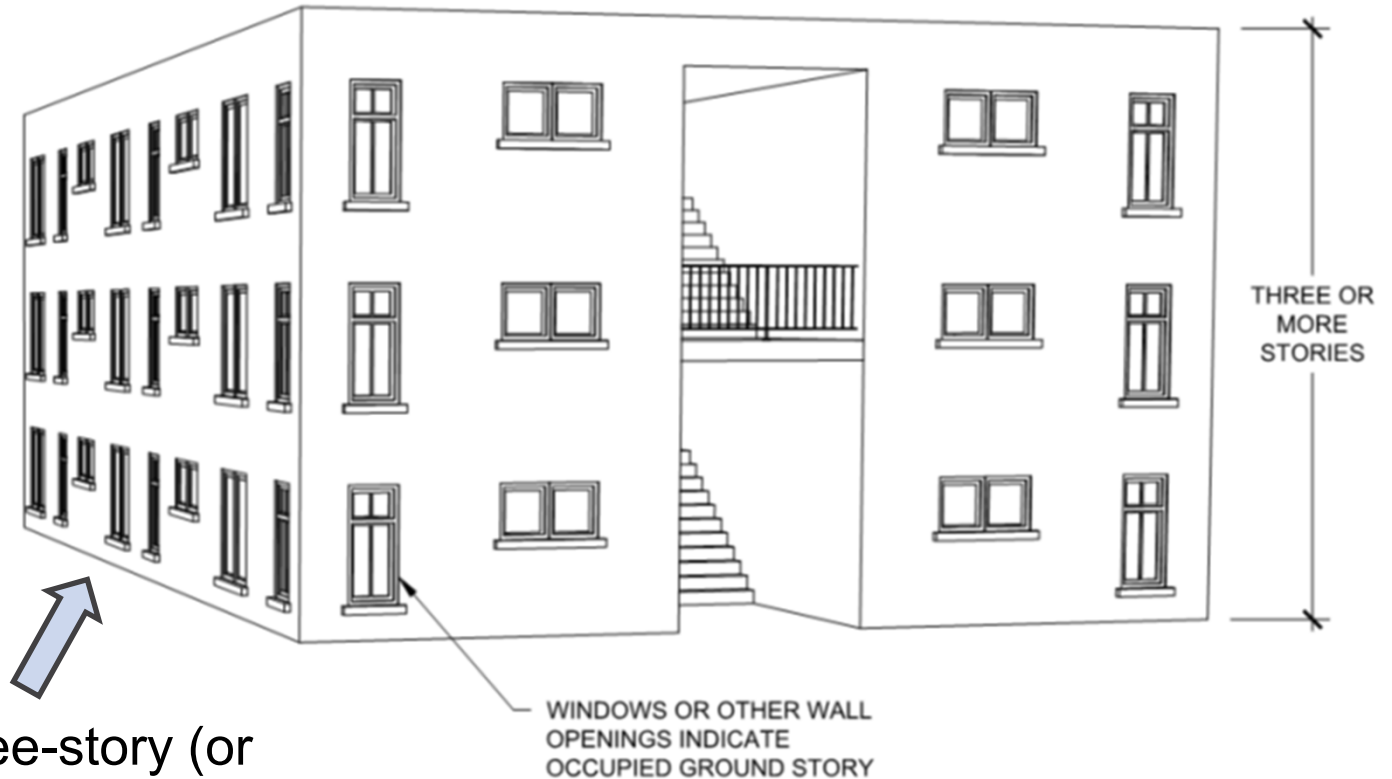
## Soft, Weak or Open Front (SWOF)



Example: A building with cripple walls. Stairs to first occupied floor and vents to area below the occupied floors are indications of possible cripple walls.

# Vulnerable Structures

## Soft, Weak or Open Front (SWOF)



Example: A three-story (or more) multi-family residential building with potential weak first story.

# Vulnerable Structures

## Unreinforced Masonry (URM)

URM buildings are constructed with *brick walls* that **are not** reinforced with *steel or other materials* to increase their structural strength





# Vulnerable Structures

## Unreinforced Masonry (URM)

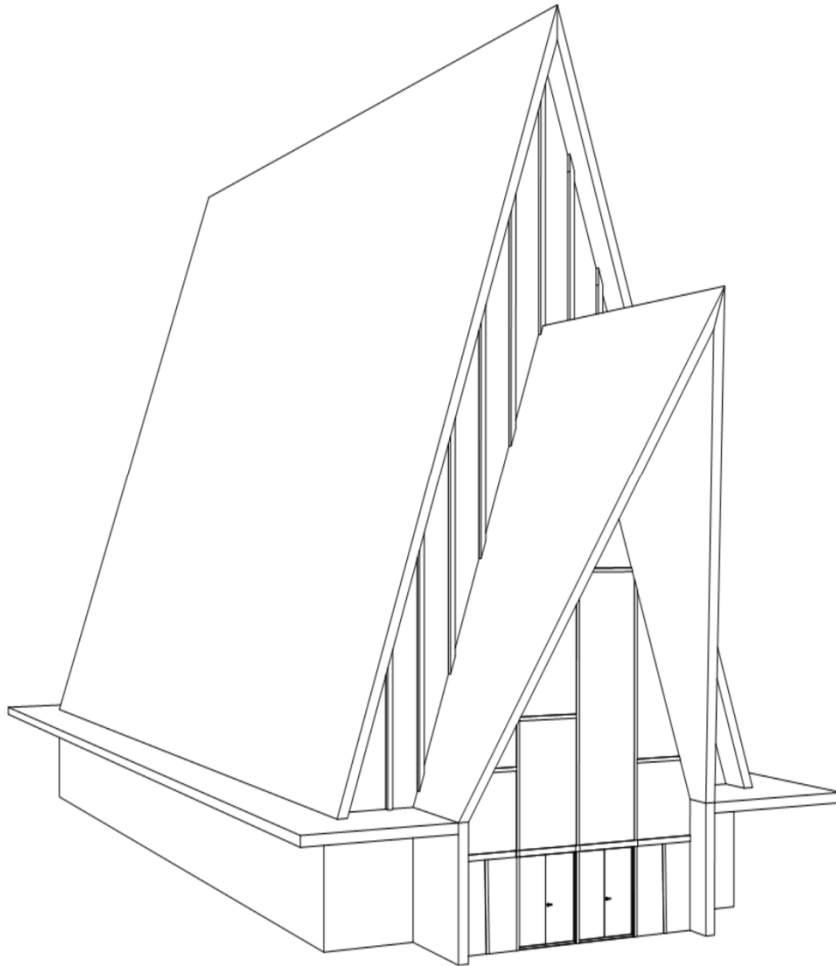
### Seismically Retrofitting URMs

- Steel "through" bolts and plates
- Steel diagonal braces that secure roof parapets



# Vulnerable Structures

## Wooden Buildings



Example: A wooden building with unique A-frame geometry, which falls outside normal light-frame construction



# Vulnerable Structures

## Rigid Wall-Flexible Diaphragm (RWFD)



Photo Credit: FEMA, 2021

Example: This type of building is typically used for warehouses or retail stores and has experienced severe damage or even collapse in past earthquakes.





# 2024 Draft Mitigation Plan: Earthquake Strategy



# Mitigation Action Plan

## City-Owned Buildings

- Building Assessment
- Strengthen and Replace City Buildings





# Mitigation Action Plan

## Privately-Owned Structures



- **Soft-Story Retrofit Program**
  - Earthquake Soft-Story (ESS) Retrofit grants reimburse eligible owners up to 75%
- **Retrofit Grants Program**
  - Available to multi-family homes of 3+ units, non-residential buildings, hotels/motels, and mixed use buildings
- **Concrete Retrofit Ordinance Research**
  - Collaborative work an Expert Engineer Advisory Team from the Earthquake Engineering Research Institute

More Information:

[www.berkeleyca.gov / construction-development / seismic-safety](http://www.berkeleyca.gov/construction-development/seismic-safety)





# Mitigation Action Plan

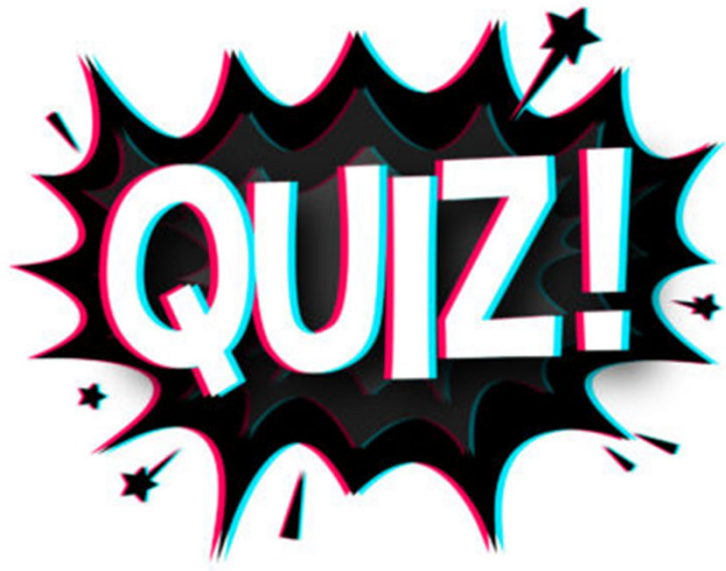
## Retrofit URM structures

- to improve seismic resistance of URM or to remove the buildings and replace them with safer buildings
- Applying available legal remedies to owners who fail to comply with the URM ordinance





# What can you do about earthquake hazard?



In the United States,  
what is the cause of  
*most injuries* and/or  
deaths during an  
earthquake?

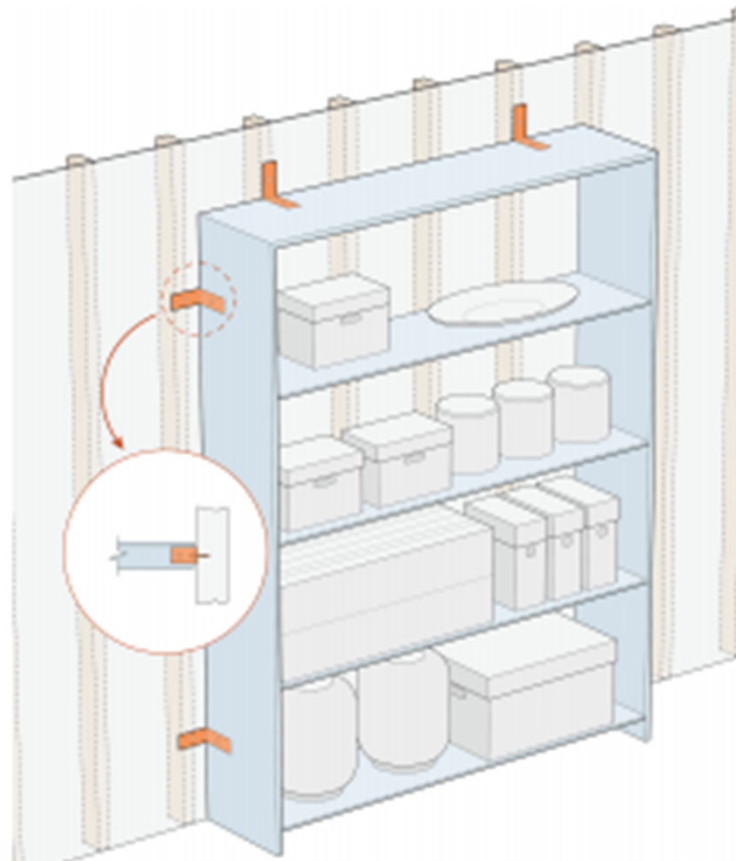




# Actions You Can Take Now

## Secure your home

store heavy and breakable objects on low shelves





# Actions You Can Take Now

## Secure your home secure bookshelves

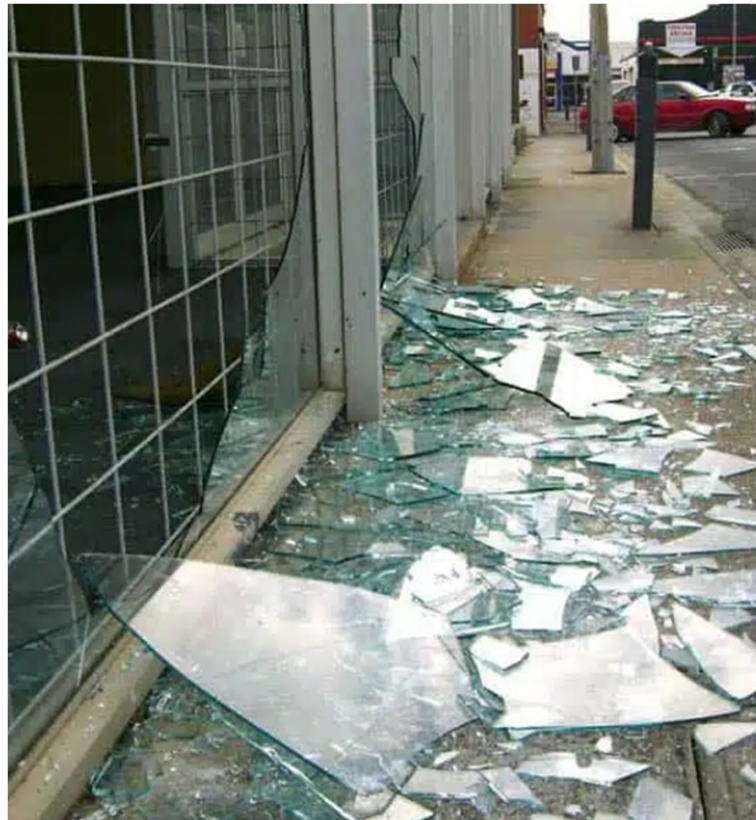




# Actions You Can Take Now

## Secure your home

move beds *away* from windows







# Actions You Can Take Now

## Secure your home

move or secure hanging objects over beds, sofas, or chairs



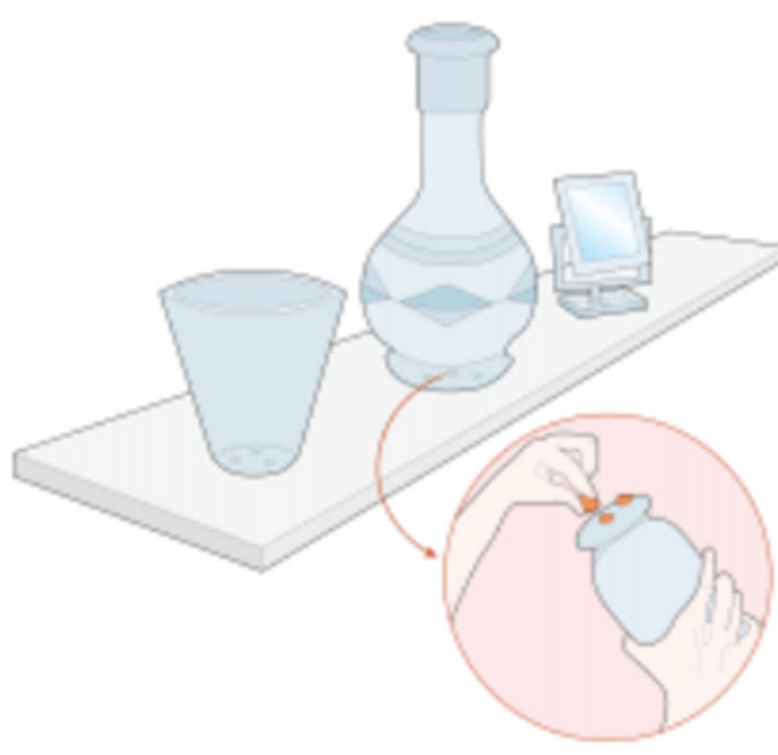
**This is pretty, but unsafe if not secured**



# Actions You Can Take Now

## Secure your home

use clear quake gel or microcrystalline wax to secure breakables in place





# Actions You Can Take Now as a Homeowner

## 1) Assess your home:

- Hire a structural engineer / Figure out your building type
- Check Building Permits for your home (Building Eye)
  - \*especially, if it's a wooden home build before 1973 or concrete home build before 1980\*

## 2) Retrofit your home (if needed)

## 3) Understand available grants:

- Funding for Seismic Retrofits
- City's Brace & Bolt program







# Actions You Can Take Now as a Renter

## Talk to your landlord

- When was the house built?
- What materials were used?
- Is your building retrofitted?
- Does it require retrofitting?





# Actions You Can Take Now

Consider purchasing **earthquake insurance** for both homeowners and renters





# Actions You Can Take Now

## Recommended



*Do you have 7 gallons per 1 person  
per week stored in your house?*



**1 gallon per  
1 person per 1 day  
AT ALL TIMES**





# What NOT to do during an earthquake!

Standing in a  
doorway



Running



Getting into the  
“Triangle of Life”





# During an Earthquake

IF  
POSSIBLE



USING  
CANE



USING  
WALKER



USING  
WHEELCHAIR

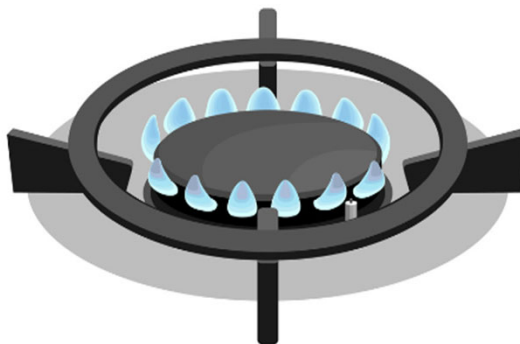


WHEN AN  
EARTHQUAKE  
HAPPENS

makeagif.com



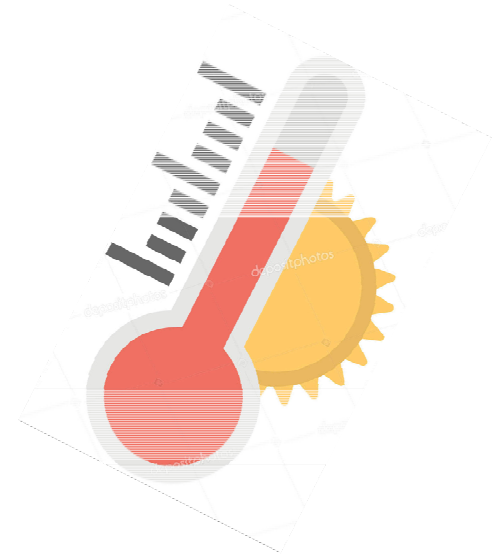
# During an Earthquake







# Next Steps



## Next Steps Today!

- Mitigation plan:
  - Share your top mitigation actions and other ideas
  - Full draft plan available in 2024
  - [Mitigation@BerkeleyCA.gov](mailto:Mitigation@BerkeleyCA.gov)



# Useful Links

- **City of Berkeley Seismic Safety:** <https://berkeleyca.gov/construction-development/seismic-safety>
- **City of Berkeley Funding for Seismic Retrofits:**  
<https://berkeleyca.gov/construction-development/seismic-safety/funding-seismic-retrofits>
- **Search Building Permits:** <https://berkeley.buildingeye.com/building>
- **CA Earthquake Authority Insurance:** <https://www.earthquakeauthority.com/>
- **United Policyholders Insurance:** <https://uphelp.org/>
- **How to prepare for, survive and recover from an earthquake:**  
<https://www.earthquakecountry.org/step1/>





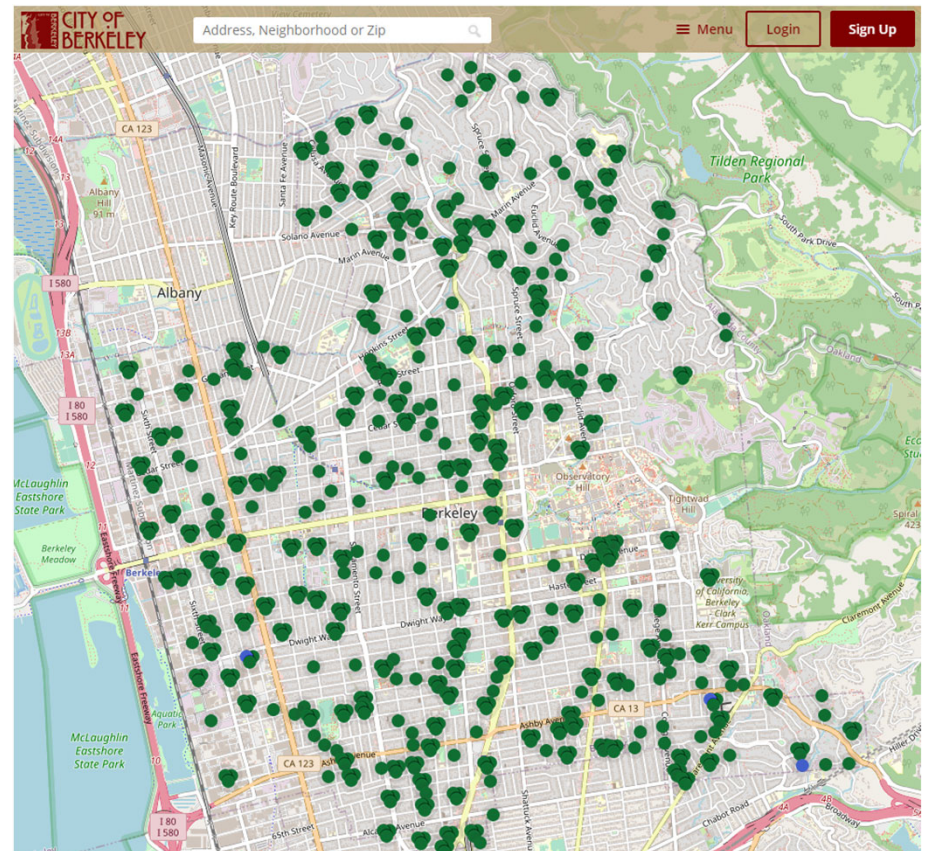
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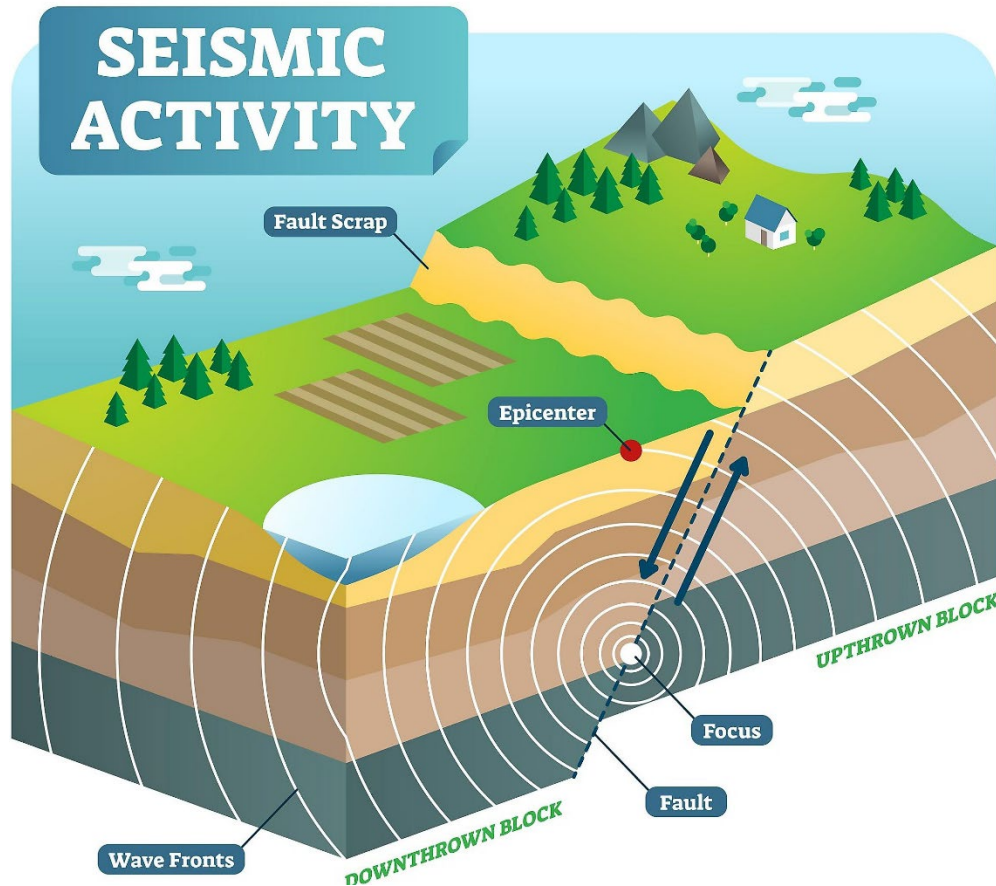
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- Does it require retrofitting?

## 2) Check Building Permits for your address

(Building Eye)





# What is an earthquake?

# **2024 Draft Mitigation Plan: Earthquake Strategy**



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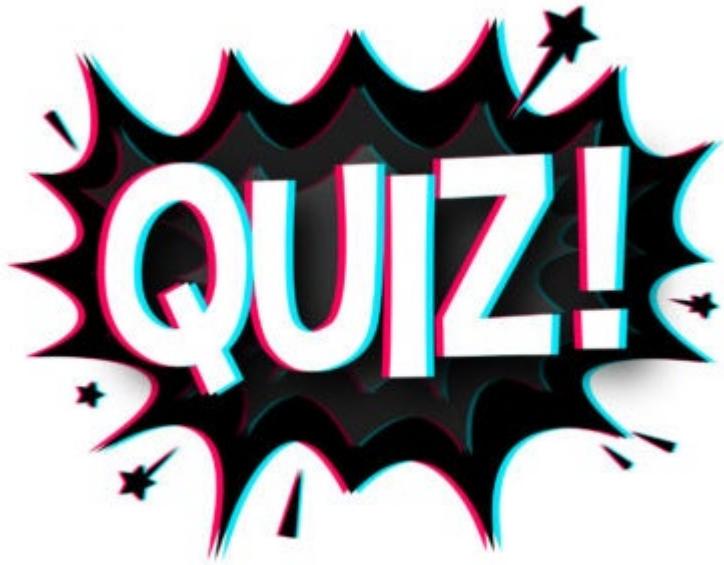
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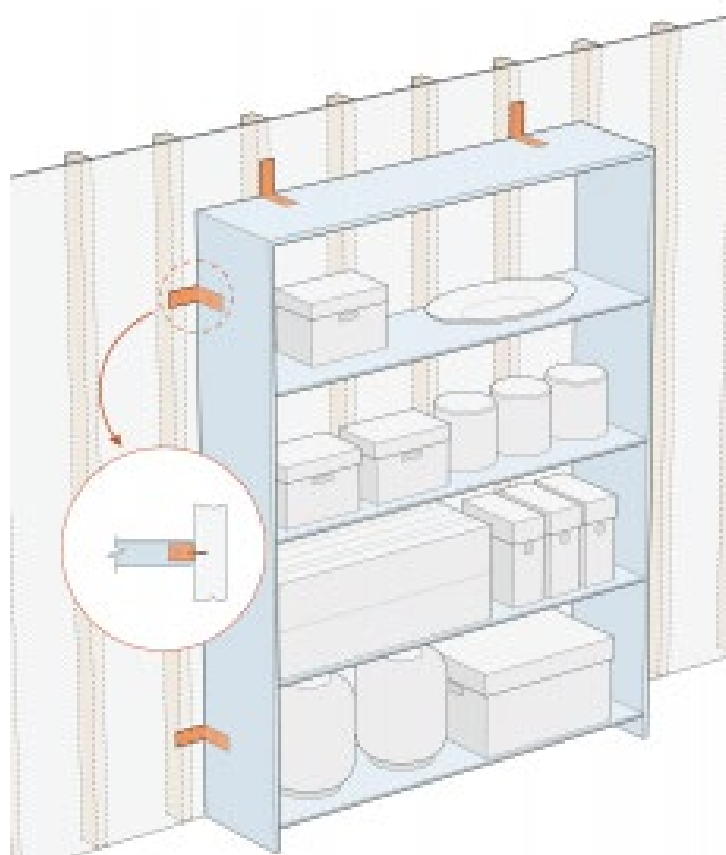


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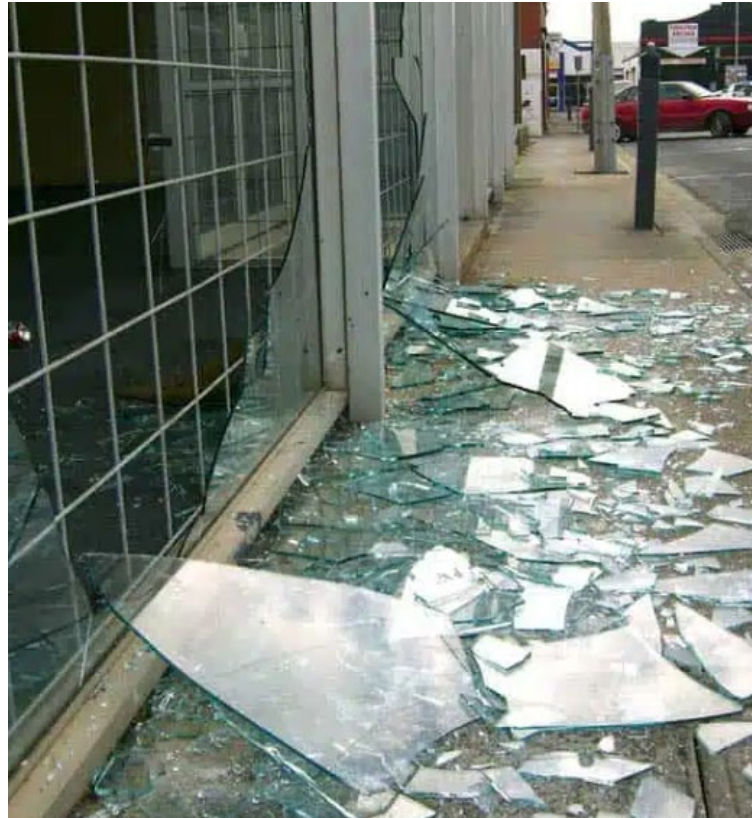
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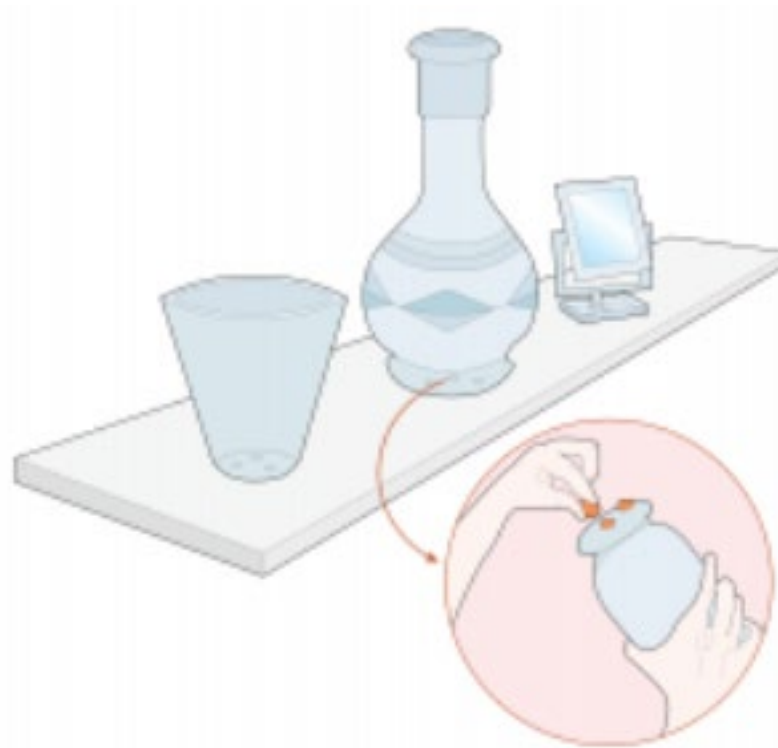
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Running



Getting into the  
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makeagif.com

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**USING  
CANE**



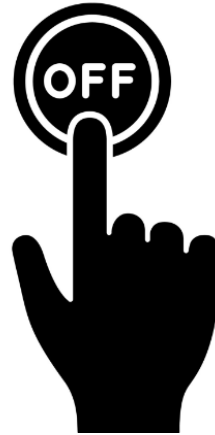
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**USING  
WHEELCHAIR**



# During an Earthquake



# Next Steps

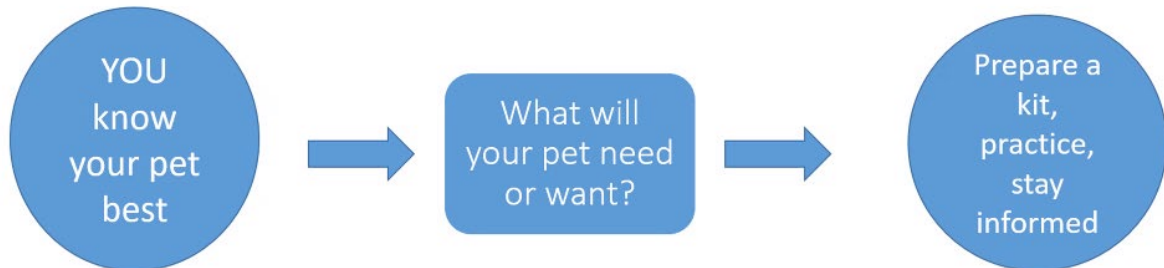




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## Evacuation Planning for Pets



- You need to understand your pets' priorities and make sure the necessities go into their emergency kits
- Emergency Kit:
  - Collapsible bowl
  - Kitty litter / box
  - Canned food (lasts longer)
  - Medications
  - Toys / beds
  - Copy of pet records from the vet hard copy / photo of it



## ID Tags = Key Lifesavers



**marin  
humane**  
Lives made happy.

- Make sure your animal is microchip

## Emergency Pet Housing Options

- Out of area relatives, friends, colleagues
- Pet-friendly hotels, motels, camping, Airbnb, other rentals
- Pet boarding facilities, veterinary hospitals (limited)
- Designated evacuation sites
- Designated disaster shelters (Red Cross doesn't always allow pets)
- Emergency housing at Marin Humane or other animal shelters

**marin  
humane**  
Lives made happy.

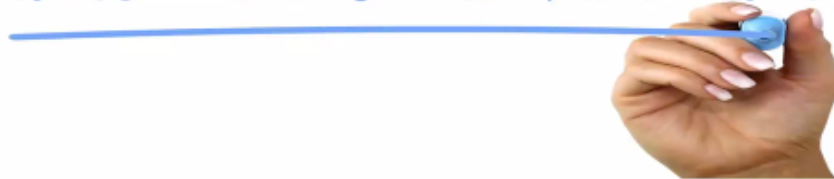


## Important Tips

- Become a “weather watcher” – Red Flag Warning Days
- Know the evacuation plan for your area and get alerts
- Stay calm around animals
- Extra planning required for special species
- Take advantage of folding pet carriers, wheeled bags, and backpacks
- Know your pet’s prescriptions, special medications, and diets
- Always take your pets with you if you need to evacuate
- Take advantage of all resources and contact Marin Humane
- Crate train your pets and include enrichment



# INFORMATION



**415-883-4621**

**[marinhumane.org](https://marinhumane.org)**

<https://marinhumane.org/get-help/marin-animal-services/disaster-preparedness/>

## **Extreme Heat**

### **Slide: Extreme Heat Events**

There are multiple factors that identify an extreme heat as a hazard and they include:

- Extreme heat days: days when temperatures reach the 98<sup>th</sup> percentile of historic maximum temperature. In Berkeley, an extreme heat day is a day above 88.3 degrees F.
- Warm nights: Nights that do not allow people to cool down and recover, which can increase health risks. In Berkeley, nights are considered warm when temperatures do not cool below 61.7 degrees F.
- Heat wave: happens when there are five or more days of extreme heat days.
- Extreme heat during unexpected times of year: occurs outside of historically hotter months.
- And the last factor is the duration of a heat wave. The longer heat waves have proportionally more negative impacts on human health and infrastructure than shorter heat waves.

### **Slide: Urban Heat Island Effect**

Extreme heat events can be further exacerbated by the urban heat island (UHI) effect, through which densely-built cities like Berkeley experience higher temperatures in comparison to surrounding more rural areas. Factors contributing to the UHI effect include:

- A relative lack of vegetation;
- Reduced air flow because of structures;
- An abundance of hard, dark surfaces—such as buildings, streets, cars and sidewalks— which absorb heat rather than reflect it. These surfaces also slowly release that absorbed heat throughout the night, contributing to warmer nighttime temperatures as well.

### **UHI Connections to...**

UHI effect could also be connected to climate change, wildfires, and the air quality.

Due to climate change, projections indicate that the number of extreme heat days, warm nights, and heat waves will increase exponentially in the next few decades. In addition to this increased frequency and duration, heat waves are also expected to occur in months not typically associated with extreme heat.

While hot temperatures do not necessarily start fires, they can decrease moisture in vegetation, increasing its flammability and the duration and severity of the fire season. Warming temperatures combined with increased development in the wildland-urban interface are projected to increase fire risk in most of the Bay Area.

While naturally-occurring ozone that exists higher in the Earth's atmosphere is beneficial to the climate, ground-level ozone can be extremely harmful to human health. Extreme heat can contribute to the formation of ground-level ozone, also known as smog, and other secondary air pollutants, when

emissions from industrial facilities, power utilities, cars, trucks and other sources chemically react in the presence of heat and sunlight. Extreme heat can also cause stagnant air conditions, causing the smog to stay low longer, and increase community exposure.

#### **Slide: Map of the Tree Coverage**

The two main factors that influence how hot it is in certain parts of Berkeley are the urban heat island effect and thermal belting.

We know that the urban heat island effect often makes temperatures hotter in the urban, more dense parts of a city. This map of the percentage of tree coverage visualizes what parts of Berkeley might be more likely to suffer from the urban heat island effect. In Berkeley, The areas shaded in darker green, predominately in the hills in east Berkeley, have the greatest percentage of tree canopy, while west and south Berkeley have the smallest percentage of tree canopy.

Urban tree canopy directly reduces the available for heat absorption surfaces and creates shading beneficial to individuals and buildings. Trees also improve air quality that often worsens during extreme heat events.

#### **Slide Thermal Belting**

Another factor that influences how hot it is in certain parts of Berkeley is thermal belting.

Although the Berkeley hills have a greater tree canopy, temperatures are often higher there than the rest of the city. The thermal belt phenomenon occurs in areas where there is a hillside and a valley below. Heat is absorbed by the ground during the day, and the heat energy radiates up from the soil at night. As the warm air rises, the radiation of the heat causes the air closest to the ground to cool. Since cold air is heavier than warm air, cooler air sinks down the hillside into the valley. As the cooler air fills the valley, the warm air heads upwards. This warm air becomes trapped on the hilltop and is referred to as a thermal belt. For Berkeley, this means that the hills are likely to be way hotter at night than the rest of the city. The map below shows temperature differentials between the Berkeley hills, flats, and coast at 11:30 pm at night on Monday, September 5. The Berkeley hills have temperature readings in the 90s while the flats and waterfront have temperatures in the 60s and 70s.

#### **Heat Index Table**

The National Weather Service uses a Heat Index to measure how hot it really feels when relative humidity is factored in with actual air temperature. The National Weather Service will initiate alert procedures when the heat index is expected to exceed 105 degrees to 110 degrees Fahrenheit (which is the orange section of the table marked as dangerous).

#### **Heat Risk Table**

Another National Weather Service HeatRisk index provides a forecast of heat-related impacts to occur after a 24-hours of exposure to heat. HeatRisk takes into consideration how unusual the heat is for the time of year, the duration of the heat including daytime and nighttime temperatures, and if those temperatures pose an elevated risk of heat-related impacts.

#### **Map of ER visits**



According to the University of California, Los Angeles, across the entire state of California, on an average heat day, there are a total of 8,222 excess emergency room visits. Alameda County has, on average, 3.5 excess visits to the emergency room for heat related problems per 10,000 persons. This map shows the rate of the excess emergency room visits in Berkeley, with the darker colors in West and South Berkeley, indicating higher rates of emergency room visits. Both, West and South Berkeley, have higher concentrations of low income individuals and people of color, due to historic patterns of disinvestment, resulting in higher risk and worse outcomes on hot days.

### **Slide Reducing Vulnerabilities**

One of the main strategies to mitigate extreme heat is to reduce Berkeley's vulnerabilities. This could be accomplished by expanding the urban forestry team and their activities, encouraging passive and energy-efficient strategies to cool down buildings, and implementing programs and projects to reduce emissions. The departments that work on reducing vulnerabilities, such as lack of vegetation, abundance of dark-absorbing surfaces and poor air quality, are *Parks, Recreation, and Waterfront Department, Office of Energy and Sustainable Development, and Public Works Department.*

Few of the implemented strategies include usage of natural ventilation, building of green/cool roofs and cool pavements, and increase in vegetation, via tree planting projects.

The existing City programs and projects to reduce emissions that contribute to poor air are

- Implement the traffic safety capital construction projects identified and prioritized in the Berkeley Pedestrian Plan (2021), Berkeley Bicycle Plan (2017), Berkeley - Vision Zero Action Plan (2020), and Berkeley Transit-First Implementation Plan; these projects are intended to encourage non-driving modes
- Implementing the City's Electric Mobility Road Map which includes electric shared mobility (bikes and scooters) as well as electric and hybrid car-sharing, and the installation of public charging stations
- Manage on-street parking and maintain parking garages to reduce emissions by making it easier to find a parking space more quickly (and thus reduce the time spent circling around looking for parking)

### **Cooling Centers**

Another extreme heat mitigation strategy consists of operating cooling centers in Berkeley.

As extreme heat becomes more frequent and severe, Berkeley buildings, including City facilities, will need to increase cooling capacity. This effort must be undertaken strategically over the coming decades to find solutions that are clean, efficient, and functional during electrical grid outages. Approaches will include natural ventilation and passive cooling techniques such as shading and orientation, particularly in new building design. For existing buildings and new construction, consideration may also be given to heat pump technology, a highly-efficient electric system (up to 400% efficient in energy-efficient buildings) with both heating and cooling capabilities.

Cooling centers are necessary, particularly for those individuals who cannot escape the heat: they either lack cooling in their homes, work outside, or are homeless. Citizens of Berkeley and others can utilize one of the five cooling centers currently operating in the City during heatwaves. Cooling centers are

located in the North Berkeley Senior Center, South Berkeley Senior Center, Central Library, Claremont Branch Library, and Tarea Hall Pittman South Branch Library. The dangers of heat have been proven in studies that have found links between rising temperatures and a range of mental health issues, including mental fatigue, aggression, and even higher rates of suicide, as well as physical health issues such as premature death, cardiovascular stress, and failure of major organs such as the heart and kidneys.

### **Vulnerable People**

- The cooling centers are particularly important for vulnerable community members, including:
- Elderly and children
- People with access and functional needs
- Underprivileged areas that lack tree canopy for shading, air conditioning and insulation in buildings, or car
- People that work outdoors and homeless populations

### **Prepare to be safe at home:**

How can you prepare to be safe at home

Gather supplies to keep yourself cool, including:

Ice – fill up all your ice trays and freeze them and any ice packs overnight

Spray bottle – to spray mist on yourself to keep cool

Personal fan – fan to point at yourself

Towel – to wet and put on your body

Plan to [keep your home cool on hot days without air conditioning](#), using:

A larger fan – to move hot air out of your home

An indoor/outdoor thermometer – set this up to know when to let cooler outside air into your home

Be ready to block sunlight and heat, using blackout curtains, reflective film, solar blankets or cardboard. Blocking your windows with a light-colored sheet facing out, followed by a dark-colored sheet facing in, can help to reflect light away and keep your home cooler.

Prepare for potential power outages (*or see power outage section*)

### **Keep Pet Safe**

How to keep pets safe on hot days:

#### **NEVER LEAVE YOUR PETS IN A PARKED CAR**

Not even for a minute! Not even with the car running and air conditioner on. On a warm day, temperatures inside a vehicle can rise rapidly to dangerous levels. On an 85-degree day, for example, the temperature inside a car with the windows opened slightly can reach 102 degrees within 10 minutes. After 30 minutes, the temperature will reach 120 degrees. Your pet may suffer irreversible

organ damage or die. Learn [how to help a pet left inside a hot car](#) by taking action or calling for help. Local law enforcement can follow [this handy guide \[PDF\]](#) on how to proceed.

### **Limit exercise on hot days**

Take care when exercising your pet. Adjust intensity and duration of exercise in accordance with the temperature. On very hot days, limit exercise to early morning or evening hours, and be especially careful with pets with white-colored ears, who are more susceptible to skin cancer, and [short-nosed pets](#), who typically have difficulty breathing. Asphalt gets very hot and can burn your pet's paws, so walk your dog on the grass if possible. Always carry water with you to keep your dog from dehydrating.

### **Don't rely on a fan**

Pets respond differently to heat than humans do. (Dogs, for instance, sweat primarily through their feet.) And fans don't cool off pets as effectively as they do people.

### **Provide ample shade and water**

Any time your pet is outside, make sure they have protection from heat and sun and plenty of fresh, cold water. In heat waves, add ice to water when possible. Tree shade and tarps are ideal because they don't obstruct air flow. A doghouse does not provide relief from heat—in fact, it makes it worse.

### **Cool your pet inside and out**

Whip up a batch of quick and easy DIY pupsicles for dogs. And always provide water, whether your pets are inside or out with you.

Keep your pet from overheating indoors or out with a cooling body wrap, vest or mat. Soak these products in cool water, and they'll stay cool (but usually dry) for up to three days. If your dog doesn't find baths stressful, see if they enjoy a cooling soak.

### **Watch for signs of heatstroke**

Extreme temperatures can cause heatstroke. Some signs of heatstroke are heavy panting, glazed eyes, a rapid heartbeat, difficulty breathing, excessive thirst, lethargy, fever, dizziness, lack of coordination, profuse salivation, vomiting, a deep red or purple tongue, seizure and unconsciousness.

Animals are at particular risk for heat stroke if they are very old, very young, overweight, not conditioned to prolonged exercise, or have heart or respiratory disease. Some breeds of dogs—like boxers, pugs, shih tzus and other dogs and cats with short muzzles—will have a much harder time breathing in extreme heat.

### **Make a Plan**

Make a plan for where to go (and how to get there) if your home gets too hot.

Consider locations you could visit that have air conditioning, like malls, stores, or community cooling centers.

Make a transportation plan – consider using friends and family, public transit, carpooling, or using a taxi or rideshare service.



If you use a wheelchair or other mobility device, you may also consider:

Pre-scheduling a paratransit trip to a cool location before the hottest hours of the day

Using [Easy Does It](#) for a Rescue Ride or Routine Transportation ([BRSD members](#) only)

Buddy up with your friends, family, and neighbors:

Make a plan to check on each other at least twice a day during a heat wave. Check to see if people are developing signs of heat exhaustion or heat stroke. Remember that people who live alone are at the greatest risk in a heat wave because no one will notice if they develop heat stroke.

Think about how you can work together to get to a location with air conditioning or a community cooling center if someone's home gets too hot.

# Hazard Presentation

Extreme Heat:

The hazards, the City's work, and steps to stay safe

# Extreme Heat



# Extreme Heat Events

## Extreme Heat Days:

- In Berkeley, it is a day above 88.3 F (31.3 C)

## Warm Nights:

- In Berkeley, it is a night that does not cool below 61.7 F (16.5 C)

## Heat Wave:

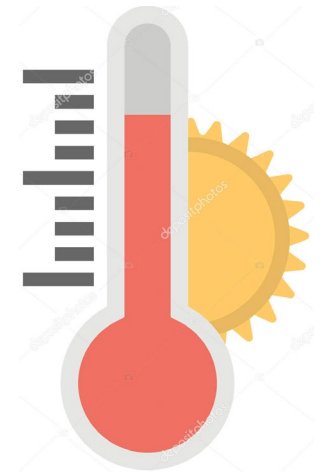
- There are 6 or more days of extreme heat

## Extreme Heat During Unexpected Times of the Year:

- Occurs outside of historical hotter seasons

## Duration of Heat Wave:

- Longer heat waves have more negative impacts



# Urban Heat Island (UHI) Effect

The heat is absorbed rather than reflected

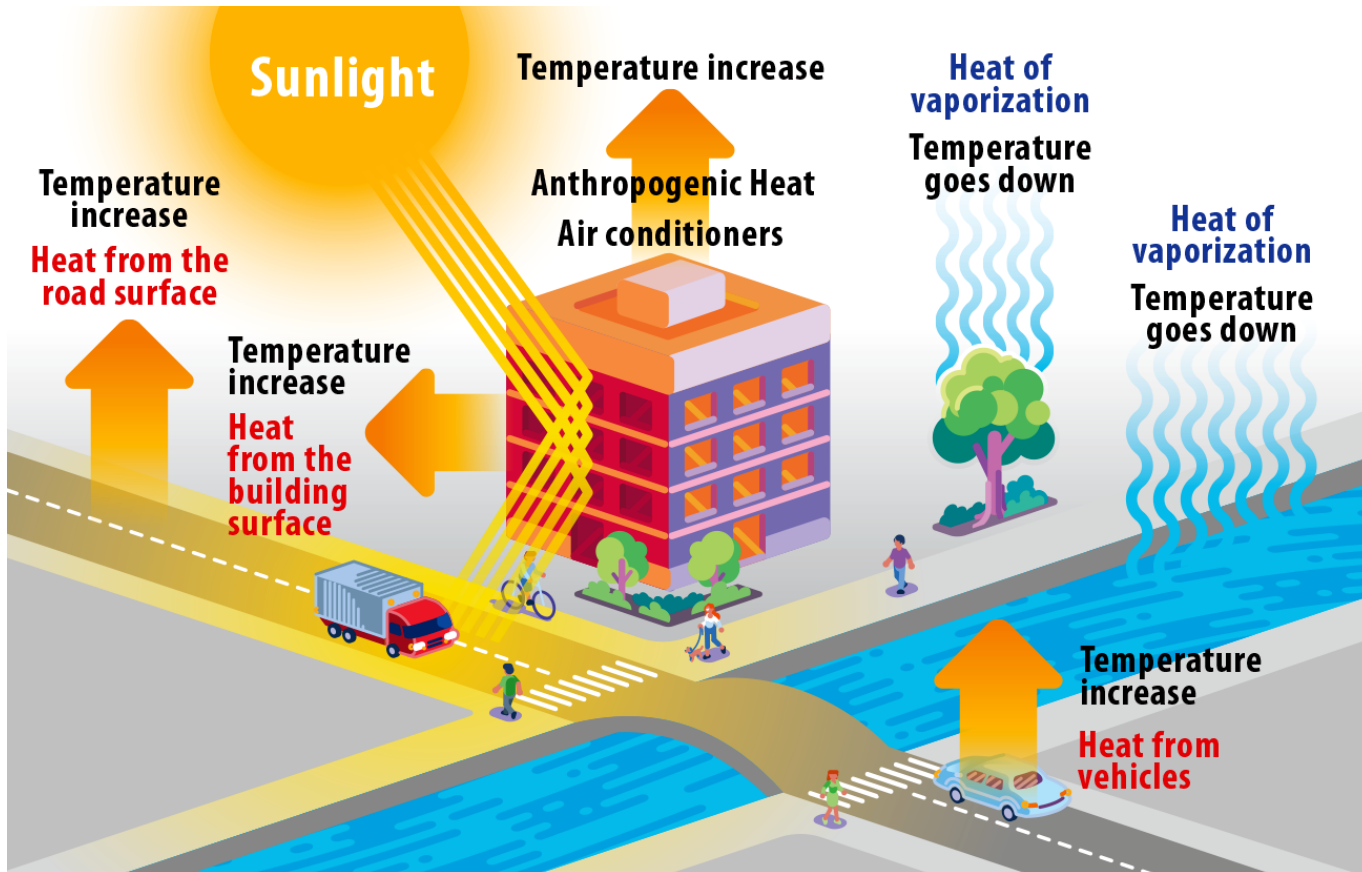


Image Credit: Pavetechinc

# UHI Connections to...

- Climate Change
- Wildland-Urban Interface Fire
- Poor Air Quality

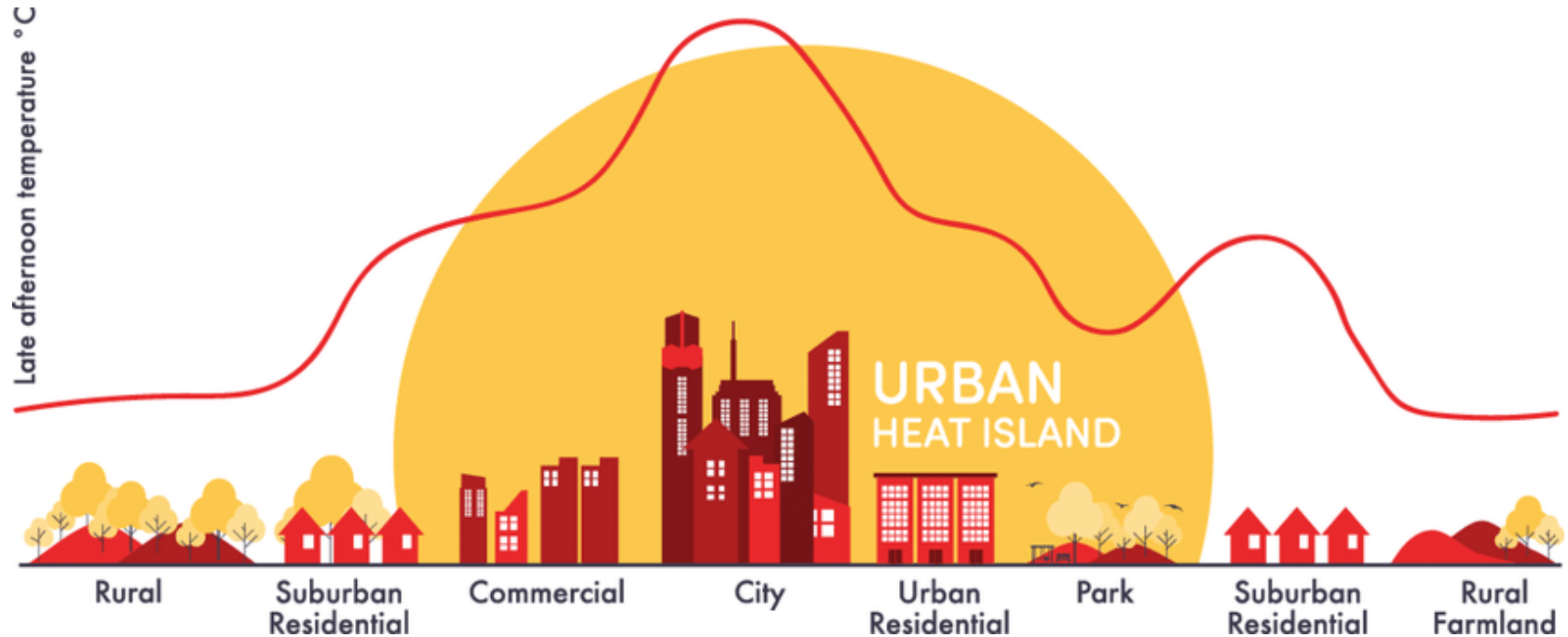
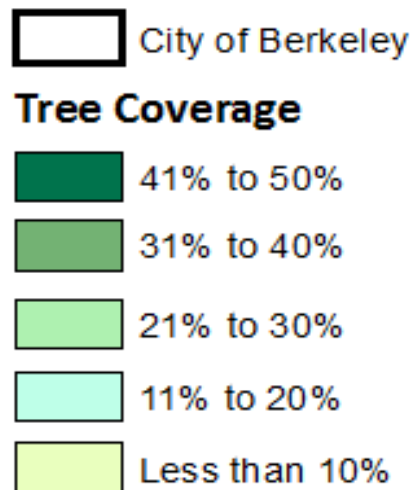
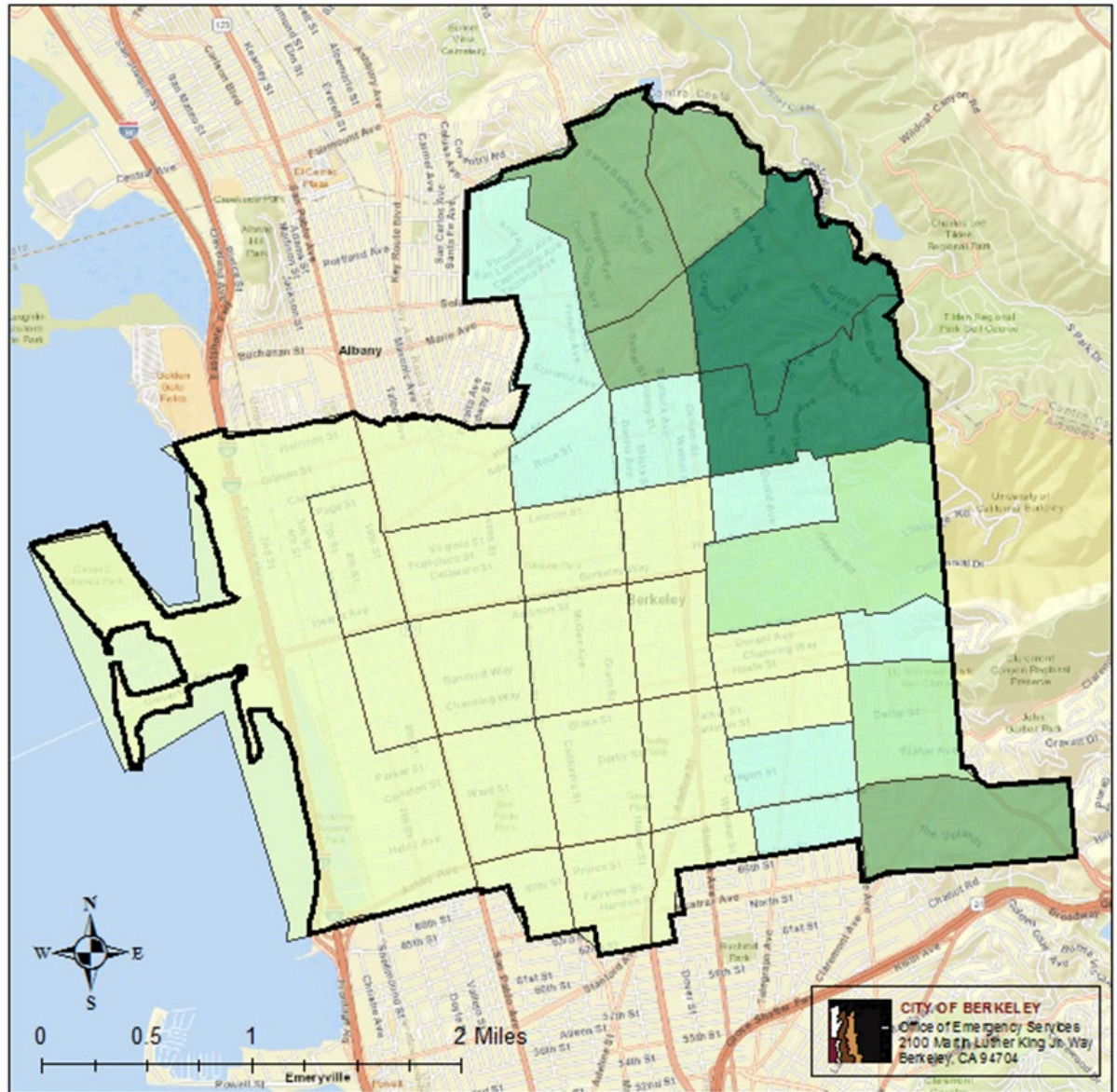


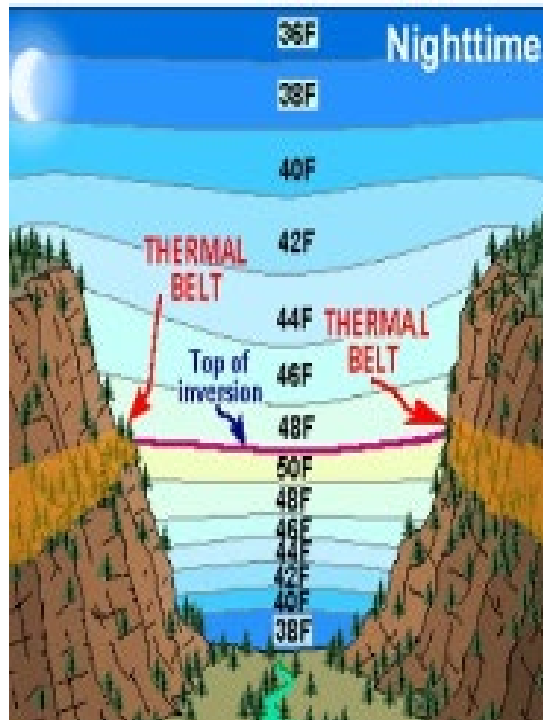
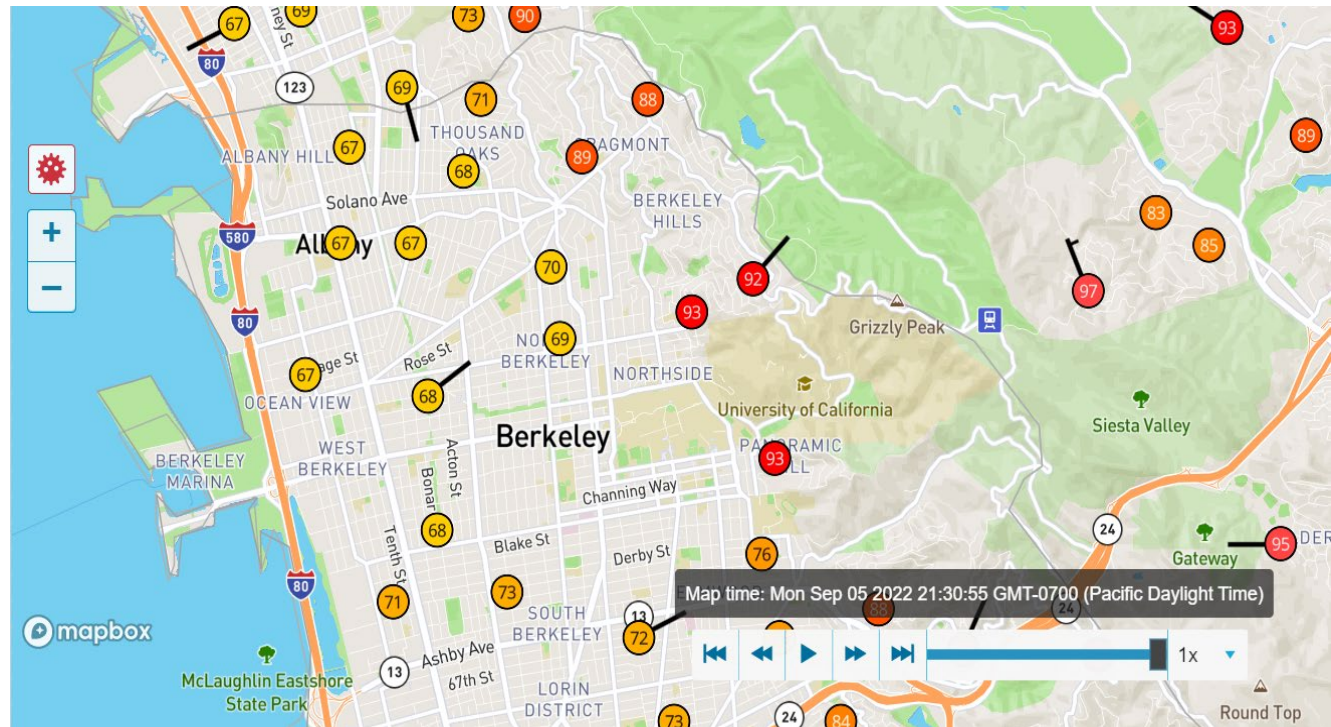
Image Credit: Community.wmo.int



# Map of the Percentage of Tree Coverage in Berkeley



## Thermal Belting occurs in areas where there is a hillside and a valley below

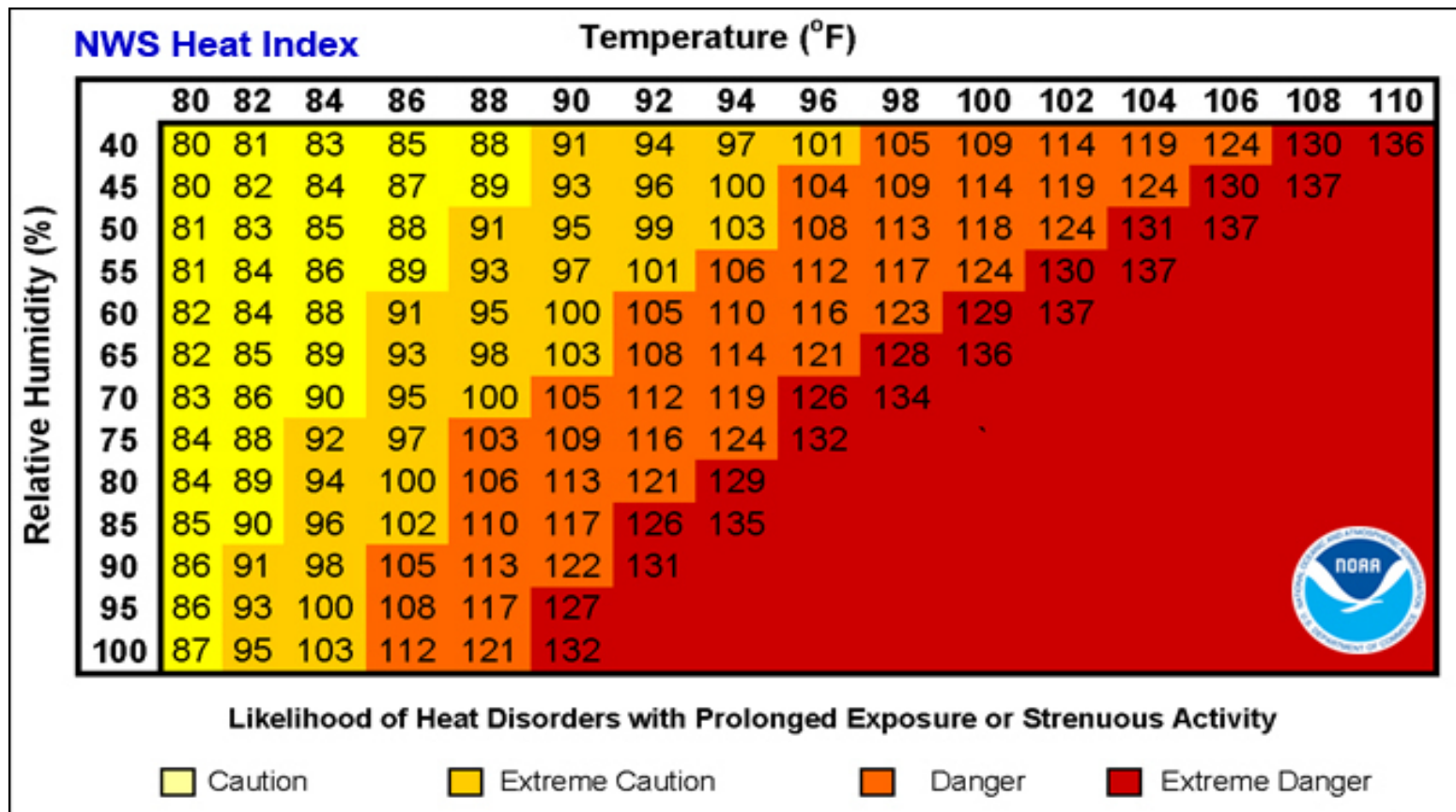


Map of temperature differentials between the Berkeley hills, flats, and coast at 11:30 pm at night on Monday, September 5.



# Heat Index Table

It tells how hot the air *really feels* to humans as it considers both **Relative Humidity & Air Temperature**



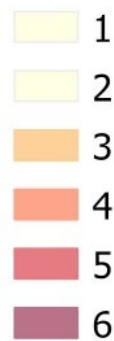
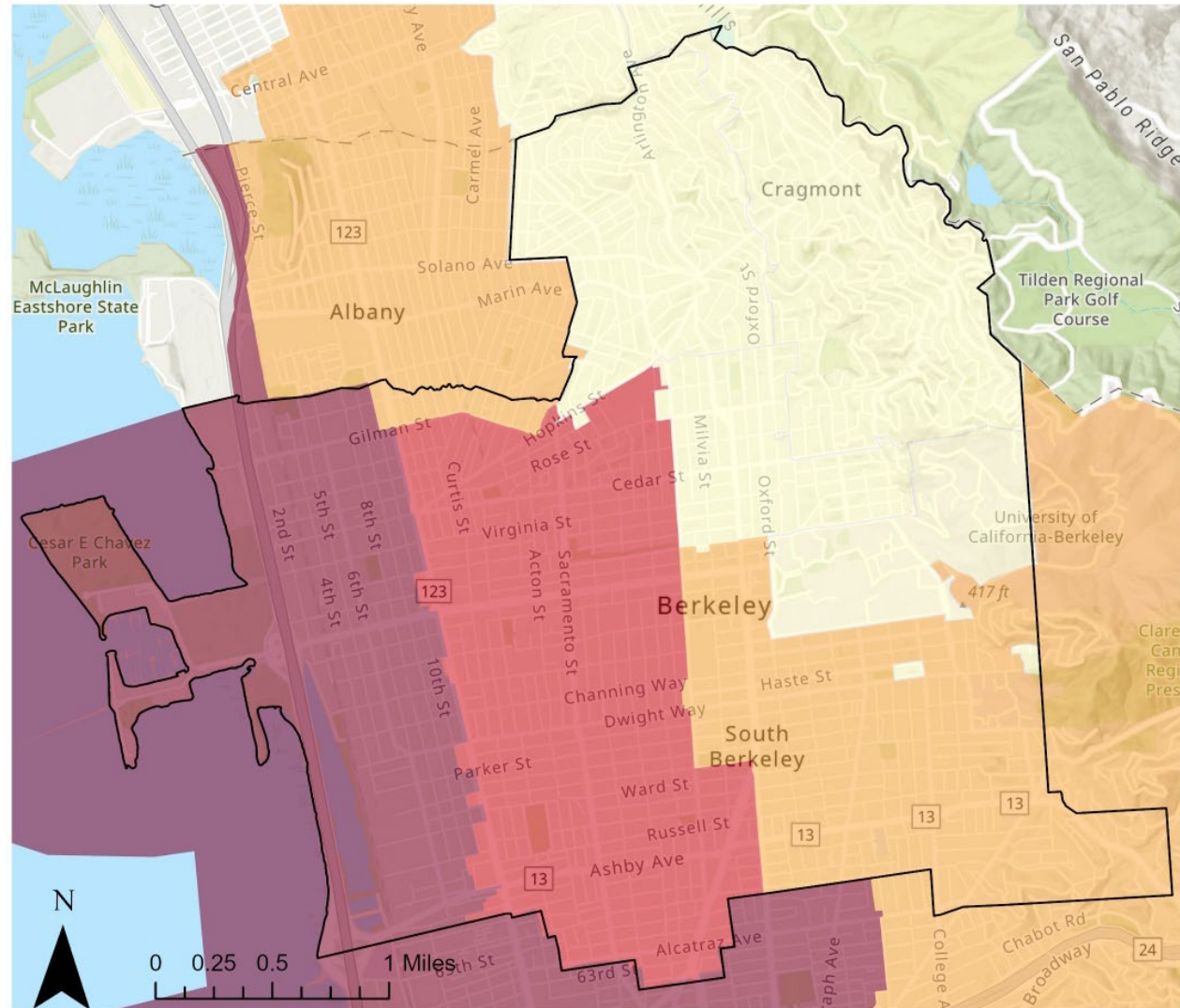


# Heat Risk Table

This index provides a forecasts of heat-related impacts to occur after the 24 hours exposure to heat

| Category     | Risk of Heat-Related Impacts                                                                                                                                                                                                                               |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green<br>0   | Little to no risk from expected heat.                                                                                                                                                                                                                      |
| Yellow<br>1  | Minor - This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.                                                                                  |
| Orange<br>2  | Moderate - This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.                                  |
| Red<br>3     | Major - This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat-sensitive industries and infrastructure.                                                                        |
| Magenta<br>4 | Extreme - This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat-sensitive industries and infrastructure. |

# Daily excess ER visits during heat-waves



Esri, NASA, NGA, USGS, FEMA, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA/USDA Heat Maps

# **2024 Draft Mitigation Plan: Extreme Heat Strategy**



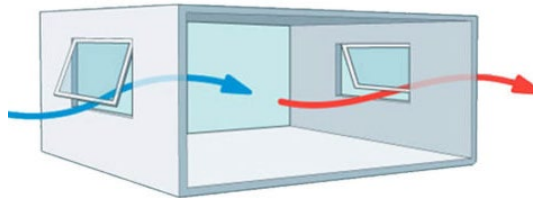
# *Reducing Berkeley's Vulnerabilities*

## Cool Pavement



Photo Credit: Berkeley Lab

## NATURAL VENTILATION



## Green Roof

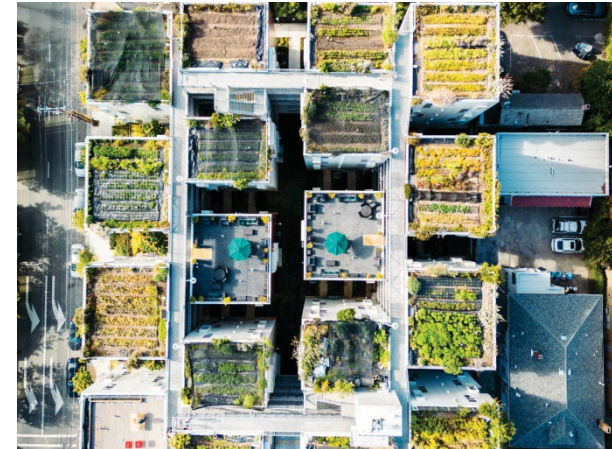


Photo Credit: Bluma Flower Farm

# Expanding Urban Forestry team and their activities

- *Parks, Recreation, and Waterfront Department*
  - Tree planting projects and increase of vegetation coverage



Photo Credit: Berkeleyside



Photo Credit: The City of Berkeley

# Encouraging passive and energy-efficient strategies to cool down buildings

- *Office of Energy and Sustainable Development*
  - Natural ventilation, shading, insulation, green/cool roofs, whole-house fans, and heat pump HVAC systems

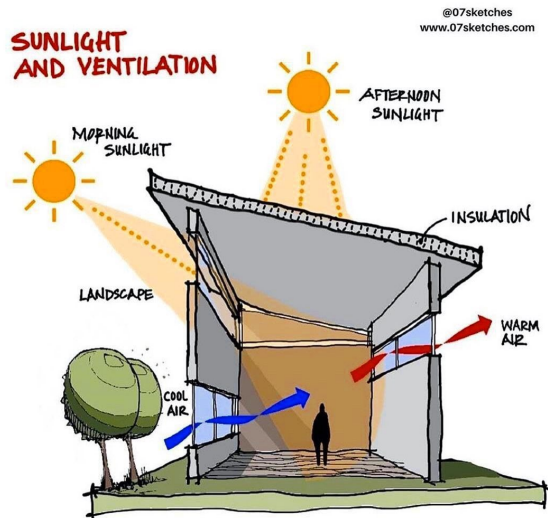


Photo Credit: Bluma Flower Farm



# Continuing to seek out funding to use cool paving materials on streets when feasible to reduce urban heat island impacts

- *Office of Energy and Sustainable Development*



Photo Credit: UCLA Newsroom

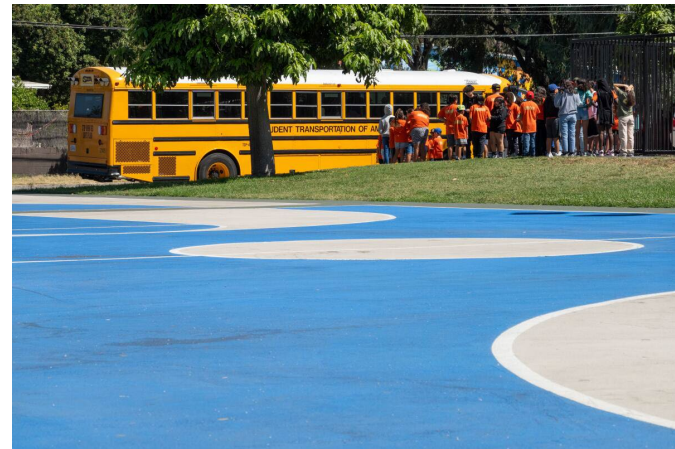


Photo Credit: LA Times

# Implementing programs and projects to reduce emissions

- *Public Works: Transportation Division*
  - Electric and hybrid car/bike/scooter-sharing, installation of public charging stations, and managing public parking

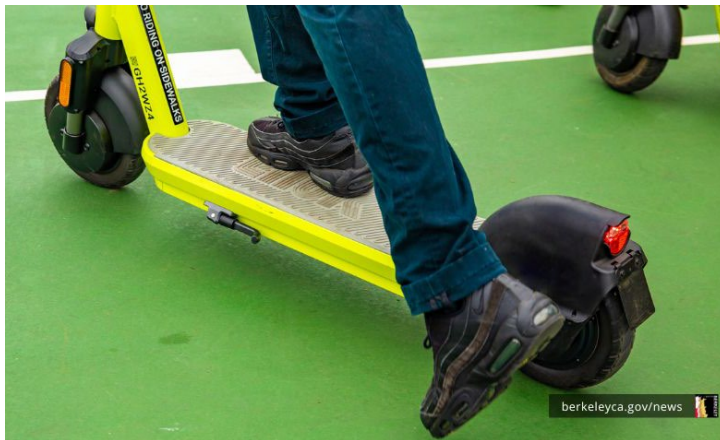


Photo Credit: City of Berkeley



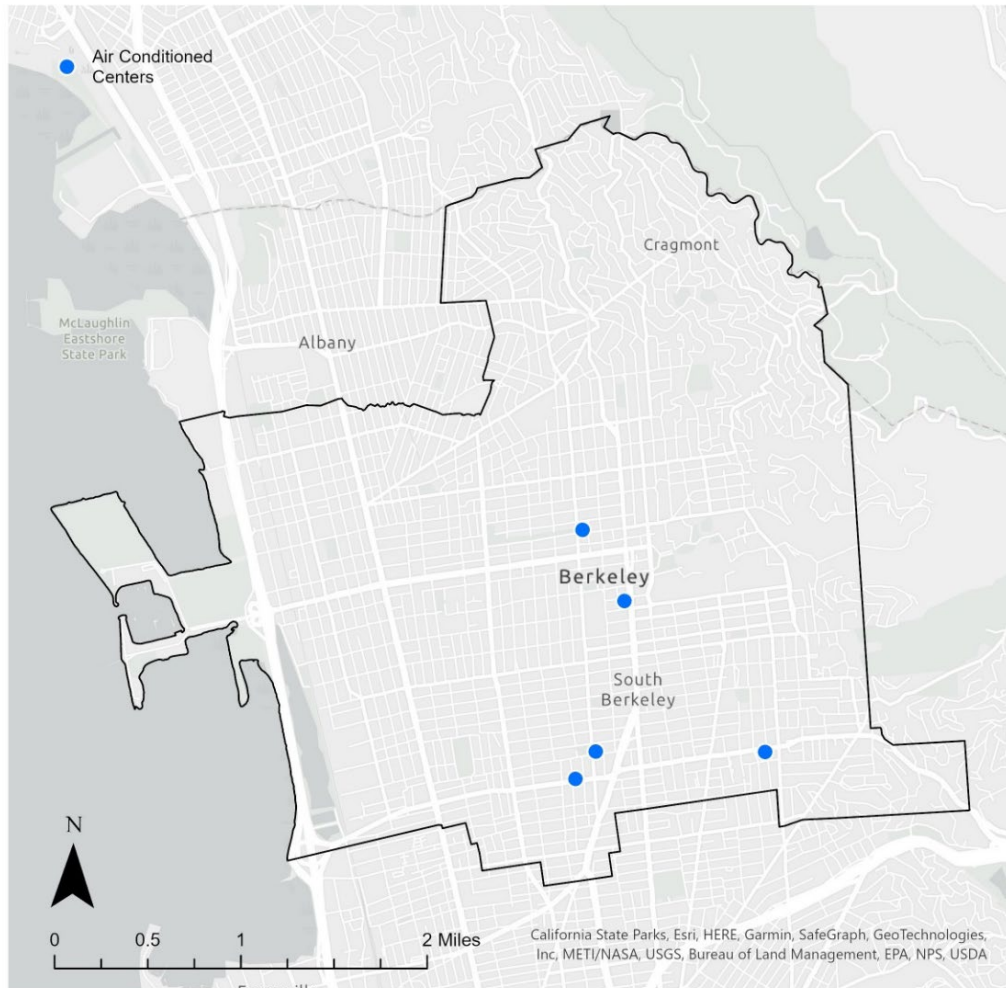
Photo Credit: City of Berkeley

# Cooling Centers in Berkeley

## Community Spaces with AC:

- North Berkeley Senior Center
- South Berkeley Senior Center
- Central Library
- Claremont Branch Library
- Tarea Hall Pittman South Branch Library

*Cooling is necessary to human physical and mental health*







## **Particularly important for vulnerable community members:**

- **Elderly and children**
- **People with access and functional needs**
- **Those from areas that lack tree canopy for shading, air conditioning and insulation in buildings or car**
- **People that work outdoors**
- **Homeless populations**

# What can you do about extreme heat?

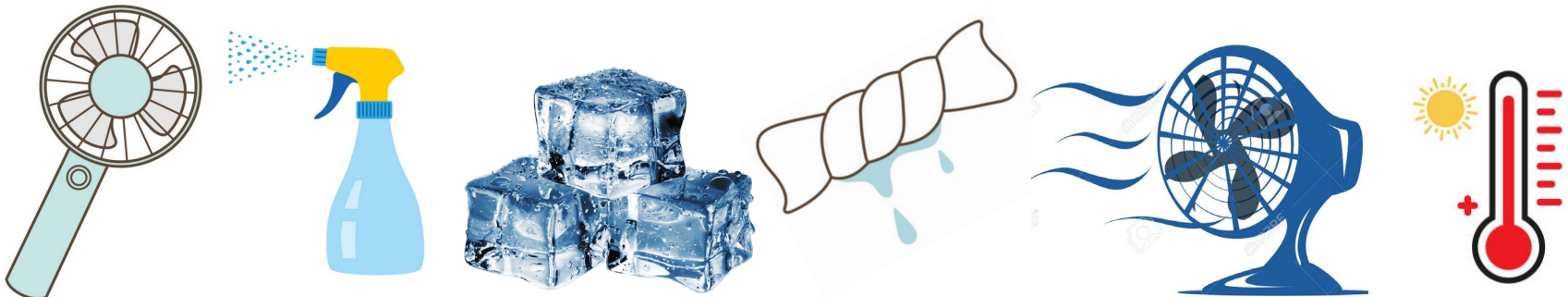
# Prepare to be Safe at Home

## Supplies to keep yourself cool:

- Ice
- Spray Bottle
- Personal Fan
- Towel

## Supplies to keep your home cool:

- Large Fan
- Indoor/Outdoor Thermometer
- Blackout Curtains/ Reflective Film/ Solar Blankets/ Cardboard







# Make a Plan

- **Where can you go when your home gets too hot?**
  - Malls, stores, or community cooling centers
- **What are your transportation options?**
  - Wheelchair or other mobility device users, please check out *Easy Does It* services
- **Who can you buddy up with?**
  - Check on each other at least twice a day during a heat wave



# During a Heat Wave...

- **Drink Plenty of Water**

- Avoid drinks with caffeine (tea, coffee, and cola)

- **Stay at home**

- Wear as little clothing as possible and choose lightweight, loose-fitting clothing
- Spray yourself with water and stand in front of a fan
- Keep your windows open at night

- **When outside**

- Use sunscreen with SPF of 15 or higher and reapply every 2 hours
- Schedule outdoor activities carefully
- Never leave children or pets in a parked car

- **Pace Yourself**

# How to Keep Pets Safe



- **Never leave your pet in a parked car!**
- **Limit exercise on hot days**
- **Don't rely on a fan**
- **Provide ample shade and water**
- **Watch for signs of heatstroke**
- **See “Pet Disaster Preparedness” The Humane Society for more info**



# Next Steps



## Next Steps Today!

- Mitigation plan:
  - Share your top mitigation actions and other ideas
  - Full draft plan available in 2024
  - [Mitigation@BerkeleyCA.gov](mailto:Mitigation@BerkeleyCA.gov)

**NOTE – MOST CURRENT VERSION OF SCRIPT IS IN NOTES FOR SLIDE DECK**

## High Wind Events

### How is wind formed?

Wind is the movement of air, traveling from areas of high pressure to low pressure. The greater the difference in air pressure, the stronger the wind becomes. High- and low-pressure systems are formed by ascending and descending air, primarily influenced by variations in temperature. Wind is characterized by its horizontal speed and the direction from which it originates.

### Wind in Berkeley

In Berkeley, high wind events are typically associated with the seasons. During winter, generally spanning November through March, high winds are linked to weather systems and cold fronts. In the summer months, temperature and pressure disparities between the Pacific Ocean and the interior valleys to the east result in stronger afternoon and evening winds from the west. In spring and fall, Berkeley experiences dry, offshore winds from the northeast, commonly known as the “Diablo Winds.” These winds are most prevalent in the fall when the jet stream shifts southward, impacting California with alternating areas of high and low pressure.

High wind events are could be felt throughout the city, with different areas experiencing varying wind strengths based on the type of wind event. For instance, the westerly wind carries oceanic moisture toward the city, and as the wind flow hits the Berkeley Hills, it splits, producing northward and southward winds. The hot and dry Diablo wind, particularly common in the spring and fall, affects the Berkeley Hills area more, while the cold storms, more common in the winter, increase wind speeds in the flats.

### Connections with wind

Climate change is contributing to the escalation of extreme storms and weather conditions, frequently accompanied by high winds. Considering the increased frequency of high wind events in recent years, it is anticipated that each subsequent year will bring more of these occurrences. Climate change is projected to instigate additional severe storms, further intensifying the frequency of damaging wind events.

Among these wind events, Diablo winds in the fall are particularly worrisome. This is due to the wildlands and vegetation being at their driest during this season. The combination of Diablo winds and dry conditions poses a significant risk of a high fire danger.



### Extent of high wind and anticipated intensities

The National Weather Service (NWS) defines “high winds” as sustained wind speeds of 40 miles per hour (mph) or greater lasting for one hour or longer, or wind gusts 58 mph or greater for any duration. The NWS issues a wind advisory when there are sustained winds of 31 to 39 mph, or gusts to 46 to 57 mph. Sustained wind speed is different than a wind gust. A wind gust is a brief increase in the wind speed typically around 20-30 seconds.

### Wind scale

This Beaufort Wind Scale measures wind severity according to visible environmental impacts, without the use of instruments. For example, when wind speeds is between 1 to 3 mph, the direction of wind could be determined by looking at the smoke drift. In these conditions there will be little if any movement with flags or tree leaves. When wind speed is between 32-38 mph, people should be careful walking under and around trees because in these conditions they get in motion. And at the higher wind speeds we could expect damages to trees and some structures.

Timing of the wind event could also play a role. If it's the first high wind event of the season, there might be more foliage, limbs, or branches that fall as the wind blows for the first time in a while.

### Vulnerabilities

High winds could pose risks to people, structures and systems.

High winds could pose significant safety risks to people. Large branches can break off trees, heavy objects may blow around, and dust and debris can get into the eyes, throat, and mouth. High winds can be particularly dangerous for people experiencing homelessness, people who work outside, and people who live in mobile or unanchored homes, like RVs that may dislodge.

Downed tree or blowing objects can result in significant damage to public and private infrastructure, including residential homes, public and private buildings, and vehicles.

Wind can take down power lines and or cause other objects to do the same. Damage to power lines can result in power outages.

### How to reduce risk from high winds?

How the whole community can work together to mitigate Berkeley's high wind hazard? The following steps are key for individual community members and households to reduce their risk from high winds.

### Keep trees maintained

- City trees are located between the sidewalk and the street, in street medians, public parks, or on other properties owned by the City of Berkeley. If you notice a tree near your home that requires attention from the forestry team, please submit a request by calling 311 or emailing [trees@berkeleyca.gov](mailto:trees@berkeleyca.gov).
- Privately owned trees fall under the responsibility of the owner. It is advisable to obtain a professional arborist assessment to identify signs of decay, dead branches, or other structural issues that could lead to future problems. Ensure the maintenance of your trees by regular trimming and pruning every few years.

### Before a wind event

- Bring in any loose outdoor items, such as holiday decorations and chairs, or securely tie them down. Aside from the risk of these items being blown away or damaged, airborne debris can pose a safety hazard.
- Be prepared for potential power outages. During winter months, consider raising the temperature on your thermostat in case you lose power for a few hours or longer. This ensures that your living space remains comfortable during unforeseen electrical disruptions.

### During high winds

- If you need to be outdoors, keep a safe distance from trees. This precaution reduces the risk of injury in case of falling branches or trees during strong winds.
- Avoid driving, particularly in high-profile vehicles, during the most intense winds. Strong gusts could potentially blow your vehicle off the road. Additionally, falling trees may obstruct the road ahead, posing a hazard that can be challenging to discern at night until it's directly in front of you. Exercise caution to ensure your safety on the road.

### Stay in a safe space until it's safe to come out.

- If you come across downed power lines, promptly report them to the appropriate authorities.
- Stay away from downed power lines to ensure your safety.
- Refrain from walking under trees, especially if there's a possibility they have been damaged by winds and could fall. This precaution minimizes the risk of injury due to falling branches or trees.

# LHMP Hazard Presentation



# Landslide

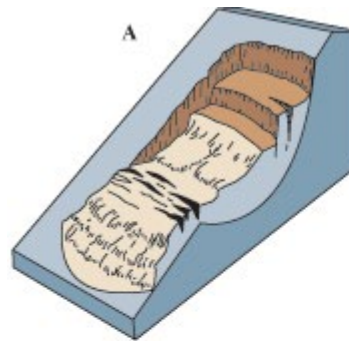


# Agenda

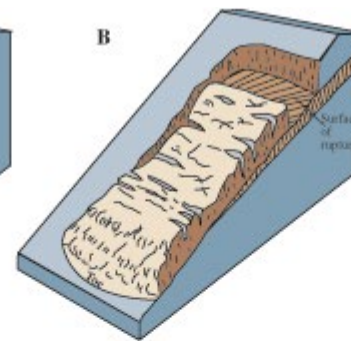
- Landslide Info
  - What is a landslide?
  - Where is it in Berkeley?
  - What could be affected by landslides
- Mitigation Strategy Actions
- Community Readiness Steps

# What is a Landslide?

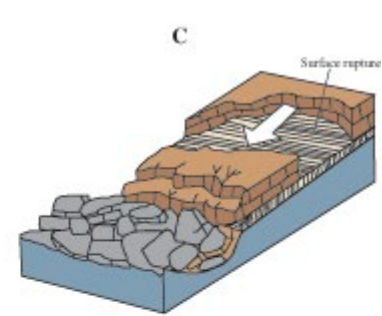
According to the United States Geologic Survey, a landslide is a movement of a mass of rock, debris, or earth down a slope.



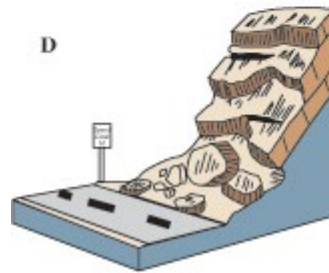
**Rotational landslide**



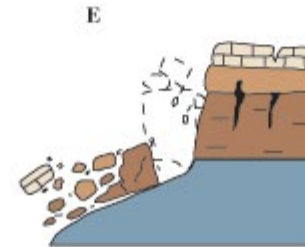
**Translational landslide**



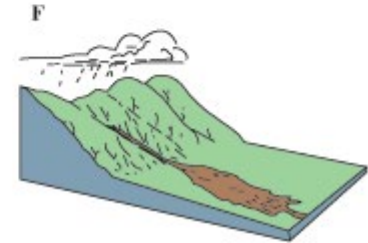
**Block slide**



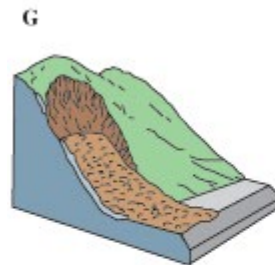
**Rockfall**



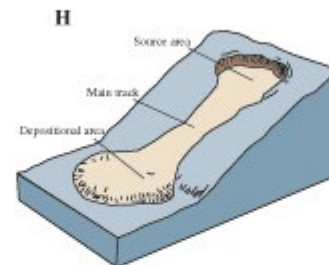
**Topple**



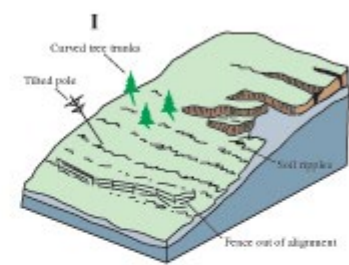
**Debris flow**



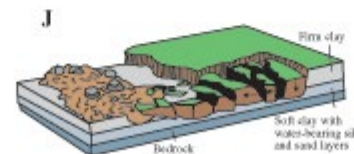
**Debris avalanche**



**Earthflow**



**Creep**



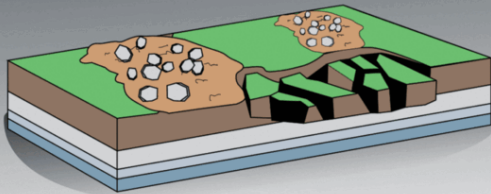
**Lateral spread**



# What is a Landslide?

## LATERAL SPREAD

When surface material extends or spreads on gentle slopes. This type of ground deformation is often associated with earthquake shaking.

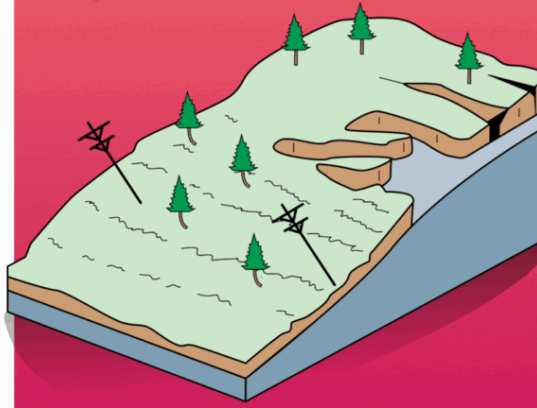


TYPES OF LANDSLIDES



## CREEP

Soil and surface material that slowly moves down a slope.

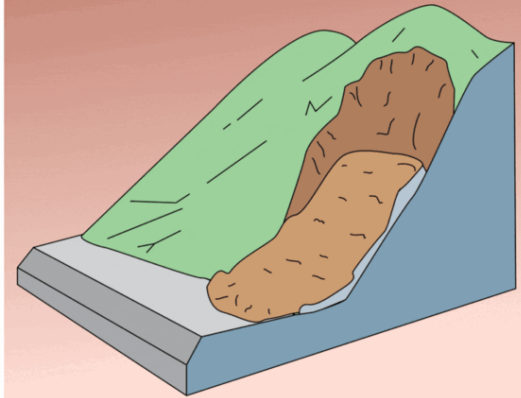


TYPES OF LANDSLIDES



## DEBRIS AVALANCHE

An extremely large and fast moving debris flow.



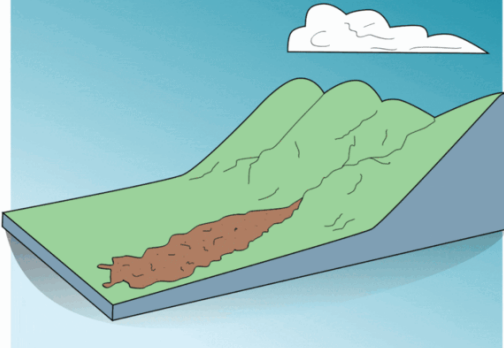
TYPES OF LANDSLIDES



# What is a Landslide?

## DEBRIS FLOW

Rapidly moving mix of water, mud, trees, and other materials that flows downvalley and can travel great distances.

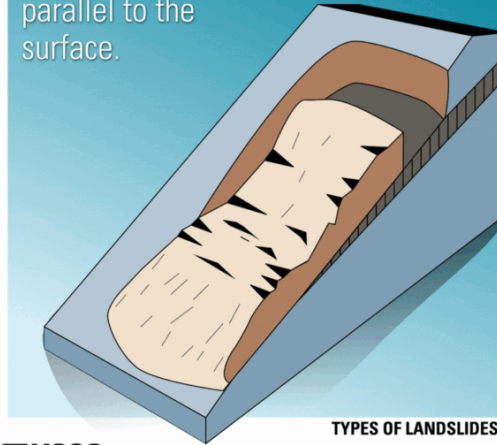


TYPES OF LANDSLIDES



## TRANSLATIONAL LANDSLIDE

Ground slides with little rotation along a flat plane parallel to the surface.

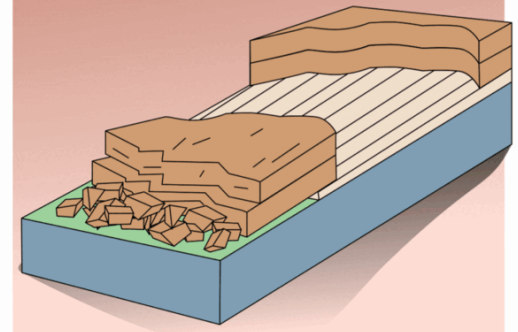


TYPES OF LANDSLIDES



## BLOCK SLIDE

A type of translational landslide made of mostly one block of surface material that moves downslope.



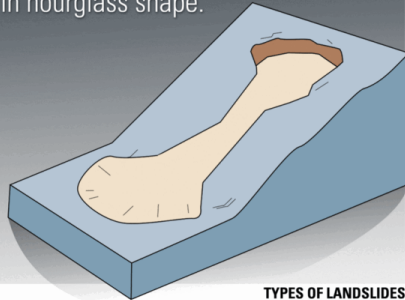
TYPES OF LANDSLIDES



# What is a Landslide?

## EARTHFLOW

Form on moderate slopes when fine-grained material liquefies and runs out in hourglass shape.

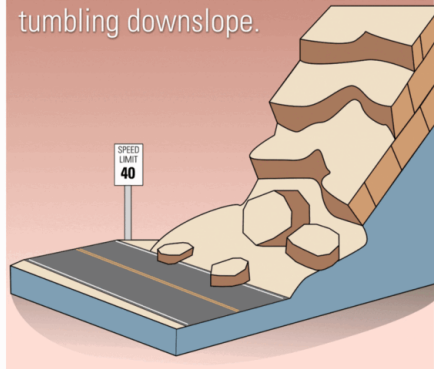


TYPES OF LANDSLIDES



## ROCKFALL

Gravity sends rocks and other materials tumbling downslope.

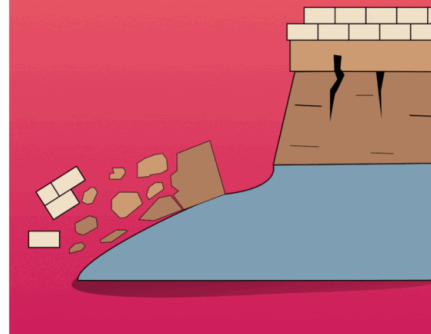


TYPES OF LANDSLIDES



## TOPPLE

Pieces of a cliff or rock face fall forward as large blocks.



TYPES OF LANDSLIDES



## ROTATIONAL LANDSLIDE

Ground rotates and slides along a curved failure plane.



TYPES OF LANDSLIDES





# What is a Landslide?



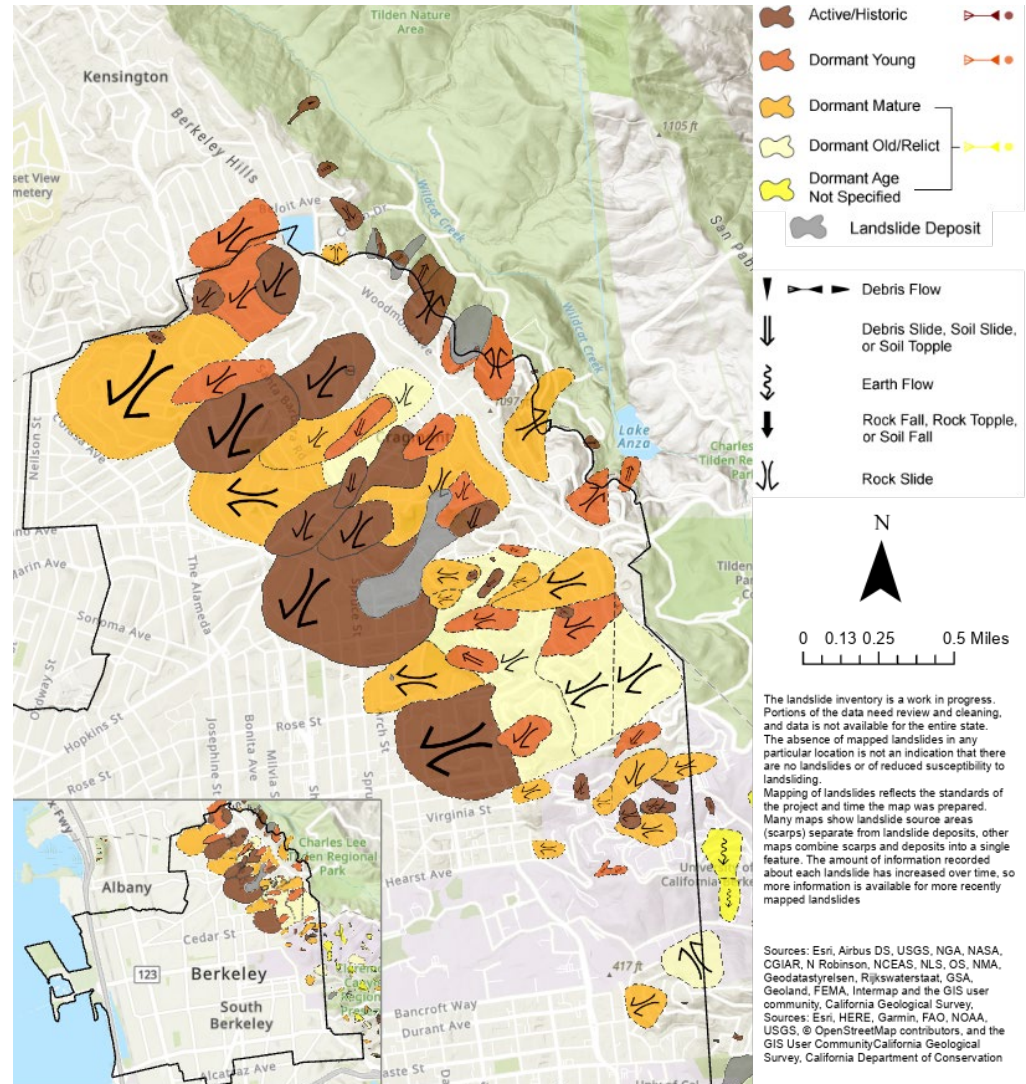
The debris flow landslide hit a home on Middlefield Road on its way down the hill from The Spiral on Jan. 16, 2023.  
Credit: Kelly Sullivan

- The most dangerous landslides in terms of life safety are fast-moving, generally shallow **debris flows**.
  - These are triggered when intense rainfall follows storms that have already saturated hillsides.
  - Once initiated, debris flows can travel great distances at relatively high velocities, flowing down drainages and onto alluvial fans and damaging any structures lying in their paths.

# Where is it in Berkeley?

This is the **Landslide Inventory** for Berkeley, focused in on the Berkeley hills.

The Landslide Inventory is an ongoing project to collect and display current and historical landslide data for the State of California.

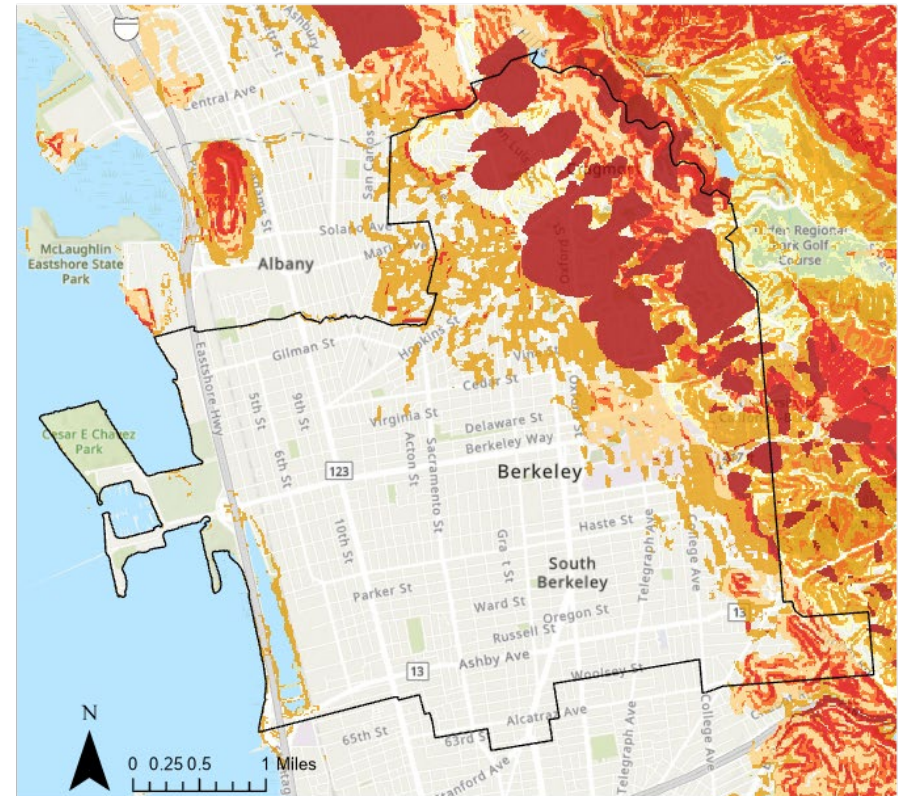




# Where is it in Berkeley?

This is a **landslide susceptibility** classes map focused on Berkeley.

Rock strength and slope are combined to create classes of landslide susceptibility.

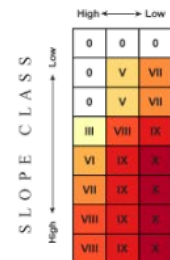


Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyreisen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community. Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, DOC/GCS California Geological Survey, California Department of Conservation

## Landslide Susceptibility Classes



## ROCK STRENGTH



## LANDSLIDE SUSCEPTIBILITY CLASSES





# What could be affected by Landslides?

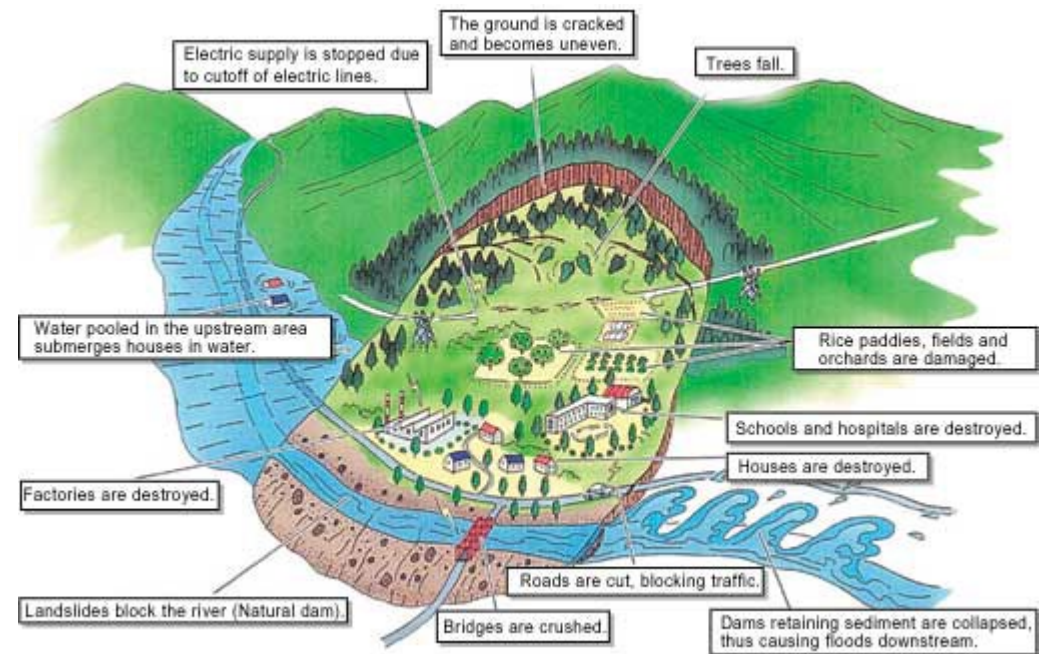


The debris flow landslide hit a home on Middlefield Road on its way down the hill from The Spiral on Jan. 16, 2023.  
Credit: Sky7 Footage

- **Preexisting and recently-active**, larger landslides are more often **triggered by exceptionally long periods of seasonal rainfall**, and sometimes do not start moving until long after the rain has stopped.

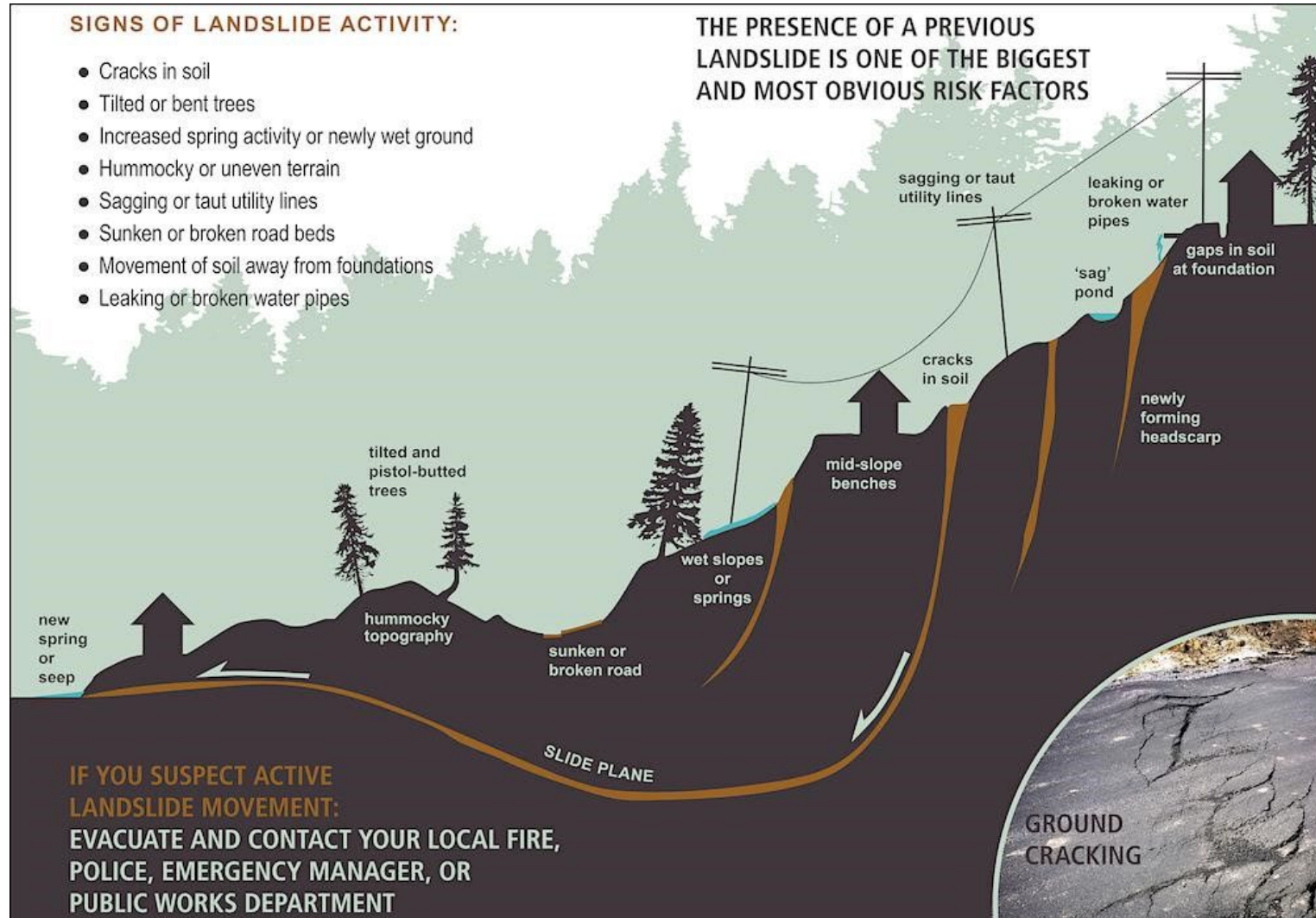
# What could be affected by Landslides?

- People
- Structures
- Systems
- Natural, historic, and cultural resources





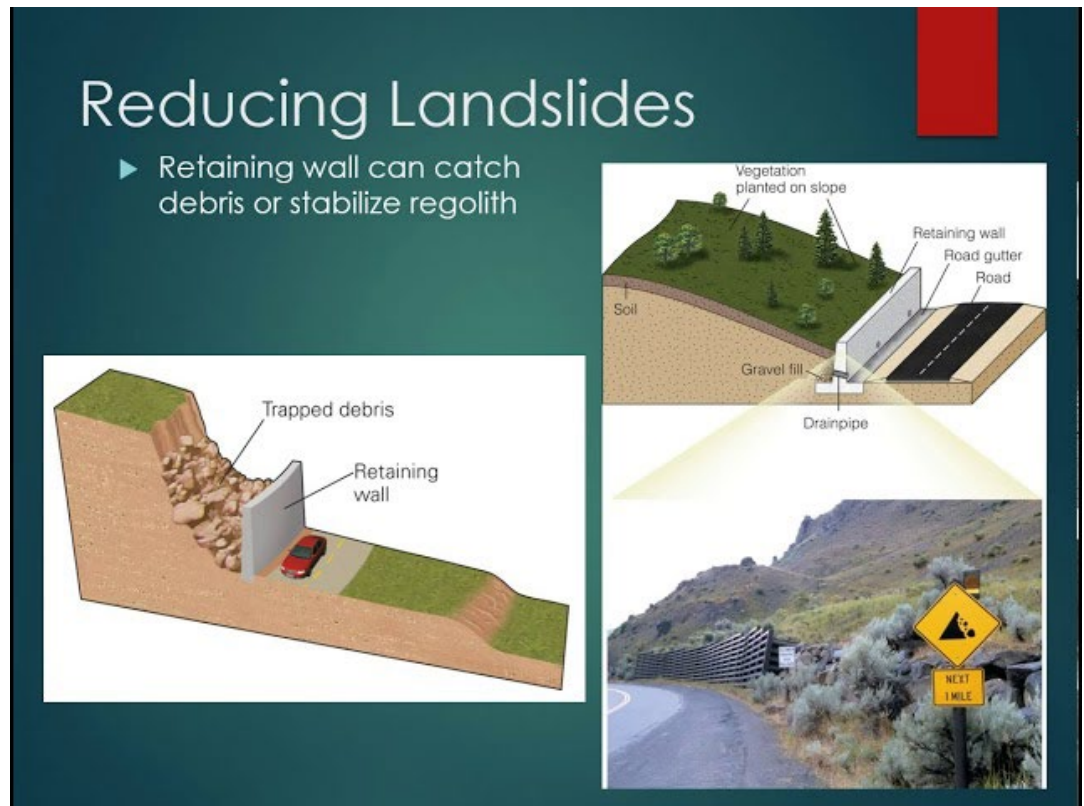




# Community Readiness Steps

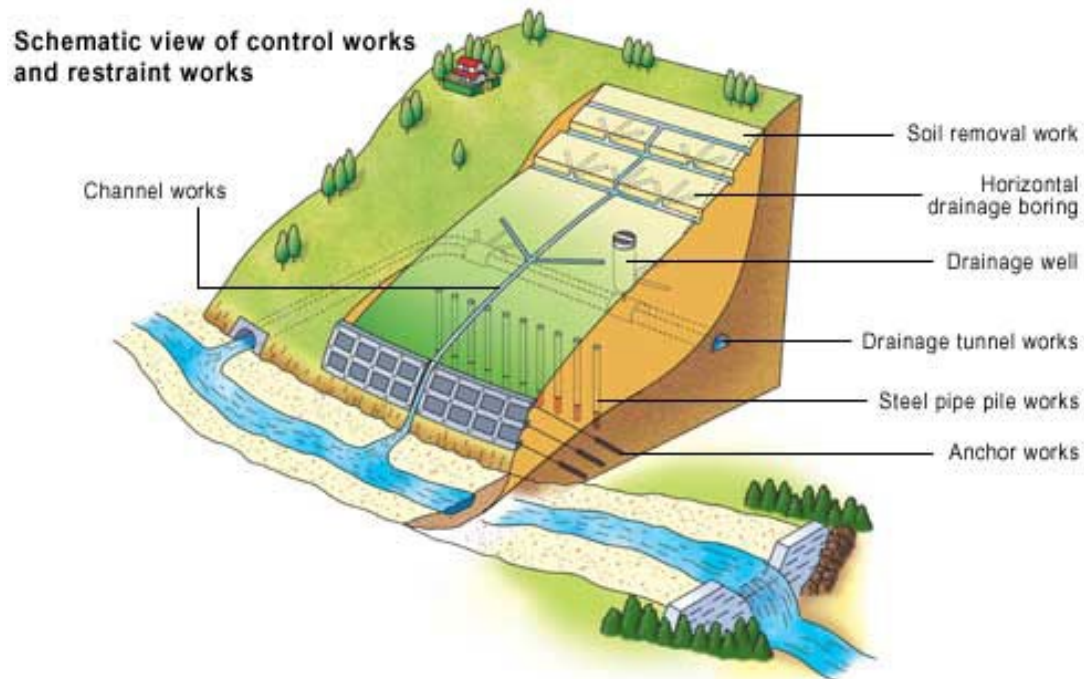
## Minimize home hazards:

- Have **flexible pipe fittings** installed to avoid gas or water leaks, as flexible fittings are more resistant to breakage (only the gas company or professionals should install gas fittings).
- **Plant ground cover** on slopes and build **retaining walls**.



# Community Readiness Steps

- In mudflow areas, **build channels or deflection walls** to direct the flow around buildings.





# Community Readiness Steps

- Landslide damage on private property is the homeowner's responsibility. And homeowner's insurance does not typically cover landslide damage.
- A **difference in conditions** insurance policy can help cover this gap, if you live in the landslide prone area.

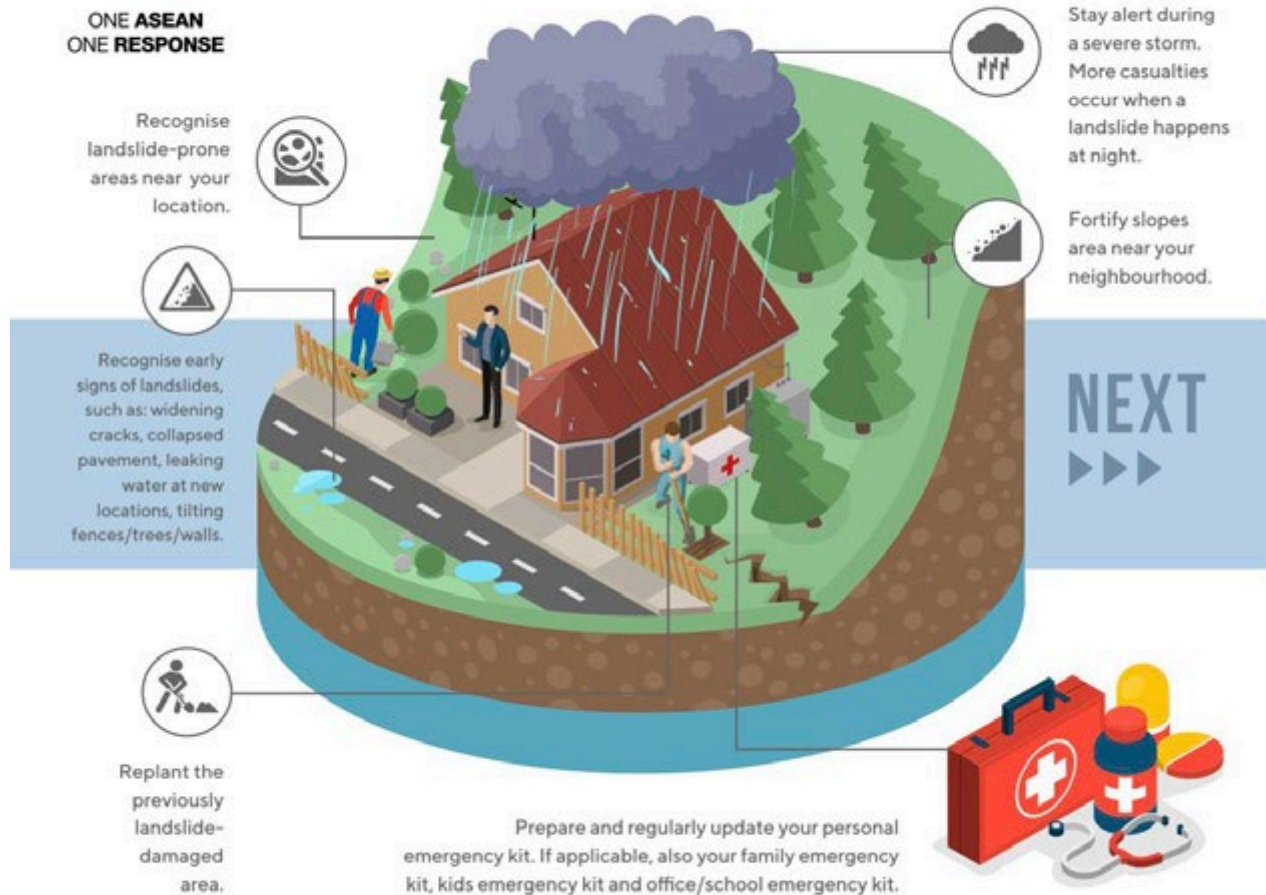




ONE ASEAN  
ONE RESPONSE

## DISASTER PREPAREDNESS TIPS

# LANDSLIDE PREPAREDNESS TIPS



[www.ahacentre.org](http://www.ahacentre.org)

**BEFORE**

# There's an App for that!

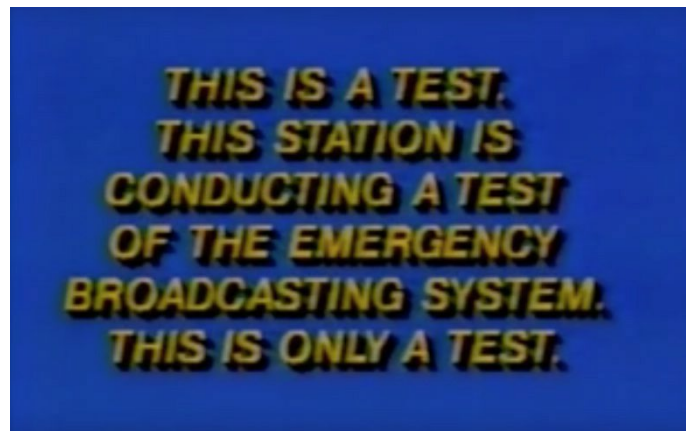
Key phone apps for emergency readiness



BDPNN Disaster Technology Workshop



# The history of emergency alert technology



## More recent focus: Phone Apps



**MyShake**



**Everbridge** (to  
get Nixle and AC  
Alert)



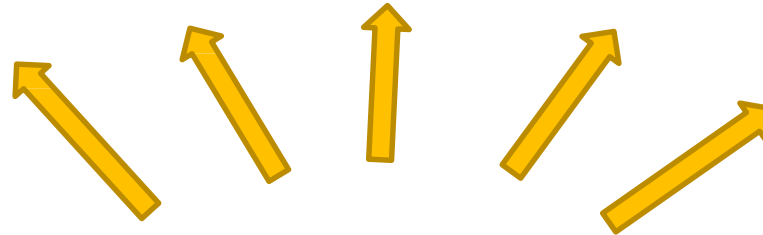
**Genasys Protect** (aka  
Zonehaven aka Berkeley's  
Emergency Map)



**EPA AirNow**



**Heat Index**



**Official Government Resources**

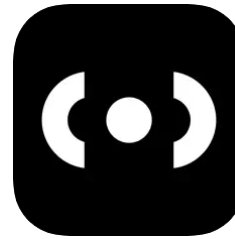
## Some other apps...



**NextDoor**



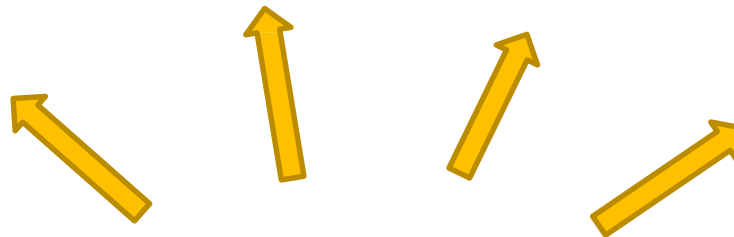
**Watch Duty**



**Citizen**



**American Red Cross**  
(suite of apps including  
Emergency!, First Aid and  
Pet First Aid)



**Not Official Government Resources**



**Now let's check out each app...**



# MyShake



- The MyShake app (developed by the UC Berkeley Seismology Lab) is the first app to provide statewide earthquake early warning alerts in California.
- Adjust notification settings by geography and magnitude
- Be a citizen scientist and help report earthquake motion

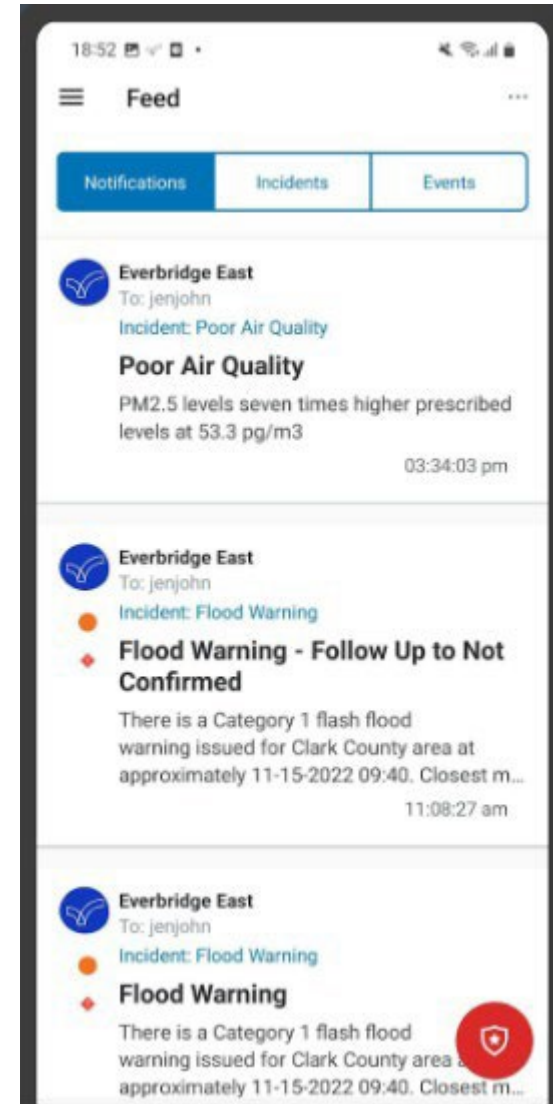




# Everbridge



- Everbridge is the supporting software for AC Alert and Nixle—so it's an important app to have!
- Manage subscriptions to public agency notifications
- See a feed of recent alerts in areas of interest
- Enable notifications to receive lower-level alerts that don't go to text





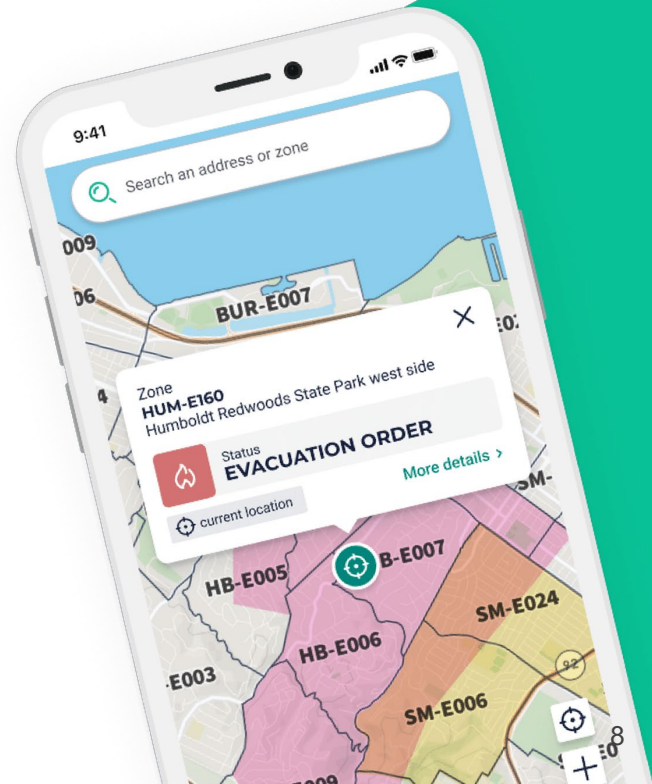


# Genasys Protect (aka Berkeley's Emergency Map, aka "Zonehaven")

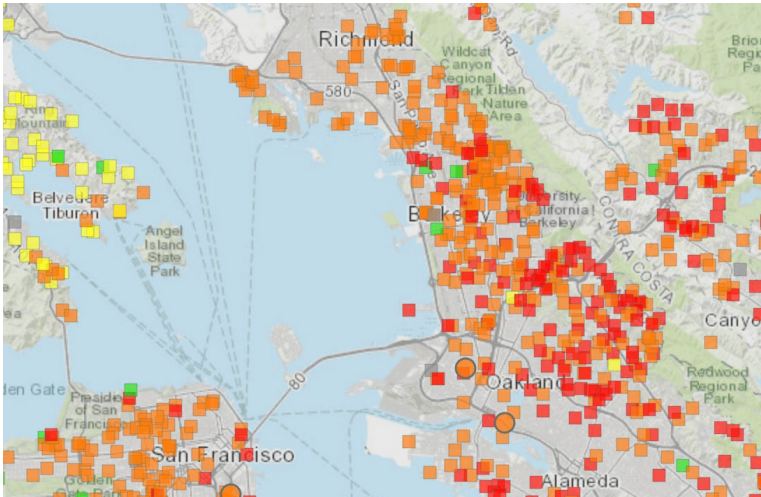


- Live, interactive map that divides City of Berkeley into planned evacuation zones
- Used in the field by first responders
- Get app notifications when there is a change to your zone

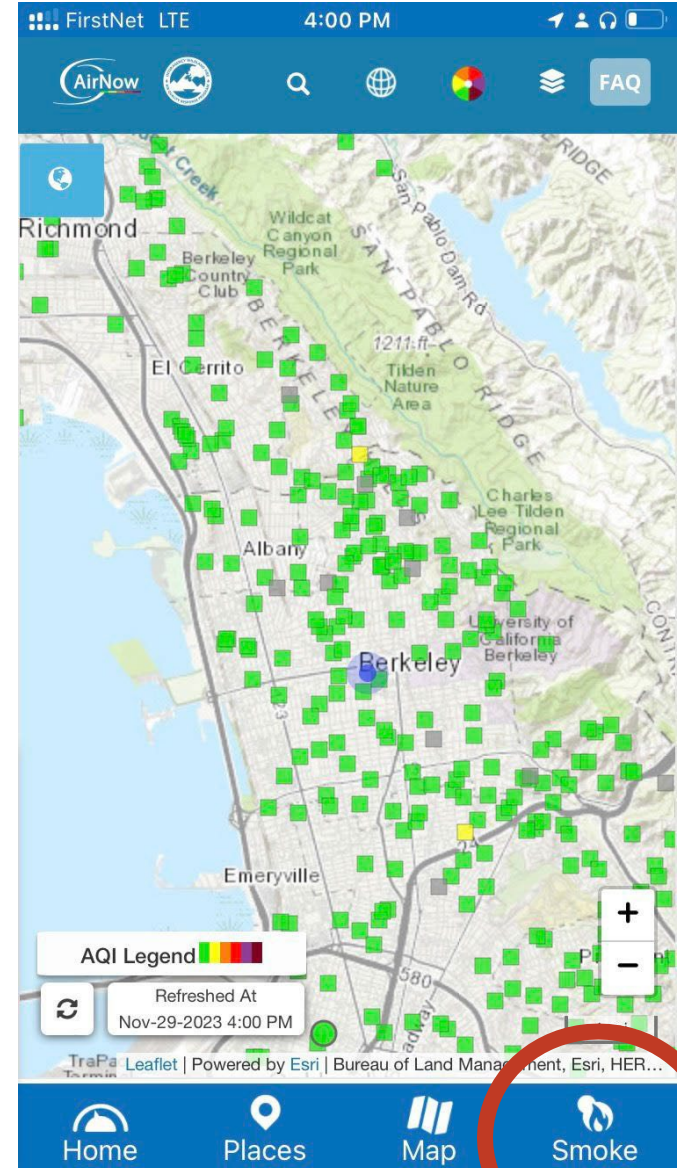
Lets check out the browser version together: **[protect.genasys.com](https://protect.genasys.com)**



# EPA AirNow

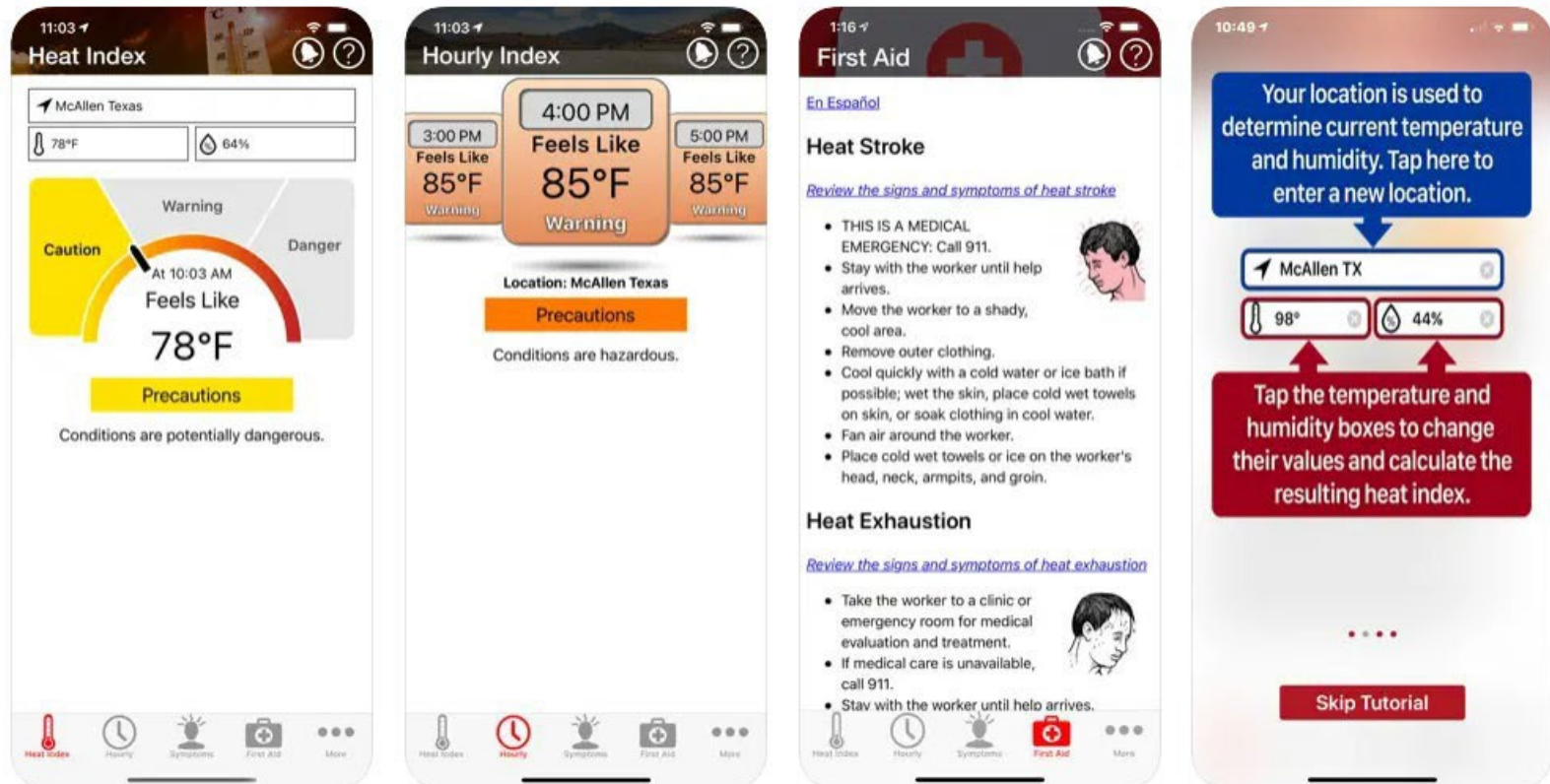


Lets check out the browser version  
together: **[fire.airnow.gov](https://fire.airnow.gov)**



Check out this tab

# OSHA Heat Safety Tool





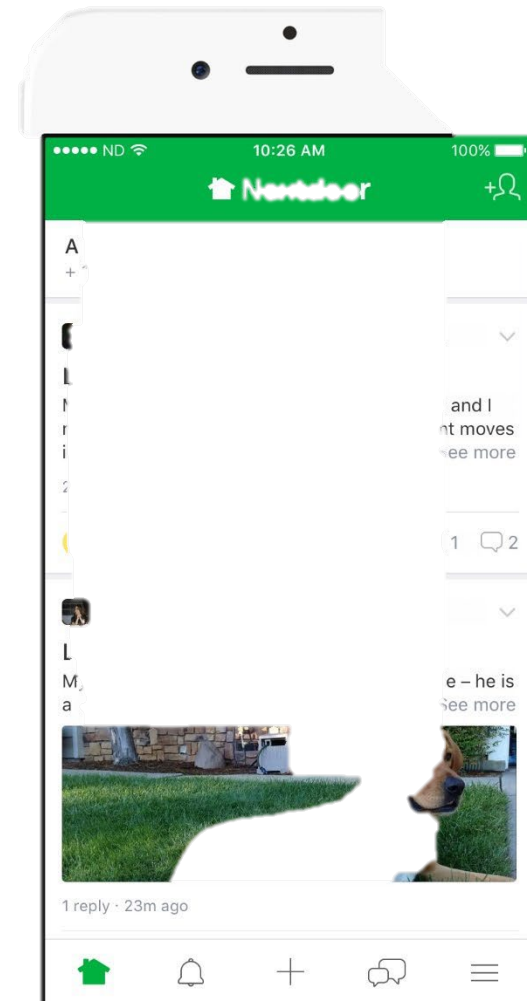
**Is there still time? Let's check out a  
couple more apps...**



# Nextdoor

## \*not an official resource

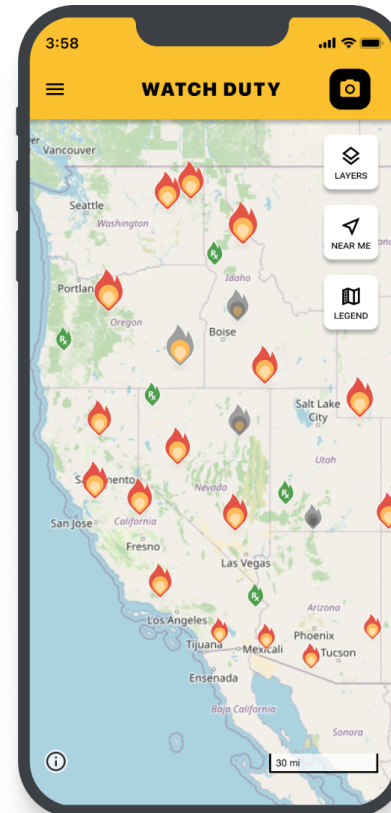
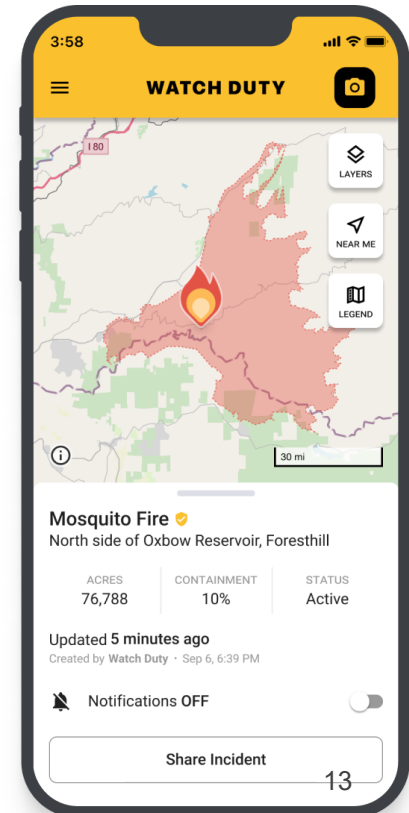
- A private social network/app for neighborhoods: meet your neighbors, get local tips, post about questions or events, buy and sell items, and more
- Get to know your neighbors!



# Watch Duty

## \*not an official resource

- Real-time updates and mapping on wildfires in participating communities
- Features a feed of updates with official emergency notifications and evacuation orders, images from fire cameras, and links to official resources
- 501(c)(3) nonprofit operated by trained volunteer reporters and scanners



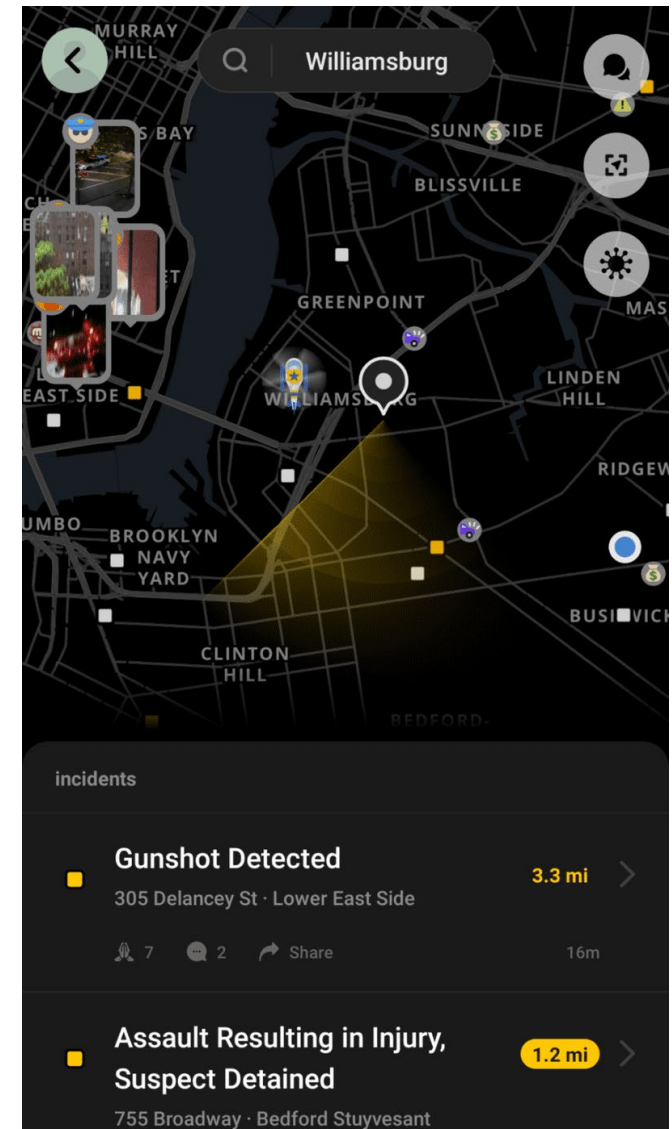




# Citizen

## \*not an official resource

- An app that sends location-based public safety alerts in real-time. Pulls initial report data from publicly available radio traffic and CAD
- False reports and misleading comments from the public happen so take with a grain of salt



# American Red Cross



- A suite of apps with useful, updated information about First Aid, Pet First Aid, and emergency preparedness
- App names are “American Red Cross- First Aid”, “American Red Cross- Pet First Aid”, and “American Red Cross- Emergency!”



# Thank you!

**Leah Greenbaum**  
**Emergency Services Coordinator**  
**City of Berkeley, Office of Emergency Services**  
**[oes@berkeleyca.gov](mailto:oes@berkeleyca.gov)**



# LHMP Hazard Presentation



# Agenda

- Background Information
  - What is the hazard?
  - Where is it in Berkeley?
  - What could be affected by it?
- Mitigation Strategy Actions
- Community Readiness Steps

# Points of Reference

- Hazard write-up: [S:\Team-Folders\Local Hazard Mitigation Plan\2024\PLAN\2024\Element B Risk Assessment](#)
  - Maps (in hazard write-up or elsewhere)
- PowerPoint from 2019 LHMP DFSC (REFERENCE)
- Proposed actions – 2 spreadsheets in here:
- [S:\Team-Folders\Local Hazard Mitigation Plan\2024\PLAN\2024\Element C Mitigation Strategy\Status of Actions](#)
- “Disaster Preparedness Presentation” – CERT: [S:\Team-Folders\Local Hazard Mitigation Plan\2024\Outreach\Hazard Information Outreach Materials](#)
- Public Outreach Content Highlights DRAFT
- [S:\Team-Folders\Local Hazard Mitigation Plan\2024\Outreach\Hazard Information Outreach Materials](#)



# Hello Winter Weather!

Flooding and High Winds:  
The hazards, the City's work, and steps to stay safe

December 9, 2023

# Winter Weather Outlook

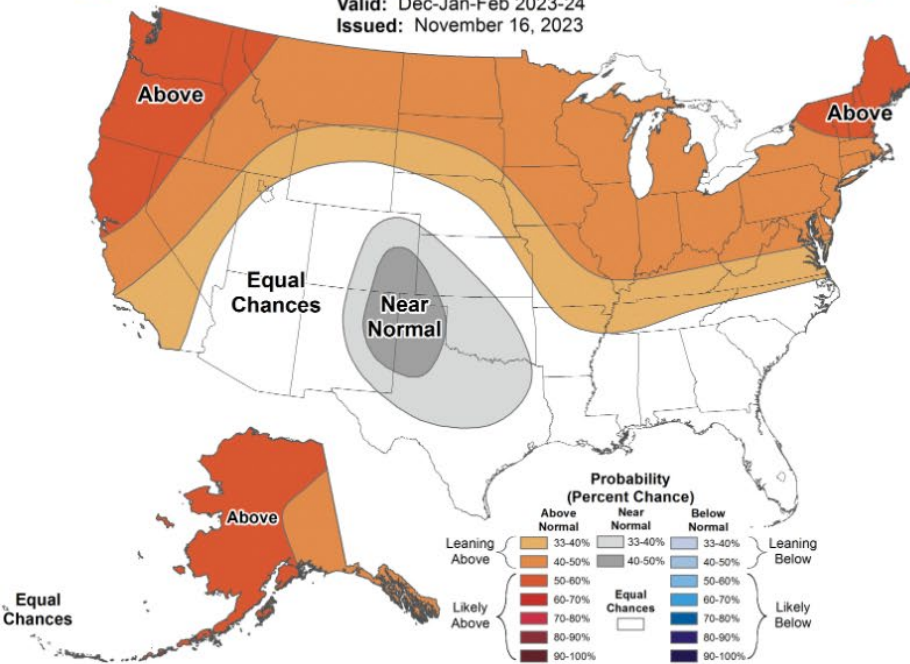
# NOAA predicts “strong” El Niño conditions



## Seasonal Temperature Outlook



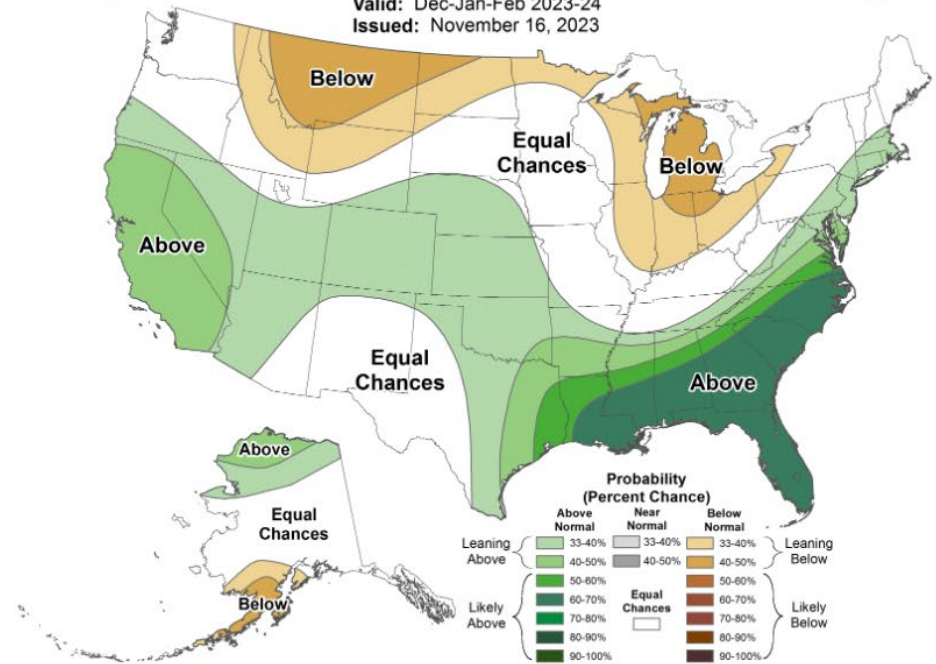
Valid: Dec-Jan-Feb 2023-24  
Issued: November 16, 2023



## Seasonal Precipitation Outlook



Valid: Dec-Jan-Feb 2023-24  
Issued: November 16, 2023





# Flooding

# What is flooding?

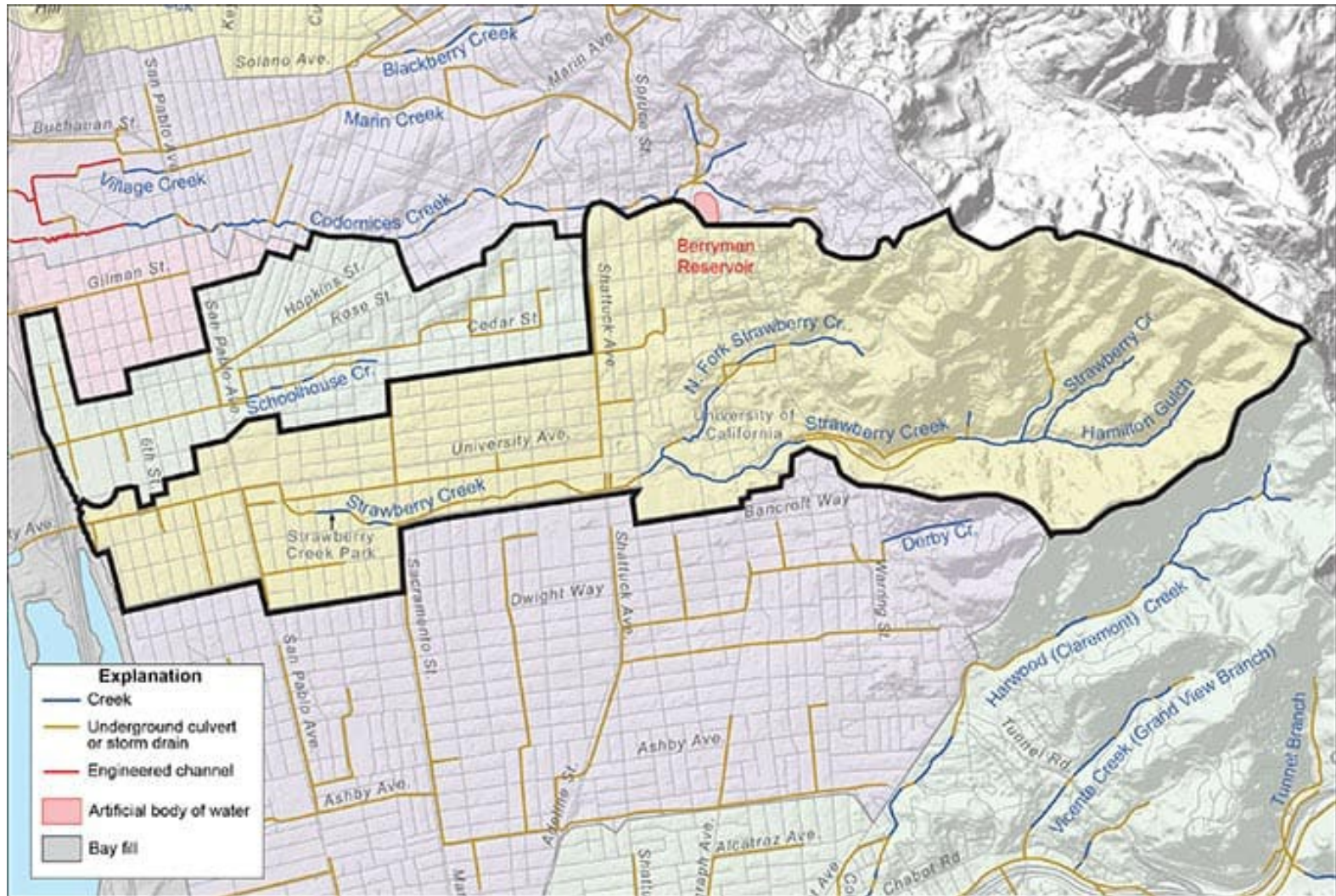


**Flooding on Parker Street near Longfellow School. Photo: Mark Coplan**

# Creek Flooding



# Creeks & Berkeley



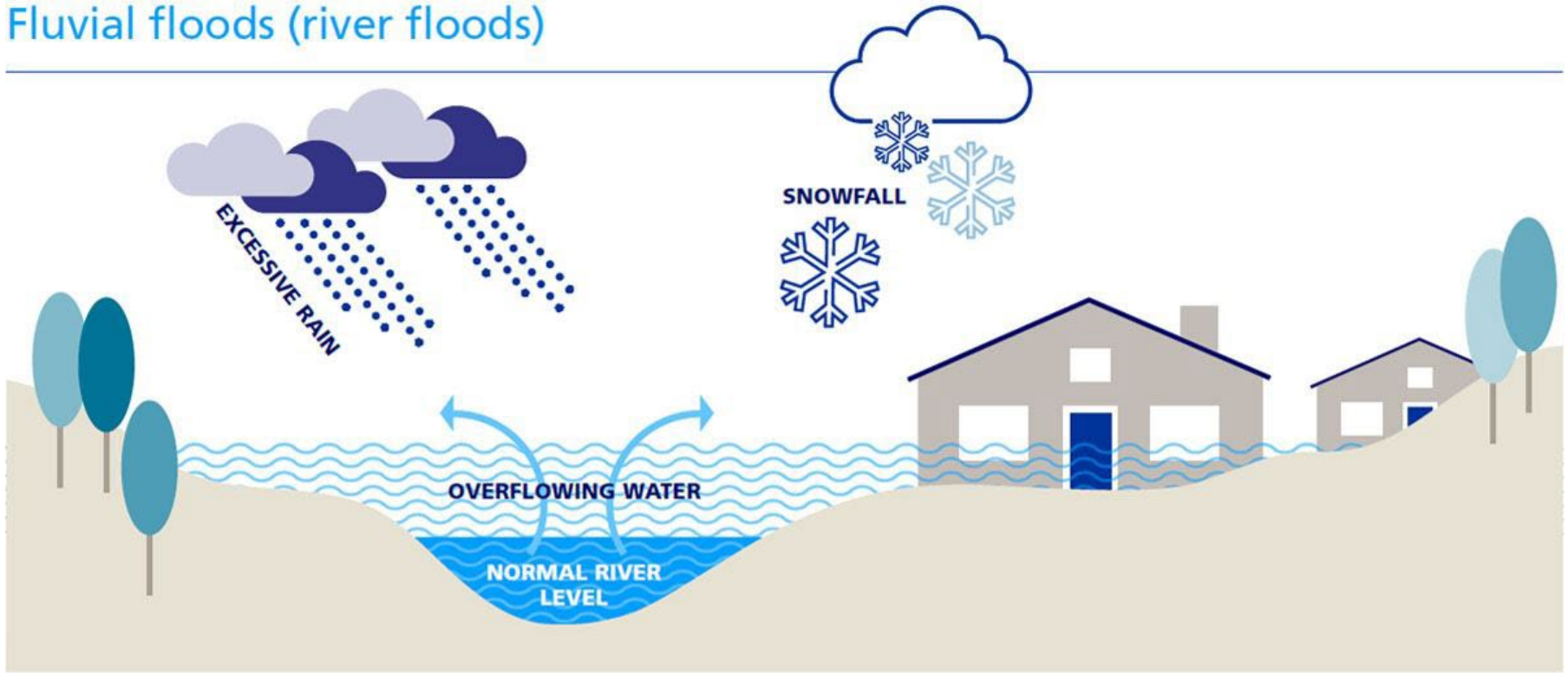
# What is Creek Flooding?





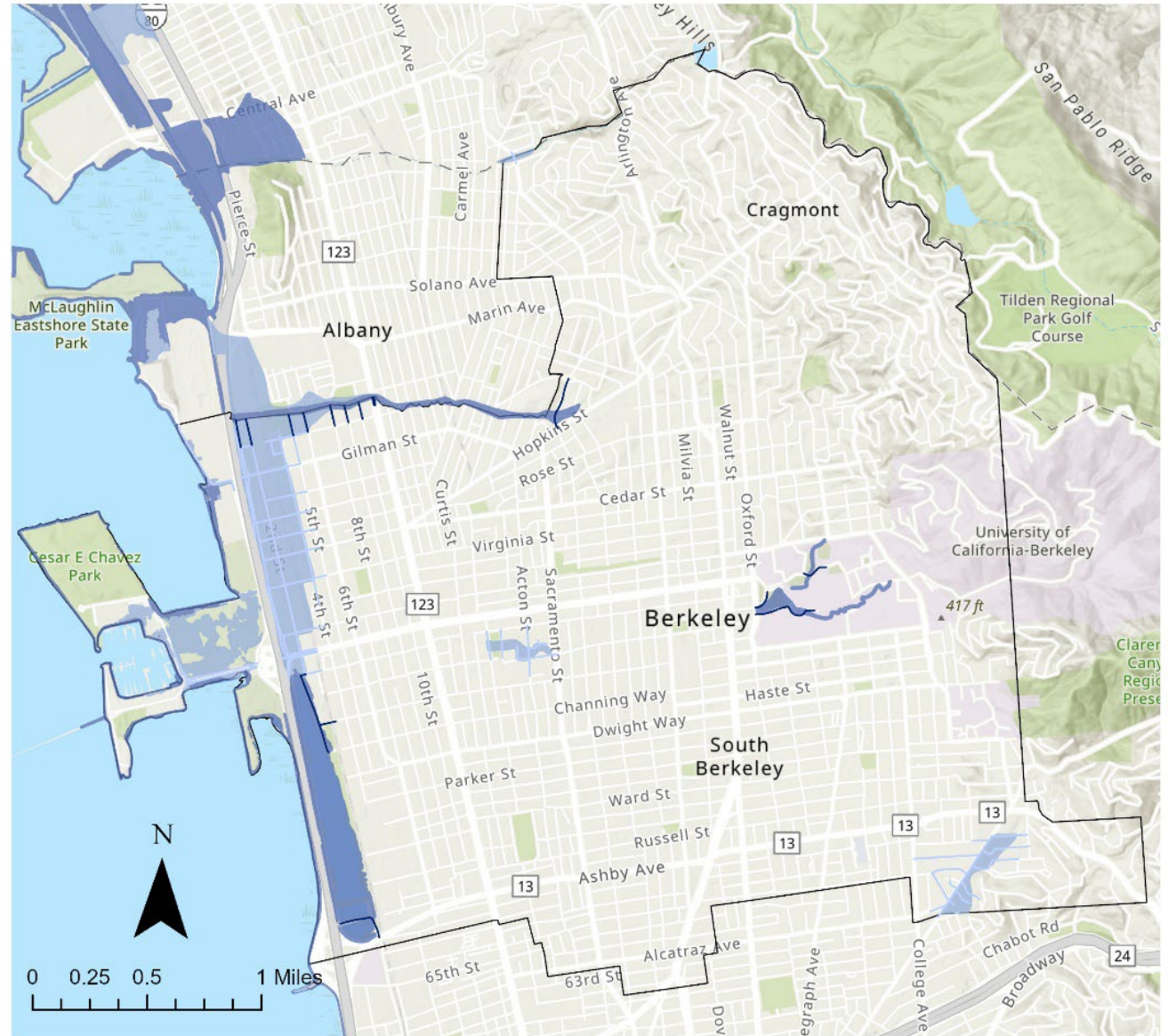
# What is Creek Flooding?

## Fluvial floods (river floods)



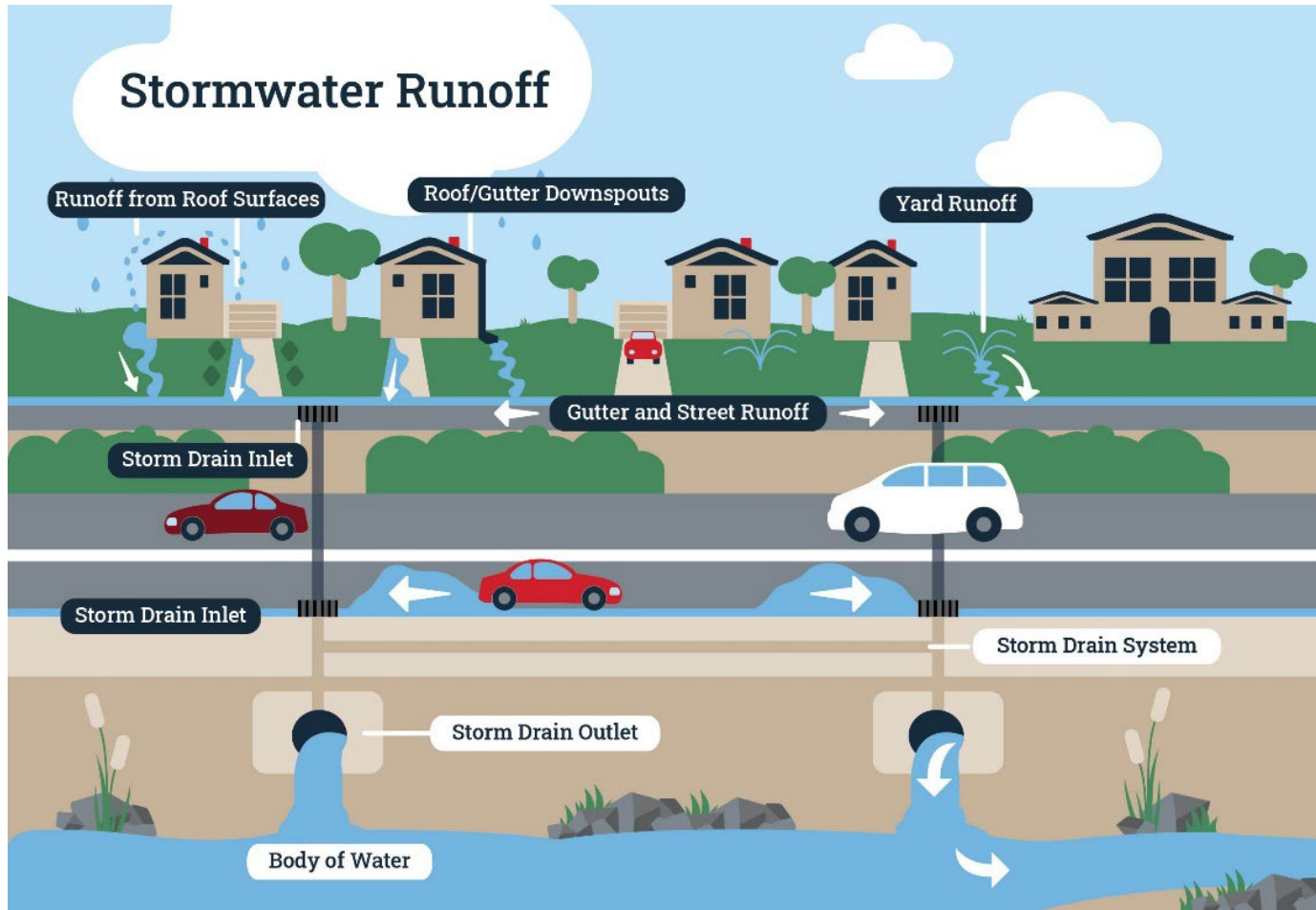


# Berkeley Floodplains



# Storm Drain Overflow

# What is Storm Drain Overflow?





# Storm Drain Infrastructure

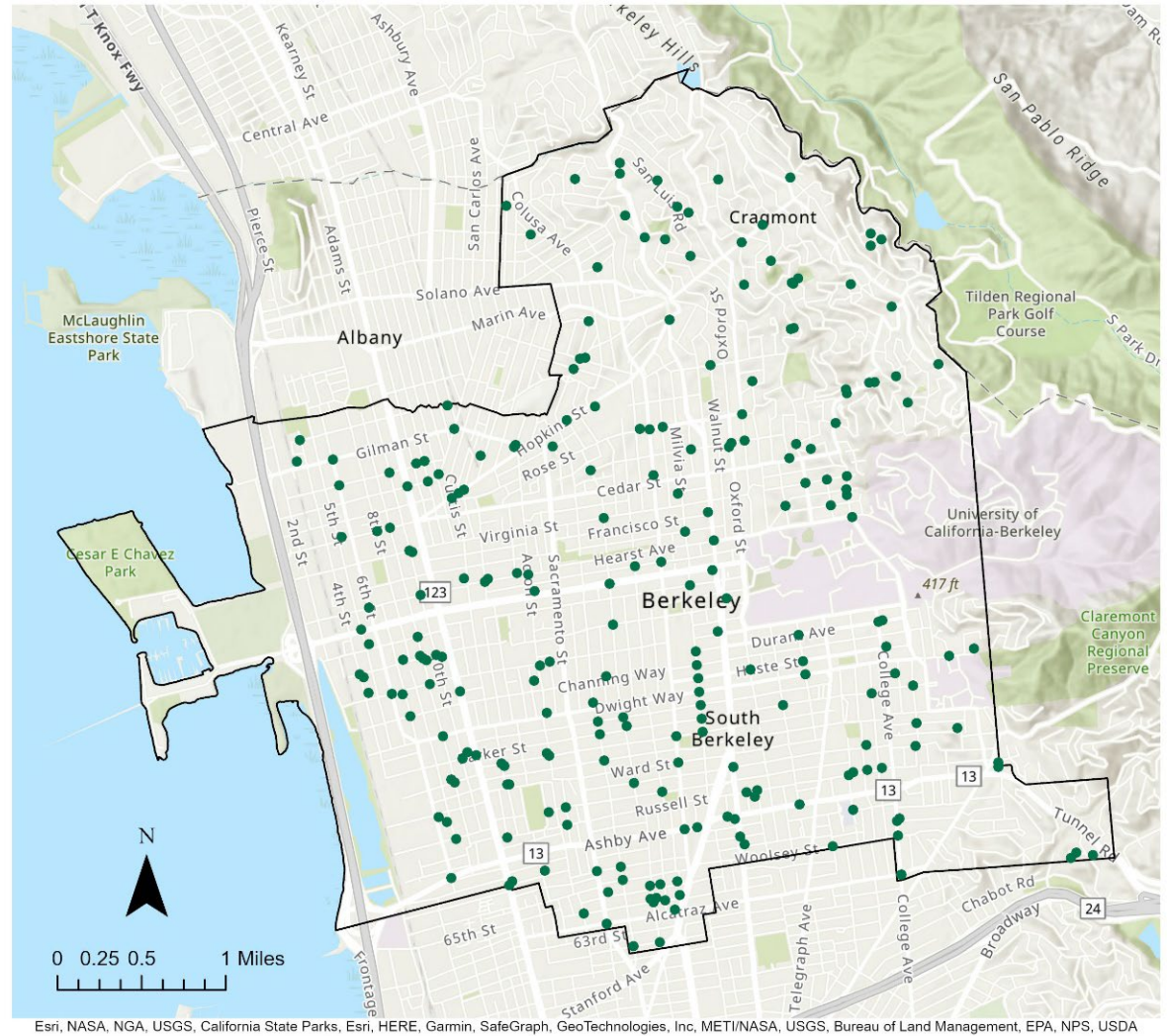
- Designed to handle 2 inches in 6 hours
- Some components of Berkeley's storm drain infrastructure are over 90 years old



Flooding in Southwest Berkeley during [last October's record-breaking storm](#).

Credit: [Guillaume Pierre](#)

# Storm Drain Issues



Storm Drain System Issues, Jan-June 2023

- Areas of Observed Storm Drain Overflow

# **2024 Draft Mitigation Plan: Flooding Strategy**

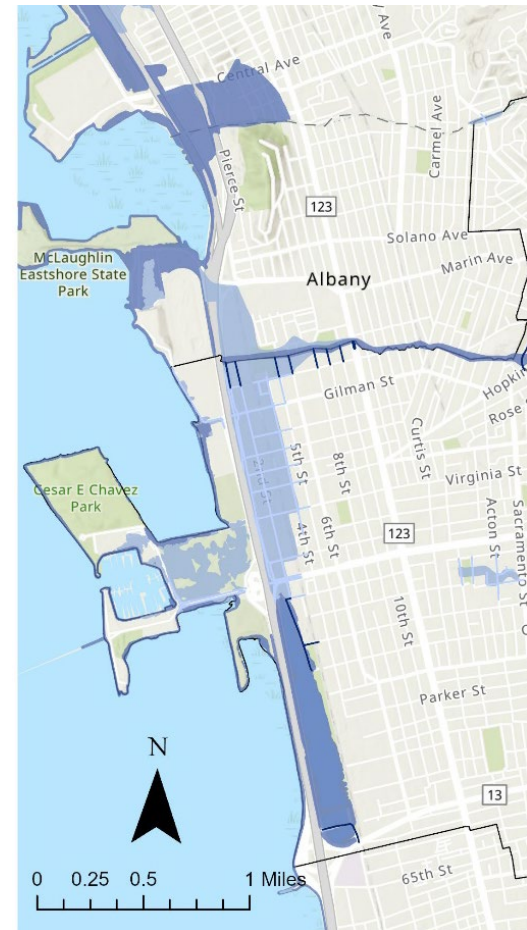


# Maintain City participation in the National Flood Insurance Program.

- Use updated FEMA maps
- Incorporate FEMA guidance into City plans and procedures



**FEMA**



# Development Standards

- Use development standards to ensure that new development does not contribute to an increase in flood potential.



# Stormwater Master Plan

Complete a Stormwater Master Plan for all City stormwater infrastructure, to:

- Identify system deficiencies
- Establish a capital stormwater improvement plan, and
- Identify funding mechanisms.





## Tide Tubes

- Renovate the tide tubes that remove storm water from Berkeley Aquatic Park and Potter Street to the Bay.



# Designing Public Improvements

- Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio-filtration systems.



Bioswale at Rose and Hopkins

# What can you do about flooding?



# Protect your neighborhood

- Flooding often occurs due to storm drain blockage. Keep water flowing by participating in the [adopt a drain program](#).



# Protect your home

- Direct water away from your building.
- Watch how water flows or accumulates around your home to identify potential trouble spots.



# Flood Insurance

- Consider **flood insurance**, since typical homeowners insurance policies do not cover flooding.



FEMA





# Are sandbags right for you?

**Do you live near a  
Berkeley creek?**

**Have you experienced  
flooding in the past?**

- Learn [how to sandbag](#)
- Learn whether sandbags will be protective for your property



# Make your sandbag plan

- If you are unable to sandbag, connect with neighbors and friends who can assist you in sandbagging to protect your home during severe storms
- Make a plan for where you'll get sandbags in significant storms.



# Where to get sandbags?

- Local hardware stores
- [City's Corporation Yard](#)
  - 10 free bags during storm season
  - Monday-Friday, 8 am - 4 pm
  - Berkeley residents and businesses only; bring ID or a business card).





## During heavy rains



- Elevate important items, if possible, especially from first floor/garage.
- Do not walk, swim or drive through flooded waters. Turn around, don't drown.
- Be ready for power/internet outage
- If your home floods, be ready for cleanup.

# High Wind Events

# How is Wind formed?

Wind is air in motion, traveling between areas of high pressure to low pressure

*The steeper the difference in air pressure, the stronger the wind is*





# Wind in Berkeley

*In Berkeley, high wind events are associated with the seasons*

- **Winter:** weather systems and cold fronts
- **Summer:** temperature and pressure differences between the Pacific Ocean and the interior valleys to the east create strong winds from the west
- **Spring & Fall:** warm, dry offshore winds from the northeast, known as “Diablo Winds”

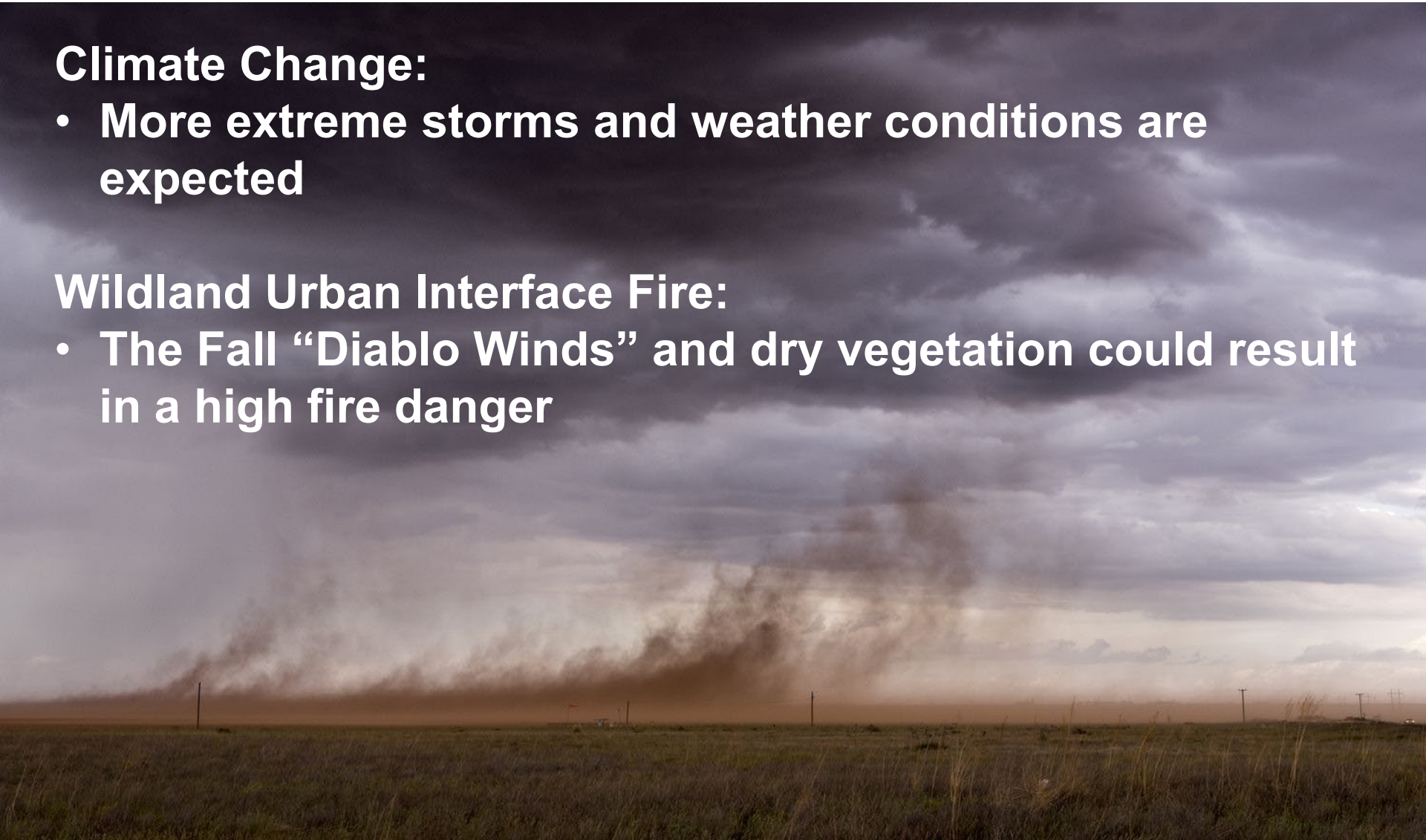


## Climate Change:

- More extreme storms and weather conditions are expected

## Wildland Urban Interface Fire:

- The Fall “Diablo Winds” and dry vegetation could result in a high fire danger



# What is “high wind”?

- ***Sustained wind*** of 40 mph or more, lasting for 1 hour or more  
or
- ***Wind gust*** (usually 20-30 seconds) of 58 mph or higher





# Vulnerabilities

## Direct

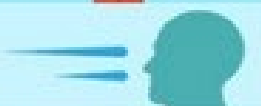
- Trees
- Utility lines
- Heavy objects
- High-profile vehicles and RVs

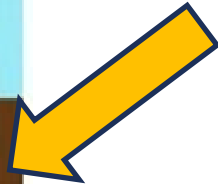
## Indirect

- People



# Beaufort Wind Scale

|           |                                     |                                                |                                                                                       |
|-----------|-------------------------------------|------------------------------------------------|---------------------------------------------------------------------------------------|
| < 1 mph   | Calm                                | Smoke rises vertically                         |      |
| 1-3 mph   | Light air                           | Direction shown by smoke drift                 |    |
| 4-7 mph   | Light breeze                        | Wind felt on face                              |    |
| 8-12 mph  | Gentle breeze                       | Leaves and small twigs in constant motion      |    |
| 13-18 mph | Moderate breeze                     | Raises dust and loose paper                    |    |
| 19-24 mph | Fresh breeze                        | Small trees and leaves begin to sway           |    |
| 25-31 mph | Strong breeze                       | Large branches in motion                       |    |
| 32-38 mph | High wind, moderate gale, near gale | Whole trees in motion                          |    |
| 39-46 mph | Gale, fresh gale                    | Twigs break off trees                          |    |
| 47-54 mph | Strong/severe gale                  | Slight structural damage                       |   |
| 55-63 mph | Storm, whole gale                   | Trees uprooted, considerable structural damage |  |
| 64-72 mph | Violent storm                       | Widespread damage                              |  |
| >73 mph   | Hurricane force                     | Devastation                                    |  |



# What can you do about high winds?



# Keep Trees Maintained



## City trees

Call 311

Email

[trees@berkeleyca.gov](mailto:trees@berkeleyca.gov)

## Private trees

Trim, prune and talk to  
arborist



# Before a wind event...



**Secure outdoor  
items**

**Be ready for  
power outages**





# During high winds...

**Stay inside if you can**

**Stay away from trees**

**If you see a downed  
power line, call 9-1-1**



Credit: Berkeleyside, Benji Friedman, March 2023 at Berkeley Marina



## During high winds...



**If you see a downed power line, stay away and call 9-1-1**

# Recap & Next Steps



## Recap

- **Creek flooding** and **storm drain issues** cause most flooding in Berkeley
- Infrastructure improvements can reduce risks
- Residents can protect their neighborhoods and homes
- **High winds** can create dangerous situations – get ready and then stay out of the way if you can!





## Next Steps Today!

- Mitigation plan:
  - Share your top mitigation actions and other ideas
  - Full draft plan available in 2024
  - [Mitigation@BerkeleyCA.gov](mailto:Mitigation@BerkeleyCA.gov)
- Learn more at today's event!
  - Adopt a storm drain
  - Learn how to sandbag and if it will protect your property

# Sea Level Rise



# Agenda

- Hazard Info
  - What is sea level rise?
  - Where is it in Berkeley?
  - What could be affected by sea level rise?
- Mitigation Strategy Actions



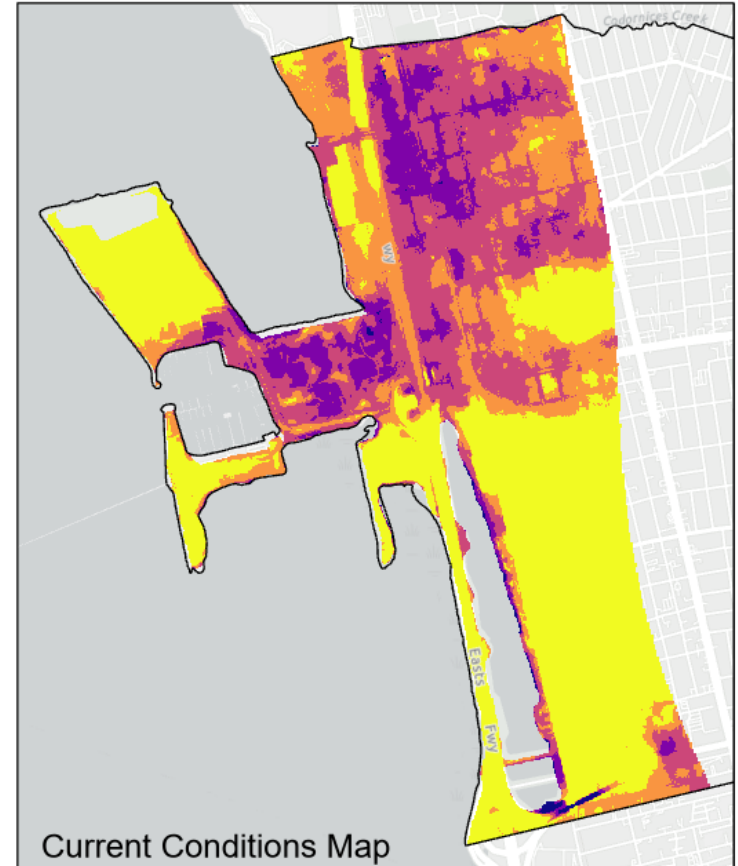
# What is Sea Level Rise?



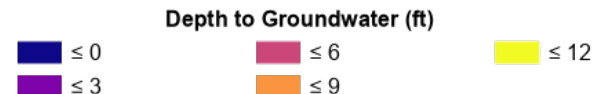
- Sea level rise is an increase in the level of the world's oceans.
- Warmer temperatures associated with climate change are causing global sea levels to rise through two processes.
  - Ice Melt
  - Thermal Expansion

# Where is it in Berkeley?

- Low-lying inland areas could flood from below by **emergent groundwater** long before coastal floodwaters overtop the shoreline
- **Emergent groundwater** is when the groundwater surfaces and the depth is less than zero.

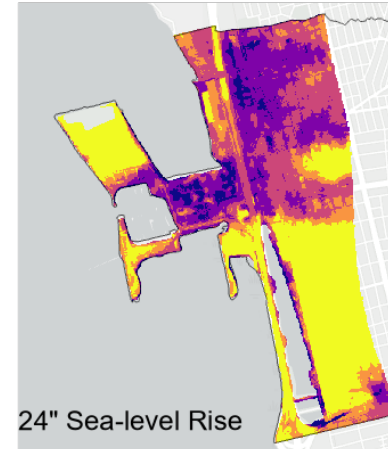
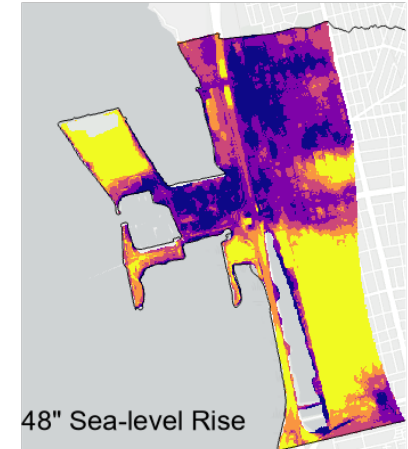
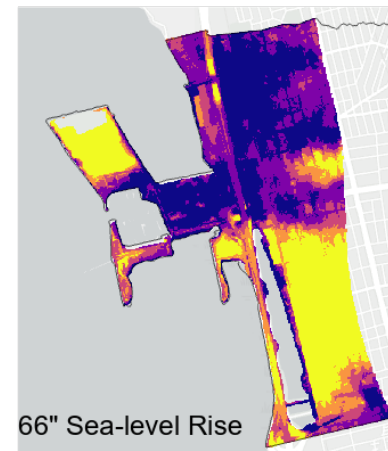
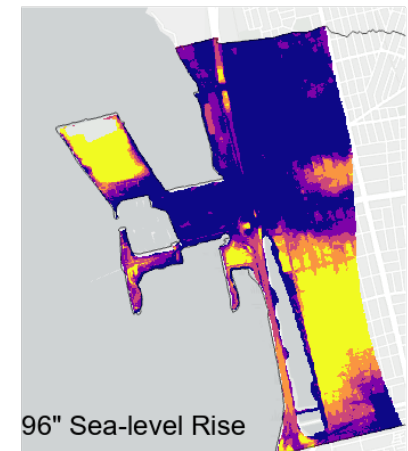
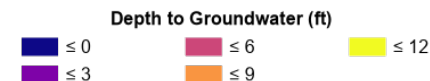


Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community Pathways  
Climate Institute, San Francisco Estuary Institute



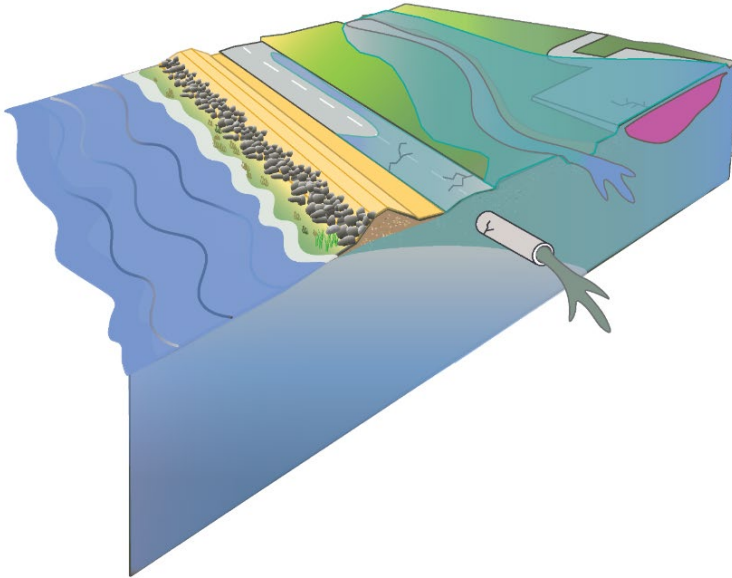
# Where is it in Berkeley?

- At 24" sea-level rise, we begin to see "emergent" groundwater.
  - As the sea-level rises, the more emergent groundwater is projected.
- At 96" sea-level rise a large portion of West Berkeley is covered by emergent groundwater.





# What could be affected by Sea Level Rise?



- Increased infiltration rates into sewer systems, flooding of basements, and damage to underground infrastructure.
- Increased risk that toxic materials could be raised and moved
- Rising groundwater will increase liquefaction hazards in response to earthquakes, particularly in former open water, mudflat, marsh, and floodplain areas that have been filled for development.

# Mitigation Strategy Actions



# Actions

- Mitigate the impacts of sea level rise in Berkeley.
  - Continue to ensure new and existing public and private developments and infrastructure are protected from floods due to sea-level rise through the permitting process for new development and conditions.
  - Identify funding and nature based solutions to adapt to sea level rise at Berkeley Waterfront areas at risk of future inundation



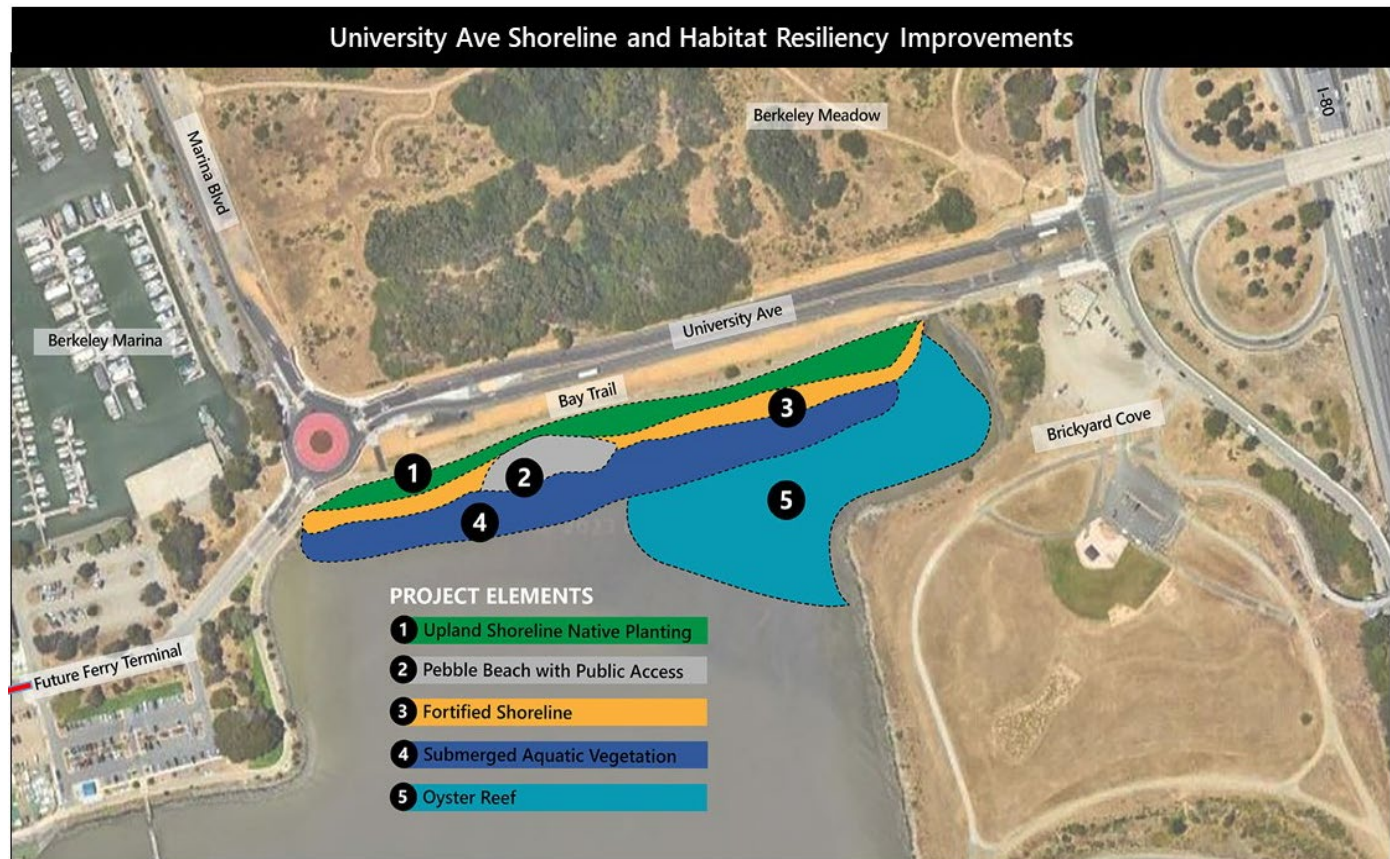
# Actions

- Marina Blvd Shoreline at Virginia Street Extension



# Actions

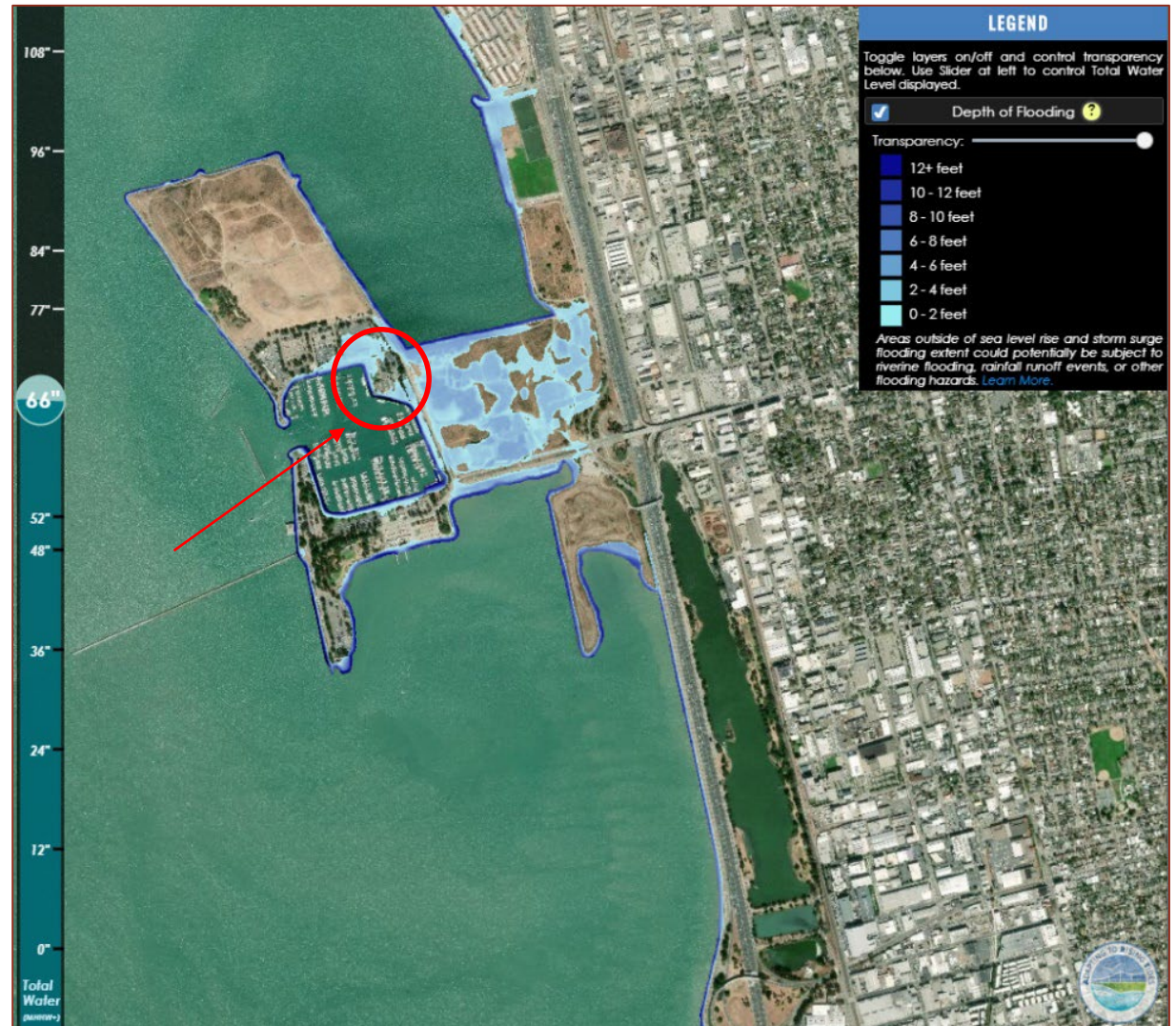
- South of University Avenue between West Frontage Road and Marina Blvd.





# Actions

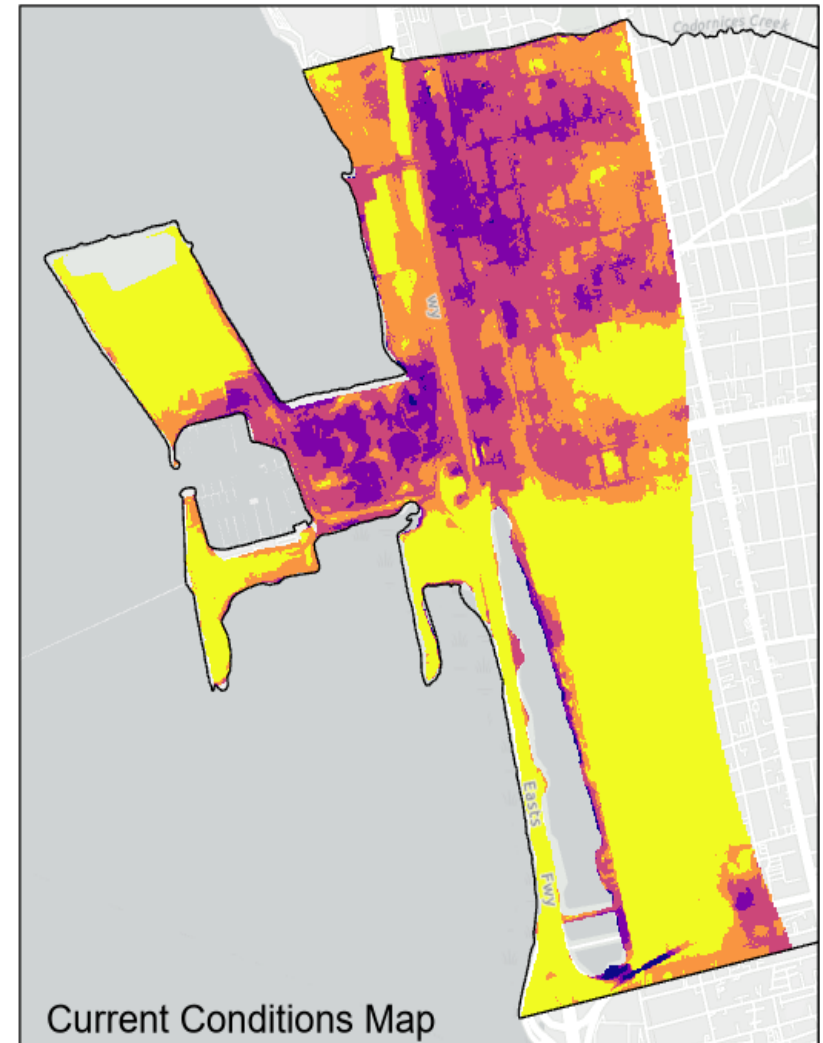
- Northeast corner of inner-harbor



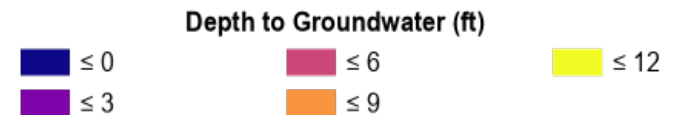


# Actions

- Conduct a groundwater study on impacts of groundwater rise combined with sea level rise on underground toxic materials



Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community Pathways  
Climate Institute, San Francisco Estuary Institute





# Thank You for Watching!

More information on the Local Hazard Mitigation Plan

# Tsunami





# Agenda

- Tsunami Information
  - What is a tsunami?
  - Where is it in Berkeley?
  - What could be affected by a tsunami?
- Mitigation Strategy Actions
- Community Readiness Steps

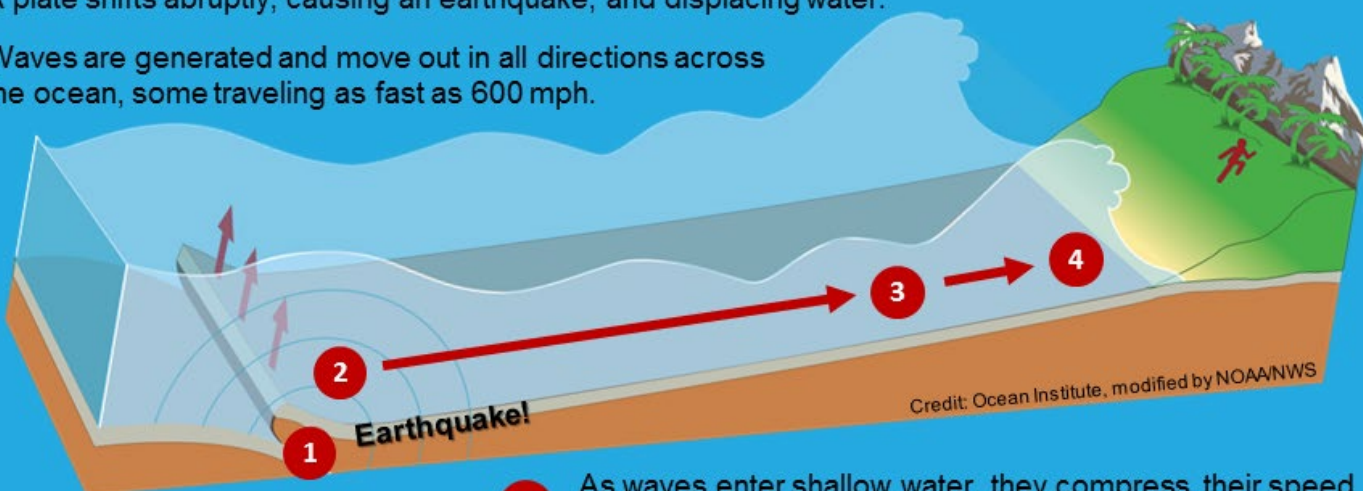
# What is a Tsunami?

# What is a Tsunami?

## How a Tsunami Works

Most tsunamis are caused by large earthquakes below or near the ocean floor.

- 1 A plate shifts abruptly, causing an earthquake, and displacing water.
- 2 Waves are generated and move out in all directions across the ocean, some traveling as fast as 600 mph.
- 3 As waves enter shallow water, they compress, their speed slows, and they build in height.
- 4 The wave height increases, and associated currents intensify, becoming a threat to life and property.



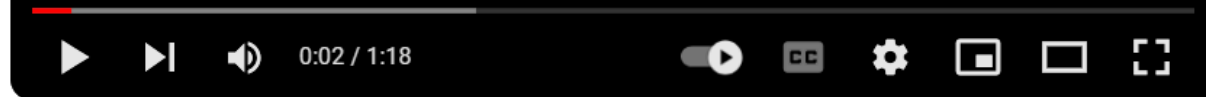
Credit: Ocean Institute, modified by NOAA/NWS

   
weather.gov/tsunamisafety



# Berkeley, California Marina Friday March 11, 2011

## Tsunami surge enters harbor



Berkeley Marina Tsunami



**Yachtblackgold**  
1 subscriber

**Subscribe**

👍 11



➦ Share



[https://www.youtube.com/watch?v=r\\_Z07BOolmc](https://www.youtube.com/watch?v=r_Z07BOolmc)



Tonga tsunami surge into the Berkeley Marina



**Berkeleyside**  
739 subscribers

**Subscribe**

👍 5



🔗 Share

⬇️ Download



[https://www.youtube.com/watch?v=hdANpkJ\\_Xzc&t=17s](https://www.youtube.com/watch?v=hdANpkJ_Xzc&t=17s)



### Tsunami Wrecks Marina in Santa Cruz California



**WDEF News 12**  
9.93K subscribers

**Subscribe**

 348



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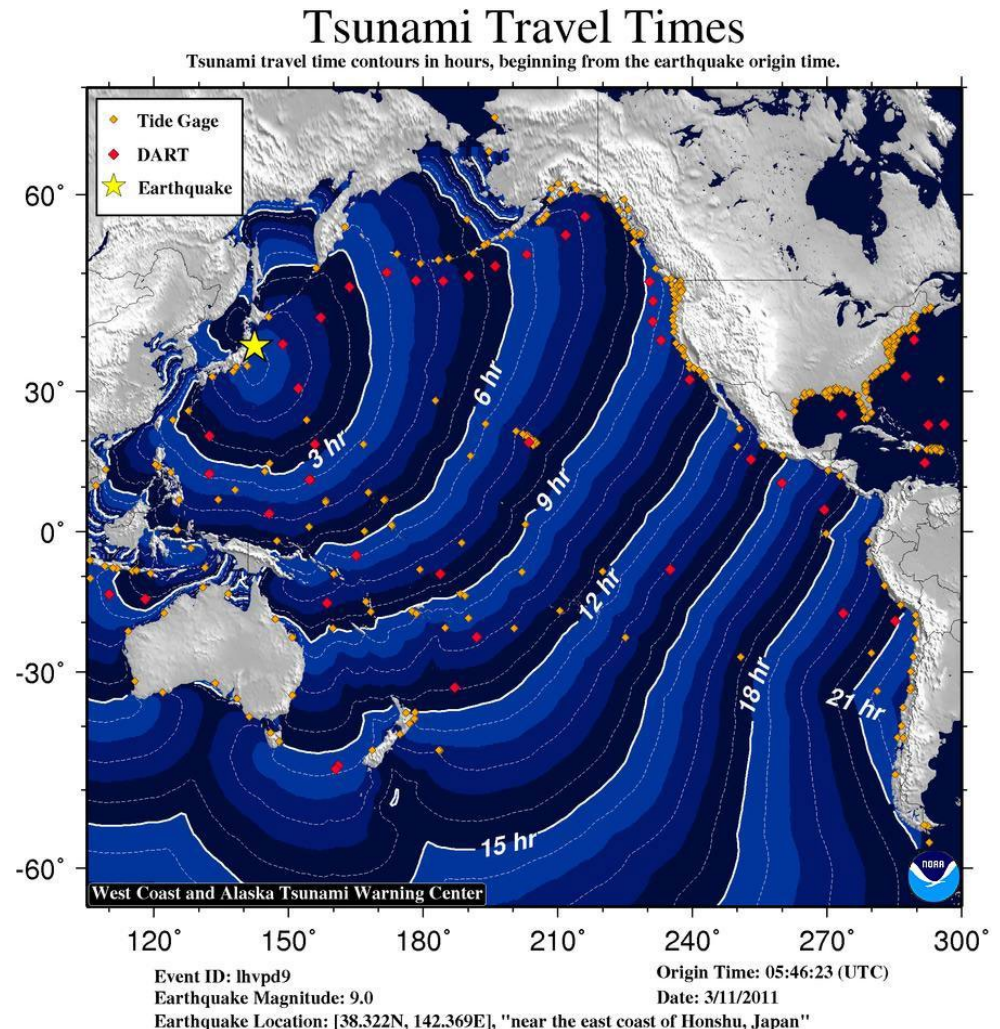


<https://www.youtube.com/watch?v=C0Afa4pjWg4>



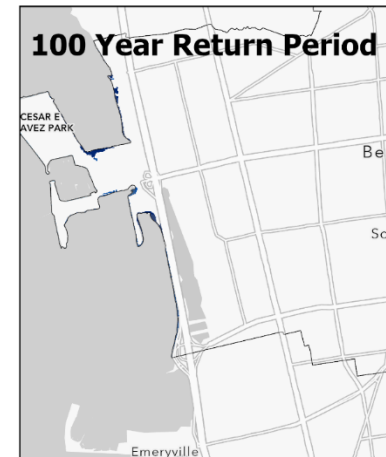
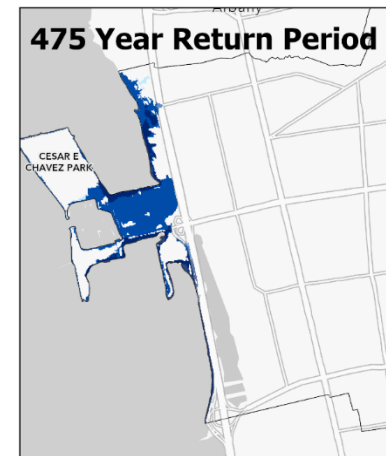
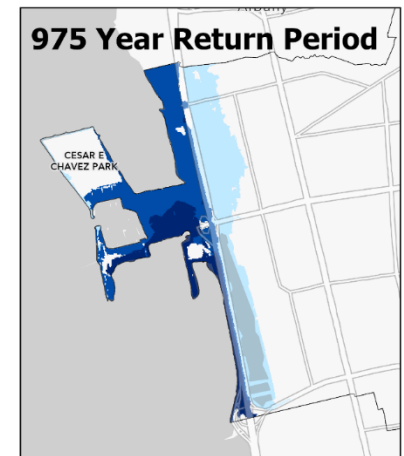
# What is a Tsunami?

- Tsunamis affecting the Bay Area can result from **offshore earthquakes within the Bay Area, or from very distant events.**
- Tsunamis impacting the Bay Area are usually generated by faults in Washington and Alaska.



# Where is it in Berkeley?

Tsunamis would mostly impact the areas of Berkeley near the Bay. From the coast to about sixth street is considered the tsunami zone. The area that we watch the most is the marina and the maritime community.



Amplitude in Meters

≤ 3.4

≤ 3.73

≤ 4.05



0.1 0.25 0.5 Miles

State of California, 2023. Probabilistic Tsunami Hazard Analysis Raster Data – Version 1, California Geological Survey and AECOM Technical Services; dated 2023.

California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

# Mitigation Strategy Actions



# Mitigation Strategy Actions

- Continue to repair and replace damaged finger docks.
  - Complete the demolition and replacement of D&E docks.
  - Consider reconstruction or repairs to J L M N and O docks as funding becomes available.



A look back: A broken dock in the marina after the March 11, 2011, tsunami entered the bay. Credit: [Betsy Dorsett](#)

# Mitigation Strategy Actions

- Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to **document and explore additional tsunami hazard mitigation measures for Berkeley's maritime communities.**



FEMA



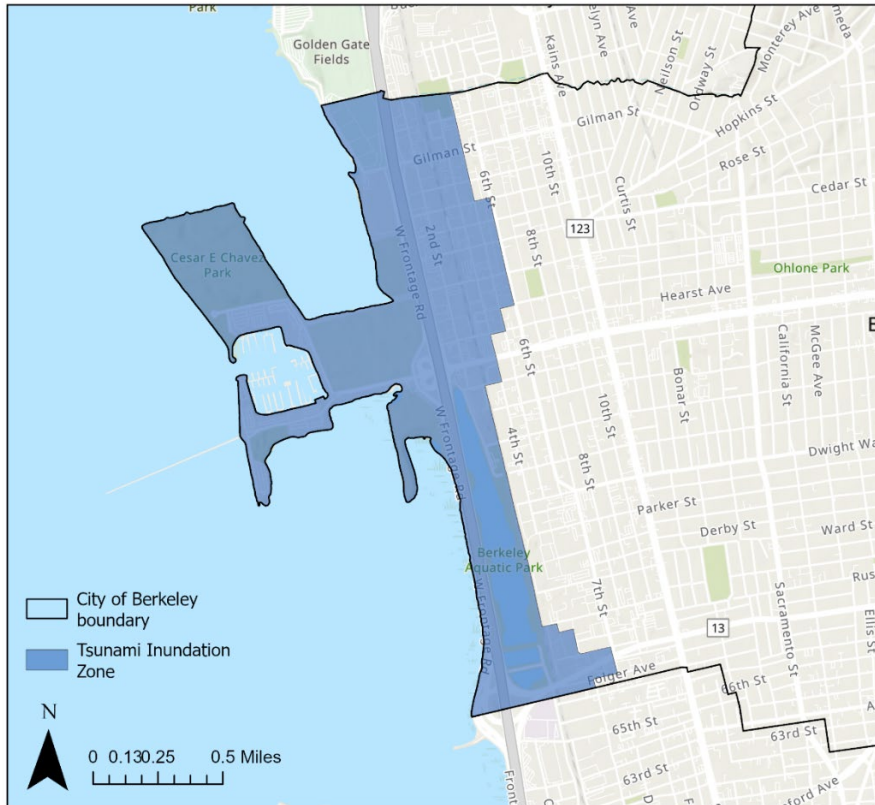
*Cal* OES  
GOVERNOR'S OFFICE  
OF EMERGENCY SERVICES



California  
Department of  
Conservation

# Community Readiness Steps





Credits: Tsunami Hazard Area Map, Alameda County; produced by the California Geological Survey and the California Governor's Office of Emergency Services; 2021, mapped at multiple scales.

California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, Esri, NASA, NGA, USGS, FEMA

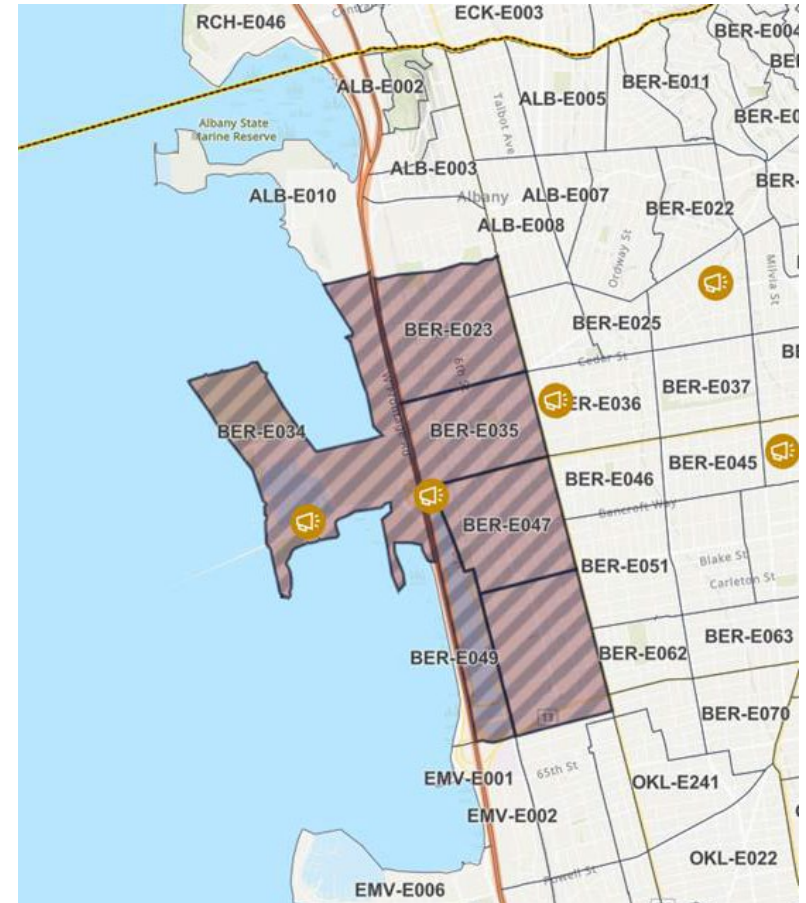
# Community Readiness Steps

- Understand Berkeley's tsunami inundation area to **identify whether you might find yourself in the tsunami inundation zone**

# Community Readiness Steps

| Tsunami Alerts                                                                                                                                      |                                                                                            |                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Alert Name                                                                                                                                          | Actions                                                                                    | Potential Hazards                                                                                            |
|  <b>WARNING</b>                                                    | Get to high ground or inland<br><b>IMMEDIATELY</b><br>Follow tsunami evacuation signage    | <b>DANGER! TSUNAMI IMMINENT!</b><br>Flooding/powerful currents<br>Wave heights > 3 ft. or unknown            |
|  <b>ADVISORY</b>                                                   | Stay out of the water and<br>away from the shore                                           | <b>STRONG CURRENTS AND<br/>DANGEROUS WAVES</b><br>in or very near coastal water<br>Wave heights of 1 - 3 ft. |
|  <b>WATCH</b>                                                     | Be prepared to take action<br>Stay tuned to local radio/TV/<br>NOAA "alert" weather radios | <b>TSUNAMI IS POSSIBLE</b><br>Alert level may change once<br>more information is known                       |
|  <b>INFORMATION<br/>STATEMENT</b>                                | No action needed                                                                           | <b>NO TSUNAMI IMPACT EXPECTED</b><br>Alert level may change once<br>more information is known                |
| <b>THREAT Message: Intended to alert international partners only. Not applicable to U.S. coasts</b>                                                 |                                                                                            |                                                                                                              |
| <b>THE NATIONAL TSUNAMI WARNING CENTER ISSUES OFFICIAL TSUNAMI ALERTS.<br/>CHECK TSUNAMI.GOV OR WEATHER.GOV WEBSITES FOR TSUNAMI ALERT DETAILS.</b> |                                                                                            |                                                                                                              |

- Bookmark and get familiar with **Berkeley's Emergency Map**





# Community Readiness Steps

- **Personal Preparedness**
  - Sign up for **AC Alert**.
  - Get familiar with the emergency tones from **Berkeley's Outdoor Warning System**.



# Community Readiness Steps

- If you live in the tsunami inundation zone, **make your household evacuation plan for tsunami**, including:
  - Where will you go – east, out of the tsunami zone
  - What will you pack
  - How will you get there, using which routes
  - Who can help if you need it





# My household will pack...

## Distant Source Tsunami

- Items to be safe and comfortable while you are away
- Medications, prescriptions, and medical devices
- Computers, electronics & chargers
- Irreplaceable items (family treasures, art, photo albums)
- Other Valuables

## Near Source Tsunami

- **Go-bag (backpack)** with basic items:
  - Flashlight/headlamp
  - Area map, marked with driving/ walking evacuation routes
  - printed list of phone numbers and email addresses for important contacts
  - battery-powered radio and extra batteries
  - prescriptions or critical medications
  - extra eyeglasses or contact lenses
  - extra set of keys
  - cell phone charger
  - copies of important documents
  - toiletries and change of clothing
  - hand sanitizer
- **As you leave, grab:** Wallet, cell phone



# Community Readiness Steps

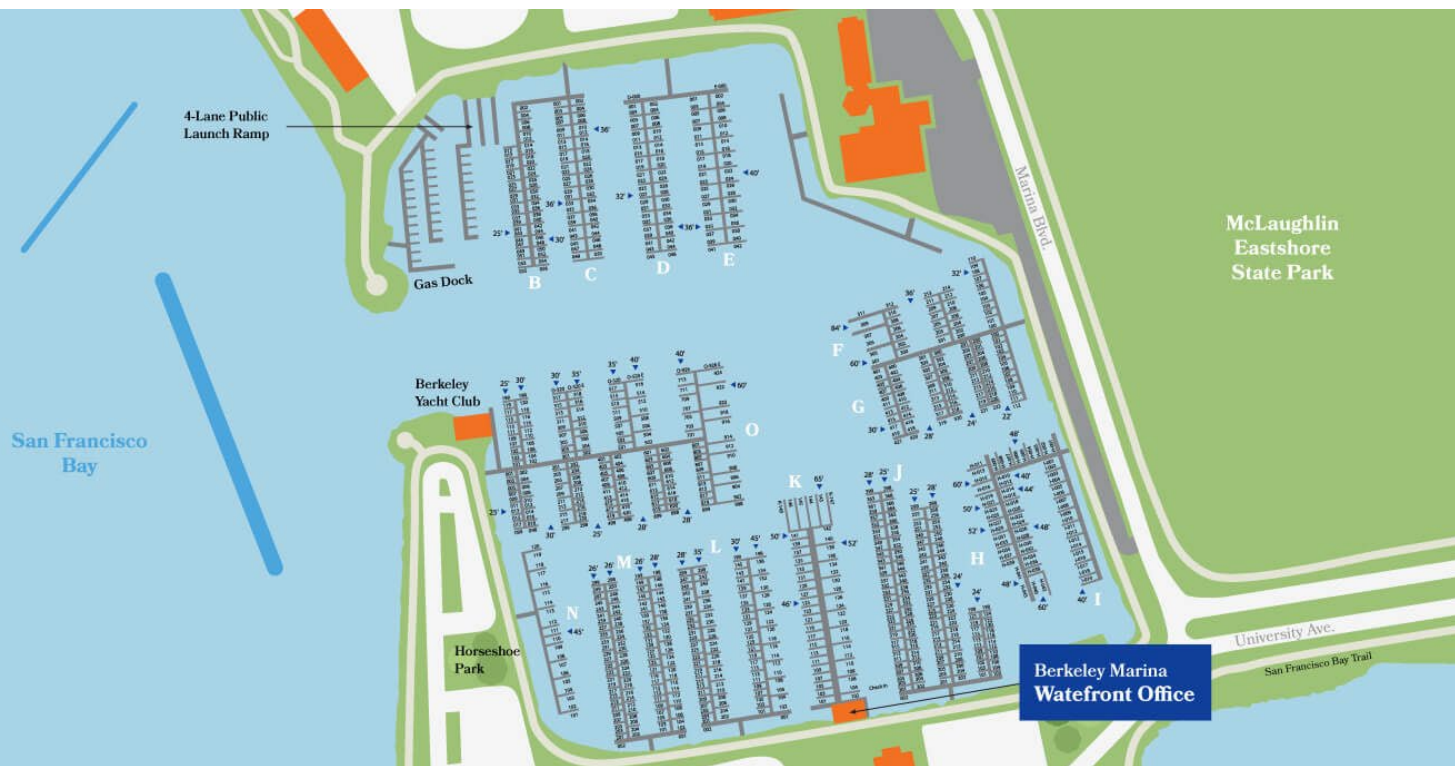


# Maritime Community

# Maritime Community

The City of Berkeley will evacuate docks and shut them down within 1 hour of a tsunami's estimated arrival.

## Berkeley Marina CALIFORNIA





# WHAT IS COVERED BY *Boat Insurance?*



# Maritime Community

Make sure your boat is secured and ready. Keep in mind that the City will shut down the dock 1 hour before the tsunami's anticipated arrival time.





# Maritime Community

Make sure your boat is secured and ready. Keep in mind that the City will shut down the dock 1 hour before the tsunami's anticipated arrival time.

- Secure your boat to the dock and tie down any loose gear.
- Check your dock line condition and replace any worn dock lines.
- Do not install fendering to the dock.
- Remove as much loose boating gear onboard as possible, especially electronics and important documents. Any gear that will remain on your boat should be secured.
- Turn off and disconnect shore power cords, water supply hoses and propane or other gas valves.
- Secure and lock all hatches and port holes. Check for leaks, and seal them as necessary.



# LHMP Hazard Presentation

# Utility Interruption

# Possible Utility Interruption

- Natural Gas
- Electrical Services
- Water and Wastewater Services
- Telecommunications





## Always Remember...

In an emergency, you should *only turn off*  
**gas and electricity** *if instructed* to do so by  
the utility company or fire department,  
or  
*if you suspect a gas leak* (smell or sound)

**Do not try to turn the gas and electricity back on yourself**



**Ask a qualified professional or PG&E**

# Gas Safety





- Natural gas is *lighter than air* and is likely to not be felt in the event of a leak
- Natural gas detectors are a *must!*
  - Place them in the house and test regularly



# Gas (PG&E)

## How to secure your home?

1. Locate and clearly label the gas shutoff valve(s)
2. Know how to shut off the gas
3. Have proper non-sparking tools for shutting off gas
4. Have your building and appliances inspected to make sure they can withstand an earthquake
5. If you are unsure of how to shut off the gas properly and safely, you should never attempt to do so!!

# Gas (PG&E)

## Gas Safety Tips

- Never use a flashlight, match or candle to look for gas leaks
- Do not store flammable materials near any gas appliance
- Do not store combustible materials near any gas appliance
- Stock your house with a fire extinguisher

## Signs of a natural gas leak



Smell



Sound



Sight



# Gas (PG&E)

## Gas Safety during an *earthquake*

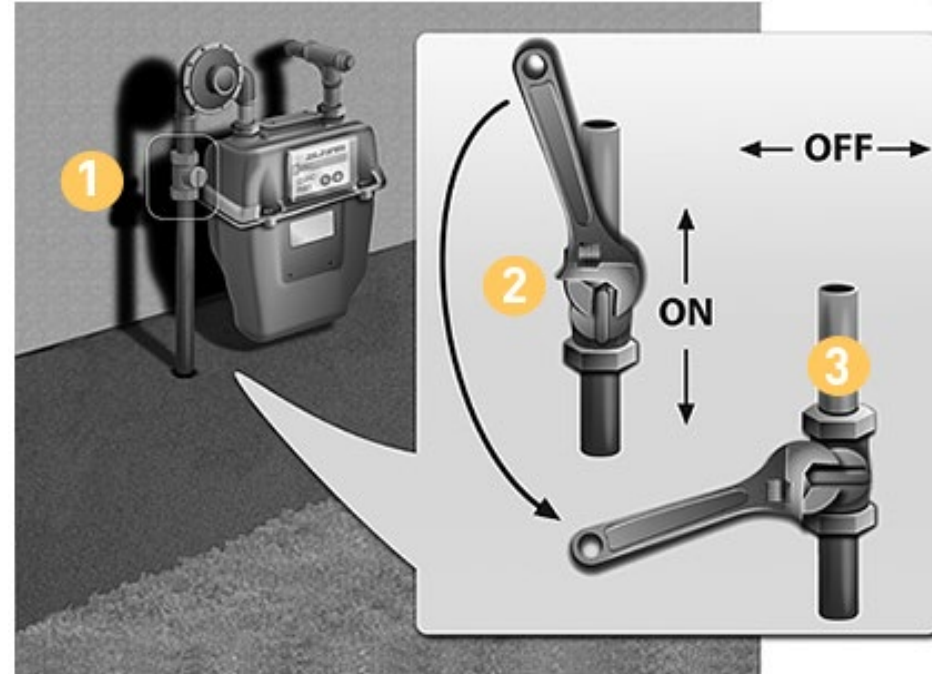
- Turn off the stove if you're cooking before you take cover
- Stay away from buildings and power lines if you're outdoors



# Gas (PG&E)

## How to turn off your gas

1. Locate the main gas shutoff valve
2. Have a wrench handy
3. Give the valve a quarter turn



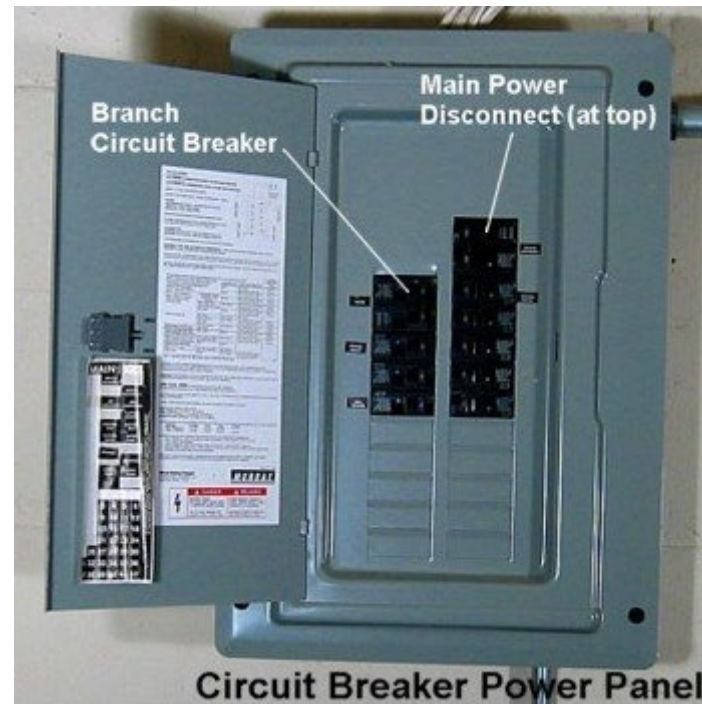
# Electrical Emergency



# Electrical Emergency

## Prior to a disaster...

- Locate & Label your electrical panel
- Remember to always shut off all the individual circuits before shutting off the main circuit breaker



# Electrical Emergency

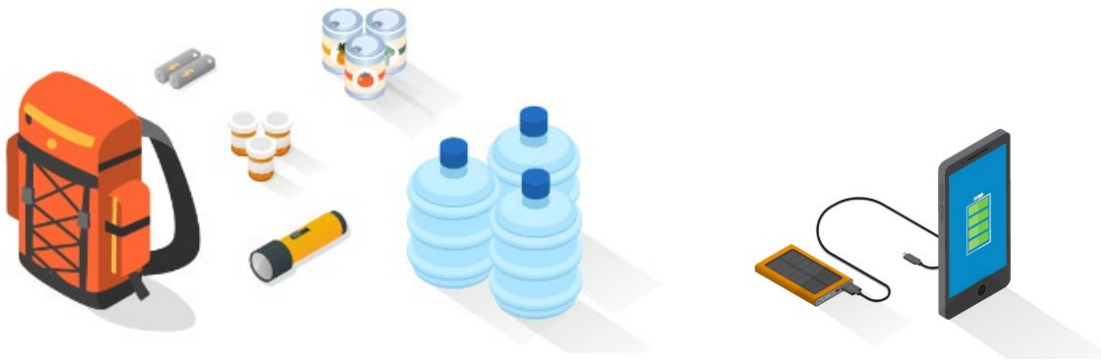
## During and right after the disaster...

- Unplug major appliances
- Locate the circuit breakers or fuses and know how to shut off the power
- Turn on the main switch or breaker first, then screw in the fuses or switch on the smaller breakers, one at a time
- Never step in water to turn off the electricity, *call a professional*



# Tips to Prepare for a Power Outage

- Make sure PG&E can reach you to alert you of a possible power outage by calling 1-800-743-5000 and updating your contact information
- Pack an emergency supply kit
  - Food, water (1 gal/person/day), medications, flashlights, batteries, and important documents
  - Fully charge your phone and consider having a battery-powered portable charger





# Tips to Prepare for a Power Outage

- Practice opening and closing your garage door manually
- If you have a car, be sure to fill the tank
- If you own an electric vehicle, make sure you have enough charge
- Keep cash on hand



# How to Protect Yourself and Others During a Power Outage

- Turn off or disconnect appliances, equipment or electronics
- Use food supplies that do not require refrigeration
- Use alternate plans for refrigerating medicines or power-dependent medical devices
- Go to a community location with power
- Avoid carbon monoxide poisoning



# How to Protect Yourself and Others During a Power Outage

Make a plan to stay safe and comfortable during power outages

- Think about: What will you need to stay warm? To keep food cool? To operate any medical devices?
- Think of family, friends, or a hotel you could stay with when your home is affected by a long-term power outage





# Downed Power Lines



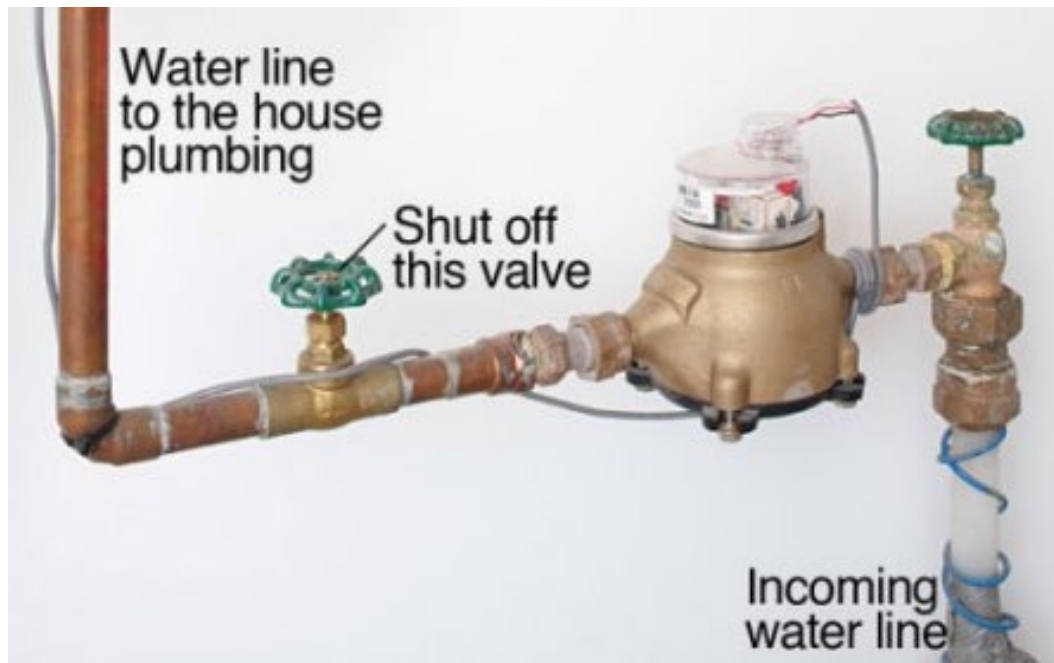
**If you see a downed power line, stay away and call 9-1-1.**

**Do not touch them. Do not touch anything that is touching the lines. Do not drive over them.**

# Water

# Water in an Emergency

## How to shut off water...



Locate your valve and learn how to shut it off



# Water Storage for Emergencies

**Goal: 1-2 gallons per person per day for 2 weeks**

*Family of 3: 2 gallons x 3 people x 14 days = 84 gallons total*

*Family of 4 = 112 gallons*

# Water Storage Options

## To consider:

- Cost
- Easy for storage or moving
- Required maintenance
- How easy it is to get and to use the water in an emergency



## Options:

- Gallons of Water
- Water Barrel
- Water Cubes
- Canned Water



# Water Storage Options

## Option 1: Gallons of Water from the Dollar Store

- Very low cost
- Easy storage/moving
  - Store this water in a cool, dark place
- Frequent refreshing required
  - Has an expiration date (12 - 18 months)
  - After expiration is still good for handwashing and other sanitation
- Easy to use in an emergency





# Water Storage Options

## Option 2: Water Barrel (55 gallons is standard size)

- Medium cost
  - Example is \$120
- Larger storage space required/challenging to move
  - Optional drum dolly is \$65
- Refreshing not frequently required
- More challenging to use in an emergency



# Water Storage Options

## Option 3: Water Cubes

- High cost
  - Examples: \$132 for 27 gallons and \$180 for 35 gallons
- Easy storage/moving
- Refreshing not frequently required
- Easy to use in an emergency



# Water Storage Options

## Option 4: Canned Water

- Very high cost
  - \$30 - \$45 for 24 12-oz cans (2.25 gallons)
- Easy storage/moving (but requires more space)
- No refreshing required
- Very easy to use in an emergency





# Useful Tips for Water Storage

## Other items to consider having on hand

- Collapsible Water Storage
- Camp Stove
- Bleach



### Disposal of “Expired” Water

When disposing water from any kind of jug, use it to water plants or fill your pool or it's not legal to pour clean water down a storm drain

# Wastewater

# Wastewater System Disruption

## Plan for **alternative bathroom options**

- Flush out any water still in the bowl, put some kitty litter/ peat moss/ lime to absorb liquid and reduce odors into the inner bag, and **go to the bathroom in the inner bag**.

Or

- Use a **large bucket**. A toilet seat can be added.



**DO NOT FLUSH**





# Wastewater System Disruption

**Avoid contact** with the sewage as it may contain harmful pathogens



# Telecommunications

# Telecommunication Disruptions

## How to prepare

- Establish a backup communication with your family
  - Choose a meeting place and time
- Explore alternative sources of information and entertainment
  - Battery-powered AM/FM radio
- Print important documents or save them to a thumb drive

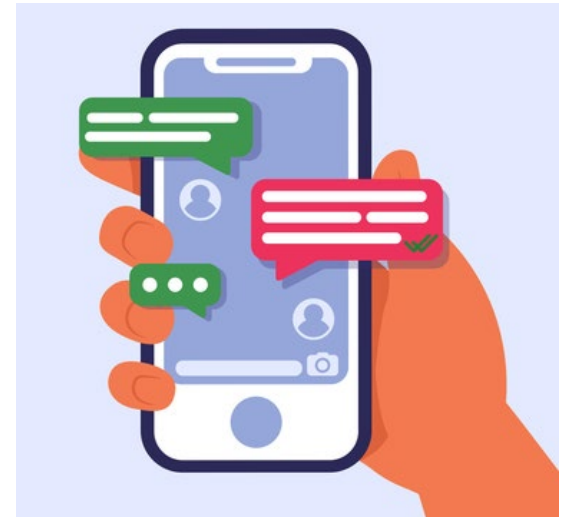




# Telecommunication Disruptions

## During an emergency

- Texts over Phone Calls
  - A text message may go through when voice calls cannot because it requires less bandwidth from the cellular network
- If internet still works, switch your phone's settings to turn on "Wi-Fi" calling to make calls through the internet



# Next Steps



## Next Steps Today!

- Mitigation plan:
  - Share your top mitigation actions and other ideas
  - Full draft plan available in 2024
  - [Mitigation@BerkeleyCA.gov](mailto:Mitigation@BerkeleyCA.gov)



- <https://www.phlush.org/set-up-and-use-your-emergency-toilet/>
- [https://madisonparktimes.com/news/2023/sep/10/after-an-earthquake-the-art-of-managing-pee-and-poop/#:~:text=Simple%20twin%20bucket%20toilets&text=Create%20two%20makeshift%20toilets%20from,bowel%20movements%20\(poop%20bucket\).](https://madisonparktimes.com/news/2023/sep/10/after-an-earthquake-the-art-of-managing-pee-and-poop/#:~:text=Simple%20twin%20bucket%20toilets&text=Create%20two%20makeshift%20toilets%20from,bowel%20movements%20(poop%20bucket).)

# Check This Out

- Gas Safety Tips (PG&E) [https://www.pge.com/en\\_US/safety/gas-safety/gas-safety-tips.page#p3](https://www.pge.com/en_US/safety/gas-safety/gas-safety-tips.page#p3)
- Gas Safety during an Earthquake (PG&E) [https://www.pge.com/en\\_US/safety/emergency-preparedness/natural-disaster/earthquakes/earthquakes.page](https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/earthquakes/earthquakes.page)
- Emergency Preparedness Kit (PG&E) [https://www.pge.com/en\\_US/safety/emergency-preparedness/preparedness-kit/emergency-preparedness-kit.page](https://www.pge.com/en_US/safety/emergency-preparedness/preparedness-kit/emergency-preparedness-kit.page)
- Emergency Tips (PG&E) [https://www.pge.com/en\\_US/safety/emergency-preparedness/emergency-preparedness.page](https://www.pge.com/en_US/safety/emergency-preparedness/emergency-preparedness.page)
- Evaluate your building (PG&E) [https://www.pge.com/en\\_US/safety/emergency-preparedness/natural-disaster/earthquakes/earthquake-safety-evaluate-your-home.page](https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/earthquakes/earthquake-safety-evaluate-your-home.page)
- Gas Shut Off devices [https://www.pge.com/en\\_US/residential/outages/planning-and-preparedness/safety-and-preparedness/gas-shutoff-devices/gas-shutoff-devices.page](https://www.pge.com/en_US/residential/outages/planning-and-preparedness/safety-and-preparedness/gas-shutoff-devices/gas-shutoff-devices.page)
- Electrical Safety (PG&E) [https://www.pge.com/en\\_US/safety/electrical-safety/turning-your-electricity-on-and-off/turning-your-electricity-on-and-off.page](https://www.pge.com/en_US/safety/electrical-safety/turning-your-electricity-on-and-off/turning-your-electricity-on-and-off.page)

# Check This Out

- Water SMART (EBMUD) pdf  
[https://www.ebmud.com/index.php/download\\_file/force/9214/0/](https://www.ebmud.com/index.php/download_file/force/9214/0/)



# Hazard Presentation

Wildland-Urban Interface Fire

The hazard, the City's work, and steps to stay safe

# Wildland Urban Interface (WUI) Fire



## What is a WUI Fire?

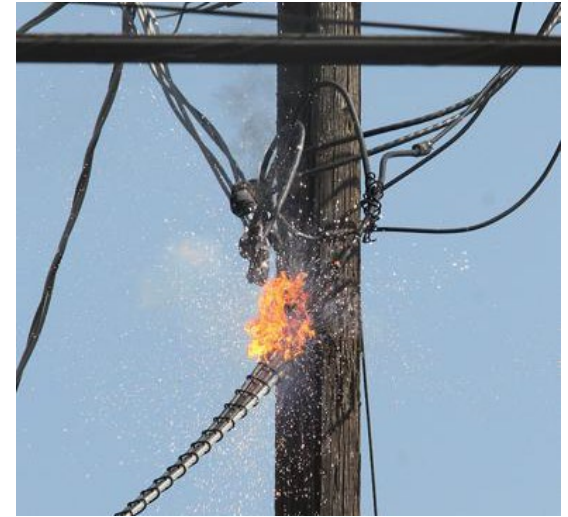
It occurs where the **natural landscape** and **urban-built environment** meet or intermix



# Sources of Ignition

## **HUMAN activity and NATURAL causes:**

- Power lines
- Sparks from campfires
- Fireworks
- Cigarettes
- Arson
- Lightning strikes



## **Dangerous Conditions for WUI Fire Spread**

- **Weather:**
  - Fall Time
  - High Sustained Winds
  - Offshore Winds
  - Low Humidity
  - Hot Temperatures
- **Fuel**
  - Dry Vegetation



## Climate Change

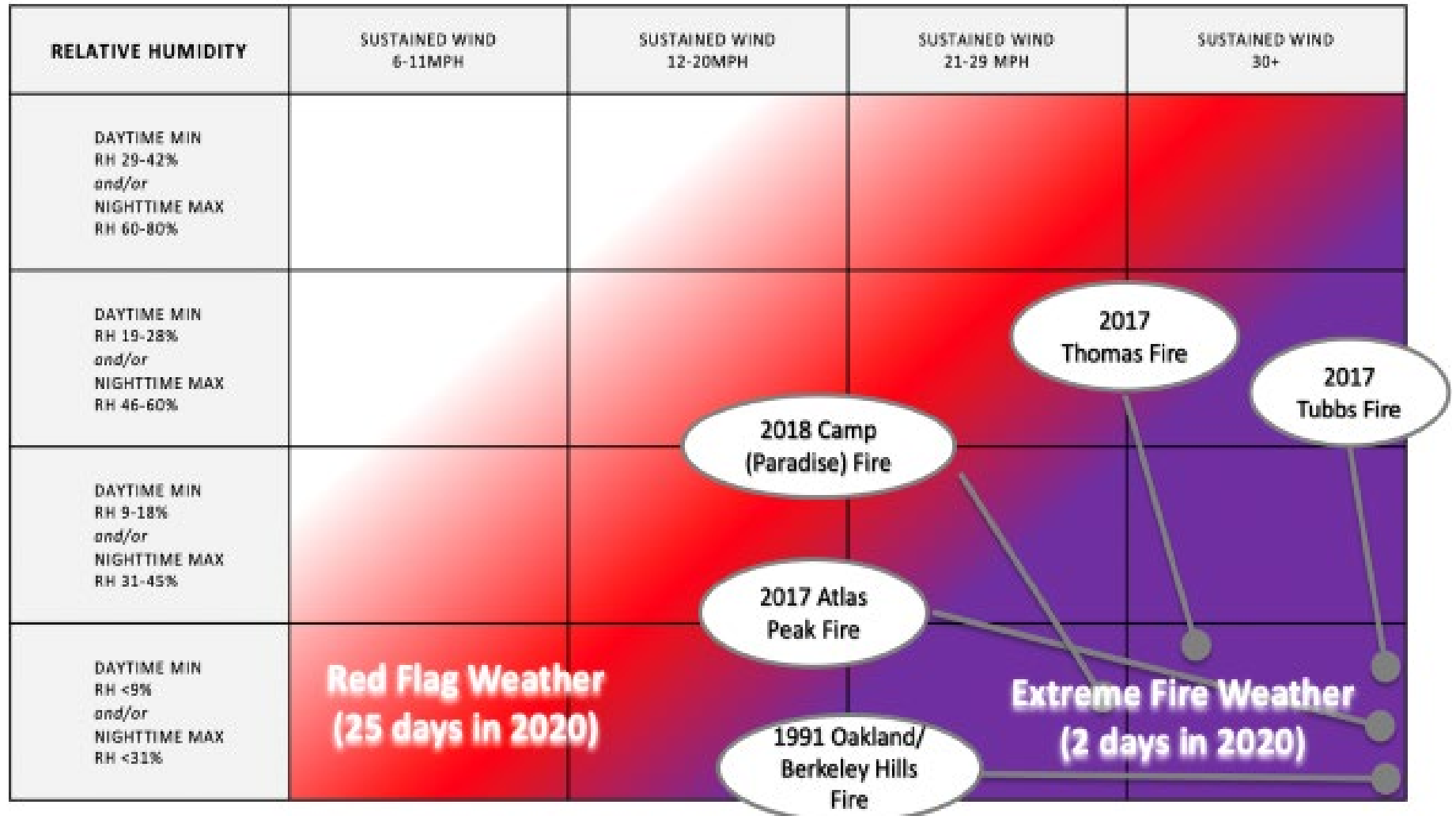
longer and drier  
summer conditions

increasing frequency  
and duration of wildfires





# Fire Weather: Know When to Go

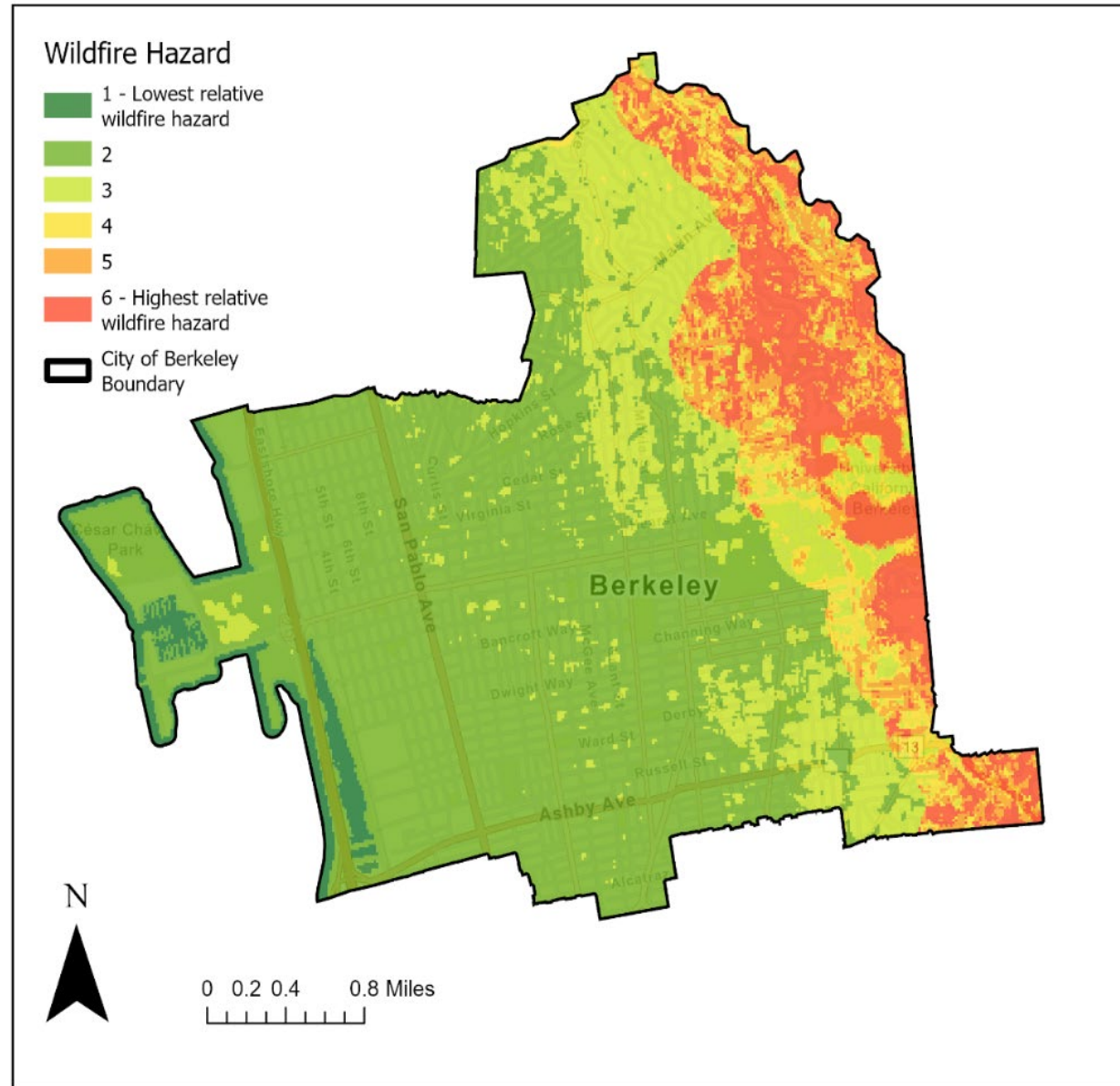


## WUI Fires:

- Increase landslide risk
- Increase air pollution
- Can lead to power outages



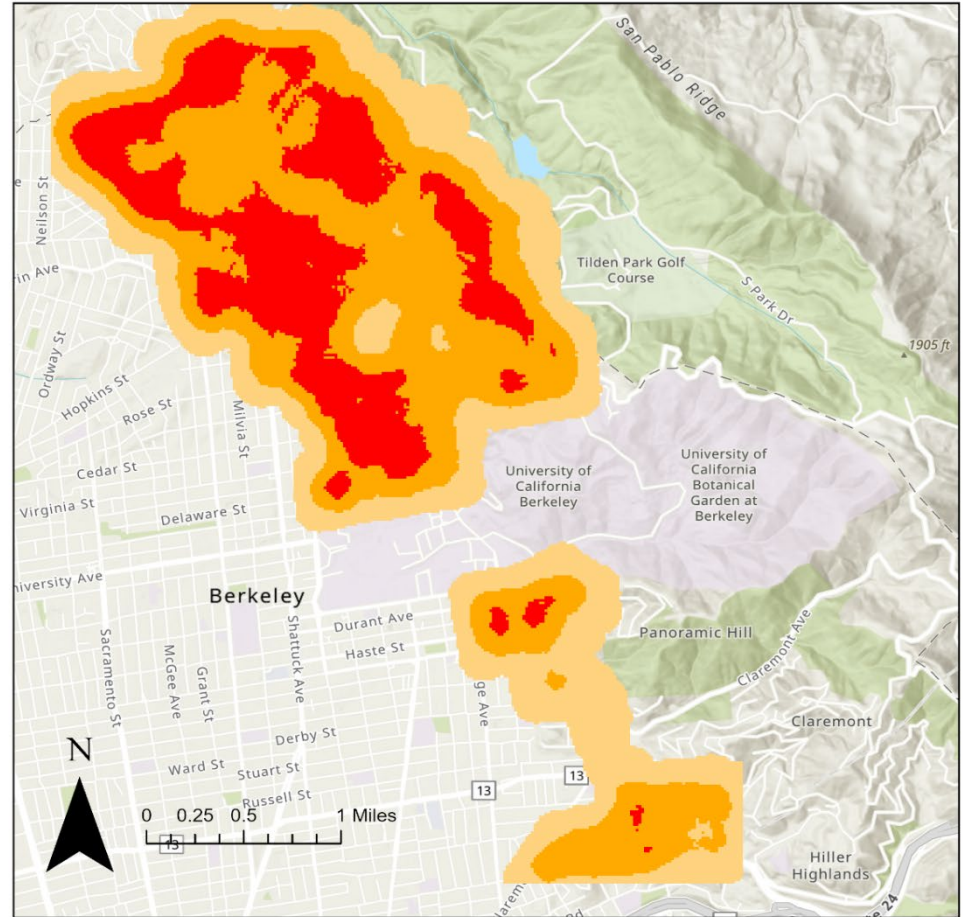
# Wildfire Hazard



Sources: 2020 Alameda and Contra Costa County Wildfire Risk to Structures and Wildfire Hazard Maps for Fire Prevention Planning, East Bay Regional Parks, et al.  
California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS



# Structure Density in Berkeley Fire Zones 2 & 3



California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA

Structure density per acre



0.001 - 2

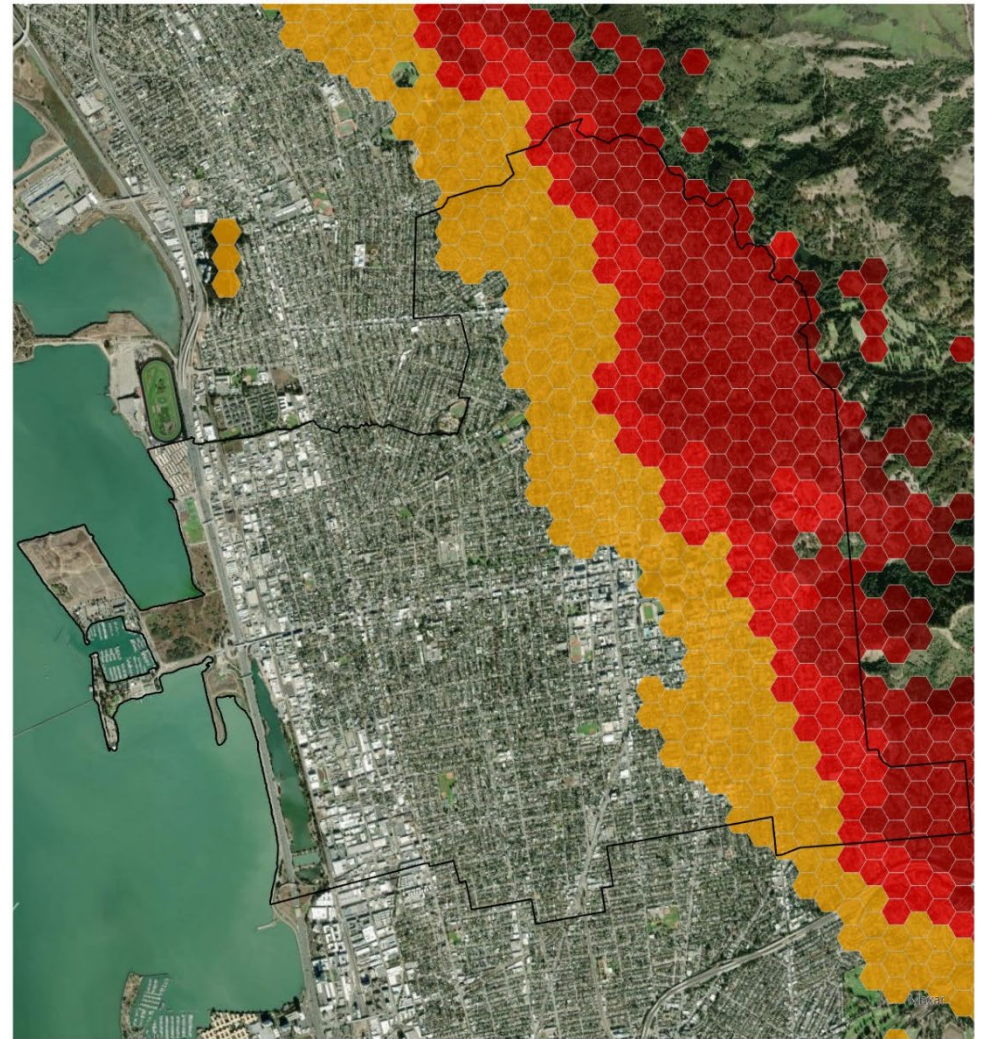


2.001 - 4



Greater than 4

# Wildfire Risk to Structures in the Berkeley Hills



East Bay Regional Park District, CAL FIRE, Tukman Geospatial, NV5, City of Berkeley OES. 3/24/2024

## Wildfire Risk to Structures

- Moderate Hazard
- High Hazard
- Very High Hazard
- Highest Hazard



0 0.5 1 2 Miles

# **2024 Draft Mitigation Plan: WUI Fire Strategy**

City Mitigation Actions



# Coordinate regional wildfire mitigation strategies with key partners and stakeholders

- East Bay Hills Wildfire Prevention Coordination Group
- Hills Emergency Forum



# Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.

- Enforce requirement for fire fuel clearance on public roadways.
- Clear hazardous vegetation along evacuation routes in Fire Zone 2.



## Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.

- Increase parking enforcement in fire-vulnerable areas during fire weather.
- Maintain and improve roadways in Fire Zones 2 and 3.





# Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.

- Publicize up-to-date maps of all emergency access and evacuation routes.
- Maintain signage and paths as-needed
- Coordinate with the Berkeley Path Wanderers
- Install handrails



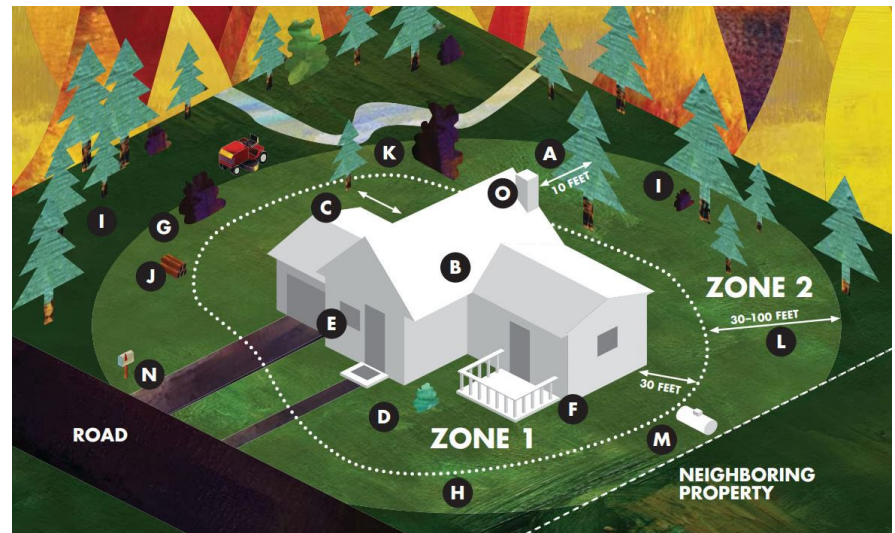
# Mitigate wildfire risk to Berkeley's overnight camps.

- Analyze fire risk at overnight camps and identify appropriate mitigation actions.



# Reduce fire risk in existing development through fire code updates and enforcement.

- Adjust inspection cycle annually based on climate change
- Annual building inspections in all Fire Zones.
- Defensible Space Inspections in Fire Zones 2 and 3.





# Reduce fire risk in existing development through fire code updates and enforcement.

- YouthWorks to staff Defensible Space inspections in Fire Zones 2 and 3.



# Reduce fire risk in existing development through fire code updates and enforcement.

- Update the Fire Code with more stringent local amendments



# Reduce fire risk in existing development through vegetation management.

- Explore options on private and public property.
- Maintain Weekly Curbside Plant Debris Collection
- Pursue external funding for vegetation management work and community education





# Reduce fire risk in existing development through vegetation management.

- Maintain Fire Fuel Debris Bin Program
- Maintain Fire Fuel Abatement Program on Public Land with technical assistance from WUI Division
- Continue to allocate UC Settlement Funding to do vegetation management projects on UC Berkeley properties.
- Maintain citywide fire fuel chipper program



# Reduce fire risk through residential assistance program.

- Continue to implement Resident Assistant Program pilot to provide home hardening materials and defensible space materials and instructions to low income residents in targeted high fire risk areas.



## Reduce fire risk through utility undergrounding.

- Urge PG&E to undergrounding line in Berkeley's Very High Fire Hazard Severity Zone (VHFHSZ) to mitigate wildfire risk and limit evacuation and ingress obstruction. Coordinate efforts with the State of CA Public Utilities Commission, and elected officials.





# **Reduce wildfire risk throughout Berkeley by implementing the Action Plan identified in the Community Wildfire Protection Plan (CWPP).**

- Implement the Action Plan in the CWPP.



# Household Risk Reduction

## For Berkeley Hills residents (Fire Zone 2 & 3)

- Review home's **Defensible Space Report** and follow the instructions on defensible space and home hardening.



**#FireSafeFriday**

**Self-Inspection Checklist**  
To prepare for your Defensible Space inspection

**General Requirements - REQUIRED BY LAW IN ZONES 1 & 2**

**REMOVE:**

- Dead and dying vegetation including trees, shrubs, vines, grass, weeds, and piles of vegetation.
- Overhanging dead limbs within 10 ft. of a structure.
- Dead and dying vegetation within 10 ft. of a structure.
- Dead and dying vegetation within 10 ft. of a structure.

**TRIM & LIMIT:**

- Trim and limit vegetation within 10 ft. of a structure.
- Trim and limit vegetation within 10 ft. of a structure.
- Trim and limit vegetation within 10 ft. of a structure.

**DISCATE & INSTALL:**

- Discate and install vegetation within 10 ft. of a structure.
- Discate and install vegetation within 10 ft. of a structure.
- Discate and install vegetation within 10 ft. of a structure.

**Did you receive your checklist in the mail?**  
If not, download a copy at [berkeleyfiresafe.org](http://berkeleyfiresafe.org)



# Protect your home

**Create a  
defensible space  
buffer around  
your home**



## Know Your Zones

- ZONE 0** 0-5 feet from a structure
- ZONE 1** 5-30 feet from a structure
- ZONE 2** 30-100 feet from a structure

Watch videos and learn how to establish Defensible Space:  
[BerkeleyFireSafe.org/dspace](https://BerkeleyFireSafe.org/dspace)

## Harden your home to protect it against fire

- Install a fire resistive roof
- Clear and maintain decks and covered porches
- Non-combustible gutter guards
- Ensure exterior vents will block wind-blown embers



Learn about Home Hardening:  
[BerkeleyFireSafe.org/Harden](https://BerkeleyFireSafe.org/Harden)

# All Berkeley residents



## Use the free Citywide Berkeley Chipper Day Program

- Curbside pickup
- Chipping
- Disposal of vegetation material



# Be ready for emergency alerts

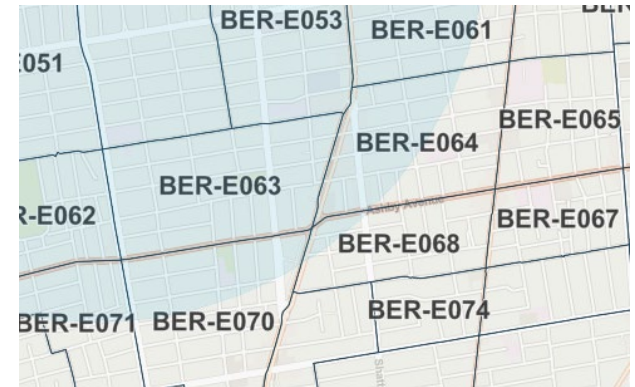
## Cell phone alerts

[AC Alert.org](https://acalert.org)



## Berkeley's Emergency Map

[Protect.Genasys.com](https://protect.genasys.com)



## Berkeley's Outdoor Warning Siren System

[Soundcloud.com/cityofberkeley](https://soundcloud.com/cityofberkeley)



# Plan for Fire Weather

- Everyone: plan to stay out of the hills during extreme fire weather
- Hills residents: Make your household fire weather plan.
  - When will you leave?
  - Where will you go?
  - What will you pack?
  - Who can help you?



Make your Household Fire Weather Plan:

[BerkeleyCA.gov/Wildfire](https://BerkeleyCA.gov/Wildfire)

# Next Steps





## Next Steps Today!

- Mitigation plan:
  - Full draft plan available at [BerkeleyCa.gov/Mitigation](https://BerkeleyCa.gov/Mitigation)
  - Share your top mitigation actions and other ideas: [Mitigation@BerkeleyCA.gov](mailto:Mitigation@BerkeleyCA.gov)

## Summary of Changes to the City of Berkeley's 2024 First Draft Local Hazard Mitigation Plan

This document outlines the revisions made to Berkeley's 2024 First Draft Local Hazard Mitigation Plan (2024 First Draft) that are present in the 2024 Final Draft Local Hazard Mitigation Plan.

1. In the Executive Summary, on page ES-5, the following information has been added about the link between growing WUI fire risk and climate change:

Climate change is resulting in longer and drier summer conditions leading to wildfires of greater frequency and duration. Increased drought conditions cause fuels to become extremely dry and more fire prone. Additionally, climate change causes more frequent bouts of extreme weather, including low humidity and high winds associated with fire weather.

2. In the Executive Summary, on page ES-6, the following information has been added:

The fire risk facing the people and properties in the eastern hills is compounded by the area's mountainous topography, **hazardous vegetation**, minimal access and egress routes, and location, overlaid upon the Hayward Fault. Berkeley's flatlands are also exposed to a fire that spreads west from the hills.

3. In Element A: Planning Process, on page A-3 the following information has been added about the Public Review of the First Draft Plan:

In response to this offer, Council Members suggested a presentation to the Safety Committee, which staff gave in July 2024.

4. In Element B: Risk Assessment, on page B-57 the following text was added:

Locations of WUI Fires and Related Hazards.

5. In Element B: Risk Assessment, on page B-68, the following text was added:

### Hazardous Vegetation

Certain plant species, including native and non-native species, have characteristics that make them ignite readily and burn intensely contributing to wildfire risk. Characteristics may include being biologically prone to burn due to chemical composition, being difficult to maintain in a fire-resistant state, presenting challenges to routine maintenance, having high surface area to volume ratio, or being prone to rapid changes in moisture content in response to environmental conditions. While these characteristics make some plants more fire-hazardous, all plants can burn if they are dead, poorly maintained, or drought stressed.<sup>i</sup>

Historically, the East Bay Hills ecosystem burned regularly. Researchers have proposed that under indigenous land management, fires due to both natural and anthropogenic ignitions occurred every 5-15 years.<sup>ii</sup> Fire is this ecosystem's natural way of clearing dead vegetation and maintaining forest health. Many California native plant species present in the East Bay Hills also need fire in order to reproduce.

Living in a fire-prone area means taking steps to mitigate risks while also recognizing that it's infeasible to remove all of our vegetation. The mere presence of a certain fire hazardous species does not always mean it must be removed. Other factors, such as maintenance and placement, are more important than the plant itself. For property owners thinking about their own landscaping, it's great to focus on California native or other pollinator friendly plants that require little water and are easy to maintain. However, "There are no published fire-wise or fire-resistant plant lists that are science based or peer reviewed. Design and maintenance are more important than plant selection."<sup>iii</sup>

To protect life and property, the Berkeley Fire Department inspects all properties in the Very High Fire Danger Severity Zone for Defensible Space, which is the buffer created between a structure on your property and the grass, trees, shrubs, or other vegetation that surrounds it. This may include the removal of certain vegetation within 100 feet from any structure. These mitigation measures, along with home hardening, are the scientifically validated actions that have the most impact on reducing the ignition potential of homes. Failure to comply with recommendations results in citations and fines.

The City, often in collaboration with regional partners, works to remove and clean up the understory of hazardous trees that are likely to burn and potentially impact people and infrastructure. For more information on these programs, review Element C: Mitigation Strategy.

6. In Element B: Risk Assessment, on page B-87, the following section was deleted and added to Element C: Mitigation Strategy, C.5 Household Mitigation Actions (see # below for what was added):

B.3.i Berkeley Household Risk Reduction

7. In Element B: Risk Assessment, on page B-111, the following section was deleted and added to Element C: Mitigation Strategy, C.5 Household Mitigation Actions (see # below for what was added):

B.4.h Berkeley Household Risk Reduction

8. In Element B: Risk Assessment, on page B-126, the following section was deleted and added to Element C: Mitigation Strategy, C.5 Household Mitigation Actions (see # below for what was added):



B.5.h Berkeley Household Risk Reduction

9. In Element B: Risk Assessment, on page B-138, the following section was deleted and added to Element C: Mitigation Strategy, C.5 Household Mitigation Actions (see 21 below for what was added):

B.6.h Berkeley Household Risk Reduction

10. In Element B: Risk Assessment, on page B-151, the following section was deleted and added to Element C: Mitigation Strategy, C.5 Household Mitigation Actions (see 21 below for what was added):

B.7.h Berkeley Household Risk Reduction

11. In Element B: Risk Assessment, on page B-167, the following section was deleted and added to Element C: Mitigation Strategy, C.5 Household Mitigation Actions (see 21 below for what was added):

B.8.h Berkeley Household Risk Reduction

12. In Element B: Risk Assessment, on page B-210, the following section was deleted and added to Element C: Mitigation Strategy, C.5 Household Mitigation Actions (see 21 below for what was added):

B.10.h Berkeley Household Risk Reduction

13. In Element B: Risk Assessment, on page B-220, the following section was deleted and added to Element C: Mitigation Strategy, C.5 Household Mitigation Actions (see 21 below for what was added):

B.11.h Berkeley Household Risk Reduction

14. In Element C: Mitigation Strategy, on page C-5, the following text was added:

Measure T1 provides \$100 million of funding from bond revenue to pay for improvements to City infrastructure and facilities. Berkeley voters passed Measure T1 in November 2016. Measure T1 funds are used for a variety of infrastructure improvements, including upgrading Senior Centers and Community Centers to immediate occupancy and increase their ability to serve the community regularly and during disasters. Future mitigation actions could include upgrading additional buildings and or building new ones.

15. In Element C: Mitigation Strategy, on page C-10 for Expanded Inventory of Potentially Seismically Vulnerable Buildings, the following text was added:

With the launch of the Retrofit Grants Program, staff conducted extensive research to update and refine the City's inventory of potentially seismically vulnerable buildings. In

addition to soft story buildings not currently subject to mandatory retrofit such as those with 3-4 residential units or commercial uses, Berkeley has numerous non-ductile concrete and tilt-up or other rigid wall-flexible diaphragm (RWFD) buildings. **Future expansion includes conducting research to determine other hazardous buildings that should be inventoried and exploring additional mandatory retrofit ordinances.**

16. In Element C: Mitigation Strategy, on page C-12 for Fire Department: WUI Division, the following text was added:

City of Berkeley Fire Department instituted a WUI division in 2021 supported with funding from Measure FF. The WUI Division is primarily responsible for the coordination of wildland mitigation efforts and related inspection activities. **The ability for the Division to expand on mitigation activities is outlined in the Action Plan of the Community Wildfire Protection Plan (CWPP).**

17. In Element C: Mitigation Strategy, on page C-26 the following text was deleted:

Currently, the City is identifying funding to upgrade the MLK Junior Youth Services Center, the Willard Clubhouse, the African American Holistic Resources Center, and the South Berkeley Senior Center.

This text was replaced with:

Currently, the City is using T1 Funds on the MLK Jr. Youth Services Center Retrofit and Renovation project and the Willard Park Clubhouse and Restroom Replacement Project. Both of these facilities will be upgraded to immediate occupancy status, meaning that post earthquake, only limited structural damage will have occurred. The Willard Park Clubhouse is currently under construction and the MLK Jr. Youth Services Center is in the design part of the process. Using T1 and General Funds, the African American Holistic Resource Center is currently in the design part of the process. The African American Holistic Resource Center (AAHRC) will be a facility to house culturally relevant services to help eliminate inequities within Berkeley's African American Community. The vision for the African American Holistic Resource Center is to host services to benefit the community with education, employment, health, mental health, and housing advocacy and supports. It will be built to immediate occupancy status.

Using funds from Measure T1 and funding from a FEMA grant, the South Berkeley Senior Center is being renovated to include disaster preparedness, electrification, energy efficient building systems, and other enhancements to the community building. It's in the design phase.

The City is currently seeking opportunities for funding and grants to develop the design and complete construction for the Frances Albrier Community Center.

18. In Element C: Mitigation Strategy, on page C-39, the following text was added

## Inventory of Potentially Seismically Vulnerable Buildings

19. In Element C: Mitigation Strategy, on page C-43, the following text was added under Resident Assistance Program:

In 2024 CalFIRE announced that the BFD was awarded a grant to fund its Defensible Space Resident Assistance Program (RAP) in the VHFHSZ over a three-year period to interrupt the contiguous vegetative fuel in these pathways and inhibit the transmission of wildfires. The RAP will provide financial assistance to Berkeley Hills residents who are low-income, senior citizens 65 years or older, and those with physical disabilities to help achieve defensible space within Zone 0, Zone 1

20. In Element C: Mitigation Strategy, on page C-44, the following text was added under Vegetation Management Programs:

The Eucalyptus Understory Cleanup is a program that provides a one-time service to bring properties into compliance with best practice hazardous vegetation management practices. Planted in plantations over 100 years ago, eucalyptus groves can produce between 10 to 30 tons of dry matter per acre per year, increasing the potential to spread a ground fire. Eucalyptus trees can be extremely expensive to remove due to their size and age. Following participation in this program, residents will be required to maintain properties in adherence with the Fire Code.

21. In Element C: Mitigation Strategy, on page C-66, the following section and text was added:

### C.5 Household Mitigation Actions

The Local Hazard Mitigation Plan is designed to address and recognize how the whole community can and does work together to mitigate Berkeley's natural hazards. The following steps are ways that individual community members and households reduce their own risks and contribute to Berkeley's collective mitigation efforts:

## Earthquakes

### Secure your home

- Store heavy and breakable objects on low shelves
- Bolt bookshelves and heavy furniture to the wall
- Move or secure hanging objects over beds, sofas, and chairs
- Use quake gel or putty to secure breakable objects in place



### For homeowners

- Assess your home by hiring a structural engineer
- Retrofit your home if needed
- Understand available retrofit grants, including the City's Brace and Bolt program
- Consider earthquake insurance

### For renters

- Talk to your landlord:
- When was the house built?
- What materials were used?
- Is the building retrofitted?
- Does it require retrofitting?
- Consider earthquake insurance

### Prepare to be safe at home

- Store water (enough for 1 gallon per person per day for 3 days)

### Practice what to do during an earthquake

- Drop, cover, and hold on
- Do not stand in a doorway, run, or get into the "triangle of life". The 'Triangle of Life' is a misguided idea about the best location a person should try to occupy during an earthquake. Based on observations of past earthquakes, this idea doesn't apply to buildings constructed within the United States. Please do not consider this as a safe hiding spot.
- Learn how to turn off gas, electricity, and water at your house. If you rent, check in with your landlord.

- If after an earthquake you smell gas, contact PG&E and tell them to shut it off or call 9-1-1

## Wildland-Urban Interface Fire

Berkeley hills residents (Fire Zone 2 & 3):

- Review home's Defensible Space Report and follow the instructions on defensible space and home hardening.
- Create Defensible Space: Understand that all of Berkeley is at risk of wildland-urban interface fire. Further, 95% of property in Berkeley is privately owned, meaning that owners have to act to make their properties defensible.
- Defensible space is the area around a home where vegetation has been specifically maintained, and flammable items have been specifically positioned, in order to reduce the spread of wildfire.
- Keep Zone 0, or the first five feet from your home, clear of combustible materials. Use hardscape like gravel or concrete, remove dead or dying plants, remove branches from chimneys, limit combustible items like patio furniture, relocate firewood, replace any combustible fencing, and consider relocating garbage containers outside this zone.
- In Zone 1, or five to 30 feet around your home, remove all dead plants and dry leaves, and trim trees regularly. Create a separation between items like shrubs and items that catch fire like patio furniture and swing sets.
- In Zone 2, or 30 to 100 feet from your home, reduce potential fuel within 100 feet of the property line. This includes cutting annual grass, creating space between shrubs and trees, removing fallen leaves, and keeping clearance around exposed wood piles.
- Harden your home to decrease the likelihood of fire igniting the structure. The highest priority items are:
  - Install a fire resistive roof
  - Clear and maintain decks and covered porches
  - Regularly clear tree debris

- Remove large rugs and combustible wood, wicker, or plastic furniture
- Ensure any small items like cushions are small enough to be moved inside on Red Flag or Extreme Weather days
- Remove anything stored under the deck or stairs
- Include a five-foot noncombustible buffer around deck and stairs
- Install non-combustible gutter guards to keep tree debris out
- Ensure the vents to your attic, basement, and crawlspace will block wind-blown embers from entering your home. You can install ember-resistant vents or cover Be ready to receive emergency information.

For all Berkeley residents:

- Use the free [Berkeley Chipper Day Program](#) for curbside pickup, chipping, and disposal of vegetation material from your residential property.
- [Sign up for AC Alert](#)
- Bookmark and get familiar with [Berkeley's Emergency Map](#)
- Get familiar with the test and emergency tones from [Berkeley's Outdoor Warning System](#)
- Make your [household fire weather plan](#).
- Stay out of the hills during extreme fire weather days.

## Extreme Heat

Prepare to be safe at home

- Gather supplies to keep yourself cool, including:
  - Ice – fill up all your ice trays and freeze them and any ice packs overnight



- Spray bottle – to spray mist on yourself to keep cool
- Personal fan – fan to point at yourself
- Towel – to wet and put on your body
- Plan to [keep your home cool on hot days without air conditioning](#), using:
  - A larger fan – to move hot air out of your home
  - An indoor/outdoor thermometer – set this up to know when to let cooler outside air into your home
  - Be ready to block sunlight and heat, using blackout curtains, reflective film, solar blankets or cardboard. Blocking your windows with a light-colored sheet facing out, followed by a dark-colored sheet facing in, can help to reflect light away and keep your home cooler.
- Prepare for potential power outages (*see utility disruption section*)

Make a plan for where to go (and how to get there) if your home gets too hot.

- Consider locations you could visit that have air conditioning, like malls, stores, or community cooling centers.
- Make a transportation plan – consider using friends and family, public transit, carpooling, or using a taxi or rideshare service.
- If you use a wheelchair or other mobility device, you may also consider:
- Pre-scheduling a paratransit trip to a cool location before the hottest hours of the day
- Using [Easy Does It](#) for a Rescue Ride or Routine Transportation ([BRSD members](#) only)

Buddy up with your friends, family, and neighbors:

- Make a plan to check on friends, family and neighbors at least twice a day during a heat wave. Check to see if people are developing signs of heat exhaustion or heat stroke. Remember that people who live alone are at the

greatest risk in a heat wave because no one will notice if they develop heat stroke.

- Think about how to work together to get to a location with air conditioning or a community cooling center if someone's home gets too hot.

#### Monitor the heat

- The Occupational Health and Safety Administration (OSHA) [Heat Safety Tool](#) helps you understand how hot it is where you are located.

#### During a heat wave

- Get Plenty to Drink: Sweating removes needed salt and minerals from the body. When it is hot, drink more water, juice and sports drinks. Avoid drinks with caffeine (tea, coffee, and cola) and alcohol. Be sure to eat regularly.
- Stay safe in your home:
  - Wear as little clothing as possible when you are at home. Choose lightweight, loose-fitting clothing.
  - Spray yourself with water or make your skin wet with towels, then stand in front of a fan. When the water evaporates it will pull heat away from your body.
  - Keep windows open at night to capture the cool air. Closing windows to trap the cool air in the morning can be helpful before the heat of the day comes. If you have an indoor/outdoor thermometer, monitor temperatures inside and outside your home. When it is cooler outside, open windows and doors to let in cool air. When temperatures are equal, close windows and doors to keep cool air in as the outdoors heats up.
- If you must go outside:
  - Choose lightweight, light-colored, loose-fitting clothing. In the hot sun, a wide-brimmed hat will keep the head cool. If you will be in direct sun, use a sunscreen with a sun protection factor (SPF) of 15 or higher and follow package directions. Reapply every 2 hours while in the sun.
  - Schedule Outdoor Activities Carefully: Try to be less active during

the hottest part of the day, late afternoon. If you must be out in the heat, plan your activities so that you are outdoors either before noon or in the evening. While outdoors, rest often in a shady area.

- Never leave children or pets in a parked car.
- Pace Yourself: If you are not used to working or exercising in hot weather, start slowly and pick up the pace gradually. Take frequent, regularly scheduled breaks. If activity in the heat makes your heart pound or leaves you gasping for breath, stop activity, get into a cool or shady area, and rest. Especially if you become lightheaded, confused, weak or feel faint.

## Poor Air Quality

Get air quality information

- Be familiar with the [Air Quality Index](#)
- Bookmark websites with key air quality information:
- Forecasts: [AirNow.gov](#)
- Real-time readings: [US EPA/US Forest Service Fire and Smoke Map](#)

Prepare your home for poor air quality

- Keep outside pollution outside by replacing or sealing leaky windows and doors. This will also make your home more energy efficient and comfortable.
- People on limited incomes should check out California Weatherization Assistance Program services offered by [Spectrum Community Services](#).
- Purchase equipment to clean the air inside your home, with filters for your HVAC system or portable air cleaners.
- HVAC system filters: If properly configured and maintained, air cleaners and specialized filters designed for use in HVAC systems may have the greatest potential to improve your entire home's air quality because most HVACs circulate very large volumes of filtered air throughout the home.
- Install a high-efficiency filter (MERV 13 rating or higher) with a MERV rating



as high as your system can handle, based on manufacturer recommendations.

- Portable air cleaners: These units are usually best for single room use, rather than multiple room or whole-house use, because of their limited capacity to circulate large volumes of filtered air.
- Purchase one or more [California Certified Air Cleaners](#) for room(s) in your home. Make sure your cleaner is on this certified list so you can be sure it will not emit harmful ozone when you use it.
- Use the “Clean Air Delivery Rate” (CADR) to [calculate the correct size portable air cleaner for the room](#).
- If an air cleaner is out of your price range, you can [construct one with a box fan](#) for a cost of \$45-\$75.

Key Actions during poor air quality events (see the California Air Resources Board’s [Smoke Ready California](#) site for details)

- **Stay inside:** The best way to prevent breathing harmful particles is to stay indoors with windows and doors closed.
- If you have a central-ducted heating/air conditioning and heating system, be sure to set the system to “on” to ensure air is being filtered constantly, rather than “auto,” which runs the system intermittently.
- If your system brings fresh air into the home, close the fresh-air intake so that it operates in in recirculation mode to prevent outdoor smoke from getting inside.
- Filter the air: Use a CARB-certified portable air cleaner and run continuously on the highest setting. This can greatly reduce indoor particle levels to further reduce impacts from smoke.
- Gather people in a room with the air purifier. A portable air cleaner will clean the air around it, but cannot is not designed to clean the air in your whole home.
- Do not run whole house fans or swamp coolers.

- Avoid activities that increase indoor pollution, such as burning candles, using gas stoves and vacuuming.
- Use a damp cloth or mop to trap settled dust and particles.
- Stay cool. Run fans, or run air conditioning on “recirculate” setting with a new filter. NOTE: If poor air quality happens at the same time as extreme heat, do whatever you need to stay cool, even if it means opening windows and doors. Heat will kill more quickly than air pollution.
- **If you must go outdoors** for long periods of times in areas of heavy smoke, you may want to wear a NIOSH-certified N95 respirator mask. Those with existing respiratory, lung or heart conditions should limit their exposure by staying indoors. Since wearing a respirator can make it harder to breathe, those with lung or heart conditions should check with their doctor before using one.
- If you purchase N95 masks, make sure they are [NIOSH-approved](#). Choose a size and model that fits your face and has no gaps. Test it by doing a [seal check](#).
- Keep a very close eye on children, who are less likely to notice or report symptoms than adults, even when they are affected.
- Look out for [signs that you or those around you need cleaner air](#). Symptoms can include:
  - Coughing
  - Throat irritation
  - Pain, burning, or discomfort in the chest when taking a deep breath
  - Chest tightness, wheezing, or shortness of breath

## High Wind

Keep trees properly maintained.

- City trees:

City trees grow between the sidewalk and the street, in a street median, in

a public park, or on any other property owned by the City of Berkeley. View a [map of Berkeley City trees](#).

- To submit a request for pruning or removal of a City tree, call 311 or email [trees@berkeleyca.gov](mailto:trees@berkeleyca.gov).

#### Privately owned trees

- All other trees are privately owned, and maintenance is the responsibility of the owner. Similarly, if a private tree or limb falls, cleanup and damages are also the responsibility of the homeowner.
- Get a professional arborist assessment to identify any signs of decay, dead branches, or other structural issues that could lead to problems in the future.

#### Before a wind event

- Bring any loose outdoor items such as holiday decorations and chairs inside, or securely tie them up. Beside the risk of these items being blown away or damaged, airborne debris can be dangerous.
- Be ready for power outages. In winter months, consider raising the temperature on your thermostat, in case you lose power for a few hours or longer.

#### During high winds

- If you must be outdoors, keep your distance from trees.
- Avoid driving during the strongest winds, especially in high-profile vehicles. Your vehicle could be blown off the road. Trees could fall in the road ahead of you, which could be hard to see at night until it's right in front of you, or they could fall on your vehicle.

### Landslide

#### Protect your home

- Have flexible pipe fittings installed to avoid gas or water leaks, as flexible fittings are more resistant to breakage. (Note, only PG&E or other professionals should install gas fittings).



- Plant ground cover on slopes and build retaining walls.
- In mudflow areas, build channels or deflection walls to direct the flow around buildings. Remember: If you build walls to divert debris flow and the flow lands on a neighbor's property, you may be liable for damages.
- If you live in an area susceptible to landslide (See Maps 23 and 24), familiarize yourself with [Landslide Warning Signs](#) and preparedness/response actions.
- Remember that landslide damage on private property is the homeowner's responsibility. Homeowner's insurance does not typically cover landslide damage. A Difference in Coverage Insurance Policy can help cover this gap, if you live in an area susceptible to landslide.

## Tsunami

For all Berkeley residents

- Understand Berkeley's tsunami inundation area (Map 25 in the Risk Assessment) to identify whether you might find yourself in the tsunami inundation zone
- If your home or business is in the tsunami inundation zone, consider purchasing flood insurance.
- Be ready to act on tsunami alerts
- [Sign up for AC Alert](#)
- Bookmark and get familiar with [Berkeley's Emergency Map](#)
- Get familiar with the test and emergency tones from [Berkeley's Outdoor Warning System](#)

If you live in the tsunami inundation zone, make your household evacuation plan for tsunami, including:

- Where will you go – east, out of the tsunami zone
- What will you pack

- How will you get there, using which routes
  - Who can help if you need it
- Know nature's warning signs of a near-source tsunami:
  - Earthquake with strong ground shaking for 20 seconds or more (making it difficult to stand or walk)
  - Loud ocean roar
  - Quickly receding water
  - If you are near the water and see these signs, move inland and to higher ground immediately. If there is time (a distant source tsunami) officials will send out alerts and instructions.
- If a tsunami alert is issued
  - Monitor your phone, the Outdoor Warning System, Berkeley's Emergency Map, and TV and radio for updates
  - Follow evacuation orders – as scientists get more information about what created the tsunami, the area that needs to evacuate will become more clearly defined
  - Do not go towards the tsunami – it makes things harder for first responders and for your fellow residents.

#### Maritime Community

- The City of Berkeley will evacuate docks and shut them down within 1 hour of a tsunami's estimated arrival.
- Make a plan for your boat
- Should you take your boat OFFSHORE?
- Generally, it is safer to keep your boat docked during a tsunami because most tsunamis are relatively small. On the rare occasion when a larger tsunami is expected (Warning level), you may consider taking your boat offshore. Berkeley's Harbormaster may provide the best advice,

considering

- The SIZE of the tsunami,
- How much TIME until it arrives onshore, and
- The PREPAREDNESS of the boat and its captain.
- You may consider hauling your boat out of the water when possible for smaller events. Expect congested boat ramps and remember that you have to get your boat out of the water and to the trailer, and out of the tsunami zone before the tsunami arrives (or before officials close the docks).
- Understand whether or not your boat insurance will cover damage caused by a tsunami. Tsunami coverage is entirely dependent on your policy and how much comprehensive coverage you have purchased.
- Make sure your boat is secured and ready. Keep in mind that the City will shut down the dock 1 hour before the tsunami's anticipated arrival time.
- Secure your boat to the dock and tie down any loose gear.
- Check your dock line condition and replace any worn dock lines.
- Do not install fendering to the dock.
- Remove as much loose boating gear onboard as possible, especially electronics and important documents. Any gear that will remain on your boat should be secured.
- Turn off and disconnect shore power cords, water supply hoses and propane or other gas valves.
- Secure and lock all hatches and port holes. Check for leaks, and seal them as necessary.
- Prepare a go-bag or backpack that you can grab and bring with you if you need to evacuate quickly for a near-source tsunami. Include:
  - Flashlight/headlamp



## Internal

- Area map, marked with driving/walking evacuation routes
- Printed list of phone numbers and email addresses for important contacts
- Battery-powered radio and extra batteries
- Prescriptions or critical medications
- Extra eyeglasses or contact lenses
- Extra set of keys
- Cell phone charger
- Copies of important documents
- Toiletries and change of clothing
- Hand sanitizer
- As you leave, grab your wallet and cell phone
- Make a list of the other items you will want to bring if you have more time to prepare to evacuate. Consider:
  - Items to be safe and comfortable while you are away
  - Medications, prescriptions, and medical devices
  - Computers, electronics and chargers
  - Irreplaceable items (family treasures, art, photo albums)
  - Other valuables

## Floods

For all Berkeley residents, protect your home and neighborhood

- Flooding often occurs due to storm drain blockage. Protect your neighborhood and keep water flowing by participating in the [adopt a drain program](#).
- Direct water away from your building.
- Routinely clean and maintain gutters, downspouts, and splash blocks so that rainwater from your roof flows easily away from your home.
- During an average rainstorm, watch how water flows or accumulates around your home to identify potential trouble spots. If stormwater does not drain away from the building, change your landscaping to improve runoff. This may include building up any sunken areas around the foundation, digging small depressions to properly channel water, and otherwise improving the yard so that it slopes away from your home.
- If you have a sump pump, make sure it has a battery-operated backup in case of power failure during a rainstorm.

Residents near Berkeley creeks, or who have experienced flooding in the past

- Implement [low-cost projects to reduce your flooding risk](#)
- Make your sandbag plan
- Learn [how to sandbag](#) and whether sandbags will be protective for your property
- If you are unable to sandbag, connect with neighbors and friends who can assist you in sandbagging to protect your home during severe storms
- Make a plan for where you'll get sandbags in significant storms. The City usually offers sandbags, and they are also available at a low cost from hardware stores.
- Consider flood insurance, since typical homeowners insurance policies do not cover flooding.
- During heavy rains

- Elevate important items, if possible, during heavy rains, especially from first floor/garage.
- Do not walk, swim or drive through flooded waters. Turn around, don't drown.
- experienced flooding in the past

After a flood

- If your home floods, review this [Field Guide for Flooded Home Cleanup](#).

## Utility Interruption

Power Outage

- Know the location of your circuit breakers and/or fuse boxes and how to check them.
- Make sure PG&E can reach you and alert you of an outage by calling 1-800-743-5000 and updating your contact information.
- Make a plan to stay safe and comfortable during power outages.
- First, think about your household's emergency power needs. What will you need to stay warm? To keep food cool? To operate any medical devices?
- Determine the power draw of the devices that you want to keep operating, and how long you want to operate them.
- Consider purchasing a power bank or generator to provide the power you need to stay safe in your home in short-duration outages.
- Make a plan to stay with family, friends, or at a hotel if your home is affected by a long-term power outage.
- When power outages are planned or likely (for example, severe storms or heat waves are forecast):
- Fully charge your phone and any chargeable devices including battery



packs and even electric vehicles.

- Make sure you have flashlights and fresh batteries close at hand.
- Prepare to use your alternate plans for refrigerating medicines or operating power-dependent medical devices.
- When a power outage occurs:
  - Unplug all electric appliances to avoid overloading circuits or damaging devices when the power turns back on.
  - Leave 1 lamp plugged in with the switch “on.” When the lamp turns back on you’ll know your home has power again. Turn your appliances back on one at a time when power is restored.
  - If you encounter a downed power line, always stay away and call 9-1-1 immediately. Do not touch anything that touching the lines or drive over them.

## Water Outage

- Each person in your household will need 1-2 gallons of water daily for drinking, washing, and cooking. Store as much water as you can. At minimum, store water for 3 days (3-6 gallons per person).
- Options for storing water include: single gallons of water, water barrels, water cubes, or canned water. When choosing the best option for your household, consider cost, ease of storage, required maintenance, and how easy it will be to access and use during an emergency.

## Wastewater Outage

If you don't have water to flush with or your sewage system isn't working:

- Modify your own toilet to collect waste without flushing. Turn the water valve to off. Flush out any water still in the bowl (the toilet shouldn't refill). Put some kitty litter, peat moss, lime, or something similar that will absorb liquid and help reduce odors into the inner bag. Go to the bathroom in the inner bag. You may be able to use the same bag more than once before replacing. Once the inner bag is full or you feel it needs to be replaced, tie it up. Insert a new inner bag and add absorbent/odor reducer for the next use.

- Use a 5-gallon bucket. You can add a toilet seat and set it up as described above.
- If sewage from plumbing fixtures backs up into your home, avoid contact with the sewage as it may contain harmful pathogens.

#### Telecommunications Outage

- Establish a backup communication with your family. Choose a meeting place and time in case you can't call each other.
- Keep a battery-powered AM/FM radio handy to receive emergency alerts if internet, phone, and television aren't working.
- Print important documents or save them to a thumb drive in case of internet outage.
- During emergencies or large events, high demand for cellular networks can make it hard to place a call. A text message may go through when voice calls cannot, because text messages require less bandwidth from the cellular network.
- If you lose cellular service completely to your phone but the internet is still working, you can switch your phone's settings to turn on "Wi-Fi" calling to make calls through the internet.

22. In the 2024 Strategy Actions Spreadsheet, the following action was added:

Reduce fire risk in existing development through vegetation management: Manage the Eucalyptus Understory Cleanup Program.

23. In the 2024 Strategy Actions Spreadsheet, the following action was added:

Evaluate potential land use controls impacts on emergency services: Ensure that Fire Department staff have the opportunity to review any proposed revisions to land use controls that would increase allowed densities, evaluate how the revised land use controls could impact the provision of emergency services, and convey that information to City Council prior to final action.

24. In Element G: Community Education, on page G-1, the following text was deleted and added:

To support this work further, ~~each hazard section~~ at the end of Element C: Mitigation Strategy has a list of individual and household actions to reduce risks associated with that hazard.

- 
- 1 <https://firesafemarin.org/>
  - 2 Stanford B, Grossinger RM, Askevold RA, Whipple AW, Leidy RA, Beller EE, Salomon MN, Striplen CJ. 2011. East Contra Costa County Historical Ecology Study. Prepared for Contra Costa County and the Contra Costa Watershed Forum. A Report of SFEI's Historical Ecology Program, SFEI Publication #648, San Francisco Estuary Institute, Oakland, CA.
  - 3 <https://firesafemarin.org/create-a-fire-smart-yard/plants/fire-hazardous-plants/>