Office of the City Manager

WORKSESSION
February 5, 2019

To: Honorable Mayor and Members of the City Council

From: Dee Williams-Ridley, City Manager

Submitted by: Dave Brannigan, Fire Chief, Department of Fire and Emergency Services

Subject: Wildfire Safety Planning

SUMMARY

Since 1923, Berkeley has repeatedly experienced wildfires that threaten the City as they blow from east to west. Following the 1991 Tunnel Fire that destroyed over 3,000 structures and claimed 25 lives, Berkeley funded and coordinated wildland urban interface fire risk reduction programs. Today, Berkeley collaborates with neighboring agencies, engages in fuel reduction strategies, plans, trains and responds to wildfires in the City and around California.

The City of Berkeley defines three Fire Zones designated in order of ascending fire risk. Fire Zone 3 is the Panoramic Hill area; Fire Zone 2 covers the remainder of the City's eastern hills; Fire Zone 1 covers the rest of the City west of the hills. While Fire Zones 2 and 3 have the highest risk of wildland urban interface fires, the entire City will benefit from environmentally responsible fuel management and carbon offset programs.

The focus of this report is communicating the coordination of existing efforts, and to highlight the need to develop a multi-year plan that includes existing programs, grant funded expansion of capacity, and that leverages partnerships to create a defensible fire resistive boundary to the City of Berkeley.

CURRENT SITUATION AND ITS EFFECTS

PARTNER AGENCY COLLABORATION

Hills Emergency Forum

The Hills Emergency Forum (HEF) was created in the wake of the 1991 Tunnel Fire in the Oakland and Berkeley Hills. The Hills Emergency Forum exists to coordinate the collection, assessment and sharing of information on the East Bay Hills fire hazards and, further, to provide a forum for building interagency consensus on the development of fire safety standards and codes, incident response and management protocols, public education programs, multi-jurisdictional training, and fuel reduction strategies.[1]

[1] Hills Emergency Forum Mission Statement http://www.hillsemergencyforum.org/mission-goals.html

Berkeley participates in monthly meetings of HEF which allows us to work with neighboring jurisdictions on the regional goal of a healthy, fire resistive wildland urban interface across the East Bay. The collaborative work of Berkeley, UC Berkeley, East Bay Regional Parks, the City of Oakland, and other agencies is focused through this group. The regional work is captured in the Hills Emergency Forum 2018 Annual Report (Attachment 1). Upcoming coordinated efforts are in the Hills Emergency Forum 2019 Workplan (Attachment 2).

PG&E

In 2018, PG&E launched their Community Wildfire Safety Program, including opening a wildfire emergency operations center in San Francisco. The Program implemented additional precautionary safety measures following the 2017 Northern California wildfires to further reduce wildfire risk, including:

- Conducting accelerated safety inspections of more than 50,000 transmission poles and towers across 5,500 miles of transmission lines in the highest wildfire-threat areas, with similar inspections across distribution lines to begin early this year;
- Further enhancing vegetation management to increase focus on addressing trees and branches that pose a higher potential for wildfire risk;
- Investing in more real-time monitoring and intelligence like adding approximately 1,300 new weather stations and nearly 600 new, high-definition cameras;
- Installing stronger and more resilient poles and covered power lines in the highest fire-risk areas; and
- Replacing equipment to further reduce wildfire risks and tailoring upgrades based on terrain and weather conditions using more granular analysis of fire-prone regions.[2]

Fuel reduction that contributes to a defensible perimeter around the City took place at the top of Panoramic Way in the summer of 2018. PG&E coordinated with UC Berkeley and neighbors to identify and remove over 40 pine trees that threatened power lines. The Panoramic Hill is designated as Berkeley's Fire Zone 3 and is a top priority for reducing the threat of wildfire. In addition, PG&E removed vegetation around power lines throughout the City. PG&E plans to file for Chapter 11 bankruptcy in late January. The impact on the Community Wildfire Safety Program is uncertain, but PG&E suggests it will remain a priority throughout the Chapter 11 process.[3]

Utility undergrounding is an issue raised to reduce the chance of a fire sparked by power lines. The City of Berkeley has ongoing efforts to plan for undergrounding

[2] https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/community-wildfire-safety.page
[3] https://www.pge.com/en_US/about-pge/company-information/reorganization.page?WT.pgeac=Reorganization_Footer

through the work of commissions, staff, and City Council. A newly budgeted position to manage the undergrounding project was approved by City Council. Given the very high cost of undergrounding and uncertainty of the program as PG&E goes through bankruptcy, future efforts to support evacuation and fire prevention through undergrounding will be weighed at many levels.

CITY OF BERKELEY PROGRAMS

Annual Inspection Program
Berkeley Firefighters inspect all properties between Grizzly Peak Boulevard and Tilden Park annually during the summer months. The inspection program is a chance for firefighters to ensure properties in this area have defensible space and no ladder fuels which can carry a fire from ground level up to houses, roofs, and the tree canopy. Property owners receive written notices of violations and firefighters return after 30 days to ensure compliance. Problem properties are referred to the Fire Prevention Division for follow up.

Fire Fuel Chipper Program
The Fire Fuel Chipper Program is a popular yard waste collection service. The Program serves properties in the hills from June through September each year. It provides brush chipping service for branches up to 5 inches in diameter. Since 2014, over 100 tons of vegetation have been collected and recycled, on average, each year.

Debris Bin Program
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. Bins can be filled with green waste removed from yards and lots. This effort yields an average of 132 tons of plant debris per year.

The Fire Fuel Chipper Program and Debris Bin Programs began in the spring of 1993. They are funded by a surcharge on the refuse bills of residents in the Fire Surcharge Area. Only properties that pay the refuse bill surcharge are eligible for using this program. A brochure which explains the program is mailed to eligible participants annually.[4]

Fire Fuel Abatement on Public Land
A fire fuel abatement program on public land. This program is maintained 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, pathways and landscaped medians. The Parks Division FY 2019 budget includes $454,851 for fire fuel management.

[4] https://www.cityofberkeley.info/fire_fuel_program/

Public Messaging

Most wildfires in California require officials to communicate emergency information as well as the ongoing status of an incident and its impacts. In the early hours of a wildland urban interface fire, emergency public messaging is challenging. The City of Berkeley has a number of tools at its disposal from pushing text messages to radio communication to knocking on individual doors. Current information on emergency alerting can be found at https://www.cityofberkeley.info/EmergencyAlerting/.

At this time there is significant review of emergency notification systems in California following the 2017 and 2018 wildfires. Best practices are being examined and systems such as sirens and home weather radios are being considered for future installation and distribution in Berkeley.

In an emergency, officials may use many different tools to communicate information and instructions to the community as described in City of Berkeley Administrative Regulation 9.3 (Attachment 3). It is incumbent on all who live, work, or visit Berkeley to understand where and how to receive emergency information:

AC Alert (https://www.cityofberkeley.info/acalert/)

AC Alert is Berkeley's primary emergency alerting system for the public. It is one of the tools the City of Berkeley uses to communicate emergency information and instructions to the community. AC Alert can send:

- Voice alerts to phones
- SMS text messages
- Email
- TTY/TDD messages

Listed AT&T "land lines" are automatically included to receive voice messages from AC Alert for emergency warnings. Community members must sign up to receive voice or text alerts on cell phones, VoIP phones, unlisted phones, TTY/TDDs or through email.

Nixle (https://www.cityofberkeley.info/police/nixle/)

Nixle is used by the Berkeley Police Department to send out emergency alerts as well as crime prevention tips. Berkeley Police encourage community members to set up an account to personalize messages they receive.

Wireless Emergency Alerts (WEA)

In an emergency, you may receive a brief text message with a special alert tones on your cell phone. This is called a Wireless Emergency Alert (WEA) message. Government agencies send WEA messages to alert community members to emergency

situations requiring their attention, such as a shelter-in-place or evacuation order. The most common WEA message is an Amber Alert sent by the California Highway Patrol.

If there is a critical threat to the Berkeley community, City officials may request Alameda County to send out a WEA message to cell phone towers in the affected area. The cell phone towers will send the message to all phones within reach, even if they are outside of the affected area.

Other sources that may have emergency instructions include:

- Radio
- Television
- Websites (www.cityofberkeley.info)
- Social Media
- Neighbors

CITY OF BERKELEY PLANS

Wildfire Evacuation Plan

A wildland urban interface fire in the City of Berkeley or a neighboring jurisdiction will trigger a rapid evacuation. The Fire Department, Police Department, and Public Works have drafted a Wildfire Evacuation Annex for the City's Emergency Operations Plan. The draft Wildfire Evacuation Annex (Attachment 4) is currently available for public review.

The plan identifies roles and responsibilities for City staff and partner agencies in conducting a simple or complex evacuation. Due to the complexity and interdependencies of the components of the plan, the draft is under review by various City departments, the Disaster and Fire Safety Commission, multiple partner agencies, and the general public. The attached draft is for review.

Elements of the Wildfire Evacuation Annex will serve to inform prioritization of limited resources for fire fuel mitigation.

Current information for the public on how to prepare for wildfire evacuation can be found at http://www.cityofberkeley.info/WildfireEvacuation/. Anyone who feels threatened or isn't sure about the danger of a wildfire is encouraged to evacuate before being told to. People with access and functional needs, or those who are dependent on electricity or other medical necessities should have a plan in place to move to safety before they are in danger should they live in, work in, or visit Fire Zones 2 or 3.

Fire Weather Coordination Plan

The Berkeley community faces significant danger from wildland-urban interface (WUI) fires. Low humidity, high temperatures, and diablo winds all contribute to high fire danger; these weather patterns are tracked on a regional level. The Berkeley Fire Department has worked with the National Weather Service to determine the specific combinations of these conditions that predict extreme fire danger specifically for Berkeley. These conditions are thresholds for a) adjusting Fire Department activities to focus on wildland urban interface fire readiness, and b) providing Berkeley-specific warnings to the public of extreme fire danger so that community members may take protective action.

The National Weather Service issues Red Flag Warnings for the Diablo Mountain Range/East Bay Hills Zone, which reaches from the hills of Contra Costa County to those south of San Jose. While these warnings indicate the potential of high fire danger across the entire zone, they do not always accurately reflect anticipated or actual conditions in the Berkeley Hills. As a result, the City of Berkeley is using two levels of fire danger weather: Red Flag Warning and Extreme Fire Weather Warning. Red Flag Warnings indicate regional weather conditions that may impact Berkeley. Extreme Fire Weather Warnings indicate serious fire weather conditions actively occurring or anticipated specifically in Berkeley. Messaging and protective actions differ based on the level of fire danger weather.

The plan outlines the four part process to follow when fire weather is expected:

Part 1: Fire Weather Level Determination
Fire Command Staff/Office of Emergency Services Staff recognize forecasted or actual fire weather conditions. They consult within the Fire Department and with the National Weather Service to determine the appropriate Fire Weather Level.

Part 2: Red Flag Warning Actions
Staff take red flag warning actions, which may include internal/external notifications and messaging, and up-staffing using partner resources.

Part 3: Extreme Fire Weather Warning Actions
Staff take extreme fire weather warning actions, including internal and external notifications and messaging, and up-staffing using internal and partner resources.

Part 4: Situation Monitoring and Cancellation
Staff monitor the situation, and adjust plans based on actual weather conditions and additional weather products released by NWS. The warning is cancelled as appropriate.

The draft plan was tested several times in the fall of 2018 and was received well by staff and the public. Future programs and restrictions based on fire weather may be triggered by steps outlined in this plan. Public review of the plan is expected in spring 2019.

Local Hazard Mitigation Plan

The Local Hazard Mitigation Plan (LHMP) was last updated and adopted in 2014 (Attachment 5). This plan considers the major natural hazards for the City of Berkeley and outlines the 5 year efforts of the City to minimize the impact of natural disasters should they occur. This plan is essential for federal grant opportunities such as the grant that funded the retrofit of James Kenney Recreation Center at 1720 Eighth Street.

The 2019 update of the LHMP is underway. After extensive staff review, the draft plan (Attachment 6) is currently with all City commissions for review and public comment. Once public comment is reviewed and incorporated, the plan must be reviewed and approved by multiple state agencies prior to approval by the Federal Emergency Management Agency (FEMA). Following FEMA approval the plan will be sent to the City Council for adoption. The projected timeline for submission to City Council is late fall 2019.

TRAINING AND RESPONSE

Prior to the 1991 Tunnel Fire, little attention was paid to proper equipment and training for wildland firefighting in the Berkeley Fire Department. Since then, Berkeley Fire has developed the capability through training and equipment. All sworn firefighters now are equipped with state of the art Nomex wildland firefighting gear, all required safety gear, and wildfire hose and equipment on all suppression apparatus. In addition, the department maintains and cross-staffs a Type III and a Type VI fire engine. These engines are designed and equipped for fighting wildland fires in nearly any terrain.

Training

To ensure a swift and decisive response to a wildland urban interface fire in Berkeley, the Department conducts annual wildland firefighter training in late spring and early summer for all 133 sworn firefighters. In 2015 Berkeley invited agencies from around the East Bay to participate in a full-scale wildland urban interface fire exercise. Volunteers from the Community Emergency Response Team program offered their properties throughout the Berkeley Hills and firefighters, police, emergency managers and dispatchers simulated wildfire response for an entire week. This year the Fire Department is planning a similar full-scale exercise that will occur following public education and firefighter training on the new wildfire evacuation plan.

Mutual Response Areas

Following the 1991 Tunnel Fire, Berkeley entered into agreements with surrounding jurisdictions to respond immediately and to any fires in shared wildland urban interface areas. Berkeley has three zones and upon report of a fire, each zone gets an automatic response from the Berkeley and the closest neighboring jurisdictions. This response sends a large number of resources immediately to control a fire. This system is above and beyond California's Master Mutual Aid Plan.

Master Mutual Aid Plan

Berkeley participates in the California Master Mutual Aid Plan. As such, we are called regularly to send resources throughout the state to fight wildfires. In return, should we need assistance, we will get mutual aid from around the state. This program is run through the Operational Area which in California is designated as the County. As requests for aid come in, county-wide strike teams are assembled and deployed. The resources that Berkeley Fire makes available for deployment are only offered if we can cover the needs of the City first. For example the night in 2017 that the Sonoma County fires ran from Napa to Santa Rosa in about one hour, Berkeley Fire received a request for immediate need mutual aid at approximately 1am. Unfortunately we had red flag weather conditions and a fire started in Tilden Park close to the Ajax Place neighborhood. Crews from Berkeley, Oakland, East Bay Regional Parks and others quickly controlled that fire, but we had to delay sending help to Sonoma County until we were sure it was under control. A crew was sent to Santa Rosa at approximately 5am.

Pre-Positioning Resources

A new state-wide program was funded in 2018 that allows for pre-positioning fire suppression crews in areas that have severe fire weather conditions. The state budget included $25 million to fund the new program which has been included in the upcoming budget proposal as well. On at least 3 occasions in the fall of 2018, Berkeley and Oakland requested pre-positioning in Alameda County due to red flag weather conditions. The Operational Area worked with the state to secure those resources and they were available had an ignition occurred.

ONE-TIME WORK FUNDED BY CITY COUNCIL

On December 4, 2018 the Berkeley City Council included $575,000 in the approved FY 2019 Annual Appropriations Ordinance for implementation of Fire Safety, Education, Prevention and Disaster Preparedness Recommendations. Allocations of that funding is shown in Table 1:

Table 1 – FY 2019 One-Time Projects	
Program	Budget
Fuel Reduction - Parks	$200,000
Fuel Reduction - Evacuation Routes/Foot Paths	$200,000
Public Education - Demonstration Fire Resistive Garden	$50,000
Public Education - Safe Passages Pilot and Evacuation Plan Outreach	$25,000
Fire Safety Signs for Parks and Fire Stations	$50,000
Fire Break Tree Removal	$25,000
Seasonal Fire Crew Program Setup	$25,000

Fuel Reduction - Parks

The Parks Division has worked on an initial recommendation for one-time fuel reduction and has prioritized the following areas in order of concern as follows:

Remillard Park - $75,000
John Hinkel Park - $75,000
Codornices Park- $50,000

Decisions for prioritization is based on the likelihood or probability of fire ignition sources, amount of existing surface fuel loads within the park, and the need for thinning and removal of ladder fuels in the park. Final work will be reviewed by a qualified botanist to ensure no impact on nesting raptors or other species of concern.

Fuel Reduction - Evacuation Routes/Foot Paths
Pending adoption of the Wildfire Evacuation Annex, Public Works and the Fire Department will evaluate roads and footpaths likely to support evacuation for initial fire fuel reduction. Paths will also be evaluated for better lighting and signage to assist in evacuation on foot.

Public Education - Demonstration Fire Resistive Garden
Fire Station #4 at 1900 Marin Avenue currently has landscaping inconsistent with fire resistant best practices. Situated on the edge of Fire Zone 2, Station 4 is an ideal location for a demonstration garden where the public will be invited to learn about designing an urban landscape that reduces the risk to the immediate property and reduces the likelihood of fire spreading through a neighborhood.

Public Education - Safe Passages Pilot and Evacuation Plan Outreach
The Berkeley Safe Passages pilot program is designed to blend traditional parking restrictions with innovative road markings and signage. Many roads in Fire Zones 2 and 3 are too narrow for parking and safe passage of vehicles when emergencies arise. Three locations will be selected to demonstrate Keep Clear corridors, no parking zones, and pedestrian access so that staff and the public can evaluate the efficacy and impact of Safe Passage corridors.

Fire Safety Signs for Parks and Fire Stations
Current Fire Safety signs at fire stations and parks are in disrepair and outdated. New signs are being designed that will indicate fire danger consistent with the new Fire Weather Coordination Plan.

Fire Break Tree Removal
The long term goal is to create a fire resistive community in Berkeley and work with neighboring agencies to reduce the fuel load near the City, effectively making a fire break with a healthy forest wildland interface. Neighbors on Wildcat Canyon Road helped the City of Berkeley and Kensington identify a stand of eucalyptus that pose a threat to homes and native forest in the vicinity. Multiple City departments as well as the El Cerrito-Kensington Fire Department are coordinating to evaluate the trees for

removal. The appropriate biologists and arborists will evaluate the trees for impacts on species if they are to be removed, with work to be done prior to the 2019 fire season.

Seasonal Fire Crew Program Setup

While the bulk of these projects will happen with one-time funding, Cal Fire and California Office of Emergency Services (Cal OES) have several hundred million dollars for awarding grants in the coming year. Cal OES has given preliminary approval to apply for a 3 year grant to fund a seasonal fire fuel reduction crew. With applications due in the spring, funding from the one-time allocation will allow a field Captain to be reassigned to a staff position to assist completing the grant and start setting the groundwork for the program.

If successfully funded, the seasonal hand crew will initially consist of Youthworks participants. As it is established, the vision is to include as many youth as possible from the Berkeley Safety Training & Education Pathway (B-STEP)[5] Fire Science program. The crew will continue the work started by this year's one-time funding. They will coordinate with Parks and Public Works to identify fuel reduction projects, they will help with property inspections and potentially help clear property for low-income residents. The crew will also assist with public education and outreach. Opportunities for the hand crew exist throughout the City for both fuel reduction and carbon offset work as discussed in the Environmental Sustainability section of this report.

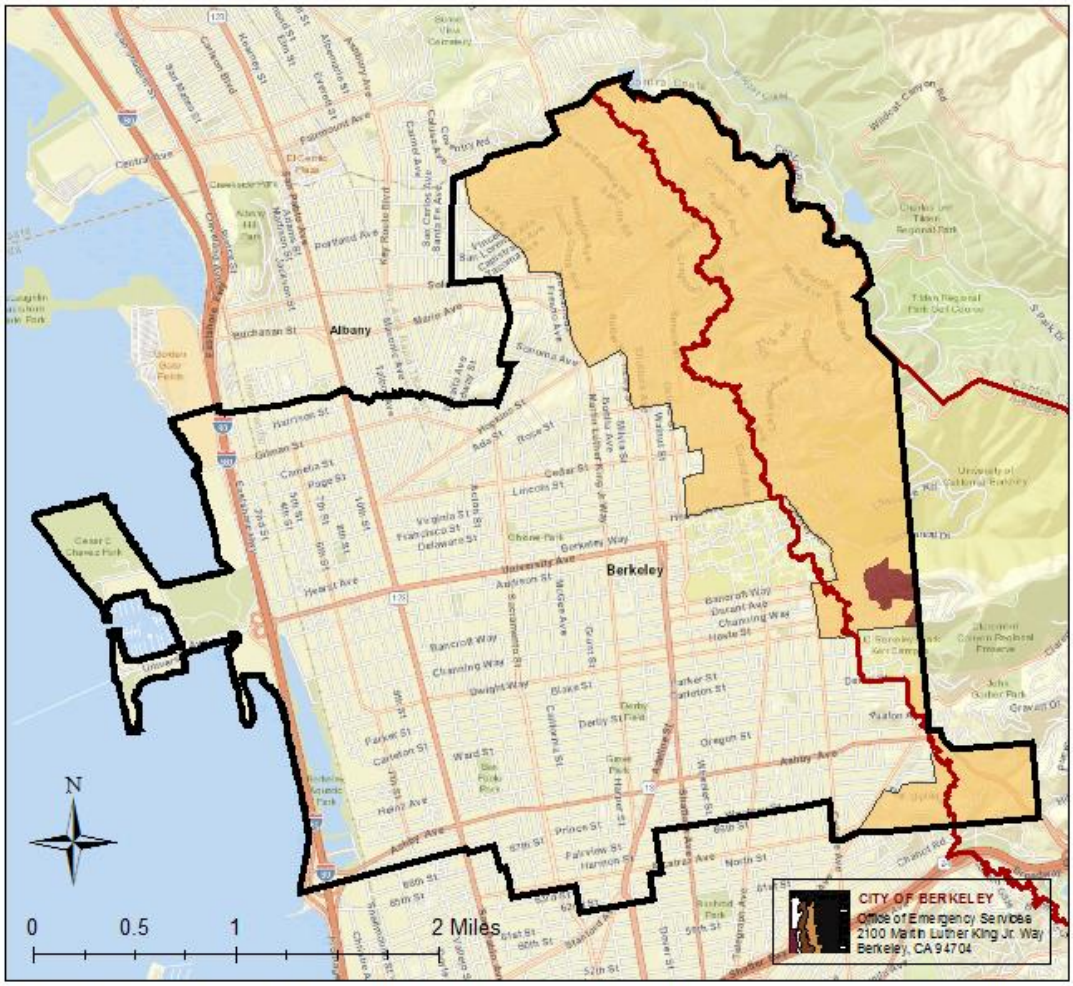
BACKGROUND

Berkeley is vulnerable to a wind-driven fire starting along the city's eastern border. The fire risk facing the people and properties in the eastern hills is compounded by the area's mountainous topography, limited water supply, 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. The flatlands are densely-covered with old wooden buildings housing low-income and vulnerable populations, including isolated seniors, persons with disabilities and students.[6]

City of Berkeley Fire Zones 2 and 3 currently include approximately 8,300 properties and have the strictest fire prevention standards in the City regarding vegetation management and fire resistive construction. Additionally, Cal Fire designates Berkeley's "Very High Fire Hazard Severity Zone." The map below illustrates the boundaries of the Cal Fire VHFHSZ as well as Berkeley's Fire Zones.

[5] http://www.b-step.info/
[6] 2014 City of Berkeley Local Hazard Mitigation Plan

City of Berkeley and State Fire Zones



Sources: Fire Zones 1, 2, and 3 as of 01/2013 Berkeley Ordinance NO. 7,157-N.S., and California Department of Forestry.

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

CA Dept of Forestry, Very High Fire Severity Zone

Berkeley Fire Zones

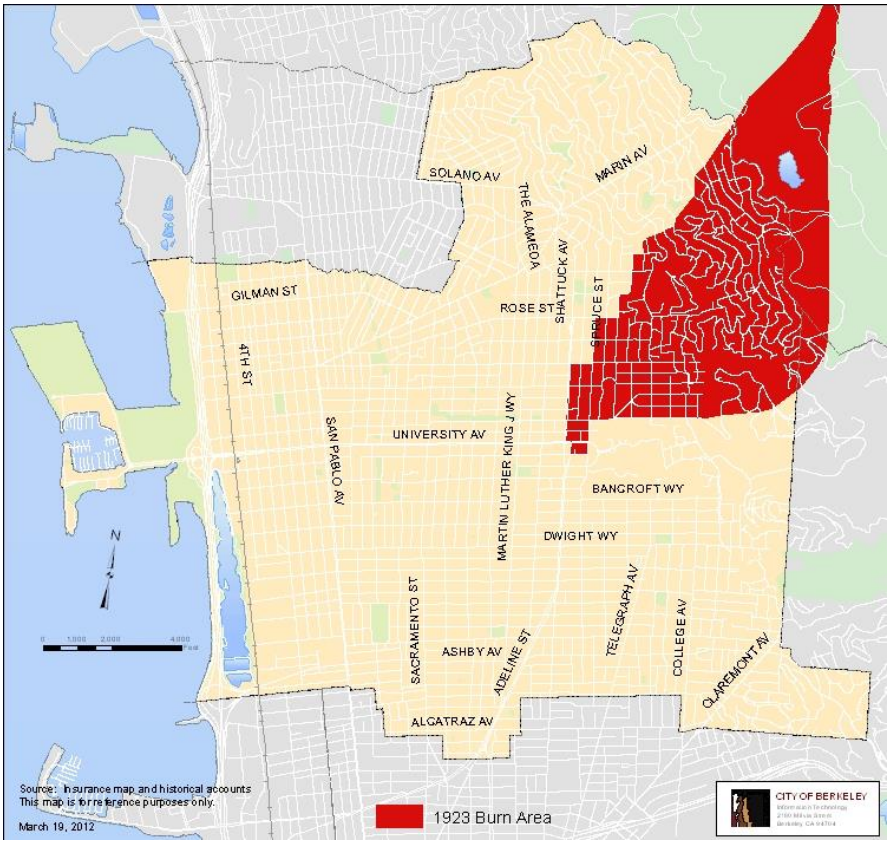
Hazardous Fire Zone 1

Hazardous Fire Zone 2

Hazardous Fire Zone 3

In 1923, a wildfire burned from the area of Lake Anza, down the northern hills of Berkeley, all the way to Shattuck Avenue. The 1991 Tunnel Fire in the Oakland and Berkeley hills destroyed 62 houses in Berkeley and more than 3,000 in Oakland. This led to an unprecedented increase in wildfire awareness.

1923 Berkeley Fire Spread



A Fire Assessment District was created in 1992 (Berkeley City Ordinance 6129-N.S.) which funded fuel abatement and inspection programs in the Berkeley hills including 3 full-time inspectors and a comprehensive fire fuel reduction program. The assessment district expired in 1997 following the passing of California Proposition 218 in 1996. With the primary funding source removed, dedicated Fire Prevention staffing was lost although some programming continues to this day in the form of the Fire Fuel Chipper and Debris Bin programs. On-duty firefighters now annually inspect a small proportion of properties in Berkeley's hills.

The 2017 fires in the North Bay and 2018 fires in Redding and Paradise were a stark reminder that wildland-urban interface fires move quickly through dry fuel with no regard to jurisdictional boundaries. These fires raised community awareness and concerns

about existing fire prevention programs and triggered a need to review these programs at all levels of the City.

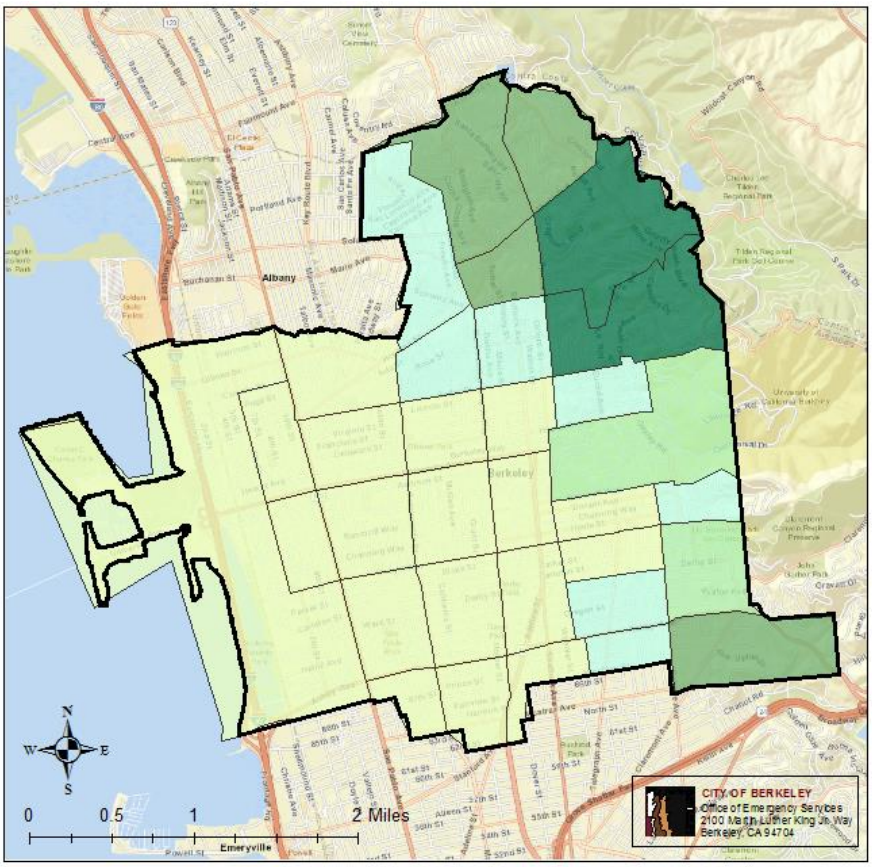
Three interrelated referrals that contained 82 distinct items (Attachment 7) were made to the City Manager and the "relevant commissions" on November 28, 2017, January 30, 2018 and February 28, 2018 addressing, in whole or in part, fire safety and community disaster preparedness measures. On July 10, 2018 the Berkeley City Council Referred the items to the Disaster and Fire Safety Commission and staff to come back and request funding as staff is able to meet the actual task. Of those items, 36 were directly related to Wildland Urban Interface fire safety and risk reduction. Of that list, 26 are ongoing projects with 15 in progress and 10 are one-time projects with 2 in progress.

ENVIRONMENTAL SUSTAINABILITY

Wildfires in California have increased in intensity and unpredictable behavior likely due to climate change and the recent drought. A bark beetle infestation has compounded the effects by adding millions of dead pine trees to the forest in California. Any comprehensive wildland urban interface fuel mitigation plan must take consider the positive impacts of existing vegetation including the benefits of a healthy tree canopy, carbon sequestration in vegetation, habitat for local fauna. The Berkeley Fire Department is working with the City Attorney's Office and the Planning Department to consider CEQA and other legal frameworks for ensuring proper environmental review.

The Fire Department seeks opportunities for carbon offset and also equity in City programs that will serve the needs of the whole community. A recent mapping of the City's tree canopy coverage shows an imbalance as you move east to west across the City. Research is needed to identify funding opportunities to support replacement and maintenance of vegetation and trees removed in Fire Zones 2 and 3 with trees in Fire Zone 1. This would help achieve the goal of a healthier canopy and understory while improving the landscape of West Berkeley to help mitigate climate change.

Percentage of tree coverage in City of Berkeley



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

City of Berkeley

Tree Coverage

- 41% to 50%
- 31% to 40%
- 21% to 30%
- 11% to 20%
- Less than 10%

Collaboration on healthy forest management was demonstrated by work at the UC Berkeley Sagehen Creek Field Station (https://sagehen.ucnrs.org/). Researchers at Sagehen embarked on a forest management plan that included stakeholders with numerous perspectives and interests. The result was the Sagehen Project, a forest management plan that was supported by all parties and approved by the US Forest

Service. While a plan for Berkeley will result in a more urban-centric proposed action, the lessons learned from Sagehen can serve as a model for a path forward.

POSSIBLE FUTURE ACTION

Existing staff and funding are limited to support increased future actions. However, Cal Fire and Cal OES are increasing grant funding rapidly to assist local agencies with wildfire risk mitigation. Top priorities to identify funding to undertake new work include:

1. Develop a Comprehensive Wildfire Fuel Reduction Plan
    - City of Berkeley
    - Berkeley Camps
    - Integration of best practices demonstrated at Sagehen
2. Support Utility Hardening
3. Fire code review and updates
    - Clarify code requirements for the public and inspectors
    - Consider the impact of accessory dwelling units on density in Fire Zones 2 and 3
    - Improve Berkeley's Fire Prevention policies and procedures for stronger follow up and enforcement of code violations.
4. Public Education and Outreach
    - Educate the public on wildfire evacuation
    - Provide support and education to residents on how to clear vegetation
    - Conduct evacuation and other disaster preparedness exercises
5. Safe Passages
    - Identify, paint, and provide signage for new "Keep Clear" pinch points on streets
    - Expand "No Parking" areas throughout dangerously narrow streets
    - Identify funding for additional capacity for parking enforcement
6. Consider implementation of additional emergency public warning systems
    - Siren warning system
    - Distribution of Weather Band Radios
7. Identify ongoing funding for the one-time work funded in FY 2019.
8. Identify ongoing funding for Fire Prevention staff
9. Ongoing review and prioritization of referred fire safety items from the Disaster and Fire Safety Commission and the City Council

FISCAL IMPACTS OF POSSIBLE FUTURE ACTION

Some public education and training can be achieved with existing resources as can fire code review and updates. Additional work with be dependent on significant new funding sources such as grants and fees.

CONTACT PERSON

Dave Brannigan, Fire Chief, Department of Fire and Emergency Services, (510) 981-3473

Attachments:
1: Hills Emergency Forum Annual Report 2018.pdf
2: Hills Emergency Forum Workplan 2019.pdf
3: Berkeley Administrative Regulation 9.3
4: Draft Wildfire Evacuation Annex
5: Local Hazard Mitigation Plan 2014
6: Draft Local Hazard Mitigation Plan 2019
7: Disaster and Fire Safety Referred Items

HILLS EMERGENCY FORUM

Annual Report 2018

City of Berkeley
City of El Cerrito
City of Oakland
California Department of Forestry and Fire Protection
East Bay Municipal Utility District
East Bay Regional Park District
Lawrence Berkeley National Laboratory
Moraga Orinda Fire District
University of California at Berkeley

HEF Mission

The mission of the Hills Emergency Forum is to coordinate the collection, assessment and sharing of information on East Bay hills fire hazards and further, to provide a forum for building interagency consensus on the development of fire safety standards and codes, incident response and management protocols, public education programs, multi-jurisdictional training, and fuel reduction strategies.

HILLS EMERGENCY FORUM

October 19, 2018

Letter from the Chair

Dear Friends:

On behalf of the Hills Emergency Forum (HEF), I am pleased to report on the twenty-sixth year of HEF activities. The Hills Emergency Forum was formed in October 1992 in direct response to the need for a coordinated regional approach to urban wildland interface fires. The 2017 fires in California heightened community awareness of emergency preparedness and coordinated response. 2018 continued with record setting wildfires, reinforcing the importance of continued collaboration.

In May, HEF members briefed local media on how the hills fire agencies were preparing for the 2018 wildfire threats. Members urged hills residents to get ready for fire season and be ready if called upon to evacuate. New and updated public information was released throughout the year. In August, we had the opportunity to share lessons learned with thirty-two (32) participants from around the world through a field tour, as a part of the three-week US Forest Service International Disaster Management Seminar.

Members' fuel mitigation projects throughout the East Bay hills have expanded our system of strategic fuel reduction zones through use of goats, hand crews and machinery. This year, the East Bay Regional Park District began utilizing FEMA Pre-Disaster Mitigation grants, matched with local funds, for hazardous fuel reduction projects and will continue over the next ten years. Other grant programs through CAL FIRE, California Fire Safe Council, Diablo Fire Safe Council, Pacific Gas and Electric Company and USA Forest Service, have provided additional funds for projects in our region. A joint project at Russell Reserve, sponsored by multiple HEF members, benefitted from these grant funds. We look forward to 2019, when additional grant funding for hazardous fuel reduction projects has been awarded to East Bay Regional Park District and the University of California through the CAL FIRE California Climate Investments program.

The 2018 Annual Report serves to document positive changes our agencies have brought to the Oakland-Berkeley Hills region. This report highlights efforts of both Hills Emergency Forum and individual members during the past year; we recognize that our work is by no means completed.

On behalf of all the members of the Forum, I would like to thank the many individuals and organizations whose support and input have enabled us to advance our agenda of emergency preparedness.

We welcome your participation and comments.

Sincerely,

Darin White, Fire Chief
City of Oakland
HEF Chair 2017-2018

Table of Contents

2018 Highlights

1. Sustained Multi-agency Partnership to Manage East Bay Hills Fire Risk.
   - Interagency issues and collaboration with other agencies.
   - Mutual aid. Joint response/ mutual aid for wildfires fire both locally and outside of region.
   - Partnerships to reduce fire hazards including Student Conservation Association, Civicorps and groups such as Friends of Beaconsfield, Claremont Canyon Conservancy, Diablo Fire Safe Council, Garber Park Stewards and Kensington neighborhood groups.
   - Response to continued effects of drought, dead/ dying trees and increased risk of wildfire.
   - Grant Funding: CAL FIRE SRA California Climate Initiative, California Fire Safe Council and US Forest Service, Pacific Gas and Electric Company drought related funding.

2. Mitigation Planning, Environmental Review and Research
   - EBMUD Watershed Master Plan Update and EIR.
   - Updates of Local Hazard Mitigation Plans in Contra Costa County
   - Continued research on accelerating decomposition of woody debris.

3. Vegetation Management
   - Joint hazardous fuel reduction project at Russell Reserve. Partner projects with PG&E in Berkeley, Canyon and Orinda.
   - EBRPD: FEMA funded projects underway. Eucalyptus and other hazardous fuels reduced in several East Bay hill parks.
   - EBMUD: second growth eucalyptus thinning, pine bark beetle damaged pine removal, brush removal, mechanical mowing and native grassland enhancement.
   - Fuel reduction by goats on EBMUD, EBRPD, LBL, Oakland and UC Berkeley parcels throughout the hills.
   - Fuel removal projects by CAL FIRE/ CDC, Civicorps, Student Conservation Association and private contractor hand crews in El Cerrito, EBRPD, Oakland and Orinda.
   - Volunteer broom busting Oakland, El Cerrito Natural Area and UC Berkeley.
   - On-going maintenance of previous fuel reduction project areas.

4. Outreach, Training, Emergency Exercises and Communications
   - May 22, 2018 briefing for local media on how hills fire agencies are preparing for 2018.
   - Coordination of member public information officers and releases.
   - Update of EBMUD "Firescape: Landscaping to Reduce Fire Hazard."
   - Update of HEF "Wildfire Evacuation Tips" and website: www.hillsemergencyforum.org.
   - Field tour for US Forest Service International Disaster Management Seminar.
   - Site visits to joint community hazardous fuel reduction projects in Orinda.

1.0 Hills Emergency Forum (HEF) Overview

1.1 2018 Highlights

The primary mission of the HEF continues to be to provide a sustainable framework for interagency communication, joint planning and coordinated response to the needs of our various constituents. The organization's goals, developed over the years and grouped into the four areas of Assessment, Mitigation, Preparedness and Response, continue to serve as milestones for our collective efforts. However, many of these goals are now in a "maintenance" mode as evidenced by the proposed 2018 Work Plan.

Sustainability and Funding

One of the on-going challenges faced by members is funding and implementing fuel reduction projects. The HEF continues to explore ways to make the forum sustainable, including pursuing additional funding mechanisms.

Prolonged Fire Season Leads to Continued Wildfire State of Emergency Response Funding

After a severe, prolonged 2017 fire season, HEF members continued to observe effects of long-term drought with an increase in pests and diseases, higher tree mortality and below normal fuel moisture levels earlier in the fire season, similar to what was being experienced throughout California.

Throughout the 2018 fire season, National Interagency Fire Center Predictive Services forecasted above normal significant fire potential conditions.[1] CAL FIRE received augmented funding to bring their staffing levels up early in the spring and retain staffing level as operationally needed through December 31st. Pacific Gas and Electric Company received a third year of drought response funding to increase their vegetation management efforts and support community fuel reduction projects through local fire safe councils and HEF member agencies.

2017-2018 California Climate Investments (CCI) Grant Program and other Funding

Through the California Climate Investments (CCI) Fire Prevention Grant Program, CAL FIRE aims to reduce the risk of wildland fires to habitable structures and communities, while maximizing carbon sequestration in healthy wildland habitat and minimizing the uncontrolled release of emissions emitted by wildfires. Three grants were awarded within the Santa Clara Unit. East Bay Regional will receive $750,000 for hazardous fuel reduction in four wildland urban interface parks, protecting over 200,000 habitable dwellings. Diablo FIreSafe Council will receive $324,020 for hazardous fuel reduction in very high fire severity zones and locally identified high fire areas in Alameda and Contra Costa County. University of California Berkeley will receive $3,621,000 for vegetation treatment in the Hill Campus to reduce potential damage to approximately 3,000 habitable structures and improve life safety for 3,000 plus residents and approximately 1,000 daytime users of the hill campus. For more information see http://calfire.ca.gov/fire_prevention/firepreventiongrants.

UC Berkley submitted three applications for hazardous fuel reduction projects in support of evacuation to the Federal Emergency Management Agency (FEMA) Hazardous Mitigation Grant Program. The campus submitted an additional application with the same program for the Blake Gardens site in Kensington. The grant application is for improved Defensible Space work at the site.

EBRPD Measure CC Funding

The District continues to move forward with planning and implementing fuels management on several sites within the Measure CC area. In 2018, the District's Fire Department will have treated over 800

[1] Source http://www.predictiveservices.nifc.gov/outlooks/monthly_seasonal_outlook.pdf

acres using contractors, crews, and goats, including brush reduction and eucalyptus stand thinning. The EBRPD Board has placed an extension measure has been placed on the November 2018 ballot to continue local, voter approved funding. For more detail see their website at www.ebparks.org/activities/features/measure_cc_commitments_made_improvements_delivered/default.htm

Interagency Issues and Collaboration with Other Agencies

HEF members have a long history of collaborating with Fire Chief organizations including the Alameda County Fire Chiefs Association and Contra Costa County Fire Chiefs Association. This year, HEF members also continued their activities with local groups, and State and Federal Agencies. The group regularly outreaches to collaborate with potential partners with similar missions of fire safety, as well as assist other agencies to understand our unique fire related issues.

Alameda County Fire Chiefs and Contra Costa County Fire Chiefs Associations: HEF Fire Chiefs continue to be active with these two organizations.

CAL TRANS: At the request of the Oakland Fire Department, CAL TRANS completed vegetation removal along both Highway 580 and Highway 13. CALTRANS removed hazardous ground fuels, brush, sapling invasive tree species (eucalyptus and acacia) and dead trees from 106th Avenue on Highway 580 to the intersection of northbound Highway 13 and Highway 24 on both sides of the freeways and the center divider median. Additionally, CAL TRANS used goats to graze approximately 110 acres of State owned lands along Highways 24 and 580.

Civicorps: Over the years, many HEF members have contracted with Civicorps (formerly East Bay Conservation Corps) for crews for fuel reduction projects. In 2018, EBRPD continued to use Civicorps and California Conservation Corps crews to enhance the existing fuel breaks by cutting, piling, and burning 1-hour and 10-hour fuels in Redwood Park, Anthony Chabot Park, Leona Open Space, Tilden Park, and Wildcat Canyon Park.

National Weather Service**:** The Monterey Forecast Office of the National Weather Service provides HEF members vital fire weather updates several times a day that are instrumental in developing local urban interface and wildfire response plans. For more information on fire weather updates see www.wrh.noaa.gov/Monterey/. Area wide outlooks and updates of seasonal predictions can also be found at the Northern California Geographic Area Coordination Center (ONCC) gacc.nifc.gov/oncc/predictive/outlooks/index.htm. For most of 2018, Predictive Services in their Seasonal Outlook and National Significant Wildland Fire Potential Outlook, reported that the fire potential would increase to above normal over northern California due to the 2017-18 rainy season producing 150-300% normal precipitation and a robust fine fuel crop and brush growth. Warmer and dryer than normal conditions are expected into the fall months.

Claremont Canyon Conservancy: HEF members continue to actively collaborate with this non-profit group on fuel management and restoration projects in Claremont Canyon. The citizen-based Claremont Canyon Conservancy focuses on long-term stewardship of Claremont Canyon to reduce wildfire hazards, improve public access and preserve or restore a healthy native ecosystem. The University of California Berkeley (UCB) and the Conservancy continue to implement the joint stewardship Memorandum of Understanding for select UC lands. The Conservancy continues to host monthly volunteer work projects toward fire management and revegetation efforts in the canyon. In 2012 East Bay Regional Park District and the Conservancy developed an on-going Right of Entry agreement, which has been renewed annually and allows neighborhood groups to conduct fuel reduction work on District lands. Several volunteer sessions were held in Claremont Canyon to find and remove eucalyptus, pine and acacia sprouts, as well as controlling broom and improving the trails needed to provide emergency access. East Bay Municipal Utility District (EBMUD), who own lands in the canyon,

also coordinates with the organization. For more information see their website at www.claremontcanyon.org/.

Fire Safe Councils: HEF members are regularly involved with the Diablo Fire Safe Council (representing Alameda and Contra Costa Counties), the Santa Clara County Fire Safe Council and the California Fire Safe Council. These groups provide the opportunity to collaborate with local homeowners, businesses and policy makers. For more information see their websites at: www.diablofiresafe.org, www.sccfiresafe.org/ and www.firesafecouncil.org.

HEF members coordinate with Diablo Fire Safe Council (DFSC) to develop grant proposals for fuel reduction, education and outreach projects throughout Alameda and Contra Costa counties. In 2018, DFSC completed two federal grants: $178,320 to continue "filling the gaps in defensible space projects" throughout the two counties and $260,000 for a community hazardous fuel reduction program for the communities of Orinda, Moraga and adjacent EBRPD lands. DFSC completed a State grant from the CAL FIRE SRA grant program for projects in Sunol. They also received $75,000 in grant funds from Pacific Gas and Electric Company to work with community members in Alameda and Contra Costa Counties and the Sunol Fire Safe Coalition. Matches to these federal and state dollars are from local funds, such as EBRPD Measure CC funds, in-kind service from HEF members and local fire agencies, as well as sweat equity from residents. Projects included chipping and fuel reduction in HEF member communities of Canyon, Berkeley, El Cerrito, Kensington, Moraga, Oakland, Orinda and Sunol. Grant funds were used to support fuel reduction along the City of Oakland right of way on Grizzly Peak Boulevard and adjacent UC Berkeley lands. HEF members worked with other stakeholders to complete a community specific update for Sunol to the Alameda County Community Wildfire Protection Plan (CWPP), which was adopted in January of 2018. This type of planning process facilitates regional collaboration, as well as provides access to federal funding.

Pacific Gas & Electric Company: Pacific Gas & Electric Company worked with several HEF partners in 2018 to increase the amount of hazardous fuel reduction around their transmission and distribution lines. These included projects with University of California, Berkeley on Panoramic Hill and at the Lawrence Berkeley Laboratory. They also worked with Moraga Orinda Fire District (MOFD) and City of Orinda for a project along Miner Road, as well as with MOFD and East Bay Municipal Utility District in the community of Canyon.

In 2018 PG&E rolled out their Community Wildfire Safety Program. This includes a dedicated center to monitor wildfire risks in real time and coordinate prevention and response efforts and expansion of the PG&E weather station to enhance weather forecasting and modeling. They are also investing in longer-term electric system hardening with stronger, coated power lines and non-wood material poles. In January 2018 the California Public Utilities Commission adopted new High Fire Threat District Maps. HEF member jurisdictions include areas identified as Tier 3- Extreme risk for wildfire and Tier 2- Elevated risk for wildfire. Enhanced safety measures in these areas also include refinement of protocols to proactively turn off electric power where extreme fire danger conditions are occurring. More information is available at www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/community-wildfire-safety.page

Mitigation Planning and Research

This past year HEF members have assisted in discussions of planning, environmental compliance documents and research related to urban wildland fire and fuel removal.

Complying with SB1241 for Wildfire Safety

Senate Bill 1241 was signed into law in 2012 and requires counties with the State Responsibility Area (SRA) and with lands designated as "*Very High Fire Hazard Severity Zones*" in Local Responsibility Area (LRA) to comply with revised Government Codes and changes in the Public Resources Code. HEF

members continue to improve wildfire safety in conjunction with revisions to the General Plan Housing Element and the Safety Element.

Oakland Vegetation Management Plan and Environmental Impact Report
The Oakland Vegetation Management Plan and Environmental Impact Report (EIR) addresses how vegetation is managed on more than 1,400 acres of city owned property and treatment of approximately 300 miles of roadway. Vegetation management activities conducted on these lands currently includes goat grazing on nine sites covering approximately 1,300 acres, vegetation clearing along 16 roadways (58 miles), monitoring for vegetation clearance along approximately 300 miles of road within the High and Very High Fire Hazard Severity Zones (16.5 square miles), and brush clearance on critical City-owned properties (~332 acres). The Plan and EIR evaluate these and additional vegetation management practices to reduce fire hazard. A draft plan was released May 2018, with draft environmental report expected in April 2019, and final EIR and certification/ notice of determination anticipated at the end of 2019. For more information see https://oaklandvegmanagement.org/

East Bay Watershed Management Plan
East Bay Municipal Utility District updated their Watershed Management Plan in 2018. The plan will help reduce the threat from wildfire to life and property, while preserving the high quality drinking water and biodiversity for the citizens of the East Bay. The management plan included an initial study and negative declaration to comply with the California Environmental Quality Act.

Local Hazard Mitigation Plans

In 2018 City of El Cerrito adopted an update to its Local Hazard Mitigation Plan (LHMP). The plan was included as an annex to the Contra Costa County plan also adopted in 2018. The LHMP serves as a coordinating document to help reduce risks from a wide range of potential events -- earthquakes and floods to wildfires and extreme heat. The Contra Costa County LHMP covers more than three dozen local agencies and special purpose districts, including HEF members Kensington Fire District and Moraga Orinda Fire District.

On August 22nd, The State Board of Forestry and Fire Protection approved the 2018 Strategic Fire Plan for California. The plan represents a vision for a natural environment that is more fire resilient, buildings and infrastructure that are more fire resistant, and a society that is more aware of and responsive to the benefits and threats of wildland fire, all achieved through local, state, federal, tribal, and private partnerships. Since the last plan update in 2010, State fire officials say it appears the impacts of climate change have resulted in increased severity of wildfires, longer fire seasons, increased extreme weather conditions, historic drought, and led to California's worst tree mortality epidemic in history. The new plan addresses those issues and highlights the need for heightened levels of fire prevention and protection of natural resources. The Santa Clara Unit Strategic Fire Plan was updated in 2017. http://cdfdata.fire.ca.gov/pub/fireplan/fpupload/fpppdf1591.pdf

Research Developments and Sharing of Best Management Practices
In 2018, EBMUD continued field testing fungi to break down plant matter. Thirty eucalyptus stumps treated with mushroom spawn showed diminished re-sprouting on most stumps and many stumps with no re-sprouts at all. Treated pine tree logs showed mycelium and fruiting bodies on many logs.

Staff Liaison Committee site visits to share best management practices included visits to two multi-agency projects at Bear Ridge and Happy Valley Road in Orinda. These projects were undertaken in collaboration with two homeowner associations, Moraga Orinda Fire District and CAL FIRE.

Vegetation Management

Extraordinary rains after years of drought meant above average dry fuel conditions for Bay Area fire protection agencies. This past year we have continued to focus on expanding fuel mitigation projects throughout the East Bay hills. We have expanded the system of strategic fuel reduction zones through use of goats, hand crews and machinery.

The management strategy for some of the projects promotes a forest conversion: the more fire resistant emerging native forest of California bay, oak, maple and redwood are retained or augmented while the fire prone existing eucalyptus/pine/acacia dominated exotic canopy forest are eradicated. The native species produce either considerably lesser fuel loads or are most fuel productive well before the peak of the regional fire season. Projects this last year included thinning pine and eucalyptus stands to reduce fuel loading and ladder fuel continuity, while promoting a healthy and vigorous understory of native plants. Other projects reduced fire hazards through the use of hand crews, grazing animals or use of prescribed fire to reduce fuel volumes and eliminate ladder fuels.

During the removal projects, the more fire resistant native trees were protected, while the trees with high fuel loads were removed and their stump cambium chemically treated with herbicide to prevent re-sprouting. Felled trees were either chipped or retained whole on the project site. Removed stems were recycled as roadside timbers, retained as habitat, or positioned for erosion control on the project site. Projects included:

- **East Bay Regional Park District** (EBRPD) completed pile burning in several of their hill parks to remove cut biomass. Much of this year's focus was on maintaining over 800 acres of existing East Bay hills fuel breaks by weed-eating, mechanical and hand removal of brush, goat grazing and eucalyptus stump re-sprout control.

  In 2018, the Park District began implementation of the FEMA hazard mitigation grant, removing hazardous fuels on several sites in Tilden, Wildcat, and Anthony Chabot parks using contractors and Civicorps.
- **East Bay Municipal Utility District** (EBMUD) managed vegetation to reduce fuel loading on 20 acres along the Oakland/Berkeley watershed interface. Combined management tactics, including herded goats, mechanical mowing and hand labor, were used to reduce fuel loading and enhance native plant populations. A volunteer group continues to assist in the removal and reduction of noxious weeds and in the enhancement of the diverse and abundant native plant species growing throughout the fuel treatment area. With support from Cal Fire Conservation Crews, EBMUD Rangers removed 580 decadent Monterey Pine trees and burned 370 brush piles on the east side of San Pablo Reservoir. EBMUD and Cal Fire Conservation Crews continued thinning and removal of eucalyptus trees and the understory vegetation at California Shakespeare entrance. Cal Fire crews and EBMUD rehabbed and continue the maintenance of the Sleepy Hollow Elementary emergency exit trail.
- **City of Oakland** The Oakland Fire Department has a dedicated Vegetation Management Unit within the Fire Prevention Bureau. The Unit is responsible for inspecting City owned parcels, managing fuel reduction in open space and parklands, inspecting private property vacant lots, responding to complaints of fire hazards and enforcement on chronic non-compliant residential and vacant lot properties. The Unit is staffed with full time inspectors.

  Fuel breaks are treated and maintained through a variety of means within the City's approximate 1,300 acres of parklands and open space primarily in conjunction with their extensive goat grazing program. In 2018, City Council approved 5-year goat grazing contract for $2.6 million to continue the program. The following locations were grazed resulting in achieving the goal of

ground fuels vegetation not exceeding 4 inches in height within 100 feet of established fuel breaks and access fire trails for Type III and Type VI apparatus.

- Sheffield Village
- Joaquin Miller Park
- Shepherd Canyon Park
- Kings Estates
- Grizzly Peak Open Space
- Dunsmuir Heights
- Castle Canyon Open Space
- Knowland Park
- Oak Knoll Naval Redevelopment

The hazardous fuel reduction enables firefighters to establish a safe anchor point when responding to wildland fire events. Additionally, Oakland did follow up treatment on 7 acres broom removal project adjacent to the Shepherd Canyon Public Works yard. In 201,7 they removed 40 tons of broom; this year the follow-up removed 6 tons.

Joint Projects: Working together with East Bay Regional Parks Fire Department, U.C. Berkeley, PG&E and East Bay Municipal Utility District, Oakland Fire's Vegetation Management Unit was able to reduce hazardous vegetation through roadside clearances, fuel breaks and goat grazing throughout the Oakland Hills. Major fuels reduction occurred inside the Shepherd Canyon area where EBRPD grazed their hillsides, PG&E cleared their transmission line right of ways of brush and dead trees and EBMUD cleared vegetation from all of their water reservoir properties. U.C. Berkeley assisted in roadside clearances along upper Claremont Avenue to Fish Ranch Road. Thank you to our partners in Fire Prevention for your assistance and cooperation.

- **Lawrence Berkeley Lab** (LBL) has completed all of the recommendations in its previous 10-year Wildland Fire Plan. The Berkeley Lab is expanding their fire protection program. A new fire management plan was completed to comply with federal requirements. LBL continues to maintain their property using goat herds and hand-labor to reduce annual fuel loads. This year they increased they use of goats with 400-700 goats on the lab for 4-5 weeks , with additional resources directed to tree removal. Invasive eucalyptus and diseased/dead trees of other species were removed and chipped in conjunction with low-level limb maintenance and other surface fuel removal
- The **El Cerrito / Kensington Fire Department** continues to aggressively manage the fire fuel loads, fire trail and the fuel breaks within their 90 plus acres of city owned natural parkland and the miles of urban interface with Wildcat and Tilden Regional Parks. This is achieved through multiple partnerships with Diablo Fire Safe Council, East Bay Regional Park District, CAL FIRE and their own community groups. Their fuel management efforts include: prescribed burns and mechanical methods (i.e. weed eating, chainsaw and mowing). Since 2012-13 the El Cerrito / Kensington has significantly reduced the acreage of prescribed burns with no broadcast burns this year due to the extreme fire hazard brought on by drought. During 2018 they completed tree and brush removal projects. These included private residential and commercial properties.
- **Moraga Orinda Fire District** sponsored two joint projects with the CAL FIRE Conservation Crews, and Diablo Fire Safe Council along Bear Creek Ridge and Orinda Downs Open Space. In collaboration with the Diablo Fire Safe Council, MOFD also worked with the communities of Bollinger Canyon and Canyon for community chipping days, as well as a juniper removal project in Sleepy Hollow. A collaborative pilot project was also completed with MOFD, PG&E, and the City of Orinda for line clearance, road paving and removal of hazardous roadside vegetation on Miner Road from Lombardy to San Pablo Dam Road.

  MOFD's new Fire Chief David Winnacker was active throughout 2018 meeting with homeowner and community groups to talk about wildfire prevention, early warning systems,

evacuation and hazardous fuel management. In addition to vegetation management, MOFD added two 10,000 gallon water tanks at Sleepy Hollow School and Wagner Ranch School for firefighting. They also identified critical water sources in Bollinger Valley and provided new fittings. A new tiller truck also was added in 2018.

- **University of California, Berkeley** (UCB) continues to work with its Fire Mitigation Committee to plan and implement fire hazard reduction projects in the Hill Campus. UCB has focused on defensible space and maintenance, while planning for future projects. UCB has managed, extended and improved its 8-mile trail network, cleared roadsides, turnouts and neighborhood interface zones with contract crews. Removal of parking along Rim Way improved emergency access and reduced congestion.

  During 2018, the campus contracted crews to perform French broom removal along Centennial Drive. The crews removed broom from each side of the road up to 30 feet. Cut broom was subsequently treated with herbicide. The work will continue next year as the campus moves to improve evacuation and access along established evacuation routes.

  In August, PG&E and UCB met to review a project to remove dead and dying pines along Panoramic Way. UCB worked closely with PG&E to reduce the impact of this project on the community by providing access to the project via the hill campus fire roads. The work consisted of removing over 50 hazardous, aging Monterey Pine and Cypress trees. The campus hosted a neighborhood meeting that resulted in complete neighborhood support of the work.

  In August, UC Berkeley was selected for a $3.6 million grant from CAL FIRE to reduce fire hazard in the Hill Campus and improve access, egress and carbon sequestration. The grant funds will be allocated over the next three years and will be instrumental in improving fire safety within the UC Berkeley Hill Campus. With the award of the CAL FIRE grant UC Berkeley is required to prepare appropriate documents. The campus is in the process of developing a Request for Proposal and Qualifications for a consultant to prepare the documents. The documents will not only cover the scope of the grant work, but also encompass all work planned for the foreseeable future.

  Diablo Fire Safe Council awarded $5,000 cost share to support use of the Cal Fire Conservation Crew on the Russell Reserve and adjacent EBRPD lands. In 2018 the project completed defensible space work around the observatories and road entrance. PG&E completed removal of trees under distribution lines and over gas lines. The project will continued to focus on reducing fuel loads and fire ladders to reduce the chance for a fire to move over the ridge from the reserve into the neighborhoods of the City of Lafayette. UC Berkeley led the coordination of the Russell Reserve joint project, a collaboration of UC Berkeley, East Bay Regional Park District, Contra Costa Fire Protection District, Moraga Orinda Fire Department with CAL FIRE Conservation Crews. In addition, the local chapter of the Society of American Foresters has adopted the Reserve as a "project", sponsoring an open house on April 21, 2108, several work days and more to come.

  Cal FIRE firefighters and Conservation Crew members participated in a one-day training exercise at Russell Reserve. The crews felled over a dozen aging, hazardous pines at the site.

- **CAL FIRE Santa Clara Unit**
  The CAL FIRE Director set goals for FY17-18 for acres of prescribed fire, acres of hazardous fuels reduction and number of defensible space LE-100 inspections. Santa Clara Unit treated 648 acres using prescribed fire with EBMUD and MOFD at Briones Reservoir, as well as at Grant Ranch County Park. CAL FIRE is continuing to work with the Regional Air Quality Control Board with additional prescribed fires being planned in the Unit. The unit also

competed 138 acres of hazardous fuel reduction projects, as well as 3,513 LE-100 defensible space inspections around homes. Overall the State met 95% of its prescribed fire acre, 65% of its fuel reduction projects acres and 87% of its defensible space inspection goals.

In addition to vegetation on public lands, HEF members work with property owners to enforce local requirements for hazard abatement and creation of defensible space on private lands.

- **City of Berkeley:** The Berkeley Fire Department annually inspects over 1,000 parcels in designated high fire risk zones for hazards such as excess vegetation. This year due to excessive vegetation cover City of Berkeley included inspection of 330 additional parcels with no additional staffing. The Fire Department also conducts complaint-driven inspections throughout the City. Residents must clear combustible brush and vegetation adjacent to building property lines and roadsides. Tree branches must be cleared from any chimney, stovepipe, or overhang over a building. All leaves, needles, and dead vegetation must be swept from roofs. This program is operated in cooperation with the East Bay Regional Park District, which has programs to limit combustible material in the wildland-urban interface zone on its property adjacent to Berkeley residences and roadways.
- **City of El Cerrito and Kensington Fire Protection District.** The City of El Cerrito and the Kensington Fire Protection District began vegetation and fire safety inspections of every one of the 10,500 plus properties within their jurisdictions and completed the inspection in early June. As a result, more than 192 letters of non-compliance were sent to property owners informing them of their violations and directing them to bring their properties into compliance with the vegetation management standards. All but three properties voluntarily brought their properties into compliance. The City abated the three properties that did not comply.
- **City of Oakland:** The City of Oakland Fire Department Fire Prevention Bureau staffs a Vegetation Management Unit specifically for the wildland urban interface areas of the city. This unit consists of four Inspectors and one Supervisor. The unit is responsible for overseeing and maintaining the records of over 21,000 residential inspections and 4,000 vacant lot parcels within the WUI area. This area is 10,590 acres in size, approximately 16.5 square miles with over 300 miles of interior roadways. In 2018 OFD brought on line a new ACCELA database to maximize efficiency of inspections and reporting. The system allows for data entry during inspection and automatic generation of letters to property owners.

  In May and June of 2018, annual vegetation management inspection training was conducted with Oakland Fire's firefighters. The Engine Companies received 2.5 hours of inspection training regarding residential defensible space inspections and the ACCELA database. The 11 Engine Companies located in the Oakland Hills completed over 19,000 initial residential inspections (compliant parcels) and 2,800 re-inspections on non-compliant residential parcels between July and September 2018. Vegetation Management Unit Fire Inspectors completed inspections on 2,020 privately owned vacant lot parcels, 416 City owned vacant lot parcels and 2,018 residential parcels between May and September 2016. As of September 2018 a total of 18,889 residential parcels and 1,389 vacant lots were compliant with Oakland defensible space requirements. 670 residential parcels and 523 vacant lots were non-compliant.
- **Moraga Orinda Fire District:** Moraga Orinda Fire District sent out notices in mid April to all 4,000 homes in their District. A second mailing was sent to those living in the high fire severity zone. They began follow-up inspections in June and continued throughout the fire season. 2018 continued a program enhanced with outreach and education. Fire personnel offered homeowners home assessments with more detailed advice on abatement and remodeling of their homes. Firewise activities included assessments for homes in Lost Valley.

To support the various City inspections and required compliance, some vegetation management programs offer services to assist homeowner in reducing fuel loads on privately owned property. City of Berkeley's Fire Fuel Chipper Program is a popular yard waste collection service. The program serves properties in the hills from June through September each year. The Department of Public Works Solid Waste Division coordinates the Fire Fuel Debris Bin Program. The Program delivers and removes 30-yard roll-off boxes from requesting neighborhoods, an effort yielding an average of 20 tons of plant debris per year. Additionally, 14,000 tons of residential plant debris is collected annually through weekly curbside collection. From mid-June to mid-August each year, a fire fuel abatement program removes an average of 125 tons of debris from 95 public sites, including parks, pathways and medians. This program is a joint effort of the City of Berkeley and the East Bay Conservation Corps.

Biomass Utilization

Disposal or use of biomass continues to be a major issue with the large hazardous fuel reductions projects currently underway. University of California Berkeley has begun discussions with PG&E about biomass utilization and the potential development of a regional gasifier. As part of the CAL FIRE grants recently award to UC Berkeley, further research will be conducted regarding installation and operations of a mobile, on-site gasifier.

Use of CAL FIRE Conservation Crews

Alameda and Contra Costa Counties are two of the few counties in the state that do not contain a CAL FIRE Conservation Camp. The nearest facility is the Delta Camp out of Suisun City. The CAL FIRE Conservation Crews have been used successfully on several local fuel mitigation projects in the East Bay. In 2002 a sixth crew was established in the Delta Camp and has been an asset to the Bay Area.

A joint HEF member agency project along Grizzly Peak Boulevard project focused on road-side clearance of brush and pruning up trees located in the road right of way from Claremont Avenue in Oakland to Centennial Road in Berkeley. This 7.1-mile stretch is both a commute route and a popular destination for locals and tourists for spectacular views of the San Francisco Bay, resulting in an increased potential for ignitions. This project supported other HEF agencies' projects along Grizzly Peak Boulevard.

An additional, multi-year, joint HEF member agency project using the Conservation Crews continued at the UC Berkeley Russell Reserve located on Happy Valley Road. The Russell Reserve project includes removal of understory shrubs and small trees, pruning of lower limbs and removal of dead and dying trees to reduce the potential of a crown fire on the valley floor. Along the southern ridge, similar fuel reduction will prevent a fire from spreading into the adjacent neighborhoods in the City of Lafayette.

This past year the CAL FIRE Crews assisted with brush cutting and pile burns in several maintenance areas on EBRPD lands in the East Bay Hills. They worked with cutting brush, trimming trees, creating brush piles and conducting pile burns from cut materials on EBMUD watershed lands, adjacent to Grizzly Peak Boulevard, and the San Pablo Reservoir Recreation Area. Their work included hand thinning to reduce fuel loading and preparing for pile burns later this winter.

The El Cerrito/ Kensington Fire Department has developed a partnership with CAL FIRE and their Conservation Crews. This partnership has been instrumental in the maintenance of crucial fire fuel reduction zones between their Natural Area Parks and the neighborhood interface zones surrounding these parks. This relationship has been so effective that El Cerrito/ Kensington Fire Department has expanded the program and the partnership with East Bay Regional Parks (EBRPD) to maintain the existing fire fuel reductions zones along the miles of EBRPD parkland urban interface with the City of El Cerrito and the Community of Kensington.

The Moraga Orinda Fire Protection District and the Town of Moraga, in partnership with CAL FIRE and Diablo Fire Safe Council, utilized the Conservation Crews for a project on Mulholland Ridge in Moraga.

The crews removed brush, cut dead trees and limbed up branches of aged Monterey Pine trees along the old ridge top roadway.

Prescribed Burn Program

Prescribed fire continues to be used by the East Bay Regional Park District, City of El Cerrito and East Bay Municipal Utility District, in cooperation with local fire agencies in the Berkeley-Oakland hills. This past year, pile burns were conducted in Tilden, Wildcat, Sibley and Anthony Chabot Regional Parks, on the San Pablo Watershed and in El Cerrito's Hillside Natural Area. Written plans are prepared for each project, with agency staff working closely with the Bay Area Air Quality Management District (BAAQMD) and CALFIRE for approvals and coordination with local fire agencies. Incident Action Plans are written for each project to define procedures for establishing control lines, making proper notifications, briefing personnel on safety considerations, managing smoke and applying appropriate burning techniques. The prescribed burns enhance firefighter skills and interagency cooperation, in addition to meeting resource and fuel management goals.

Prescribed burning within the City of El Cerrito has been used for more than twenty years to reduce wildland-urban-interface fuels. In recent years, prescribed burns have been conducted in conjunction with mechanical means of vegetation management. This year El Cerrito restricted their prescribed burning to pile burns due to the extreme fire hazard brought on by the years of drought. They instead focused more on hand labor to remove heavy brush and limb trees. Historically, the brush and branches that were cut were either chipped in place and broadcast spread in the area or moved to safe areas and piled for burning. By taking this approach they were able to reduce the fuel loads in areas that were considered unsafe for prescribed burning. This has enabled the City to provide pinpoint accuracy in reducing the fuels that create the greatest risk of wildland-urban-interface fire loss within the City.

The City of El Cerrito and the community of Kensington continue to manage their two demonstration vegetation management projects, along Leneve Place to Camp Herms, developed in conjunction with the East Bay Regional Park District. They continue to manage 90 acres of city property with a year round program that use hand labor, control burns and mechanical methods to maintain fuel management zones at the borders of the city and parklands.

Preparedness

Evacuation planning

After the 2017 fires in the North Bay, HEF members increased their focus on helping their communities prepare for evacuation. City of Berkeley expanded their wildfire evacuation preparedness including new materials on when and how to evacuate at https://www.cityofberkeley.info/WildfireEvacuation/. A new evacuation brochure and map of potential routes was developed and widely distributed, including through Berkeley High School students. In Kensington, their April annual wildfire safety presentation focused on *Ready! Set! Go!,* highlighting evacuation and the community warning systems. An article in the monthly Kensington Outlook reinforced that "emergency preparedness must start block by block."

Lawrence Berkeley Lab provided a campus-wide training/ informational session on evacuation planning and general wildland fire safety to its general population. The training session included the concept that a site-wide evacuation may not be a realistic or executable strategy, and rather some personnel may need to relocate to pre-specified buildings known as SAFE Buildings (Safety Area For Emergencies). Evacuation history has demonstrated that approximately 2 hours are required to completely evacuate the Lab; therefore, alternative options were developed. Additional information covered the FireWise program, defensible space, and what to do in a wildfire emergency at home, on vacation, or at the Lab. Much of this training was spawned from LBL personnel attending the National Fire Academy's class on "Wildland Urban Interface: Fire Adapted Communities."

In conjunction with the Russell Reserve hazardous fuel reduction project, UC Berkeley drafted an evacuation guide to inform first responders of resources available. HEF SLC members reviewed and updated the "Wildfire Evacuation Tips" and "Why is Evacuation from Wildfire Different?" available on the HEF website http://hillsemergencyforum.org/wildfireevacuation.html. They also shared new research findings such as "Should I Stay or Should I Go Now? Or should I Wait and See? Influences on Wildfire Evacuation Decisions." https://www.fs.usda.gov/treesearch/pubs/55590

Ignition prevention

In April 2018, CAL FIRE Santa Clara Unit shared copies of their "*Operational Guide for Use of Equipment in Grass, Brush or Forest Covered Areas*" with HEF member agency representatives. Each year, the region experiences vegetation fires started by local agency mowing, equipment operations and private residences yard mowing. Mower use can ignite fires even with the relative humidity at 30% or higher. The document offers guidelines for:

- Equipment inspection prior to working season and in preparation for each work day (including: spark arrestors for all equipment powered by an internal combustion engine)
- Tools required on each piece of equipment (including: round pointed shovel and backpack pump water (5 gallon) fire extinguisher)
- Operational procedures within 24 hours of a predicted red flag event as determined by the National Weather Service, including on-going weather sampling and immediate operations cessation if relative humidity is at or below 30% or sustain wind speeds reach 10 mph or higher
- Applicable laws and regulations
- Contact information
- Equipment Use Safety.

Guidelines apply to both agency owned and hired or contracted private equipment and operations. CAL FIRE also partnered with the California Wildland Fire Coordinating Group to promote the "One Less Spark, One Less Wildfire" campaign. http://www.preventwildfireca.org/OneLessSpark/

HEF is also interested in developing remote surveillance to increase regional detection capabilities. The surveillance could be through remote devices, cameras, or potentially drone operations. The goal of the surveillance devices is early detection of ignitions and other potential hazardous behavior to support rapid response.

UC Berkeley Facilities Services recently funding a comprehensive patrol of the area through UC Police Department. The Hill Patrol, consisting of UCPD Security Patrol Officers, tours the area bi-monthly and reports on activity and conditions along established fire roads and trails.

Weather Monitoring and Fire Danger Operations Plan

The local uses of Remote Automated Weather Stations (RAWS) data are important. Weather information is used to maximize the efficiency and effectiveness of fire patrols and deployments. National Weather Service (NOAA) forecasters in Monterey issue Fire Weather Watch and Red Flag Warnings for the East Bay (see web site at www.wrh.noaa.gov/Monterey/). These watches and warnings trigger heightened alert and deployment of additional local fire suppression resources when responding to a fire. RAWS provide more current local microclimate data in five zones that can be used to confirm the NOAA red-flag warning. This confirmation of local weather can prevent the over deployment of resources when the local conditions are not as severe as general statewide conditions. Occasionally, local RAWS data will also provide data that recommends the use of additional suppression resources even when no NOAA red-flag warning has been issued. These red-flag warnings and fire weather watches signal cooperative patrols throughout the high hazard areas. The information is also used by EBRPD, Oakland and El Cerrito as a part of their high fire danger park announcements, use restrictions and to set dispatch levels by EBRPD, LBL, Berkeley, Oakland, El Cerrito and EBMUD. The data from the

RAWS can be accessed at a web site developed by the East Bay Regional Park District at www.ebparks.org/about/fire/raws**.**

Mutual Aid

HEF agency personnel and equipment participated in the suppression of several large fires throughout California during 2018. EBRPD personnel staffed OES engine 348 on the Cranston Fire, in Riverside County, and the Mendocino Complex Fire. Berkeley Fire sent personnel to the County Fire in Yolo County in July. Local firefighters also provided mutual aid to the Lake County fire and others in northern and southern California.

In addition to record setting fires across the state, there were several local fires during 2018. Fortunately these remained relatively small. Prior, hazardous fuel reduction efforts and coordinated response resulted in no damage to homes or loss of life.

- Tunnel Road, Oakland (near Firestorm Memorial Garden) 1.5 acres. June 7, 2018.
- La Salle Drive, Moraga. 5 acres. June 8, 2018.
- Buckingham Fire, Moraga. 45 acre Ignition caused by tractor installing defensible space adjacent to 20 homes. Evacuation required. July 2, 2018.
- Lime Ridge Open Space, Walnut Creek. 368 acres Crystal Ranch subdivision evacuated June 29, 2018. Restarted June 30 and burned additional acres.
- Marsh Fire along Marsh Creek Road, Morgan Territory. 247 acres Wed July 24 - July 25, 2018 Mandatory evacuation lifted Friday 7/26.
- Canyon, multi-agency response, September 13, 2108.

Interagency Exercises and Preparedness Training

In August 2018, CAL FIRE, EBMUD, Moraga Orinda Fire District and Contra Costa County Fire District conducted a wildland training burn on the Briones watershed near Bear Creek and Happy Valley Roads in Orinda. The exercise allowed for not only fuel reduction, but also multi-agency drill using live fire.

In December 2017 Lawrence Berkeley National Laboratory completed an annual drill focused on a simulated evacuation event.

City of Berkeley Fire Department conducts regular training and drills to keep firefighters ready to respond to a wind-driven WUI fire in the hills, which could transition into a fast-moving urban firestorm in the flatlands. All firefighters are certified in basic wildland firefighting and receive four sessions of wildland training, including fire behavior, structure protection, tactics and off-road driving. All firefighters receive annual training to understand "fire weather" and to perform surveillance of critical fire weather patterns. Additionally, firefighters hone these skills in annual wildland firefighting training drills with Alameda and Contra Costa Counties, as well as regional communications and staging drills to familiarize outside agencies with Berkeley target hazards and staging areas. The department also provided extensive off-road driver training. Due to the extreme drought conditions the department has provided additional training for the potential extreme fire behavior.

The University of California, Berkeley is creating an updated Wildland Fuel Management Plan for the Hill Campus. During 2018 the campus continued the process of developing GIS layers for fire management in the Hill Campus, including access and gates, management responsibilities, water supply, and treatment history. All are compatible with and available to HEF members. The University shared the spatial data with the City of Berkeley so they can include it in their response maps. The University of California Office of Emergency Management developed an 'app' to assist awareness of students and staff of the need for emergency preparedness plans and to help development individual plans. It is at http://oem.berkeley.edu/download-our-app-main-page.

Heli-tack Support

EBRPD maintained its two helicopters, Eagle VI and Eagle VII, for use on fires this year. During the prolonged hot, dry months of the summer and fall, the Helicopter Unit teams up with the EBRPD Fire Department to provide Heli-tack and water bucket responses to fires. Bambi Bucket® equipment is carried on all routine patrol flights, enabling a rapid response to fires. If a fire should erupt, the Bambi Bucket is quickly attached to the helicopter for direct attack. Ponds, streams and lakes are ready water sources for providing rapid delivery of water on active fires via the Bambi Bucket. During times of extreme fire hazards, selected, specially trained Park District Fire Fighters act as Heli-tack crewmembers and are transported swiftly to fires. Once deployed at the fire scene, Heli-tack crews act in concert with the water-dropping helicopter in an effort to extinguish fires quickly.

Outreach, Media Relations and Disaster Communication

Public Outreach

HEF members have used a variety of methods over the years to distribute fire safety information to their constituencies including newspaper articles, brochures and hands-on workshops in neighborhoods. During "Red Flag" days many HEF members fly fire weather flags at fire stations, on the watershed and at recreation facilities. These bright red pennant flags were provided in 2008 by the Diablo Fire Safe Council to increase public awareness of periods of increased fire danger. Several members also participated in open houses at local fire stations during National Fire Prevention Week in October. Berkeley hosted a community wildfire forum in July.

Throughout 2018, HEF SLC members continued their public outreach efforts. In May, HEF members briefed local media on how the hills fire agencies were preparing for the 2018 wildfire threats and urged hill residents to prepare for fire season and be prepared if called upon to evacuate. New and updated public information was released throughout the year including an update to the EBMUD booklet "Firescape: Landscaping to Reduce Fire Hazard." HEF SLC members reviewed and updated "Wildfire Evacuation Tips" and "Why is Evacuation from Wildfire Different?" available on the HEF website http://hillsemergencyforum.org/wildfireevacuation.html. Lawrence Berkeley Lab and Moraga Orinda Fire District installed new fire danger signs. HEF members also supported the California Native Plant Society in distribution of their new "Fire Recovery Guide," available digitally at https://www.cnps.org/give/priority-initiatives/fire-recovery and through CNPS's Sacramento Office.

HEF members also coordinated their public information officers with updated contact lists and invitation to participate in monthly meetings. A presentation by MOFD Emergency Preparedness Officer Dennis Rein shared lessons learned during large fires and the continual challenge of delivering unified messages during complex incidents.

In September 2018, the City of Oakland developed a public service announcement on the importance of defensible space and hazardous fuel reduction. Aerial footage shows how the partnership of homeowners and agencies is making a difference in reducing the fuel loads of the East Bay Hills. The PSA will be shown on the Oakland station KTOP TV10 https://www.oaklandca.gov/topics/ktop-tv-10. High definition aerial footage was also shared with HEF member agencies.

Training:

City of Berkeley provides a 20-hour training to give residents the skills to organize on their own when disaster strikes and ensure they're ready with crucial information when emergency crews arrive. The CERT academy, run by the Berkeley Fire Department, is a city program that brings free training to Berkeley residents, who can then go on to take more specialized classes and share information with their neighborhood groups. The weekend training program teaches participants how to set up a chain of command structure and organize into key groups with the aim of turning a chaotic situation into order. Training modules include fire suppression, search and rescue operations and disaster first aid.

2018 HEF MEDIA OPPORTUITY

Hills Fire Agencies Prepare for 2018 Wildfire Threats

Noah Berger / Special To The Chronicle

On Tuesday, May 22, at 11:00 AM, representatives from Alameda and Contra Costa fire agencies briefed local media on how the hills fire agencies are preparing for 2018 wildfire threats. The media opportunity was held on Grizzly Peak Boulevard at the site of the "Grizzly Fire," above University of California, Berkeley and Lawrence Berkeley National Laboratory.

The August 2, 2017, "Grizzly Fire" showcased success from working together to prevent wildfire. Approximately 200 fire fighters from 14 Alameda and Contra Costa fire agencies contained the "Grizzly Fire." There were many favorable conditions that resulted in successful firefighting that day: previous hazardous fuel management, fire agencies' response through the mutual aid system, rapid public notifications, closures and evacuations. However, the Grizzly Fire also highlights opportunities for improvements as fire agencies recognize wildfire as a year-round threat.

Daphne White, Berkeleyside

Participants at the media opportunity included representatives from:

- Alameda County Fire Department
- CALFIRE
- City of Alameda Fire Department
- Berkeley Fire Department
- East Bay Regional Parks District
- El Cerrito – Kensington Fire Department
- Lawrence Berkeley National Laboratory
- Moraga – Orinda Fire District
- Oakland Fire Department
- University of California Berkeley

David Yee

Media that attended and produced stories urging hills residents to prepare for fire season and be prepared if called upon to evacuate, included:

- Berkeleyside (on-line 400,000 views/month)
- KCBS Radio
- KNTV - NBC Bay Area/ Telemundo
- KRON 4
- San Francisco Chronicle (164,800 daily circulation)

Noah Berger / Special To The Chronicle

The Hills Emergency Forum facilitates a cooperative approach among nine governing organizations addressing urban wildland interface fire issues in the Oakland-Berkeley hills.

The City of Oakland Fire Department's Emergency Management Division has a similar training program called Communities of Oakland Respond to Emergencies (CORE). This includes workshops where participants received training in Fire Prevention, First Aid, Evacuation Preparedness and Community / Neighborhood Disaster response. CORE also provided classes with interpretation in Spanish, Cantonese, Mandarin and Vietnamese.

In March, EBMUD, with assistance from HEF SLC members, incorporated presentations on vegetation management for fire prevention into their annual staff training workshops on Integrated Pest Management. These workshops highlighted how EBMUD staff work contributes to ignition prevention, improved fire control, as well as use of prescribed fire.

Lawrence Berkeley Lab provided a campus-wide training/ informational session on evacuation planning and general wildland fire safety to its general population. (See Evacuation Planning on page 1.11. For further detail)

Media Coverage: HEF members regularly contribute and share relevant information in local and national news coverage and special interest series that address wildland fire safety, fuel management and other environmental issues such as reduced visibility and degraded air quality. 2018 news stories included:

California News Wire Services. "Overnight Fire in Oakland Hills Tamed by 3 departments." Piedmont Patch. June 7, 2018.

White, Daphne. "Urban wildfires are the new normal and everyone should be prepared, Berkeley Filmmaker Says. Berkeleyside. May 21, 2018.

Kundu, Anisa. "Berkeley air quality safe despite wildfire in Yolo County." Daily Californian. July 3, 2018.

"Bay area sky turns orange as northern California wildfire forces evacuations." Associated Press. July 2, 2018

Due, Linnea. "Emergency Preparedness must start block by block. " Kensington Outlook. March 2018.

Gomez, Mark. "No spare the air alert in effect for Saturday." San Jose Mercury News. August 24, 2018.

Hurd, Rick. "Three alarm wildfire contained near Campolindo." East Bay Times. July 3, 2018.

"Three-Alarm grass fire in Moraga contained, evacuation order lifted (20 homes evacuated)." KPIX TV. July 2, 2018.

Hurd Rick. "Fire crews extinguish wildfire near Campolindo High School in Moraga." Bay Area News Group. June 8 2018.

Johnson, Autumn. "Moraga Brush Fire: 45 acres charred." Patch National Staff. July 2, 2018.

Stone, Erin. "Large brush fire forces evacuations near Moraga High School." SF Chronicle. July 2, 2018.

Community Outreach:

In May, several members of the HEF SLC participated in the *California Fire Science Consortium "Living with Fire in California's Coast Ranges".* This conference was designed to provide an understanding the October 2017 Fires for property owners, the public, policy makers, planners, managers, scientists, educators, and any others who are interested in the intersection of human communities and fire. The event was sponsored by a coalition of educational, fire and resource management, and extension organizations. Two days of presentations by experts, with question-and-answer sessions and ample opportunity for audience participation was followed by a day of field tours.
http://www.cafiresci.org/events-webinars-source/category/livingwithfirecoastranges

In summer 2018, Diablo Fire Safe Council and CAL FIRE Santa Clara Unit joined the residents of Sunol expanding their defensible space education program and fuel reduction activities. Through funding from Pacific Gas and Electric Company that paid professional crews to remove dead and dying trees and a

chipping program that leverage homeowners sweat equity efforts to remove vegetation fuels from around their homes

This past year also saw continued outreach and coordination with local neighborhood groups. East Bay Regional Parks District partnered with Diablo Fire Safe Council and the Kensington homeowners to facilitate the neighborhood group's efforts through a right of entry agreement to reduce fuel levels on public lands adjacent to their homes. A similar right of entry partnership has also been established with the Claremont Canyon Conservancy in Claremont Canyon.

Moraga Orinda Fire District hosted two open house / safety fair events to provide residents with information about emergency preparedness and wildfire risk reduction. Regional partners participating in these events included Diablo Fire Safe Council, Red Cross, Community Emergency Response Team, Contra Costa County Community Warning System, East Bay Regional Park District, East Bay Municipal Utility District and Pacific Gas & Electric

UC Berkeley Facilities Services and the Cal Forestry Club continue their annual reforestation project on Tightwad Hill above Memorial Stadium. Over 20 Forestry Club members planted over 100 native trees and shrubs throughout the are. The Campus has a strong interest in continuing the annual work.

Presentations and Tours

Society of American Foresters (SAF): The Society of American Foresters, along with UC Berkeley Facilities Services and the Cal Forestry Club, hosted an Open House at the Russell Reserve site in Lafayette. The event was geared towards introducing the public to not only the site, but also to the many community groups performing land management, wildlife and native plan advocacy. Over 25 community members visited the site. UCB is investigating the idea of hosting another Open House in the near future.

International Seminar on Disaster Management: On August 13, 2018, HEF SLC members hosted a field tour for the US Forest Service International Programs Disaster Management Seminar. The program shares U.S. expertise with an international audience helping them build capacity in their own countries and develop a network of disaster managers worldwide. Thirty two participants attended from 23 countries. Attendees were representatives from national, regional and municipal disaster management offices, the US Agency for International Development (USAID), US Embassies and USFS International program. Five of the participants have direct responsibility for wildfire related activities. Other participants are concerned about disaster management and risk reduction from both natural and man-made disasters. The program showcased disaster management systems at the federal, state, local and private levels. HEF focused on the 1991 Tunnel Fire and lessons learned. Presentations included an overview of the Tunnel Fire with footage from the fire, background on the HEF and a driving tour of the fire area. They also participated in a computer simulations exercise based on the 2017 Tubbs Fire. The day provided a variety of opportunities for interaction and highlighted the Hills Emergency Forum cooperative approach.

Web Site: The Forum pursues effective methods of communicating information on East Bay hills fire hazards and mitigation techniques. The HEF continues to update their web site to provide information on the forum, fire hazards in the East Bay hills and fuel mitigation http://www.hillsemergencyforum.org. The e-mail address provides another point of access for residents at hillsemergencyforum@comcast.net.

Legislative Outreach

Since the formation of the HEF, members have provided support to state legislators to help shape legislation related to fire safety and fuel mitigation. The HEF continued to monitor legislative issues and the impact of current and past legislative.

2018
DISASTER MANAGEMENT SEMINAR
USDA FOREST SERVICE INTERNATIONAL PROGRAMS

On August 13, 2018, HEF SLC members hosted a field tour for the 2018 International Seminar on Disaster Management through the USDA Forest Service (USFS) International Programs. The seminar shared U.S. expertise with an international audience helping them build capacity in their own countries and develop a network of disaster managers worldwide.

32 participants attended from 23 countries:

Bangladesh	Bhutan	Botswana	Brazil
Chile	Ethiopia	El Salvador	India
Indonesia	Malasia	Morocco	Mozambique
Myanmar	Namibia	Nigeria	Palau
Peru	Philippines	Russia	South Africa
Tunisia	Ukraine	Uzbekistan	

Attendees were representatives from national, regional and municipal disaster management offices, the US Agency for International Development (USAID), US Embassies and USFS International program. Five of the participants have direct responsibility for wildfire related activities. Other participants are concerned about disaster management and risk reduction from both natural and man-made disasters.

The 15-day seminar showcased disaster management systems at the federal, state, local and private levels. HEF members focused on lessons learned from the 1991 Tunnel Fire. Presentations included an overview of the Tunnel Fire with footage from the fire, background on the HEF and a driving tour of the fire area. The group visited the area impacted by the Tunnel Fire. They also participated in a computer simulated wildfire exercise based on the 2017Tubbs fire.

The day provided a variety of opportunities for interaction and highlighted the Hills Emergency Forum cooperative approach. Speakers included representatives from:

CAL FIRE Santa Clara Unit
East Bay Municipal Utility District
East Bay Regional Park District
Oakland Fire Department
Moraga Orinda Fire District.

The Hills Emergency Forum facilitates a cooperative approach among nine governing organizations addressing urban wildland interface fire issues in the Oakland-Berkeley hills.

Sudden Oak Death (SOD). In 2018 HEF members continue to be affected by and to monitor the spread of this disease in the region. Members received up to date science-based recommendations on SOD management and treatment from a 4-hour training on 4/18/18. The SODMAP Project (SOD Blitz) is a partnership of scientists and citizens, working together to create the most complete distribution map of a forest disease ever produced in North America. The SOD Blitz training of 2018 took place April through June. Results are typically released in the Fall at https://nature.berkeley.edu/matteolab/?page_id=148. In 2016, the surveys documented a substantial increase in SOD from 2015 levels associated with high rainfall levels. 328 Blitz volunteers surveyed nearly over 14,300 trees. The first outbreaks of the pathogen south of Monterey County were documented. It was also found for the first time on Mount Diablo and in the City of Piedmont. In the East Bay-West (UC Berkeley) area 739 trees were surveyed with 5.8% showing symptoms. 241 trees were sampled with 18.3% testing positive for the pathogen (estimated true infection rate 6.4%). The infection rate was higher in the East Bay-East areas where 654 trees were surveyed with 13.3% showing symptoms. 75 trees were sampled with 29.3% testing positive for the pathogen (estimated true infection rate 4.7%). Past surveys have identified the pathogen on UC Berkeley Campus and southward movement of SOD in the Orinda area. Both Alameda and Contra Costa County are under State and Federal quarantine. This quarantine placed special rules regarding movement and use of susceptible plants, as well as sanitation practices that must be followed to minimize spread of the pathogen. While the course of the disease is unpredictable and variable, death of the shrub or tree is almost certain. The pathogen is known to attack 17 species, 16 of them found in California including madrone, bay laurel, redwood, Douglas fir and two species of native oaks. The three-step SOD management practice has been updated. Up-to-date information can be found through the at https://nature.berkeley.edu/matteolab/?page_id=2345.

Light Brown Apple Moth (*Epiphyas postvittana*): Early spring 2007, an outbreak of light brown apple moth was positively confirmed in Alameda and Contra Costa counties. The moth is considered a High-Risk pest; if left unchecked it has the potential for significant economic losses due to major impact on fruit crops. During 2017, quarantines remain in effect restricting intrastate shipment of plant materials, including biomass from fuel reduction projects. The moths live on eucalyptus and can affect a wide variety of plants. All materials leaving the counties must be inspected, including materials produced during fuel reduction projects.

ANNUAL ROTATION OF HEF CHAIR

2019	University of California, Berkeley
2020	City of Berkeley
2021	Lawrence Berkeley National Laboratory
2022	City of El Cerrito
2023	California Department of Forestry and Fire Protection
2024	Moraga Orinda Fire Protection District
2025	East Bay Municipal Utility District
2026	East Bay Regional Park District
2027	City of Oakland

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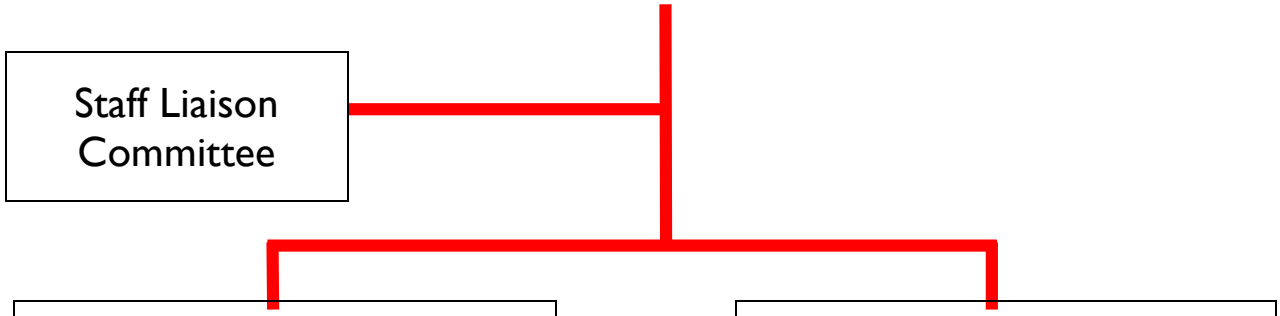
9/10/18

Organization Structure

HILLS EMERGENCY FORUM

City of Berkeley
City of El Cerrito
City of Oakland ★
California Department of Forestry and Fire Protection (CAL FIRE)
East Bay Municipal Utility District (EBMUD)
East Bay Regional Park District (EBRPD)
Lawrence Berkeley National Laboratory (LBNL)
Moraga Orinda Fire Prevention District (MOFD)
University of California, Berkeley☆



East Bay Hills Fire Chiefs Consortium

Alameda County
Albany
Berkeley ❖
CAL FIRE ❖
Contra Costa Co.
EBMUD ❖
EBRPD ❖
El Cerrito ❖
Fremont
Hayward
LBNL ❖
MOFD ❖
Oakland ❖
Piedmont
Richmond

Vegetation Management Consortium

CAL FIRE ❖
City of Berkeley ❖
City of Oakland ❖
City of Piedmont ❖
EBMUD ❖
EBRPD ❖
LBNL ❖
UC Berkeley ❖

☆ 2019 Chair
★ 2018 Chair
❖ HEF Member

9/10/18

2.0 Report Background and Overview

This report describes activities undertaken to achieve the HEF's 2018 workplan. The workplan, which appears in the Appendices, identified goals and projects in four critical areas of emergency management: assessment, mitigation, preparedness and response. It sets a milestone or due date for action and it designates the lead or responsible standing committee, organization or jurisdiction. We have organized the report by these goals and include the group with the primary responsibility.

The Staff Liaison Committee:

The HEF's administrative component -- the Staff Liaison Committee (SLC) -- is comprised of representatives from all member agencies. The SLC is responsible for developing and monitoring progress on the Forum's annual workplan, analyzing HEF policy issues for agency executives, identifying issues for possible legislative support, and coordinating the HEF annual public meeting.

Two subcommittees are activated by the SLC as needed to address specific issues -- the East Bay Fire Chiefs (EBFC) and the Vegetation Management Consortium (VMC).

East Bay Fire Chiefs

EBFC consists of the chief officers from fire departments in Alameda and Contra Costa Counties and representatives of allied agencies, such as the California Department of Forestry and Fire Protection (CAL FIRE). It aims to standardize equipment and training for the two counties, assure coordinated responses to major incidents, and educate the East Bay community about wildland fire safety. Fire Chiefs from the East Bay meet on a regular basis in conjunction with the Alameda and Contra Costa County Chiefs Associations.

Vegetation Management Consortium

The VMC includes representatives from the East Bay cities, other public agencies and utilities, who have a stake in fire safety and fuel management in the East Bay hills. Its focus is fire-hazard reduction through vegetation management strategies.

The third section of the report summarizes the accomplishments of the HEF member agencies during 2018. All activities are discussed in terms of the four key areas -- assessment, mitigation, preparedness, response -- and in light of HEF's goals in each area. Finally, Section 4.0 is a summary of the proposed 20189 Goals and Workplan.

This report is not an exhaustive list of ongoing efforts by each agency to manage fire risk. It simply highlights important interagency efforts conducted under the Forum's auspices.

3.0 Workplan Accomplishments

Assessment

Goal: *Assess critical infrastructure support systems, operation plans, and public concerns.*

Objective: *Continue quarterly meetings with fire jurisdictions regarding water supply and delivery issues.*

Status: The Berkeley Fire Department Disaster Firefighting Water System is operational for those times when the regular firefighting water system is not available or has limited flow. Department wide training was completed October 2010. The system has two 6,000 gallon per minute pumps HS-900s, six hose-layer units each with a mile of 12 inch ultra large diameter hose and the necessary connections to create a firefighting water main flowing up to 12,000 gallons a minute. Normal distance the hose can be deployed depending on elevation is three miles. Longer deployments of up six miles are possible at 5,000 to 6,000 gallon per minute flows.

The pumps do not depend on drafting for access to the bay or lakes for water. The system is truck transportable and the hose is deployed at speeds up to 15 mph. Deployment time from pump at water source to hose deployed with water flowing over a two mile distance is one hour or less depending on conditions with a crew of five people. The system has hose recovery units that assist loading hose back into the hose-layers. The equipment is containerized and only two transport trucks are needed to deploy the system.

In addition the system has a smaller pump HS 150 and 5-inch hose system, which can provide 1,000 gallon per minute flows over a mile for smaller operations or extension of the larger system. The system is not part of the mutual aid system at this time but regional events that impact on Berkeley could warrant use of the system outside of Berkeley.

The City of El Cerrito provides fire protection services for the adjacent unincorporated community of Kensington. The Kensington Fire Protection District continues to improve the waterflow at its interface edge with East Bay Regional Park District lands. This is a five-phase project of which, four of the five phases have been completed. Phase V of the project originally consisted of installing cisterns in strategic locations. Completion of geotechnical studies indicated the soil was unstable and would not support cisterns in close proximity to residential units. Because of this, phase V was reevaluated, and the determination was made that looping the existing fire mains would provide the best water supply for the area in consideration. Along with enhancing the areas of concern, they found the looping would greatly enhance the water main system in adjoining parkland urban-interface neighborhoods. They are currently working with property owners to establish easements to install new water mains to facilitate the looping of the fire main system. The City of El Cerrito has been undertaking a similar water flow study for their area.

The California Water/ Wastewater Agency Response Network (Cal WARN) supports and promotes statewide emergency preparedness, disaster response and mutual assistance matters for public and private water and wastewater utilities. At least annually, each of the 6 regional chairs provides member utilities an updated list of emergency contacts and a database of available equipment. Website: calwarn.org

Objective: *Revise fire response plans to incorporate review comments.*

Objective: *Conduct annual review of local fire response plans for urban wildland intermix fires.*

Status: All participating fire jurisdictions have response plans for urban/wildland intermix fires in the East Bay hills. These plans identify equipment and staffing levels for different levels of response, incident coordination procedures and guidelines for resource deployment during major incidents, and are periodically reviewed and updated.

In 2011 the East Bay Regional Park District updated their Fire Danger Operating Plan. Fire restriction levels were supported with more focus on visitor behavior changes as fire danger increases. Additional minor adjustments were made in 2012. In 2018, the District's Fire Department continues to provide timely information on weather and fuel conditions to park staff, visitors, and contractors in the parks. The information is found on its webpage and through the use of fire danger rating signs.

The El Cerrito/Kensington Fire Department continues their commitment to maintaining complete comprehensive emergency response plans. In 2018 they completed, and the City Council approved and adopted, the updated Local Hazard Mitigation Plan (LHMP). The City of El Cerrito and the Kensington Fire Protection District have worked in conjunction with other Contra Costa County Cities and Special Districts to update and enhance their LHMP that identify risks within their jurisdictions and allow them be able to receive pre disaster mitigation grants. High-risk priorities identified in the LHMP include reducing the risk of wildfire within their jurisdictions. The Contra Costa County updated LHMP was also completed in 2018, and includes the communities of Kensington, Moraga and Orinda.

In addition to emergency response plans and the LHMP, the El Cerrito/Kensington Fire Department has an unyielding dedication to providing the most effective urban interface fire response possible. This has been demonstrated over the past couple of years by the purchase two type 3 fire engines. These engines are specifically designed for wildland and wildland-urban interface fires and have been strategically assigned to their two most demanding wildland interface stations.

City of Berkeley also adopted their updated Local Hazard Mitigation Plan in 2014 and City of Oakland in 2016. Both cities participated in the parallel but separate initiatives "Resilient Berkeley" and "Resilient Oakland." The programs were part of the Rockefeller Foundation 100 Resilient Cities program http://www.100resilientcities.org/cities/.

Goal: *Support continued funding for fuel hazard assessment and mitigation programs.*

Objective: *Develop plan for updating 1995 GIS base date (vegetation & residential hazard).*

Objective: *Re-evaluate programs in light of Proposition 218 funding challenges.*

Status: Agencies update data regarding their individual properties on an on-going basis. Forum members continue to search for an effective methodology to update the data on fuel hazard assessment on a region-wide basis.

Funding remains the primary challenge to completing the regional assessment update and mitigation programs. A variety of funding sources have been pursued at the Local, State and Federal levels.

EBRPD, UC Berkeley and the City of Oakland have continued to work with supporting Claremont Canyon Conservancy and their fuel removal projects in Claremont Canyon area to improve fire safety. The Claremont Canyon Conservancy continues to be a major supporter with both volunteers to assist in the management and stewardship of wildlands as well as financial gifts towards Claremont Canyon fuel reduction projects. EBRPD, El Cerrito Fire Department, Kensington Fire District, and Diablo Fire Safe Council have supported similar stewardship projects with the residents of Kensington and Berkeley along the interface with Wildcat Canyon and Tilden Regional Parks, as well as El Cerrito parklands.

The citizens of the City of Oakland voted in Fall 2004 to fund their Wildfire Prevention Assessment District (WPAD) to provide funding for a period of ten years. In November 2013 registered voters within the boundaries of the Oakland Wildfire Prevention Assessment District (WPAD) received mail-in ballots to vote for the renewal of the District. The results of the vote were just 66 votes shy of the 67% approval rating necessary. The final assessment for the WPAD was collected in 2014. The program expended all of those funds in 2017.

Prevention/ Mitigation

Goal: *Incorporate recommendations from the Fuel Management Plan and support AB 337 information sharing requirements.*

Objective: *Incorporate the Fuel Management Plan (FMP) in all planning and mitigation projects.*
Status: The FMP has been incorporated into each member's guiding policy documents and projects that are underway.

Objective: *Monitor 2018 plans for goat-grazing and joint maintenance operations.*
Status: HEF members continue to benefit from joint Request For Proposal for multi-year contracts that were issued in past years. This resulted in a more coordinated effort throughout the region and the identification of new goatherds. Grazing has proven to be a cost-effective wildfire prevention measure in specific areas. Goat contractors have helped reduce fuel loads on properties managed by City of Oakland, East Bay Municipal Utility District, East Bay Regional Park District and Lawrence Berkeley Laboratory. Over 500 acres were managed using goats. This continues to be a popular fuel reduction technique with some neighboring residents, while being anathema to others. The City of Oakland issued new RFPs in 2018 and awarded multi year contracts, including for goat grazing with enhanced treatment precautions and controls. EBMUD continues using goats to reduce fuel loading and convert from brush to grassland.

Objective: *Share Geographic Information Systems (GIS) report and data with other agencies (upon request)*
Status: The GIS data was distributed to HEF members on CD-ROM. As the data is refined and updated it will continue to be shared with HEF members and others.

Goal: *Promote implementation of fire code compliance programs*
Objective: *Provide public education about code requirements.*
Objective: *Conduct and track inspections on private property.*
Objective: Issue notices of violations, monitor corrective action.
Objective: Report on inspection and compliance programs.
Status: During 2018, the **City of Berkeley** completed inspections with compliance for 100% of the over 1330 properties in the Berkeley Hazardous Fire Area. The Fire Department also conducts complaint-driven inspections throughout the City.

El Cerrito has over 4,000 properties it inspects in its very high fire hazard severity zones (VHFHSZ) and 6,000 properties outside of the VHFHSZ, with an additional 2,000 in Kensington. To date, the El Cerrito Fire Department continues a very proactive public education program to make the citizens aware of the extreme fire dangers in the community. Along with this public education, El Cerrito aggressively pursues citizen compliance with the City Council's approved vegetation management standards. These standards require property owners to maintain these minimum vegetation standards or risk having the City Council declare the properties a fire hazard and forcefully abating non-compliance properties. This past year, the fire safety inspection program had voluntary compliance rate over 99%. As a result the El Cerrito / Kensington Fire Department had to abate the fire hazard on only three properties this year.

MOFD inspected all of the properties in the Orinda and Moraga District to assure compliance with their vegetation management program. This includes about 1,800 properties located in the Very High Fire Hazard Fire Severity Zones. District staff works closely with property owners to educate as they bring their properties into compliance with District standards. If deficiencies are not corrected the District can place work orders to have the work done and the property owner is billed for the work. This year over 99% of properties complied with District standards.

Oakland In May and June of 2018, annual vegetation management inspection training was conducted with Oakland Fire's firefighters. The Engine Companies received 2.5 hours of inspection training regarding residential defensible space inspections. The 11 Engine Companies located in the Oakland Hills completed over 19,000 initial residential inspections (compliant parcels) and 2800 re-inspections on non-compliant residential parcels between July and September 2018. Vegetation Management Unit Fire Inspectors completed inspections on 2,020 privately owned vacant lot parcels, 416 City owned vacant lot parcels and 2,019 residential parcels between May and September 2018. As of September 2018 a total of 18,889 residential parcels and 1,389 vacant lots were compliant with Oakland defensible space. 670 residential parcels and 523 vacant lots are non-compliant.

Goal: *Continue annual fuel reduction actions.*

Objective: *Continue annual maintenance of existing fuel breaks*

Objective: Continue fuel reduction (including removal of hazardous trees on public property)

Objective: Evaluate options for restoring curbside vegetation recycling programs for private lands in hills (June – October).

Status: HEF members have continued and expanded on-going fuel reduction projects.

East Bay Municipal Utility District (EBMUD) thinned understory and expanded fuel treatment on the Oakland/Berkeley watershed interface. With support from Cal Fire Delta Camp crews, EBMUD Rangers removed 580 decadent Monterey Pine trees and burned 370 brush piles on the east side of San Pablo Reservoir. With support of Cal Fire Delta Camp, EBMUD continued thinning and removal of eucalyptus trees and understory vegetation at California Shakespeare entrance, and continued maintenance of the Sleepy Hollow Elementary School emergency exit trail. Combined management tactics, including herded goats, mechanical mowing and hand labor, were used to reduce fuel loading and enhance native plant populations.

East Bay Regional Park District (EBRPD) continued their on-going fuel mitigation projects using tree hand falling, prescribed fire, goats, mechanical treatments, and hand crews, maintaining over 800 acres of existing East Bay hills fuel breaks. These include removal of eucalyptus and Monterey pines, broom and other brush in existing fuel management zones along the urban wildland interface in Miller Knox, Tilden, Claremont, Sibley, Leona, Redwood, Wildcat Canyon, Lake Chabot, and Anthony Chabot Regional Parks. In 2018, the District began implementation of the FEMA hazard mitigation grant, removing hazardous fuels on several sites in Tilden, Wildcat and Anthony Chabot Regional Parks.

UC Berkeley continues to managed, extended and improved its 8-mile fire road/ trail network, cleared roadsides, turnouts and neighborhood interface zones with contract crews for fire access while addressing erosion and invasive species concerns. UCB has focused on defensible space and maintenance. Treatment areas include: near homes on Panoramic Hill, corporation yard in Strawberry Canyon, Russell Reserve, and reducing fire hazard in advance of football games on "Tightwad Hill" is ongoing.

The cities have found creative ways to find dedicated funding sources for urban wildland fire prevention services. **Berkeley's Fire Fuel** Curbside Chipper and Debris Bin Programs for residents of the Berkeley hills high-risk fire area continued to be popular. Debris bags are available throughout the year.

The **City of Oakland** Fire Department, Fire Prevention Bureau staffs a Vegetation Management Unit that planned and scheduled a variety of fuel reduction activities this year, including: contracts specifically targeting invasive French broom, fuel breaks within the City's approximate 1300 acres of parklands and open space primarily in conjunction with their extensive goat grazing program. Working together with East Bay Regional Parks Fire Department, U.C. Berkeley, PG&E and East Bay Municipal Utility District, Oakland Fire's Vegetation Management Unit was able to reduce hazardous vegetation through roadside clearances, fuel breaks and goat grazing throughout the Oakland Hills. Major fuels reduction occurred inside the Shepherd Canyon area where EBRPD grazed their hillsides, PG&E cleared their transmission line right of ways of brush and dead trees and EBMUD cleared vegetation from all of their water reservoir properties. U.C. Berkeley assisted in roadside clearances along upper Claremont Avenue to Fish Ranch Road.

The **City of El Cerrito** and the community of Kensington continue to manage their two demonstration vegetation management projects, along Leneve Place to Camp Herms, developed in conjunction with the East Bay Regional Park District. They continue to manage 90 acres of city property (parks, trails, fire trails etc.) with a year round program that use hand labor, prescribed burns (pile burns) and mechanical methods to maintain fuel management zones and manage the areas along the fire trails at the interface of Kensington and Tilden/ Wildcat Canyon Regional Parks (EBRPD).

Objective: *Evaluate the potential for sharing specialized equipment (for brush-clearing and chipping) among HEF agencies.*

Objective: *Foster inter-jurisdictional cooperation in the buffer zone identified in the Fuel Management Plan*

Status: Member agencies actively seek new ways to foster inter-jurisdictional cooperation and share information on specialize equipment or operators coming into the region.

HEF members collectively are seeing the results of the multiple, regional on-going fuel reduction projects with additional contractors interested in bidding on projects and improved efficiencies and cost effectiveness. Members are have also been able to share information about the options for dealing with biomass generated by fuel reduction projects.

Preparedness

Goal: *Provide continued support for coordinated safety planning in Agency and City Plans.*

Objective: *Ensure that General Plans contain updated state-mandated Safety Elements that are compatible between jurisdictions.*

Status: This is an ongoing effort to ensure that the elements in agency plans are compatible and in compliance with SB1241 for wildfire safety. To this end, the SLC shares information and seeks to establish strong lines of communication between agencies.

Many HEF members have adopted long range plans and environmental compliance documents incorporating wildland fire hazard reduction. Existing plans include:

In 2010, the East Bay Regional Park District Board of Directors adopted the Wildfire Hazard Reduction and Resource Management Plan and certified its Environmental Impact Report. The study focus was the wildland-urban interface along the western edge of the East Bay hill parks, including Wildcat Canyon, Tilden, Claremont Canyon, Sibley, Huckleberry, Roberts, Redwood, Leona, and Anthony Chabot. Best Management Practices incorporated in this hazard reduction plan are also applied to fuels treatment projects elsewhere within the Park District

The University of California, Berkeley 2020 Long Range Development Plan (LRDP), and the 2020 LRDP Environmental Impact Report (EIR). UC Berkeley 2020 Hill Area Fire Fuel Management Program informed the 2020 LRDP and provides the organizational and technical basis for continued vegetation management on Regent's land. In 2016 UC Berkeley finalized an Addendum to the UC Berkeley 2020 Long Range Development Plan Environmental Impact Report, which completed its CEQA requirements for the FEMA-funded projects.

Lawrence Berkeley Laboratory finalized its 2006 Long Range Development Plan and Environmental Report in July 2007. A new fire management plan was completed to comply with federal requirements.

Oakland Safety Element Update to the Oakland General Plan, Initial Study and Negative Declaration adopted November 2004. Oakland is currently developing a comprehensive Vegetation Management Plan and Environmental Impact Report with an anticipated certification in 2019.

East Bay Municipal Utilities District adopted it East Bay Watershed Management Plan in 2018, updating the 1996 Watershed Master Plan and 2000 Fire Management Plan.

HEF members participated in the 2010 update of "Taming Natural Disasters," the Multi-jurisdictional Local Hazard Mitigation Plan (LHMP) for the San Francisco Bay Area prepared by the Association of Bay Governments. This was the required five-year update of the annexes to the initial plan prepared in 2004. The Disaster Mitigation Act of 2000 (DMA 2000) required state and local communities to have an approved multi-hazard mitigation plan in place by November 1, 2004, in order to be eligible for FEMA pre- and post- hazard mitigation grant funds (Public Law 106-390). This Act established a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). Since 2010, HEF members have updated their LHMPs on an individual basis, Oakland's being last updated in 2016.

In 2004, the City of Berkeley developed and adopted its first Hazard Mitigation Plan. The Plan identified natural hazards in Berkeley and a five-year strategy to further protect Berkeley's people, buildings, infrastructure and environment from their impacts. Staff used the latest research and an extensive public review process to develop the 2014 Plan update, This update allows Berkeley to apply for federal mitigation grant programs and State recovery funding.

In 2018 City of El Cerrito adopted its LHMP and had it included as an annex to the Contra Costa County plan, also adopted in 2018. The unincorporated area of Kensington, City of Orinda and Town of Moraga are also included in the Contra Costa County LHMP.

Goal: *Continue Citizen emergency training programs.*

Objective: *Maintain citizen emergency programs, such as CORE and CERT.*

Status: Berkeley, El Cerrito, Moraga Orinda Fire District (MOFD) and Oakland have continued to find funding to support their CERT programs that help prepare citizens for emergencies. Lawrence Berkeley Laboratory also offers training to their employees.

City of Berkeley provides a 20-hour training to give residents the skills to organize on their own when disaster strikes and ensure they're ready with crucial information when emergency crews arrive. The CERT academy, run by the Berkeley Fire Department, is a city program that brings free training to Berkeley residents, who can then go on to take more specialized classes and share information with their neighborhood groups. The weekend training program teaches participants how to set up a chain of command structure and organize into key groups with the aim of turning a chaotic situation into order. Training modules include fire suppression, search and rescue operations and disaster first aid.

El Cerrito and Kensington continue to enhance public awareness and provide public education in disaster preparedness and response. Their program is an all risk emergency preparedness program, training for earthquake, flood, wildland urban interface fire defensible space, terrorism and will begin training citizens to handle large-scale pet emergencies and sheltering. To reach a broader citizen base, El Cerrito and Kensington has begun working with their neighborhood watch programs to ensure a diverse and comprehensive training program is delivered. The program teaches all required CERT components and standards and adds these additional programs for continuing education.

MOFD continues to support their District's CERT program that trains citizens in Moraga and Orinda in emergency preparedness. Their Emergency Preparedness Coordinator continues to build relationships with these groups to increase efficiency, cooperation and consistency. Education relating to creating defensible space and surviving fires in the wildland urban interface is included in the curriculum presented to all CERT students. In 2014 the Sleepy Hollow neighborhood of Orinda was recognized as the first FIREWISE community in Contra Costa County. The Ready Set Go! Program continues to prepare residents for wildfire.

Oakland continues to train its citizens through Communities of Oakland Respond to Emergencies (CORE) in addition to public education program in the schools. Since its inception in 1990 they have trained more than 22,000 residents. This includes workshops where participants received training in Fire Prevention, First Aid, Evacuation Preparedness and Community / Neighborhood Disaster response. CORE also provided classes with interpretation in Spanish, Cantonese, Mandarin and Vietnamese.

Lawrence Berkeley Laboratory's Emergency Services Staff has also taught CERT classes in the last few years. The class is designed to educate people about disaster preparedness for the hazards that may impact their work areas and trains them in basic response skills. It is voluntarily open to all staff.

All three cities coordinate and train amateur radio enthusiasts and promote citizen involvement in awareness programs. The Oakland Radio Communications Association (ORCA) ham radio operators continue to refine their emergency system by participating in monthly training and testing of equipment, as well as conducting a formal annual test of their full system with a Simulated Emergency Testing (SET) at all Oakland fire stations.

Goal: *Continue interagency preparedness coordination and training.*

Objective: *Continue to evaluate the performance of the Remote Automated Weather Station (RAWS) equipment*

Status: The Remote Automated Weather Stations (RAWS) continues to be included as a line item in East Bay Regional Park District's annual budget to support maintenance of four stations that are representative of large portions of the East Bay Hills and surrounding regions. In 2009 Oakland fire Department replaced its two nearly obsolete RAWS with new, state-of-the-art equipment. These stations, together with four RAWS owned by other agencies in the two county area, form part of a National Fire Danger Rating System network. Up to date information from these stations and others that serve the HEF membership can be found at http://www.ebparks.org/about/fire/fire_danger_and_weather_information.htm

Objective: *Conduct interagency training in systems operations and development of user protocols.*

Objective: Expand interagency prescribed burns for training and fuel management purposes. 1) Conduct a two day Wildland Fire Academy. 2) Conduct two interagency fire exercises and prescribed burns.

Status: In August 2018, CAL FIRE, EBMUD, Moraga Orinda Fire District and Contra Costa County Fire District conducted a wildland training burn on the Briones watershed near Bear Creek and Happy Valley Roads in Orinda. The exercise allowed for not only fuel reduction, but also multi-agency drill using live fire.

During the region's MRA drills and training, the City of El Cerrito and the Kensington Fire Protection District participated in the annual Mutual Response Area Exercise (MRA) with the City of Berkeley and other participating agencies. During this exercise, participating agencies conducted strategic fire apparatus assignment and response for a major wildfire. Firefighters attending the exercises practiced hose lays and mobile attack. As in years past, EBRPD will invite HEF members and other agencies to join their Basic Wildland Training courses (S-190, S-130) in years when the courses are scheduled for new firefighters at the District.

Objective: *Expand public education programs*

Status: HEF members continue to provide information to the local communities through various programs and direct homeowner association contacts. During "Red Flag" days many HEF members fly fire weather flags at fire stations, on the watershed and at recreation facilities. Lawrence Berkeley Lab and Moraga Orinda Fire District installed new fire danger signs. In 2018, Berkeley hosted a community wildfire forum in July. Several members also participated in open houses at local fire stations during National Fire Prevention Week in October.

Goal: *Plan and conduct public safety and outreach programs to improve public awareness during the 2018 fire season*

Objective: *Issue information on fire safety to newspapers and other media outlets.*

Objective: *Conduct Public Safety Programs during fire season.*

Objective: *Maintain and update HEF website and e-mail*

Objective: *Develop a compendium for homeowners of existing research about common landscape plants and fuel management treatments.*

Status: SLC members participated in public safety and education outreach programs including response to requests for information from local newspapers, radio and television. Oakland continues to educate and prepare students through its Junior Fire Marshal and Public Education programs in the Fire Prevention Bureau, as well as through CORE. The HEF web site www.hillsemergencyforum.org and hillsemergencyforum@comcast.net e-mail continues

to provide information about the HEF and an electronic method to connect with the organization. In September 2018, the City of Oakland developed a public service announcement on the importance of defensible space and hazardous fuel reduction. Aerial footage shows how the partnership of homeowners and agencies is making a difference in reducing the fuel loads of the East Bay Hills. High definition aerial footage was also shared with HEF member agencies.

New and updated public information was released throughout the year including an update to the EBMUD booklet "Firescape: Landscaping to Reduce Fire Hazard." HEF SLC members reviewed and updated "Wildfire Evacuation Tips" and "Why is Evacuation from Wildfire Different?" available on the HEF website.

The SLC continues to look for opportunities to link with other relevant research. They regularly share information about continuing or new pests in the area such as the Light Brown Apple Moth and the spread of Sudden Oak Death. This includes incorporating quarantine restrictions and best management practices into fuel reduction contracts. This year the group continued to share best management practices with field trips for staff and visitors.

Goal: *Strengthen media coordination among Agency Representatives*

Objective: *Provide information briefing materials and sessions as required to cover local issues.*

***Objective*:** *Support the HEF joint information system, including the prescribed burn notification protocol.*

Status: The Staff Liaison Committee distributes materials and conducts briefing sessions with information officers (IOs) highlighting issues attractive to local media in order to continue reinforcing regional protocols, multi-agency preparedness and response actions. HEF members also coordinated their public information officers with updated contact lists and invitation to participate in monthly meetings. In May, members briefed local media on how the hills fire agencies were preparing for the 2018 wildfire threats. Local media helped urge hill residents to prepare for fire season and be prepared if called upon to evacuate.

Goal: *Inspect and maintain readiness level of infrastructure, such as fire roads.*

Objective: *Evaluate storm damage from winter rains and refurbish fire roads as needed.*

Objective*: Maintain existing fire roads.*

Status: HEF members continue the annual process of evaluating storm damage and maintaining fire roads where required. The 2017-18 winter storms lead to creeks running full and local flooding. Downed trees and aggressive growth of flashy fuels resulted in an increase of fuels.

Response

Goal: *Maintain and refine formal Mutual Response*

Status: Formal Mutual Response Agreements (MRAs), some of which are over twenty years old, continue to be effective between fire agencies in the Oakland-Berkeley hills area. Several wildfires during 2018 proved the effectiveness of local response agreements. The area covered by MRAs has expanded to the east side of the hills through discussions with Moraga Orinda Fire District. City of Berkeley is updating MOUs with Albany, El Cerrito, Kensington, Lawrence National Laboratory, and Moraga/Orinda. These are in addition to the existing agreements in place with Oakland and East Bay Regional Parks District.

During fires in areas of "mutual threat," both Alameda County and Contra Costa County Fire Departments also provide aid. The Santa Clara Unit of CAL FIRE continues to provide support; backfilling positions of suppression personnel. City of Berkeley and Oakland MRA radio procedures are consistent with the rest of Alameda, Contra Costa and CAL FIRE

agencies using the statewide mutual aid channel CAL FIRE Tac2, V-Fire 22, V-Fire 23 and CAL FIRE Tac 6.

Countywide Emergency Notification System

In 2013, the Alameda County Civil Grand Jury recommended that the County take the lead in developing a countywide emergency notification system. Berkeley staff members provided subject matter expert guidance to Alameda County on its procurement of a countywide emergency notification system for joint use by the County and its cities. This countywide system provides an opportunity for the City to harness new emergency alerting technology from the federal Integrated Public Alert and Warning System (IPAWS). This system sends wireless emergency alerts to mobile phones based on their real time location, instead of relying on pre-emergency signups. IPAWS will also automatically coordinate alert deliveries from multiple systems, instead of requiring a manual activation process for each system. In May 2015 the countywide system contract began. The notification system was utilized during several of the 2018 wildfires.

Goal: *Monitor and support the implementation of SEMS by EBFCC/ HEF agencies*

Objective: *Monitor implementation of Gov. Code 8607 (SEMS) requirements.*

Objective: *Expand mutual aid agreements with water utilities. Work with statewide program to increase signatories.*

Status: Each agency in the HEF monitors their own plans and training related to the state-wide Standard Emergency Management System (SEMS) and National Incident Management System (NIMS). Continued training and coordination in the uniform Incident Command System (ICS) is provided at each of the mutual aid drills. As of this year, the state wide mutual aid agreement has been signed by 135 water utilities. http://www.calwarn.org. EBMUD also has signed a mutual assistance agreement with Los Angeles Department of Water and Power (LADWP) and Las Vegas Valley Water District.

2019 Hills Emergency Forum Goals

Annual Focus

- ❑ Collaboration with Other Agencies
- ❑ Legislative Outreach
- ❑ Public Education
- ❑ Special Projects

Primary Responsibility

Assessment

- ❑ Assess critical infrastructure support systems, operation plans, and public concerns. *(SLC)*
- ❑ Support continued funding for fuel hazard assessment and mitigation programs. *(SLC)*

Prevention/ Mitigation

- ❑ Incorporate recommendations from the Fuel Management Plan and support AB 337 information-sharing requirements. *(SLC)*
- ❑ Promote implementation of fire code compliance programs. *(SLC)*
- ❑ Continue annual fuel reduction actions. *(SLC)*

Preparedness

- ❑ Provide continued support for coordinated safety planning in Agency and City plans. *(SLC)*
- ❑ Continue Citizen emergency training programs. *(SLC)*
- ❑ Continue interagency preparedness coordination and training. *(EBFCC)*
- ❑ Plan and conduct public safety and outreach programs to improve public awareness during the 2018 fire season. *(SLC)*
- ❑ Strengthen media coordination among Agency Representatives. *(SLC)*
- ❑ Inspect and maintain readiness level of infrastructure, such as fire roads. *(EBFCC)*

Response

- ❑ Maintain and refine formal Mutual Response Agreements. *(EBFCC)*
- ❑ Monitor and support the implementation of SEMS by EBFCC/ HEF agencies. *(EBFCC)*

Hills Emergency Forum 2019 Workplan

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Projects		Objectives		Milestones	Lead
A.	**Assessment**				
1.	Water system	a.	Continue quarterly meetings with fire jurisdictions regarding water supply and delivery issues.	Ongoing	EBMUD
2.	Fire Response	a.	Revise fire response operation plans to incorporate 2018 review comments.	October 2019	EBFCC
		b.	Conduct annual review of local fire response plans for urban-wildland intermix fires.	Annual	EBFCC
3.	Public Comment	a.	Acknowledge and evaluate public comments on threat zone management issues.	April 2019	SLC
4.	Hazardous Fuel Assessment	a.	Develop plan for update of 1995 GIS base data (vegetation & residential hazards).	October 2019	SLC
5.	Funding for Mitigation Programs	a.	Re-evaluate programs in light of Proposition 218 funding challenges.	October 2019	SLC
B.	**Prevention/ Mitigation**				
1.	Fuel Management Plan (FMP)	a.	Incorporate FMP in all planning.	October 2019	SLC
		b.	Monitor 2019 goat grazing contracts and joint maintenance operations.	October 2019	SLC

Hills Emergency Forum 2019 Workplan

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Projects	Objectives	Milestones	Lead
2. Support implementation of AB 337 (Bates)	a. Share Geographical Information System (GIS) data with other agencies (upon request).	October 2019	VMC
3. Promote and support full implementation of municipal programs for fire safety codes, inspection and enforcement	a. Provide public education about code requirements.	Ongoing	Berkeley El Cerrito Oakland
	b. Conduct and track inspections on public & private properties.	Annual	Berkeley El Cerrito Oakland
	c. Issue notices of violations, monitor corrective action.	Annual	Berkeley El Cerrito Oakland
	d. Report on inspection and compliance programs.	Annual	Berkeley El Cerrito Oakland
4. Fuel Reduction	a. Continue annual maintenance of existing fuelbreaks	Annual	
	❖ EBRPD: Maintain 15 miles of existing fuelbreak. Control suckers from cut eucalyptus stumps.		EBRPD
	❖ EBMUD: Maintain 1.5 miles of multi-agency fuelbreaks within District lands. Remove suckers from 19 acres of eucalyptus stumps in Oakland urban wildland interface. Manage ridgetop annual grasslands.		EBMUD
	❖ UCB: Maintain 8 miles of defensible space, including roadside and fire trail maintenance.		UCB
	❖ Oakland: Maintain 4 miles of existing fuelbreak.		Oakland
	b. Continue fuel reduction (including removing hazardous trees on public property).		SLC
	❖ EBRPD: Thin stands of eucalyptus trees in Anthony Chabot Park.		EBRPD

Hills Emergency Forum 2019 Workplan

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Projects	Objectives	Milestones	Lead
B. Mitigation (continued) 4. Fuel Reduction (cont.)	❖ EBMUD: Maintain 15 acres using goat grazing. Maintain 10 acres by hand labor. Continue selective removal in ridgetop Eucalyptus groves, culling 1,000 stems per year. Maintain 1.2 mile grassland fuel break along ridge at Grizzly Peak Blvd and Fish Ranch Road.		EBMUD
	❖ UCB: Maintain 37 acres using goat grazing. Maintain an additional 18 acres using hand crews. Manage 15 acres to develop and maintain ground force fire suppression zone at ridgetop interface with Panoramic Hill residential area. Manage 25 acres at Claremont Canyon Headslope for eucalyptus resprouts (Phase 1 - 3 removal projects) . Continue Phase 4 selective culling of eucalyptus and pine.		UCB
	❖ Berkeley: Continue use of hand crews to reduce fuels on public lands.		Berkeley
	❖ El Cerrito Continue use of hand crews, machinery and prescribed fire to reduce fuels on public lands and at buffer between City and EBRPD park lands.		El Cerrito
	❖ Oakland: Continue use of goat grazing and hand crews to reduce fuels on 320 acres of public lands.		Oakland
	❖ LBNL: Maintain 170 acres to reduce potential wildland fire effects. Manage 30 acres to maintain a Striketeam Fire Suppression Line at midcanyon wildland interface. Manage 20 acres to intermix zone standards to minimize effect of firebrand, and to minimize other ignitions on developed side of interface. Manage 20 acres to permit ground force suppression at border of natural areas within lower canyon intermix zone.		LBNL

Hills Emergency Forum 2019 Workplan

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Projects		Objectives	Milestones	Lead
B.	**Mitigation (continued)**			
4.	Fuel Reduction (cont.)	c. Continue Berkeley's and Oakland's curbside vegetation recycling programs for private lands in hills (June - October).	Annual	Berkeley El Cerrito Oakland
		d. Evaluate the potential for sharing specialized equipment (for brush-clearing and chipping) with HEF agencies.	October 2019	SLC
		e. Foster inter-jurisdictional cooperation in the buffer zone identified in the Fuel Management Plan.	October 2019	SLC
C.	**Preparedness**			
1.	Promote coordinated safety planning in Agency and City plans	a. Ensure that General Plans contain updated state-mandated Safety Elements that are compatible between jurisdictions.	October 2019	SLC
2.	Maintain citizen training	a. Maintain citizen emergency programs, such as CERT	October 2019	Berkeley El Cerrito Oakland MOFD
3.	Continue interagency preparedness coordination and training	a. Continue to evaluate performance of the Remote Automated Weather Stations (RAWS) equipment.	October 2019	EBFCC
		b. Conduct interagency training in systems operations and develop user protocols.	October 2019	EBFCC

Hills Emergency Forum 2019 Workplan

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Projects		Objectives		Milestones	Lead
C.	**Preparedness (continued)**				
3.	Continue interagency preparedness coordination and training (cont.)	c.	Expand interagency prescribed burns for training and fuel management purposes.	October 2019	EBFCC
4.	Improve Public Awareness	a.	Issue information on fire safety to newspapers and other media outlets.	Annual	SLC/ EBFCC
		b.	Expand public education programs during Wildland Fire Prevention Month (June).	Ongoing	EBFCC
		c.	Conduct Public Safety Programs during fire season.	Ongoing	SLC
		d.	Maintain and update a HEF website. http://www.hillsemergencyforum.org and e-mail hef@value.net	October 2019	SLC
5.	Media Support	a.	Provide information briefing materials and sessions as required to cover local issues.	Ongoing	SLC
		b.	Support the HEF joint information system, including the prescribed burn notification protocol.	October 2019	SLC
6.	Maintain Fire Roads within the study area	a.	Evaluate storm damage from winter rains and refurbish fire roads as needed.	Annual	EBFCC

Hills Emergency Forum 2019 Workplan

6

Projects	Objectives	Milestones	Lead
C. Preparedness (continued)			
6. Maintain Fire Roads within the study area (cont.)	b. Maintain 155 miles of existing fire roads. Continue to maintain 6 miles of existing fire roads. Maintain 25 miles of existing fire roads. Maintain 8 miles of existing fire roads.	Ongoing	EBRPD EBMUD Oakland UCB
D. Response			
1. Mutual Response Agreements (MRAs)	a. Refine MRAs among EBFCC members.	Ongoing	EBFCC
2. Support Standardization Emergency Management System (SEMS)	a. Monitor implementation of Gov. Code 8607 (SEMS) requirements.	Ongoing	EBFCC
	b. Expand mutual aid agreements with water utilities. Work with statewide program to increase signators.	Ongoing	EBMUD

5.0 Appendices

2018 Hills Emergency Forum Goals

2018 Hills Emergency Forum Workplan

Staff Liaison Committee Members

2018 Hills Emergency Forum Goals

Annual Focus

- ❑ Collaboration with Other Agencies
- ❑ Legislative Outreach
- ❑ Public Education
- ❑ Special Projects

Primary Responsibility

Assessment

- ❑ Assess critical infrastructure support systems, operation plans, and public concerns. *(SLC)*
- ❑ Support continued funding for fuel hazard assessment and mitigation programs. *(SLC)*

Prevention/ Mitigation

- ❑ Incorporate recommendations from the Fuel Management Plan and support AB 337 information-sharing requirements. *(SLC)*
- ❑ Promote implementation of fire code compliance programs. *(SLC)*
- ❑ Continue annual fuel reduction actions. *(SLC)*

Preparedness

- ❑ Provide continued support for coordinated safety planning in Agency and City plans. *(SLC)*
- ❑ Continue Citizen emergency training programs. *(SLC)*
- ❑ Continue interagency preparedness coordination and training. *(EBFCC)*
- ❑ Plan and conduct public safety and outreach programs to improve public awareness during the 2018 fire season. *(SLC)*
- ❑ Strengthen media coordination among Agency Representatives. *(SLC)*
- ❑ Inspect and maintain readiness level of infrastructure, such as fire roads. *(EBFCC)*

Response

- ❑ Maintain and refine formal Mutual Response Agreements. *(EBFCC)*
- ❑ Monitor and support the implementation of SEMS by EBFCC/ HEF agencies. *(EBFCC)*

Hills Emergency Forum 2018 Workplan

1

Projects		Objectives		Milestones	Lead
A.	**Assessment**				
1.	Water system	a.	Continue quarterly meetings with fire jurisdictions regarding water supply and delivery issues.	Ongoing	EBMUD
2.	Fire Response	a.	Revise fire response operation plans to incorporate 2017 review comments.	October 2018	EBFCC
		b.	Conduct annual review of local fire response plans for urban-wildland intermix fires.	Annual	EBFCC
3.	Public Comment	a.	Acknowledge and evaluate public comments on threat zone management issues.	April 2018	SLC
4.	Hazardous Fuel Assessment	a.	Develop plan for update of 1995 GIS base data (vegetation & residential hazards).	October 2018	SLC
5.	Funding for Mitigation Programs	a.	Re-evaluate programs in light of Proposition 218 funding challenges.	October 2018	SLC
B.	**Prevention/ Mitigation**				
1.	Fuel Management Plan (FMP)	a.	Incorporate FMP in all planning.	October 2018	SLC
		b.	Monitor 2018 goat grazing contracts and joint maintenance operations.	October 2018	SLC

Hills Emergency Forum 2018 Workplan

2

Projects	Objectives	Milestones	Lead
2. Support implementation of AB 337 (Bates)	a. Share Geographical Information System (GIS) data with other agencies (upon request).	October 2018	VMC
3. Promote and support full implementation of municipal programs for fire safety codes, inspection and enforcement	a. Provide public education about code requirements.	Ongoing	Berkeley El Cerrito Oakland
	b. Conduct and track inspections on public & private properties.	Annual	Berkeley El Cerrito Oakland
	c. Issue notices of violations, monitor corrective action.	Annual	Berkeley El Cerrito Oakland
	d. Report on inspection and compliance programs.	Annual	Berkeley El Cerrito Oakland
4. Fuel Reduction	a. Continue annual maintenance of existing fuelbreaks	Annual	
	❖ EBRPD: Maintain 15 miles of existing fuelbreak. Control suckers from cut eucalyptus stumps.		EBRPD
	❖ EBMUD: Maintain 1.5 miles of multi-agency fuelbreaks within District lands. Remove suckers from 19 acres of eucalyptus stumps in Oakland urban wildland interface. Manage ridgetop annual grasslands.		EBMUD
	❖ UCB: Maintain 8 miles of defensible space, including roadside and fire trail maintenance.		UCB
	❖ Oakland: Maintain 4 miles of existing fuelbreak.		Oakland
	b. Continue fuel reduction (including removing hazardous trees on public property).		SLC
	❖ EBRPD: Thin stands of eucalyptus trees in Anthony Chabot Park.		EBRPD

Hills Emergency Forum 2018 Workplan

Projects	Objectives	Milestones	Lead
B. Mitigation (continued) 4. Fuel Reduction (cont.)	❖ EBMUD: Maintain 15 acres using goat grazing. Maintain 10 acres by hand labor. Continue selective removal in ridgetop Eucalyptus groves, culling 1,000 stems per year. Maintain 1.2 mile grassland fuel break along ridge at Grizzly Peak Blvd and Fish Ranch Road. ❖ UCB: Maintain 37 acres using goat grazing. Maintain an additional 18 acres using hand crews. Manage 15 acres to develop and maintain ground force fire suppression zone at ridgetop interface with Panoramic Hill residential area. Manage 25 acres at Claremont Canyon Headslope for eucalyptus resprouts (Phase 1 - 3 removal projects) . Continue Phase 4 selective culling of eucalyptus and pine. ❖ Berkeley: Continue use of hand crews to reduce fuels on public lands. ❖ El Cerrito Continue use of hand crews, machinery and prescribed fire to reduce fuels on public lands and at buffer between City and EBRPD park lands. ❖ Oakland: Continue use of goat grazing and hand crews to reduce fuels on 320 acres of public lands. ❖ LBNL: Maintain 170 acres to reduce potential wildland fire effects. Manage 30 acres to maintain a Striketeam Fire Suppression Line at midcanyon wildland interface. Manage 20 acres to intermix zone standards to minimize effect of firebrand, and to minimize other ignitions on developed side of interface. Manage 20 acres to permit ground force suppression at border of natural areas within lower canyon intermix zone.		EBMUD UCB Berkeley El Cerrito Oakland LBNL

Hills Emergency Forum 2018 Workplan

Projects		Objectives	Milestones	Lead
B.	**Mitigation (continued)**			
4.	Fuel Reduction (cont.)	c. Continue Berkeley's and Oakland's curbside vegetation recycling programs for private lands in hills (June - October).	Annual	Berkeley El Cerrito Oakland
		d. Evaluate the potential for sharing specialized equipment (for brush-clearing and chipping) with HEF agencies.	October 2018	SLC
		e. Foster inter-jurisdictional cooperation in the buffer zone identified in the Fuel Management Plan.	October 2018	SLC
C.	**Preparedness**			
1.	Promote coordinated safety planning in Agency and City plans	a. Ensure that General Plans contain updated state-mandated Safety Elements that are compatible between jurisdictions.	October 2018	SLC
2.	Maintain citizen training	a. Maintain citizen emergency programs, such as CERT	October 2018	Berkeley El Cerrito Oakland MOFD
3.	Continue interagency preparedness coordination and training	a. Continue to evaluate performance of the Remote Automated Weather Stations (RAWS) equipment.	October 2018	EBFCC
		b. Conduct interagency training in systems operations and develop user protocols.	October 2018	EBFCC

Hills Emergency Forum 2018 Workplan

Projects		Objectives		Milestones	Lead
C.	**Preparedness (continued)**				
3.	Continue interagency preparedness coordination and training (cont.)	c.	Expand interagency prescribed burns for training and fuel management purposes.	October 2018	EBFCC
4.	Improve Public Awareness	a.	Issue information on fire safety to newspapers and other media outlets.	Annual	SLC/ EBFCC
		b.	Expand public education programs during Wildland Fire Prevention Month (June).	Ongoing	EBFCC
		c.	Conduct Public Safety Programs during fire season.	Ongoing	SLC
		d.	Maintain and update a HEF website. http://www.hillsemergencyforum.org and e-mail hef@value.net	October 2018	SLC
5.	Media Support	a.	Provide information briefing materials and sessions as required to cover local issues.	Ongoing	SLC
		b.	Support the HEF joint information system, including the prescribed burn notification protocol.	October 2018	SLC
6.	Maintain Fire Roads within the study area	a.	Evaluate storm damage from winter rains and refurbish fire roads as needed.	Annual	EBFCC

Hills Emergency Forum 2018 Workplan

Projects	Objectives	Milestones	Lead
C. Preparedness (continued)			
6. Maintain Fire Roads within the study area (cont.)	b. Maintain 155 miles of existing fire roads. Continue to maintain 6 miles of existing fire roads. Maintain 25 miles of existing fire roads. Maintain 8 miles of existing fire roads.	Ongoing	EBRPD EBMUD Oakland UCB
D. Response			
1. Mutual Response Agreements (MRAs)	a. Refine MRAs among EBFCC members.	Ongoing	EBFCC
2. Support Standardization Emergency Management System (SEMS)	a. Monitor implementation of Gov. Code 8607 (SEMS) requirements.	Ongoing	EBFCC
	b. Expand mutual aid agreements with water utilities. Work with statewide program to increase signators.	Ongoing	EBMUD

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Rev. 9/26/18

Hills Emergency Forum 2019 Workplan

1

Projects		Objectives		Milestones	Lead
A.	**Assessment**				
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		b.	Conduct annual review of local fire response plans for urban-wildland intermix fires.	Annual	EBFCC
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Hills Emergency Forum 2019 Workplan

2

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Hills Emergency Forum 2019 Workplan

3

Projects	Objectives	Milestones	Lead
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4. Fuel Reduction (cont.)	❖ EBMUD: Maintain 15 acres using goat grazing. Maintain 10 acres by hand labor. Continue selective removal in ridgetop Eucalyptus groves, culling 1,000 stems per year. Maintain 1.2 mile grassland fuel break along ridge at Grizzly Peak Blvd and Fish Ranch Road.		EBMUD
	❖ UCB: Maintain 37 acres using goat grazing. Maintain an additional 18 acres using hand crews. Manage 15 acres to develop and maintain ground force fire suppression zone at ridgetop interface with Panoramic Hill residential area. Manage 25 acres at Claremont Canyon Headslope for eucalyptus resprouts (Phase 1 - 3 removal projects) . Continue Phase 4 selective culling of eucalyptus and pine.		UCB
	❖ Berkeley: Continue use of hand crews to reduce fuels on public lands.		Berkeley
	❖ El Cerrito Continue use of hand crews, machinery and prescribed fire to reduce fuels on public lands and at buffer between City and EBRPD park lands.		El Cerrito
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Hills Emergency Forum 2019 Workplan

4

Projects		Objectives	Milestones	Lead
B.	**Mitigation (continued)**			
4.	Fuel Reduction (cont.)	c. Continue Berkeley's and Oakland's curbside vegetation recycling programs for private lands in hills (June - October).	Annual	Berkeley El Cerrito Oakland
		d. Evaluate the potential for sharing specialized equipment (for brush-clearing and chipping) with HEF agencies.	October 2019	SLC
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Hills Emergency Forum 2019 Workplan

Projects		Objectives		Milestones	Lead
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3.	Continue interagency preparedness coordination and training (cont.)	c.	Expand interagency prescribed burns for training and fuel management purposes.	October 2019	EBFCC
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		c.	Conduct Public Safety Programs during fire season.	Ongoing	SLC
		d.	Maintain and update a HEF website. http://www.hillsemergencyforum.org and e-mail hef@value.net	October 2019	SLC
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Hills Emergency Forum 2019 Workplan

6

Projects	Objectives	Milestones	Lead
C. Preparedness (continued)			
6. Maintain Fire Roads within the study area (cont.)	b. Maintain 155 miles of existing fire roads. Continue to maintain 6 miles of existing fire roads. Maintain 25 miles of existing fire roads. Maintain 8 miles of existing fire roads.	Ongoing	EBRPD EBMUD Oakland UCB
D. Response			
1. Mutual Response Agreements (MRAs)	a. Refine MRAs among EBFCC members.	Ongoing	EBFCC
2. Support Standardization Emergency Management System (SEMS)	a. Monitor implementation of Gov. Code 8607 (SEMS) requirements.	Ongoing	EBFCC
	b. Expand mutual aid agreements with water utilities. Work with statewide program to increase signators.	Ongoing	EBMUD

A.R. NUMBER: 9.3
ORIGINAL DATE: 5/14/14
POSTING DATE: 7/1/17
PAGE 1 OF 4 PAGES

CITY OF BERKELEY ADMINISTRATIVE REGULATIONS

SUBJECT: Use of the AC Alert system and 1610 AM radio for Emergency Public Information and Warning (EPIW)

PURPOSE
To establish guidelines for City use of the *Alameda County Unified Mass Notification Service* ("AC Alert") and 1610 AM radio to issue *Emergency Public Information and Warning (EPIW)* messages.

POLICY
Berkeley City government shares many kinds of information with the community using many different delivery systems. This policy concerns development and delivery of *Emergency Public Information and Warning (EPIW)* messages. EPIW messages are issued to share protective action instructions when there is a threat to life or property in Berkeley city limits.

This policy guides the structure and content of EPIW messages for dissemination over any City platform. Consistent use of this policy and associated tools will ensure that the City delivers consistent messages to the community in an emergency.

The City has access to multiple systems used to disseminate emergency public information and warning messages. This policy addresses usage of two of these systems: 1610 AM radio and AC Alert.

This policy does not address the use of AC Alert and 1610 AM for non-EPIW communications.

1610 AM
1610 AM is an FCC-licensed radio station run by the City of Berkeley. The station plays recorded messages, in order and on repeat. Authorized staff can record messages into the queue. 1610 AM is audible in many, but not all, areas of Berkeley. All messages broadcast on 1610 AM will also be distributed in publicly-available written format.

AC Alert
AC Alert is an emergency notification system run by Alameda County Sheriff's Office. AC Alert enables the City to send voice, text, TTY/TDD, fax, and email notifications to community members. Listed AT&T "land lines" are automatically included in the system. Community members must sign up to receive voice or text alerts on cell phones, VoIP phones, unlisted phones or through email.

AC Alert can also send messages through other notification systems as described below:

Nixle Via AC Alert
Nixle is a Police Department-managed community notification system focused on law enforcement matters. Subscribers must opt in to receive Nixle messages. Any EPIW message sent through AC Alert will also be sent to Nixle subscribers.

Social Media Via AC Alert
AC Alert messages can also be posted automatically to designated social media accounts.

IPAWS via AC Alert
AC Alert also provides the ability to disseminate messages using the federal Integrated Public Alert and Warning System (IPAWS) and associated capabilities, including Wireless Emergency Alerts (WEA) and the Emergency Alert System (EAS). When there is an imminent threat to the Berkeley community, the City of Berkeley may request that the Alameda County Sheriff's Office activate IPAWS to share protective action instructions.

System Activation
If a threat to life or property is identified, the following City staff positions are authorized to request activation of City or County EPIW systems:

- City Manager or designee
- Police Command Staff (Acting Watch Commander and above)
- Fire Command Staff (Duty Chief and above)
- Public Health Officer

City staff not listed above should report threats to life or property, along with recommended protective actions, to the Public Safety Communications Center. Communications Center staff will consult with the appropriate individual(s) from the list above to determine if EPIW systems should be activated.

Public Safety Communications Center supervisors, Office of Emergency Services staff, and Police Department Public Information Officers are trained to activate AC Alert and 1610 AM. They are also trained to contact the Alameda County Sheriff's Office for IPAWS activation. These personnel are referred to as "EPIW system activators" below. EPIW system activators will work with the authorized message requestor to develop the message and to determine the appropriate EPIW systems/functions to use to disseminate the message.

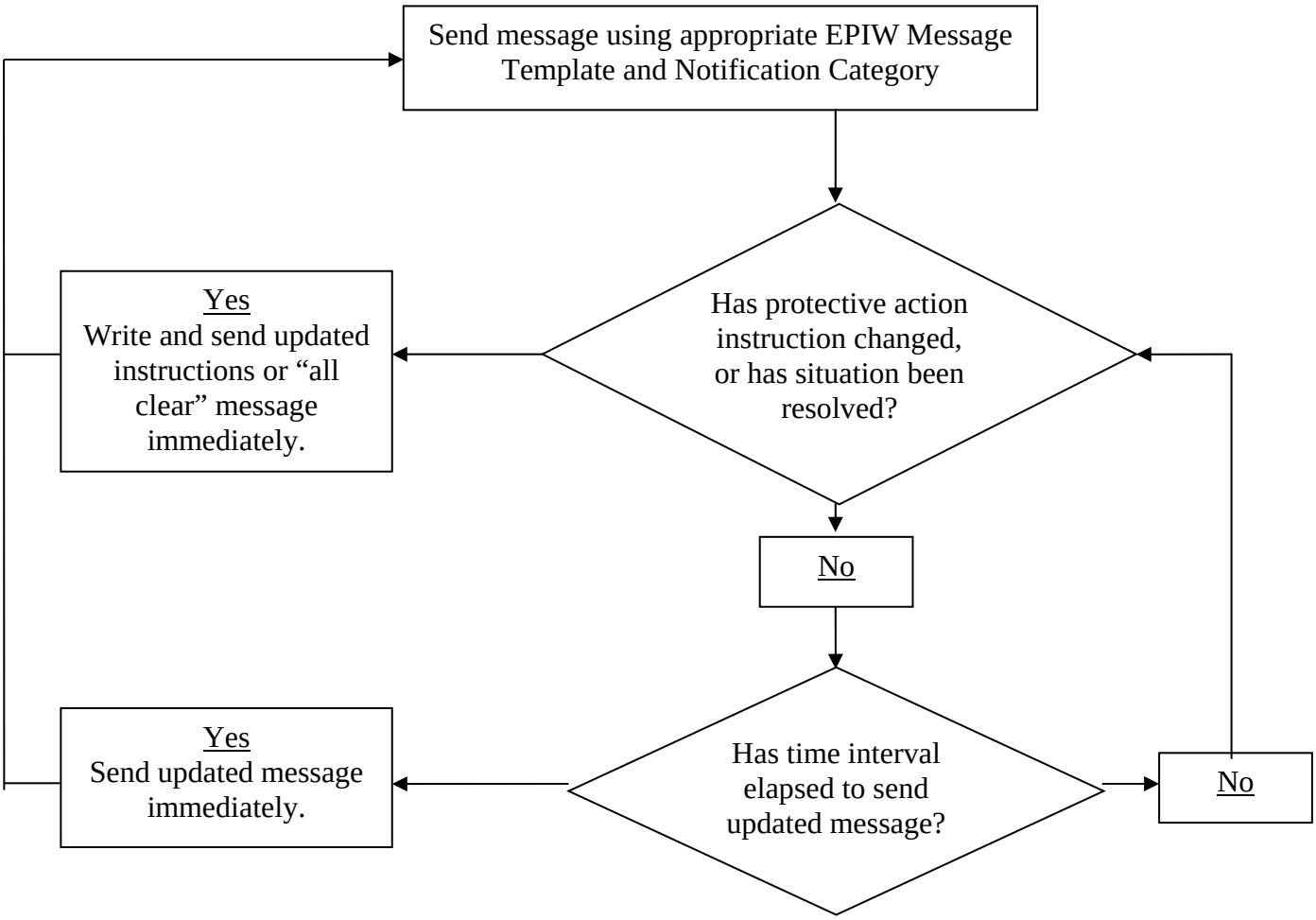
PROCEDURE

See Attachment 1 to view procedure in decision-making chart format.

1. When threat and protective actions are identified, Authorized Requestor contacts Public Safety Communications Center, OES staff, or Police Department PIOs ("EPIW system activators").
2. Requestor and EPIW system activator use *EPIW Message Templates* to develop message.
3. EPIW system activator uses *EPIW Notification Category Selector* to determine appropriate system(s) to use to send the message.
4. EPIW system activator uses appropriate AC Alert notification template and 1610 AM to send the message.
5. If appropriate, EPIW system activator requests County activation of IPAWS using *IPAWS Activation Request Protocol*.
6. Requestor updates EPIW system activator on status of threat and any changes to recommended protective actions at determined time intervals or as the situation changes.
7. EPIW system activator works with requestor to develop and send message updates using appropriate systems.
8. When the situation has been resolved, EPIW system activator ensures that an "all-clear" message is available to recipients.

RESPONSIBLE DEPARTMENT: **Fire Department** **TO BE REVISED:** Every 2 years	Approved by: Department Director City Manager

Attachment 1: Procedure Flow Chart



City of Berkeley

Wildfire Evacuation Plan

DRAFT 10-19-18

Table of Contents

I. INTRODUCTION

Berkeley faces an ongoing threat from a very likely wildland-urban interface (WUI) fire along its hillsides, where wildland and residential areas intermix. WUI fires can be sparked by both human activity and natural causes. Once ignited, these fires can be difficult to contain when they occur during extreme fire weather conditions. A WUI fire can move with breathtaking speed, expanding to one square mile in under an hour, and consuming hundreds of structures in an hour.

The Berkeley Hills areas include about 8,300 properties.

d) Purpose

This *Wildfire Evacuation Plan* describes how the City of Berkeley will direct, coordinate, and support evacuation of people and animals out of an area threatened by wildfire. The goal of these activities is to minimize the loss of life by evacuating the maximum number of people and animals possible from the immediate hazard area as quickly as possible.

Each emergency situation will dictate response priorities. This document provides structure and considerations to guide responders' decision-making process.

e) Scope

This Plan considers City departments' coordination with each other to direct and support evacuation during a wildfire. It describes Berkeley's evacuation zones and City government's communication and decision-making structures. It highlights key considerations for first responders, including anticipated resource gaps, but does not direct tactical decision-making. This Plan covers protocols and procedures for evacuations implemented across geographic areas and is not intended to cover site-specific evacuations.

This Plan can be used in conjunction with other plans, policies and procedures designed to protect the community:

- Firefighting tactics (see Fire Department Standard Operating Procedures)
- Mass Care and Sheltering of Evacuees (see ESF 6: *Mass Care and Recovery Support Annex*)
- Emergency Public Information and Warning System Procedures (see Administrative Regulation 9.3: *Use of the AC Alert System and 1610 AM Radio for Emergency Public Info and Warning (EPIW)*)
- County/Regional evacuation (see *San Francisco* Bay *Area Regional Emergency Coordination Plan* (RECP) and the Regional Catastrophic Earthquake Plan's Mass Transportation/Evacuation Plan)

f) Hazard Overview

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 East Bay Regional Park District, the City of Oakland or

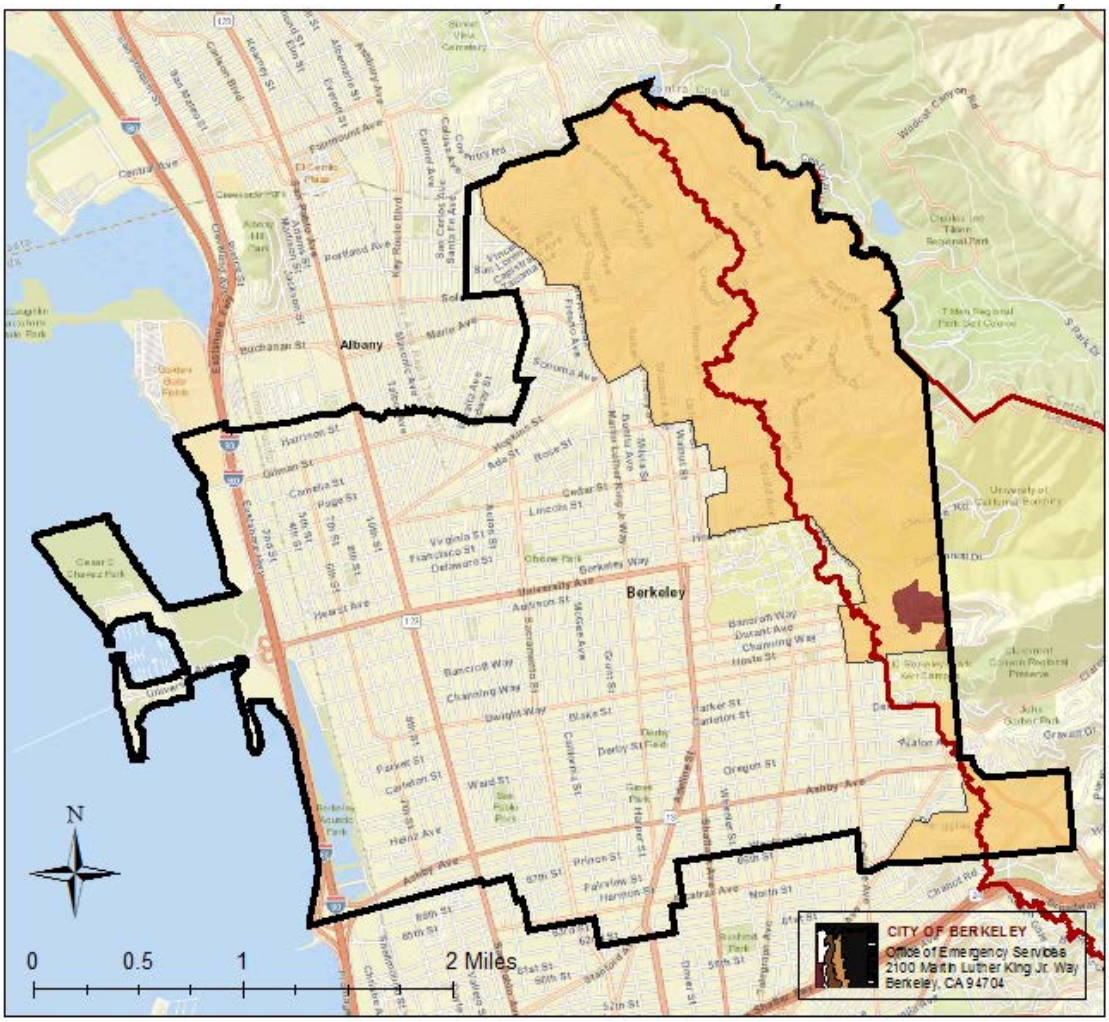
Contra Costa County. The WUI fire risk facing Berkeley's wildland-urban interface area is compounded by the area's mountainous topography, its limited water supply, its minimal access and egress routes, and its location, overlaid upon the Hayward Fault. These factors have all contributed to the area's significant WUI fire history. Given the right wind conditions, a fire in one of these areas could quickly encroach into Berkeley.

The Berkeley Fire Department has divided the city into Fire Zones 1, 2, and 3, designated in order of ascending fire risk. Fire Zone 3 is the Panoramic Hill area specifically; Fire Zone 2 covers the remainder of the city's eastern hills; Fire Zone 1 covers the rest of the City west of the hills. Fire Zones 2 and 3 currently include about 8,300 properties. 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.

Additionally, CAL FIRE has designated Berkeley's "Very High Fire Hazard Severity Zone."

The map below illustrates the boundaries of the CAL FIRE VHFHSZ, as well as Fire Zones 1, 2, and 3.

Map 1: Hazardous Fire Zones in Berkeley



City of Berkeley

CA Dept of Forestry, Very High Fire Severity Zone

Berkeley Fire Zones

Hazardous Fire Zone 1

Hazardous Fire Zone 2

Hazardous Fire Zone 3

II. ASSUMPTIONS

Integration of Emergency Management Structures

This Plan integrates the concepts and structure defined by the National Incident Management System (NIMS), the California Standardized Emergency Management system (SEMS), and the National Incident Command System (ICS).

- In any disaster, primary consideration is given to the preservation of life.
- In a catastrophic incident, damage control and disaster relief will be required from the State and federal governments, other local governments, and private organizations.
- The City Emergency Operations Center (EOC) may or may not be activated in support of an event. EOC activation will be determined based on the scope and scale of the event.
- Electronic communications utilizing information technology systems will be compliant with Section 508 of the Rehabilitation Act.
- All printed public education material produced to support this Annex for distribution to the general public shall be available in accessible formats.

Field/Emergency Operations Center Coordination

Field operations directed by the Unified Command Post will focus on saving lives and property.

The UCP will operate without EOC support in the initial phase of incident response. Depending on the time and day, this could be several hours. If activated, the EOC's capability to provide support will grow over time.

The EOC can support the UCP by providing information and coordinating resources to help the UCP develop and implement the event-specific evacuation plan.

The UCP and the EOC together will coordinate transportation support activities. The UCP will direct any transportation support activities occurring in the areas under active threat from the fire; the EOC will coordinate transportation support activities in the rest of the City.

The EOC will coordinate mass care and shelter activities for evacuees.

Coordination outside Berkeley Boundaries

Evacuation operations, including routes and resources, may need to be coordinated with across multiple jurisdictions and authorities both inside Berkeley (e.g., UC Berkeley and the Lawrence Berkeley National Lab) and outside of Berkeley (e.g., Kensington, Oakland, East Bay Regional Parks and Albany.) Whenever possible, this coordination should occur both at the field level Unified Command Post and at the Emergency Operations Center (EOC).

This plan addresses movement of a targeted portion of the Berkeley population out of a hazard area created by a wildfire. The Regional Emergency Coordination Plan (RECP) addresses mass movement of

the Berkeley population out of Berkeley. This plan, and the City's Emergency Operations Plan, coordinate with the RECP.

Hazard Scenario Assumptions

A wildfire requiring evacuations could result in the following circumstances that would further challenge response:

- Electrical power may be out in multiple areas of the City. Power outage may be due to infrastructure damage or due to Pacific Gas & Electric temporarily turning off electricity to customers who are served by PG&E electric lines that run through extreme fire-threat areas. In either case, power outage may affect a larger area of the City than the area immediately threatened by a fire.
- Residents could be displaced; requiring shelter and social services support. Mass care and sheltering activities could be short term or long term depending on the severity of the incident.
- Transportation infrastructure could be damaged and in limited operation. Vital vehicle corridors could be damaged and impassible. Reestablishment of transportation infrastructure will be critical.
- Fires occurring as a result of earthquake could cause additional infrastructure, roadway, and communications system damage that would further challenge evacuation and firefighting efforts.

Resource Availability and Prioritization

A Complex Evacuation (see below) will quickly utilize the City's law enforcement and firefighting resources. The Unified Command Post will rely on external resources to effect an evacuation. Even with external resources, the Unified Command Post will have to balance resource allocation among three activities: firefighting; roadway management; and door-to-door notifications.

In the event of a Complex Evacuation, only life-threatening or serious injury-type calls for service should be dispatched from the City's Emergency Communications Center.

Community Member Responsibilities

Community members have specific responsibilities to prepare to evacuate from a wildfire:

Prepare to evacuate

Community members should make a plan with all members of their households to evacuate their neighborhoods with their neighbors, caregivers, and loved ones.

Because community members may not receive warning, and because the path of a fire is by nature unpredictable, community members must prepare by identifying and practicing multiple evacuation routes that are appropriate for their homes.

Most evacuees will use privately-owned automobiles to escape a wildfire. Past events have demonstrated that roadways may be blocked due to excessive traffic and/or impacted infrastructure. Community members may need to evacuate without their vehicles, or they may need to abandon their vehicles in order to completely exit the evacuation zone.

When planning for evacuation, people with disabilities and others with access and functional needs have additional considerations including:

- The need to evacuate with Durable Medical Equipment (DME), Consumable Medical Supplies (CMS), medication, and service animals
- Transportation methods that accommodate access and functional needs.

Know when to evacuate

Some wildfires requiring evacuation will have little to no warning.

Community members must evacuate immediately if an evacuation is ordered for their area. Community members are responsible for being ready to receive emergency public information and warning messages from multiple sources, including AC Alert, radio, television, and internet.

Community members should consider whether they will need extra time to evacuate (such as people who may need assistance from caregivers and families with children). If they are located outside the zone(s) being evacuated but near the hazard area, they should immediately activate their evacuation plans using their own resources and networks.

However, community members may not receive warning of a fast-moving wildfire. Community members should not wait to receive an official order before evacuating. Community members should evacuate immediately if:

- An evacuation is ordered for their area
- They see or experience visible fire in an adjacent home, visible fire in a home close by with strong winds, and/or strong winds carrying smoke and/or embers through or over our neighborhood.
- They feel threatened.

Know how to evacuate

Time permitting, evacuating community members should:

- Wear long pants and long sleeves, heavy shoes, goggles/glasses, and a dry bandanna/cloth for face cover.
- Bring a flashlight, a cell phone, and pets, and a map with their pre-selected routes.

- Agree on where to meet and a common friend/relative to contact if separated.

Many affected community members will not have performed these responsibilities at the time a wildfire evacuation is needed.

Access and Functional Needs

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.

This plan includes ways to identify and address access and functional needs among community members affected by the emergency.

III. CONCEPT OF OPERATIONS

Evacuation involves the safe movement of people and animals out of a hazard area. The Concept of Operations comprehensively defines the strategies that will be used to effect evacuation in a wildfire scenario. Strategies involve identifying, monitoring, and predicting the extent of the fire and impacts to evacuation infrastructure; making key decisions to allocate resources to implement an incident-specific Traffic Control Plan; and other activities to support evacuation.

Response strategies for wildfire evacuation are described below in four sections:

a) Evacuation Levels
b) Evacuation Zone Identification and Monitoring
c) Incident Planning for Evacuee Movement in Complex Evacuations
d) Wildfire Evacuation Support Activities

Later in this plan, Section IV: *Roles and Responsibilities* establishes the responsible parties for the activities described in this Concept of Operations. Section V.c: *Response Actions* describes these activities in a sequential order.

a) Evacuation Levels

Berkeley defines two levels to describe necessary evacuation circumstances and associated strategy: Simple Evacuation and Complex Evacuation:

- Simple Evacuation: Often evacuations occur as first responders perform day-to-day operations. These are termed *Simple Evacuations*. Simple Evacuations are generally small-scale and can be implemented using available staffing and normal resources.
- Complex Evacuation: Under some circumstances evacuations of larger areas may be necessary. In these circumstances, more resources and greater capabilities will be needed to effect an evacuation, as well as to provide support to evacuated populations. This scenario is termed *Complex Evacuation*. Need for a *Complex Evacuation* could be immediately obvious, for example in a wildfire spreading from Tilden Park into the Berkeley Hills neighborhoods. Alternately, a *Simple Evacuation* could evolve to become a *Complex Evacuation* as the incident develops (for example, a house fire that spreads out of control in the Berkeley Hills neighborhoods).

b) Identification of Evacuation Zone(s)/Key Locations

This section outlines concepts, considerations, and tools to define the area to be evacuated, for both simple and complex evacuations.

<u>Hazard Monitoring</u>

The first step in a wildfire evacuation involves identifying the area at risk. Fire and Police Commanders will perform this step together considering:

- Fire extent (direct and areas impacted by smoke and embers)
- Anticipated spread (considering weather, dryness, topography)
- Roadway/traffic conditions

Police Commanders must be engaged in this discussion because they are primarily responsible for affecting the evacuation. In most scenarios the area that could be impacted by the fire will be defined by the fire's extent and anticipated spread. However, impacted roadways and high volumes of traffic could extend the hazard area if particular neighborhoods are cut off by traffic decisions.

Area to Evacuate

Once the hazard area has been identified, the area to be evacuated will be defined. In many cases this will be the same as the overall hazard area. In some cases, the hazard area will be divided into different sections with different instructions, such as:

- Evacuate now
- Prepare to evacuate

In a small incident requiring a Simple Evacuation, the incident commanders on scene will identify the hazard area and evacuation areas. In a larger event, incident commanders may need to coordinate with the Emergency Operations Center in order to define the hazard area, evacuation areas, and Community Safe Refuge Areas (see *Community Safe Refuge Areas* below).

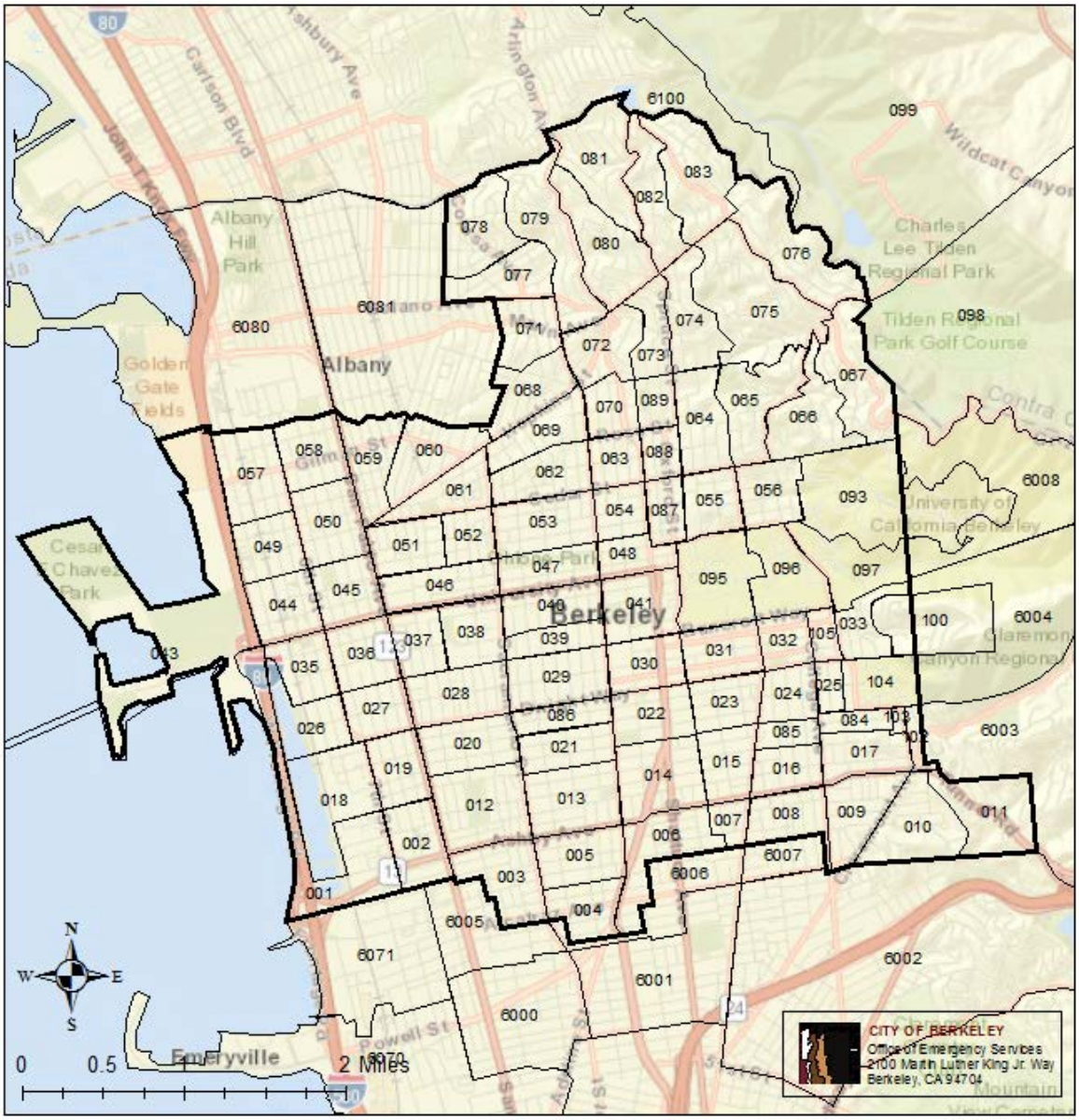
The UCP (Field-Level) will make these decisions. If the EOC is activated, the EOC will provide supportive information to Field-Level commanders.

Evacuation Zones

Berkeley has been divided into Evacuation Zones. Zones have been designed to have similar populations. Evacuation Zones will serve two response functions:

1. Field Commanders will use Evacuation Zones to define the boundaries of an area to be evacuated. Especially in the Berkeley hills, where streets are not gridded, communicating evacuation orders using Evacuation Zones will provide speed and clarity of communication among responders and the community.
2. Evacuation Zones will serve as suggested thresholds for decision-making by Incident Commanders. If an incident involves or will shortly involve multiple evacuation zones, this may indicate that the evacuation cannot be implemented without extensive external assistance. Incident Commanders should consider activating the EOC and calling for mutual aid to facilitate field-level evacuation activities.

Map 2: City of Berkeley Evacuation Zones



Key Locations

As part of evacuation planning, the UCP must also identify key response sites, critical facilities, and facilities with vulnerable populations in the Evacuation Zones, as well as Community Safe Refuge Areas outside of the Evacuation Zones.

- Response sites include the UCP, staging areas, bases, and Community Safe Refuge Areas (see below).
- Critical facilities are those locations that are high priorities for protection due to either their role in ensuring ongoing operations (e.g., power substation, pumping station, etc.) or supporting incident response (e.g. fire stations).
- Facilities with vulnerable populations have a high density of people with access and functional needs (e.g., schools and nursing homes.)
- Community Safe Refuge Areas serve as locations outside of the hazard area to which pedestrian evacuees can be directed to receive further information and instructions.

If activated, the EOC can provide support in identifying these sites.

c) Incident Planning for Evacuee Movement in Complex Evacuations

In complex evacuations, once the area to evacuate has been defined, incident-specific decisions must be made for the best routes for evacuees to use to move out of the hazard area. This section outlines the resources and considerations for responders to determine the best routes for the incident, as well as how those decisions can inform development of a supporting Traffic Control Plan.

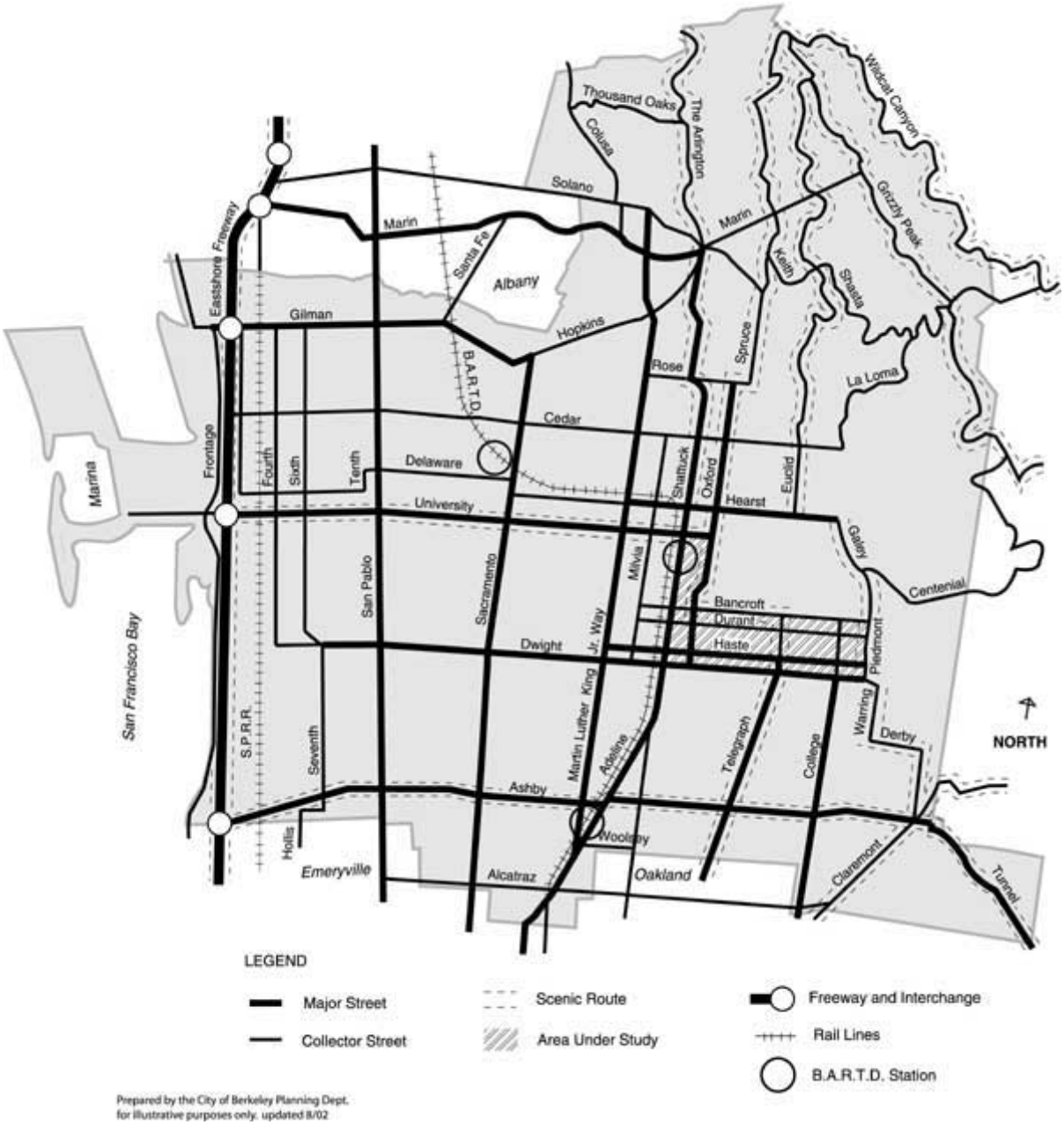
Berkeley's Vehicular Circulation Network

Per the *Vehicular Circulation Network* below, the City's roadways are designated as major streets, collector streets, and local streets, in order of descending capacity.

This plan does not specify capacity of various roadways because calculated roadway capacity will not appropriately estimate traffic flow for an emergency situation. Evacuation will cause a surge in traffic, and traffic flow will be best facilitated by removing blockages at intersections and along roadways. Resources assigned to roadway management will focus on removing blockages from major and collector streets.

Because there are no major streets in the Berkeley hills, vehicular evacuation for most hills residents will involve navigating local streets to access a collector street to move out of the hazard area.

Map 3: Vehicular Circulation Network



Pedestrian Pathways

In the city's many steep neighborhoods with winding roads, public pathways take the shortest, most direct routes, mimicking city block grids that do not exist. These pathways can assist evacuation and firefighting efforts in the hills, because most of the paths offer more expeditious evacuation routes than the surrounding city streets.

In preparedness outreach, the City instructs community members to always be ready to evacuate without a car and to be aware of the locations of developed paths that may reduce evacuation distance. However, because developed pathway conditions vary widely from those with concrete steps and railings to those with wooden steps, these paths may not be good options for evacuees with mobility issues or low vision. For these evacuees, the City recommends City streets for pedestrian evacuation.

Community Safe Refuge Areas

A Community Safe Refuge Area is a landmark outside the immediate hazard area. A Community Safe Refuge Area serves as a location to which evacuees can be directed to receive further information and instructions.

Community Safe Refuge Areas are most likely to be used in a Complex Evacuation, either:

- By people evacuating on foot
- As drop-off point for people being evacuated ad-hoc by responders. In this scenario, responders may need to quickly drop-off evacuees and then return into the hazard area to continue door-to-door notifications.

Evacuees leaving in vehicles should not stop at a Community Safe Refuge Area; they are expected to drive further away from the hazard area to an Evacuation Center or another location with services.

Community Safe Refuge Areas are not intended to provide mass care services. Depending on the incident, the UCP or EOC may direct transportation resources to move evacuees from Community Safe Refuge Areas to Mass Care service sites. (See *Community Transportation below* for more details.)

In this way, Community Safe Refuge Areas serve as an interface between wildfire evacuation activities and broader City efforts to support evacuees.

When issuing an evacuation order for a Complex Evacuation, the UCP should identify one or more Community Safe Refuge Area(s), so that people evacuating on foot and responders know how far they need to travel to be outside the hazard area. Community Safe Refuge Areas should be located away from staging areas so that gathered evacuees do not interfere with other incident response activities.

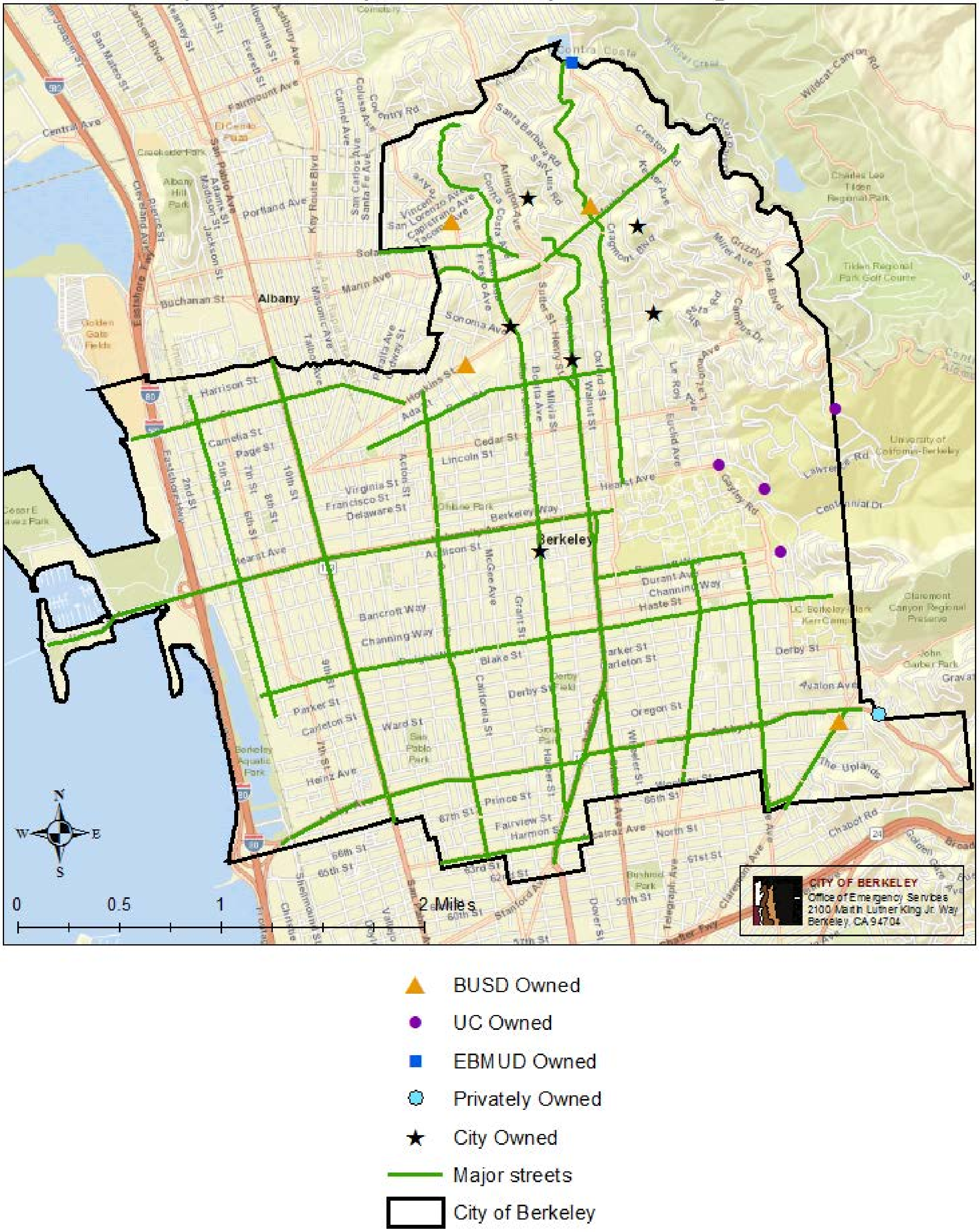
Community Safe Refuge Areas identified in this plan will not all be available and may not be safe in an actual incident. Community members should prepare to receive information about which Community Safe Refuge Areas are active during an incident. If that information is not available, evacuees should proceed as far as possible away from the perceived threat.

Depending on the extent of the fire, the Unified Command Post may need to select different Community Safe Refuge Areas. If activated, the EOC can provide support for this decision.

Attachment A lists possible Community Safe Refuge Areas for wildfire evacuation.

Map 4 below illustrates the locations of possible Community Safe Refuge Areas for wildfire evacuation, along with major streets which may be used for Community Transportation (see *Community Transportation* below).

Map 4. Community Safe Refuge Areas and Major Streets



Priority Transportation Routes

Fire ignition and path/speed of spread are not easily predicted. A single "flush plan," or predetermined set of evacuation routes and directions, will not effectively support wildfire evacuation planning needs. Additionally, while evacuees and responders may use many routes to get out of or into the hazard area, limited resources cannot support clearance and active management of all possible routes.

Therefore wildfire evacuation response will involve identification of incident-specific Priority Transportation Routes to support responder ingress and community evacuation.

The Incident Traffic Control Plan (see below) will identify Priority Transportation Routes. Priority Transportation Routes will be highest priority for route clearance and traffic management activities.

When establishing Priority Transportation Routes, the UCP will consider:

- Zones under evacuation order
- Hazard area and potential area of hazard spread
- Current route status/hazard impacts to routes
- Key response sites
- Community Safe Refuge Area(s)
- Critical facilities inside and adjacent to the Hazard Area
- Vulnerable facilities in the Hazard Area
- Vehicular Circulation Network (see above)
    - Emphasis on Major Streets and Collector Streets both inside and adjacent to the Hazard Area
- Additional circumstances (time of day, existing traffic flow, etc.)

The EOC can provide supportive information to help the UCP determine or update Priority Transportation Routes.

Traffic Control Plan (TCP)

The primary goal of the Traffic Control Plan will be to support the safe and quick movement of community members out of the hazard area while maintaining responder access to the hazard area. The Traffic Control Plan allocates personnel and equipment resources to clear roadways and provide active and passive traffic control of the Priority Transportation Routes. The TCP is developed considering evacuation areas, priority transportation routes, and available resources.

The Traffic Control Plan may:

- Establish of special traffic patterns both inside and outside of the evacuation zone:
    - Change path of travel on specific streets
    - Restrict travel on specific streets
    - Put traffic signals in "flash" mode to facilitate traffic flow
- Include traffic controls outside of the immediate hazard area if necessary to relieve congestion in areas impacted by the incident.
- Include traffic controls to prevent people from entering the hazard area.

- Designate evacuation routes, including recommended routes for those:
    - Evacuating by car
    - Evacuating on foot
    - Evacuating using assistive devices
- Designate separate routes for responder ingress
- Assign resources to remove roadway obstructions, including debris (by Public Works) and parked cars (private towing companies, at BPD discretion)
- Include a map of impacted areas and routes. Note that any publicly distributed map shall include a detailed written description of the map.

In Simple Evacuations, the Traffic Control Plan will be developed by a BPD commander on scene. In Complex Evacuations, Public Works – Transportation Division staff will coordinate with Police Department staff to develop and implement the plan. In Complex Evacuations this responsibility may shift from the field level to Department Operations Centers and/or the Emergency Operations Center. In the EOC, this activity occurs between the Law Enforcement Branch and the Construction and Engineering Branch of the Operations Support Section.

Once developed, the Evacuation Route/Traffic Control Plan must be communicated to responders so that it may be implemented. The plan must also be communicated to the public via *Emergency Public Information and Warning* (described below).

During implementation of the TCP, it will be necessary to monitor the situation in order to identify and address any issues, such as gridlock. As incident circumstances change (e.g., the hazard area grows, an evacuation route becomes blocked, additional responders become available, etc.) the TCP must also be updated and re-communicated to responders and the public for implementation. This situation monitoring will be a combined responsibility of field responders and the EOC, if activated.

d) Wildfire Evacuation Support Activities

The table below outlines activities that may be undertaken to support an evacuation. For each activity, the table identifies whether the activities would be part of a Simple or Complex Evacuation.

Activity	Simple Evacuation	Complex Evacuation
Emergency Public Information and Warning	Yes – often in-person	Yes
Access Control and Reentry	Yes – narrow and short-term	Yes – possibly extensive and ongoing
Door-to-door Notification and Assistance	Yes	Unlikely
Health and Medical Support	Yes	Yes, may be limited inside evacuation area
Animal Response	Yes	Yes
Community Transportation	No	Yes
Evacuation Centers/ Mass Care and Shelter	Possible, depends on expected incident duration	Yes
Resource Management	Yes	Yes
Policy Support	No	Yes

Each activity is described in detail below including related access and functional needs considerations.

Emergency Public Information and Warning

Both simple and complex evacuations require Emergency Public Information and Warning (EPIW). The goal of EPIW alerting is to motivate people in danger to take protective action. In an evacuation context, this means:

- Motivating people to evacuate immediately in areas under evacuation order, and
- Motivating people to prepare to evacuate in areas that may be ordered to evacuate.

The City plans to use multiple systems, including AC Alert and the 1610 AM radio station, to disseminate EPIW messages to affected populations per existing protocols.[1] The City plans to send EPIW messages in both verbal and text-based formats so that all community members, including people with access and functional needs, can receive the messages in the format that works best for them.

In life-threatening emergencies, the City may also request that the Alameda County Office of Emergency Services activate the Integrated Public Alert and Warning System (IPAWS), which includes television scrolls, radio interrupts, and wireless emergency alerts to mobile phones.

The UCP will direct the 9-1-1 Communications Center to send initial community notifications as early as possible in an incident to allow as much evacuation time as possible for those in danger, and to give as

[1] See Administrative Regulation 9.3: *Use of the AC Alert System and 1610 AM Radio for Emergency Public Info and Warning (EPIW)*

much advance warning as possible to people who may need extra time to evacuate (such as people who may need assistance from caregivers and families with children).

Because the evacuation plan will evolve over time, follow-up messaging may be necessary to provide more specific instructions. The UCP will direct the 9-1-1 Communications Center to update messages as necessary in order to provide the most current instructions to community members.

Evacuation messaging templates are included in Attachment B: *Wildfire Evacuation Messaging*. If evacuation messaging includes a map, a detailed written description of the map must also be included to ensure that it is accessible to people who may not be able to see the map.

Additionally, field responders may also use their apparatus to signal the need to take protective action to community members. Responders may sound apparatus sirens and do announcements over loudspeaker. These alerting options should be used in conjunction with other EPIW alerting systems, as these methods cannot provide specific response instructions, and they may exclude people who are indoors, asleep, have impaired hearing, or otherwise cannot hear the messages.

Access Control and Reentry

An evacuated area may be hazardous to those people who attempt to reenter. Evacuated areas are also vulnerable to property-related crime by persons without authorized access.

A Simple Evacuation may involve shutting down a street while incident response occurs. A Complex Evacuation may be a longer-term shutdown of access to an impacted neighborhood, along with establishment of reentry checkpoints to manage the community's return.

In either scenario, commanders must consider whether they will permit entry into the evacuation area for caregivers who need to assist in the evacuation of area residents, for example, family members helping elderly relatives or in-home caregivers providing support to clients.

When the area is determined to be safe enough for law enforcement to enter, law enforcement responders shall provide organized patrols inside the perimeter of the evacuation zone to enforce the evacuation and ensure evacuated persons do not reenter before the evacuation order is lifted. These organized patrols will also deter criminal activity in the area. If safety concerns do not allow for organized patrols within the evacuated area, law enforcement should establish hard containment security perimeters immediately outside of the evacuation zone perimeter to prevent entry into the area.

Reentry of evacuated areas by residents will be coordinated through the EOC. Safety concerns must be mitigated before community members can reenter the area, and utilities may need to be restored before residents can remain onsite. Depending on the impact of the fire, reentry may be permitted with certain restrictions, for example allowing limited groups of people into affected areas, and only during daylight hours.

Door-to-Door Notification and Assistance

If resources allow, field responders may perform “door-to-door” evacuation notifications for households, businesses and other gatherings in the hazard area.

The primary goal of door-to-door notification is to motivate the community members most at risk to evacuate immediately. Community members will be more likely to evacuate if they receive consistent information and instructions from multiple trustworthy sources, including from EPIW messages and door-to-door notifications. In this way, door-to-door notification can be considered to be an “in-person” EPIW message.

Door-to-door notifications will include considerations for people who have difficulty seeing and hearing and understanding.

The secondary goal of door-to-door notification is to coordinate ad-hoc assistance to enable a community member to evacuate if that person cannot do so alone.

Provision of door-to-door notifications and assistance is very resource-intensive. In complex evacuations with wide areas of impact, incident commanders may need to greatly reduce or suspend door-to-door notifications in order to facilitate other evacuation response activities. Community members should not expect door-to-door notifications or assistance from emergency responders during evacuation.

Health and Medical Support

The City of Berkeley Fire Department provides emergency medical services (EMS) through its Engine and Truck companies, all of which are staffed with a paramedic and Advanced Life Support (ALS) equipment; four ambulances, each staffed with two paramedics; and mutual aid agreements to request EMS resources from outside the City of Berkeley.

All City of Berkeley Fire Department paramedics are also firefighters. In a Complex wildfire evacuation, most City Fire and EMS resources will be initially allocated to the UCP. The UCP Fire Commander will determine how to best allocate City ambulances and the firefighter/paramedics that staff them. In a fast-moving WUI fire, firefighter/paramedics may be fully allocated to the UCP for firefighting or evacuation activities.

In a complex wildfire evacuation, the Fire Commander in the Unified Command Post will request EMS mutual aid from the Alameda County Regional Emergency Communications Center (ACRECC) to support wildfire evacuation activities. The Fire Department (Deputy Chief or Chief assigned to cover the City) will also request EMS mutual aid from ACRECC in order to maintain service to areas of the City not under threat from fire.

The majority of EMS mutual aid will be provided by private ambulance companies, although some may come from fire agencies. The UCP will assign its ambulance resources to respond inside/outside of the area under evacuation order considering roadway conditions, current/predicted path of fire, and capability of the ambulance (private or fire agency ambulance). The UCP may also direct assigned ambulance resources to Community Safe Refuge Area(s).

Community members experiencing medical emergencies during a wildfire evacuation will continue to call the 9-1-1 Communications Center to request medical assistance. The Communications Center will determine whether the call is coming from an area under evacuation order and will forward calls for service from within the evacuation area to the UCP. The UCP will triage those requests and will respond as resources allow.

Guidance to evacuees will include the following:

- Individuals dependent on medical devices, such as respirators, sleep-apnea monitors, and wheelchairs will bring those with them as feasible.
- Medical professionals and personal assistants already in the process of supporting a person with medical needs will be expected to accompany the evacuee.
- Definitive medical treatment may be temporarily unavailable due to the event.

The EOC will coordinate with the Fire Department and the Department of Health, Housing, and Community Services to provide health and medical support to evacuees at Community Safe Refuge Area(s), Evacuation Centers, and other mass care sites (see ESF 6: *Mass Care and Recovery Support Annex*). This may involve staffing mass care sites with medical personnel, or using community transportation to transport evacuees needing medical treatment to appropriate medical facilities.

Animal Response

"Animals" includes service animals[2], pets, and livestock[3]. Low evacuation rates from past disasters have resulted in laws requiring that animal planning be included in mass evacuations[4]. People are more likely to evacuate if they can do so with their animals.

Service animals must always be evacuated with their owners. If at all possible, pets and livestock should evacuate with their owners. Those evacuating in vehicles should bring their pets in kennels/crates, with food and other pet care supplies, if possible. Emergency messaging (see *Emergency Public Information*

[2] Service animals are defined as dogs that are individually trained to do work or perform tasks for people with disabilities. Examples of such work or tasks include guiding people who are blind, alerting people who are deaf, pulling a wheelchair, alerting and protecting a person who is having a seizure, reminding a person with mental illness to take prescribed medications, calming a person with Post Traumatic Stress Disorder (PTSD) during an anxiety attack, or performing other duties. Service animals are working animals, not pets. The work or task a dog has been trained to provide must be directly related to the person's disability. Dogs whose sole function is to provide comfort or emotional support do not qualify as service animals under the ADA. Miniature horses who have been individually trained to do work or perform tasks for people with disabilities are service animals as defined by the Department of Justice regulations.
http://www.ada.gov/service_animals_2010.htm.

[3] Berkeley's only known population of large animals is the horses at Golden Gate Fields, which is not in the hazard area for wildfire evacuation.

[4] Pets Evacuation and Transportation Standards Act of 2006: http://www.gpo.gov/fdsys/pkg/PLAW-109publ308/pdf/PLAW-109publ308.pdf

and Warning in Section III.d *Wildfire Evacuation Support Activities*) will instruct evacuees to bring their animals.

The City of Berkeley's Animal Care Services Division (BACS) leads the City's animal response activities, including field services and sheltering. BACS maintains vehicles and staff for animal transport, staffs and operates the Dona Spring Animal Shelter on Bolivar Drive, maintains emergency sheltering supplies for animals, and manages a cadre of volunteers to serve in day-to-day operations as well as emergencies.

In a wildfire evacuation, BACS will use multiple approaches to support evacuated animals. BACS may be represented at the:

- Animal Shelter
- Emergency Operations Center - Operations Support Section
- Community Safe Refuge Areas
- Mass Care Sites (Evacuation Centers, disaster shelters, etc.)

Field operations

During wildfire evacuation, BACS staff will not enter areas under threat. Instead, BACS will work through the EOC to monitor and provide support to evacuated animals at Community Safe Refuge Areas. This may involve crating or providing physical support to contain animals who have evacuated with their owners on foot, as well as transporting animals to the Animal Shelter or to Evacuation Centers as they are established.

When the fire threat has been mitigated and the evacuated area has been determined to be safe and navigable, BACS may also respond inside the impacted area. BACS will allocate resources to managing stray animals through a combination of roaming patrols, as well as possibly responding to requests for service for particular homes that have been evacuated.

While BACS does not have formalized MOUs for field response, BACS may call on partner agencies in surrounding jurisdictions to assist with these activities.

Sheltering Operations

BACS will coordinate sheltering of evacuated animals. Potential shelter locations include the City Animal Shelter, the Berkeley Humane Society (under MOU with BACS), and collocated animal sheltering at disaster shelters for human evacuees. Animal Sheltering operations and coordination are detailed in ESF 6: *Mass Care and Recovery Support Annex* and ESF 11: *Animal Response Annex*.

<u>Community Transportation</u>

In wildfire evacuation, Community Transportation involves use of transit resources to move collected evacuees from a location outside the hazard area to a location providing mass care services. A Complex

Evacuation may require Community Transportation to move evacuees from a Community Safe Refuge Area to an Evacuation Center.

Community Transportation in this context would be coordinated in the EOC's Operations Support Section by the Law Enforcement Branch, the Construction and Engineering Branch, and the Community Branch.

Key points of information to affect Community Transportation include:

- Transportation needs (estimated number of people and animals, including number needing wheelchair or gurney transport)
- Community Safe Refuge Areas to pick up community members and animals (predesignated and/or spontaneous)
- Evacuation Center locations to drop off community members and animals
- Recommended route to Evacuation Center locations

Responders may perform ad-hoc evacuation of community members as part of their *Door-to-Door Notification and Assistance* activities. However, the time and resources are unlikely to be available to do evacuation out of the hazard area with Community Transportation.

To access transportation resources, the City will request City transportation resources as well as partner assets from elsewhere in Berkeley and Alameda County. Access to County transportation resources such as Paratransit vehicles and AC Transit buses would be through coordination with the Alameda County Sheriff's Office of Emergency Services or the Alameda County Operational Area EOC (if activated). Any requests for transportation resources must include vehicles with accessible capacity.

Evacuation Centers/Mass Care and Shelter

An Evacuation Center is a designated site where the City and partners will provide basic mass care services to evacuees, such as snacks, water, restroom access, and connection to instructions and information. Evacuation Centers are designed as very-short-term operations of a few hours or less. If evacuees require overnight sheltering, the EOC will coordinate activation of one or more disaster shelters. An Evacuation Center may become a shelter site or the EOC may designated a more appropriate location to provide emergency sheltering for evacuees.

Evacuation Center Designation

Evacuation Centers should be designated as early as possible to give evacuees a location to go. An Evacuation Center situated away from:

- The hazard area so that the Evacuation Center will not need to be relocated if the incident grows
- Staging areas, the UCP, and other incident response sites, so that evacuees may be properly served without interfering with other incident response activities

The UCP may designate an Evacuation Center as part of an evacuation order. If the UCP does not specify an Evacuation Center site, the EOC's Mass Care Branch will designate one[5], notifying the UCP, Dispatch, and PIO/JIC for communication to the community. Once the Evacuation Center is designated, the EOC is responsible for coordinating resource needs for the site. During non-business hours, Evacuation Center locations may be initially closed or unable to provide services. As the response progresses, the City will provide more mass care services. ESF 6: *Mass Care and Recovery Support Annex* outlines care and shelter practices in Berkeley.

Resource Management

City EOC Not Activated:

- The UCP will request resources through the Field UCP Logistics Section.
- If the UCP Logistics Section cannot fulfill the request, the Field UCP Logistics Section shall contact the Communications Center (Dispatch) to obtain resources as needed.
- Communications Center staff will request further resources from:
    - City Departments
    - City Partner agencies (see *Partner Coordination* below)
    - Alameda County agencies

City EOC Activated:

- The UCP will request resources through the Field UCP Logistics Section.
- If the UCP Logistics Section cannot fill the request, the Field UCP Logistics Section will request resources from City Departments:
    - If a Department is represented at the UCP, the UCP will route the request directly to the Department/DOC
    - If a Department is not represented at the UCP, the UCP will route the request to the EOC Operations Support Section.
        - At the EOC level, resource requests will be coordinated through the Operations Section as described in Emergency Operations Plan Section 2.3.5 *Resource Management*.

Policy Support

A Complex Evacuation from a wildfire will create a need for Policy-level decision-making. Complex evacuations may require the Director of Emergency Services to provide support by making emergency policy decisions. Emergency policy decisions are those decisions that change or suspend City rules and regulations. Potential policy issues for an evacuation scenario include:

- Ongoing access control for evacuated areas
- Access to vacated homes by emergency services personnel in response to owner request
- Approval of emergency contracts for supportive equipment and services

[5] See *Shelter Site Identification Procedure*, which incorporates Access and Functional Needs considerations

- Reentry procedures for residents and the general public

Policy decisions would normally require City Council approval. Because evacuation scenarios generally evolve quickly, it is likely that policy decisions will initially be made by the DES rather than the City Council. These decisions must be approved by the City Council as soon as is practicable. See EOP Base Plan Section 2.2.2 *Policy Group* for details.

At any time, the Director of Emergency Services may assemble an ad-hoc Policy Group of experts to advise on emergency policy decisions. For wildfire evacuation, key individuals that the DES may engage in a Policy Group include:

- Police Chief
- Director of Public Works
- Transportation Division Manager
- City Attorney
- Fire Chief
- Health Officer
- Waterfront Manager
- Toxics Division Manager
- Public Information Officer

e) Partner Coordination

City responders may coordinate at the field, Department, EOC, and Policy levels with partners external to Berkeley City government in order to implement a wildfire evacuation. Some key partners are listed below, along with descriptions of necessary coordination and clarification of responsibilities.

<u>Mutual Response Area Partners</u>

The Berkeley Fire Department participates with other departments in a Mutual Response Area concept. When a fire breaks out in areas of the east bay hills that are highly vulnerable to fast-moving fires, departments from outside the jurisdiction may respond in order to quickly quell the fire. In Berkeley's Mutual Response Areas, responding departments may include:

- Moraga/Orinda Fire
- Oakland Fire
- El Cerrito/Kensington Fire
- East Bay Regional Parks Fire

This means that even without a mutual aid request to the County, these agencies may be participating in response efforts during a wildfire evacuation in Berkeley.

<u>Berkeley Partners</u>

UC Berkeley

Berkeley Fire provides Fire and EMS services to UC Berkeley. UCPD is in charge of law enforcement on the UC Berkeley campus.

If wildfire may impact any area of the UC Campus, including if Berkeley Fire will recommend evacuation for any of areas of the UC Campus, UCPD would be responsible for implementing that evacuation. Therefore, UCPD should be part of the Unified Command Post if any areas of the UC Campus may be in any way affected by wildfire response.

UC Berkeley would likely activate its own Emergency Operations Center and should send a liaison to the City of Berkeley's Emergency Operations Center if the City EOC is activated.

UC Berkeley has its own emergency notification systems that should be used in tandem with City processes (see *Emergency Public Information and Warning* in Section III.d *Wildfire Evacuation Support Activities*) to issue evacuation information and instructions to students, staff and faculty.

Because the UC Berkeley campus borders a significant portion of Berkeley's hills area, the fastest evacuation routes for community members might involve roadways and walking paths on the UC Campus. If the City wants to recommend evacuation routes through Campus property, the City must coordinate with UCPD through the UCP and/or the EOC. Regardless of the City's recommendation to the community, the UC Berkeley Campus can expect that evacuating community members may travel to or through the UC Campus as they leave the hazard area.

Lawrence Berkeley National Lab

LBNL sits on the border between Berkeley and the wildlands managed by the East Bay Regional Parks District. A wildfire could first enter Berkeley on LBNL property.

LBNL's Fire and HazMat response is provided through a contract with Alameda County Fire. UCPD is in charge of law enforcement on the Lab campus. The City of Berkeley provides EMS to the LBNL campus.

If wildfire could affect any area of the LBNL campus, including if Berkeley Fire will recommend evacuation for any of area of the LBNL Campus, LBNL should be represented at the Unified Command Post. If the UCP recommends evacuation of areas of the LBNL Campus, LBNL officials will determine the course of action and UCPD would be responsible for implementing that evacuation.

Additionally, if the LBNL was under threat of wildfire, LBNL would activate its own Emergency Operations Center. LBNL should also send a liaison to the City of Berkeley's Emergency Operations Center if the City EOC is activated.

LBNL has its own emergency notification systems that should be used in tandem with City processes (see *Emergency Public Information and Warning* in Section III.d *Wildfire Evacuation Support Activities*) to issue evacuation information and instructions to personnel onsite.

Because the LBNL campus occupies a significant portion of Berkeley's wildland-urban interface, the fastest evacuation routes for community members could involve roadways and walking paths on the

LBNL Campus. However, due to the hazardous materials in place on the LBNL Campus, using these paths may pose additional dangers to both evacuees and to the LBNL Campus.

If the City wants to recommend evacuation routes through LBNL Campus property, the City must make this request to LBNL through the UCP and/or the EOC. LBNL will determine whether it is safe to open the LBNL Campus for evacuation. Regardless of the City's recommendation to the community, the LBNL Campus can expect that evacuating community members may attempt to travel to or through the LBNL Campus as they leave the hazard area.

Berkeley Unified School District

California Senate Bill 187 (SB 187) and California Education Code Section 35294.1-222 mandate that all California public schools have a comprehensive school safety plan, which must be reviewed and updated annually. SB 187 defines what the document should cover, including procedures to accommodate children and youth with disabilities. The California State Board of Education supports the mandate with Policy #01-0223.

BUSD schools situated in Fire Zones 2 and 3 are considered facilities with vulnerable populations (see *Key Locations* above) and are included on maps used by field responders and the City EOC.

The City will coordinate with BUSD through the City of Berkeley Emergency Operations Center. BUSD currently has a designated EOC Partner Representative position in the EOC Operations Support Section, Community Branch. Additionally, BUSD may establish its own EOC to coordinate its operations. Until the City EOC is activated, BUSD shall communicate status and resource requests through the 9-1-1 Communications Center.

Students in public K–12 schools are a dependent population, and as such, BUSD is responsible for the custodianship of the students until they are released to a custodial adult. BUSD will provide the necessary personnel and resources to ensure that students with disabilities and others with access and functional needs are evacuated and supported until they are released to their custodial adult.

At each school site, staff coordinate evacuation out of school buildings. In the event a campus requires a full evacuation, BUSD provides for the relocation of students to an alternative school district property. Schools may consider predesignating a backup location for this kind of incident and communicating it to parents/guardians in advance of an emergency.

BUSD may use its own transportation resources (buses) to evacuate the school, depending on the particular circumstances of the scenario, including available resources and the Traffic Control Plan. If BUSD opts to use buses to evacuate students, questions about entry points and recommended routes shall be routed to the Unified Command Post.

If BUSD needs assistance from the City to evacuate, BUSD must immediately communicate those resource requests to the City. The Communications Center or City EOC will determine whether the call is coming from an area under evacuation order and will forward calls for service from within the evacuation area to the UCP. The UCP will triage those requests and will respond as resources allow.

The City may request that BUSD preemptively evacuate schools near to the evacuation zone in order to reduce potential congestion on affected roadways from parents/guardians picking up their children.

The City may request assistance from BUSD buses in order to move evacuees from Community Safe Refuge Areas to Mass Care sites.

In a wildfire evacuation in Berkeley, BUSD will:

- Monitor public Emergency Public Information and Warning (EPIW) systems for information and instructions that may be targeted at school sites
- Maintain communication with:
    - School sites
    - City of Berkeley (via 9-1-1 Communications Center or EOC, if activated)
    - Parents of affected children
- Coordinate evacuation of school sites
    - Serve as first point of resource provision for school sites
    - Forward resource requests to the City as needed
    - Provide reception sites for evacuating BUSD schools
- Respond to resource requests from City of Berkeley for incident support, likely from BUSD school buses.

Easy Does It

Easy Does It Emergency Services provides assistance to the elderly and individuals with disabilities living independently in the City of Berkeley. Should a disabled person experience an unforeseen crisis or a temporary lapse in his or her own regular attendant care, that person can call upon Easy Does It for assistance at the time of need. In a Disaster, EDI services may include:

- Forwarding City EPIW messages to clients in impacted areas
- Dispatching emergency attendants to evacuation center
- Using EDI transportation to pick up wheelchair users
- Carrying clients up and down stairs
- Independent Living Case Management
- Wheelchair repair

Per SEMS, Easy Does It is a Private Nonprofit organization operating within the City of Berkeley Local Government area.

<u>Key Partners on Berkeley's Borders</u>

Berkeley shares borders with cities and a special district. Because a fire could affect multiple jurisdictions simultaneously, each potential response partner is described below.

East Bay Regional Park District

The East Bay Regional Park District maintains and operates a system of parks throughout Alameda and Contra Costa Counties. Coordination with EBRPD is critical, as multiple parks on Berkeley's borders could be the source of a wildfire that burns into Berkeley:

- Tilden Regional Park, on Berkeley's northeastern border
- Claremont Canyon Regional Park, on Berkeley's southeastern border (within the City of Oakland borders)

At the field level, the EBPRD Fire Department serves as one of Berkeley's Mutual Response Area partners (see above) and would likely be requested to provide mutual aid.

Additionally, a fire could affect both EBRPD and Berkeley simultaneously. In a fire burning in both jurisdictions, the UCP must include both EBRPD and Berkeley fire and law enforcement representatives. EBRPD and Berkeley would coordinate at the Emergency Operations Center level to ensure that both jurisdictions maintained a common operating picture in order to coordinate evacuation information and instructions for affected areas.

City of Oakland

The City of Oakland, sitting on Berkeley's southern border, may need to coordinate at multiple levels with the City of Berkeley during a wildfire response.

At the field level, the Oakland Fire Department serves as one of Berkeley's Mutual Response Area partners (see above) and would likely be requested to provide mutual aid.

Because the cities share a border, it is possible that evacuees from a Berkeley fire would evacuate into the city of Oakland.

Additionally, a fire could affect both Oakland and Berkeley simultaneously; in fact, Berkeley and Oakland share the Panoramic Hill neighborhood, which is considered to be Berkeley's most vulnerable to wildfire. In a fire burning in both cities, the UCP must include both Oakland and Berkeley fire and law enforcement representatives. Additionally, the cities of Oakland and Berkeley would coordinate at the Emergency Operations Center level to ensure that both cities maintained a common operating picture in order to coordinate evacuation information and instructions for affected community members in both cities.

City of Albany

The City of Albany, sitting on Berkeley's northwestern border, may need to coordinate at multiple levels with the City of Berkeley during a wildfire response.

At the field level, mutual aid would likely be requested from the Albany Fire Department (fire and EMS) and the Albany Police Department (law enforcement).

Because the cities share a border, it is possible that evacuees from a Berkeley fire would evacuate into the city of Albany. The cities of Albany and Berkeley would coordinate at the Emergency Operations Center level to ensure that both cities maintained a common operating picture in order to coordinate evacuation information and instructions for affected community members in both cities.

Community of Kensington

The community of Kensington, sitting on Berkeley's northeastern border, may need to coordinate at multiple levels with the City of Berkeley during a wildfire response.

At the field level, the El Cerrito-Kensington Fire Department serves as one of Berkeley's Mutual Response Area partners (see above) and would likely be requested to provide mutual aid.

Because they share a border, it is possible that evacuees from a Berkeley fire would evacuate into the city of Kensington.

Additionally, a fire could affect both Kensington and Berkeley simultaneously. In a fire burning in both cities, the UCP must include both El Cerrito-Kensington and Berkeley fire and law enforcement representatives.

Per SEMS, because Kensington sits in Contra Costa County, EOC-level communication should be through the Alameda County and Contra Costa County Operational Area Emergency Operations Centers. The County EOCs must coordinate on behalf of Berkeley and to ensure that both jurisdictions maintain a common operating picture in order to coordinate evacuation information and instructions for affected community members in both jurisdictions.

<u>County-Level Partners</u>

Alameda County Regional Emergency Communications Center (ACRECC)

The Alameda County Regional Emergency Communications Center (ACRECC) is located at the Lawrence Livermore National Laboratory (LLNL) and is operated by the Alameda County Fire Department (ACFD). ACRECC serves as the Alameda County Operational Area Coordinator.

As such, ACRECC will receive requests for law, fire, and EMS mutual aid from the City of Berkeley. The Unified Command Post will originate these requests, which will be forwarded to ACRECC through the City of Berkeley 9-1-1 Dispatch Center. ACRECC will coordinate with other cities and jurisdictions to assign resources to the City of Berkeley.

Alameda County Sheriff's Office of Emergency Services and Homeland Security (AlCo OES)

AlCo OES coordinates emergency management activities for Alameda County at the SEMS Operational Area level. For wildfire evacuation, this coordination involves two key functions:

- AlCo OES processes requests for activation of the Integrated Public Alert and Warning System (IPAWS), which is a key part of Berkeley's Emergency Public Information and warning capability. While the City of Berkeley can directly send messages to the community through its own systems, the most powerful capabilities for community notification and warning exist at the County level. These systems are Wireless Emergency Alerts, which can target alerts to people in a hazard area based on their real-time locations, and the Emergency Alert System, which can interrupt radio and television programming.
- AlCo OES manages the Alameda County Emergency Operations Center. The AlCo EOC coordinates information and resources for jurisdictions within Alameda County. Representatives from utilities and organizations serving multiple cities in the County may sit at the Alameda County EOC in addition to or in lieu of providing representatives to the City of Berkeley EOC. The AlCo EOC serves as Berkeley's EOC-level connection for the State Office of Emergency Services Coastal Region. The City of Berkeley EOC will share situation status information and resource requests not being directed to ACRECC (see above) with the AlCO OA EOC for further coordination.

American Red Cross of the Bay Area – Alameda County (Red Cross)

The Red Cross supports coordination of care and shelter services. For wildfire evacuation, this may entail providing Community Safe Refuge Areas and Mass Care sites with basic support services that could include water, snacks, basic first aid, and mental health support as necessary.

If requested, the Red Cross may help to staff positions in the EOC Operations Support Section Mass Care Branch.

For American Red Cross responsibilities refer to ESF 6: *Mass Care and Recovery Support Annex*.

Utility Partners

EBMUD

EBMUD water systems will be used for firefighting activities. The Unified Command Post may request changes to the water distribution system from EBMUD. EBMUD's involvement in a wildfire evacuation will be related to support of firefighting tactics.

At the time of the event, the UCP may communicate with EBMUD through the Communications Center or through an EBMUD Liaison at the UCP. Additionally, EBMUD may also provide a liaison to the EOC Operations Support Section – Construction and Engineering Branch. If this is not possible, the City's EOC will connect with these representatives through the Alameda County OA EOC.

PG&E

Pacific Gas and Electric Company provides natural gas and electric service to the Berkeley community. While PG&E does not play a specific role in implementing wildfire evacuation, the status of the company's infrastructure poses particular concern in a wildfire scenario.

A wildfire could be caused by electric power and distribution lines, conductors and/or the failure of power poles. To mitigate the possibility of a wildfire initiated by PG&E infrastructure, the utility may temporarily turn off electricity to customers who are served by PG&E electric lines that run through extreme fire-threat areas. While the utility plans to provide as much advance notice as possible before taking this step, it has not provided specific thresholds or criteria that the City can monitor.

This power shutoff could impact evacuation efforts by reducing the City's ability to communicate with residents through EPIW systems and impacting the City's transportation infrastructure.

At the time of an event, PG&E may provide an Agency Representative at the UCP if requested. PG&E may also provide a liaison to the EOC Operations Support Section – Construction and Engineering Branch. If this is not possible, the City's EOC will connect with these representatives through the Alameda County OA EOC.

IV. ROLES AND RESPONSIBILITIES

Evacuations, like all emergency operations in the State of California, occur within the context and under the authority of mandated plans and response systems that describe coordination within and between multiple levels of government response. SEMS describes these levels, which are reflected in State and local emergency plans and procedures. This document serves as both a Functional Annex and Hazard-Specific Appendix to the City's Emergency Operations Plan - Base Plan, which clarifies organization within the Local Jurisdiction level.

Evacuation operations require particular attention to the coordination within and between each level of government response. Operations will follow the framework of SEMS, NIMS, ICS, and the EOP Base Plan by adhering to the six organizational levels:

1. Field (Incident Command (IC), Unified Command (UC), Area Command)
2. Local Jurisdiction (City of Berkeley, including EOC and Policy organizations)
3. Operational Area (Alameda County agencies)
4. Cal OES Coastal Region
5. State of California
6. Federal

Responsibilities for the Field, Local, and Operational Area levels are detailed further in the sections below.

a) Field Responsibilities

Unified Command Post Representatives:

- Fire and Rescue
    - Berkeley Fire Department
    - May also include:
        - Moraga/Orinda Fire
        - Oakland Fire
        - El Cerrito/Kensington Fire
        - East Bay Regional Parks Fire
        - Alameda County Fire
        - CAL FIRE
- Law Enforcement
    - Berkeley Police Department
    - May also include:
        - UC Berkeley Police
        - Oakland Police
        - Kensington Police
- Emergency Medical Services
    - Berkeley Fire Department
- Public Works
    - City of Berkeley Public Works Department

        - Streets Division
        - Transportation Division
    - May also include:
        - Pacific Gas and Electric Liaison
        - East Bay Municipal Utilities District Liaison
- City of Berkeley Emergency Communications Center[6]
- Emergency Management
    - City of Berkeley Office of Emergency Services Liaison (EOC not activated)
    - City of Berkeley Emergency Operations Center Liaison

All of the Unified Command Post representatives are listed in the table below, along with their Wildfire Evacuation Responsibilities at the UCP.

[6] While the Emergency Communications Center will not be physically present at the UCP, the Communications Center will perform a key coordination role for the UCP.

Function	Wildfire Evacuation Responsibilities

Fire and Rescue	• Establish Unified Command with appropriate Law Enforcement and Public Works representatives
	• Identify hazard area(s) and Zone(s) to be evacuated
	• Coordinate with Law Enforcement to develop and update evacuation plan
	  o Identify Community Safe Refuge Areas
	  o Advise on fire conditions and impacts on evacuation routes
	  o Update plan as situation warrants
	• Support implementation of evacuation plan
	  o Support evacuation of the identified areas, as necessary, which may include the use of public address systems and/or door-to-door notification.
	• Direct Fire Suppression and Rescue personnel
	• Request Fire Mutual Aid as needed

Law Enforcement	• Establish Unified Command with appropriate Fire and Rescue and Public Works representatives
	• Serve as lead City department for evacuation operations
	• Coordinate with Fire Department to develop and update evacuation plan
	  o Receive from Fire: Community Safe Refuge Areas, hazard areas, and areas to be evacuated
	  o Establish evacuation routes from areas to be evacuated to selected Community Safe Refuge Areas
	  ▪ As needed, adjust traffic flows to maximize egress capacity. This may include blocking streets, changing streets to one-way, and/or changing traffic signal flow.
	  ▪ If possible, establish designated responder-only ingress routes
	  o Update plan as situation warrants
	• Implement Evacuation Route/Traffic Control Plan
	  o Secure evacuated areas and control ingress and egress to maintain perimeter control during an evacuation
	  o Manage and control selected evacuation routes.
	  ▪ Deploy Parking Enforcement Officers to direct vehicle traffic
	  ▪ Coordinate with Public Works-Streets Division to adjust traffic signals and position traffic management resources
	  ▪ Coordinate with private towing companies to remove parked cars as needed
	  o Support evacuation of the identified areas, as necessary, which may include the use of public address systems and/or door-to-door notification
	  o As resources permit, provide support to people who cannot evacuate without assistance
	  o Monitor implementation of the Evacuation Route/Traffic Control Plan and update the plan as necessary
	• Manage law enforcement personnel and material resources for evacuation activities
	  o Mobilize department personnel and material resources
	  o Request Law Enforcement Mutual Aid as needed
	• Implement and Request Community Notifications
	  o Direct Communications Center to send emergency alerts
	  ▪ Update Communications Center any time Evacuation Route/Traffic Control Plan is updated
	  o Consider use of public address systems and/or door-to-door notification in evacuated areas.
	• Communicate with other law enforcement entities as needed

Emergency Medical Services	• Receive and prioritize requests for Emergency Medical Services in areas under UCP control
	  o From field responders
	  o From Emergency Communications Center
	• Direct assigned emergency medical system resources
	  o Determine with Fire and Law commanders whether/which resources to allow in evacuation zone
	• Request EMS mutual aid as needed

Public Works: Streets	• Support implementation of Evacuation Route/Traffic Control Plan
	  o Install appropriate signage, traffic control devices, and barricades
	  o Remove debris or other roadway obstructions to facilitate evacuation or ingress for emergency personnel
	• Change traffic signals as requested by Police Department

Public Works: Transportation	• If possible, provide a Traffic Engineer to the UCP to support Police Department in development of Evacuation Route/Traffic Control Plan for Complex Evacuation
Utility Liaisons	• Communicate with utilities to provide UCP with updated information on outages and impacts

Communications Center	• Support incident communications for involved departments and agencies
	• Craft and send Emergency Public Information and Warning messages per Administrative Regulation 9.3
	• Communicate Evacuation Route/Traffic Control Plan to AC Transit
	• Receive calls from community
	  o Communicate current evacuation instructions to callers
	  o Log requests for evacuation assistance and forward to UCP for triage

Emergency Management	• Maintain communication between the Local Government Level and the Field Level to ensure maintenance of a Common Operating Picture
	• Forward non-mutual-aid resource requests to the EOC for processing
	• Coordinate with the EOC/City Departments and partner agencies on response activities not being coordinated by the UCP
	  o Community Safe Refuge Area support activities
	  o Mass Transportation from Community Safe Refuge Areas to mass care sites
	  o Mass care and shelter activities (activation of Evacuation Centers)

b) Local Emergency Operations Center Responsibilities

Supporting EOC Positions:

- EOC Management Section
  - EOC Coordinator
  - Public Information Officer/JIC
  - Liaison Officer
- EOC Operations Support Section
  - Coordinator
  - Fire and Rescue Branch
  - Law Enforcement Branch
  - Construction and Engineering Branch
    - Transportation Unit
    - Construction and Engineering Unit
  - Mass Care Branch
    - Shelter Unit
    - Animal Care Unit
  - Health and Medical Branch
  - Community Branch
- EOC Plans/Intelligence Section
  - Situation Analysis Unit
  - Resource Status Unit
  - Access and Functional Needs Technical Specialist
- EOC Logistics Section
  - Supply/Procurement Unit

All of the above EOC positions are listed in the table below. The table identifies the Unit/Position, the Unit/Position's Wildfire Evacuation responsibilities, and the Emergency Support Functions associated with those responsibilities. "Normal Duties" is listed to indicate that the position should be activated to perform normal duties in support of wildfire evacuation. For additional details on normal duties for each position, see the City of Berkeley *Emergency Operations Plan*.

EOC Unit/ Position	ESF	Wildfire Evacuation Responsibilities
Management Section		
EOC Coordinator	5: *Emergency Management*	• Normal Duties
Public Information Officer/JIC	15: Public Information	• Normal Duties

EOC Unit/ Position	ESF	Wildfire Evacuation Responsibilities
Liaison Officer	5: *Emergency Management*	• Normal Duties • Coordinate with Community Branch and Construction & Engineering Branch to get transportation resources to move evacuees without cars from Community Safe Refuge Areas to Evacuation Centers
Operations Support Section		
Coordinator	5: *Emergency Management*	• Normal Duties • Establish and maintain an EOC liaison at the UCP to relay information to the Emergency Operations Center
Fire and Rescue Branch	16: *Evacuation*	• Normal Duties
Law Enforcement Branch	16: *Evacuation*	• Normal Duties • Coordinate evacuation operations with: o Construction and Engineering Branch to designate evacuation routes o PIO/JIC to ensure public messaging has current information • With Construction and Engineering Unit, monitor traffic status to recommend changes to the Evacuation Route/Traffic Control Plan
Construction and Engineering Branch	3: *Public Works and Engineering* 16: *Evacuation*	• Normal Duties • Maintain information on the status of City Roadways • Coordinate with Caltrans and County to maintain information on status of non-City roadways • With Law Enforcement Branch, monitor traffic status to recommend changes to the Evacuation Route/Traffic Control Plan • Work with UCP and Mass Care Branch to coordinate incoming transportation resources to move evacuees without cars from Community Safe Refuge Areas to Evacuation Centers
Mass Care Branch – Shelter Unit	5: *Emergency Management* 6: *Mass Care and Recovery Support* 7: *Logistics*	• Normal Duties • Coordinate with Plans/Intelligence Section to anticipate need for evacuation centers • Provide coordination and support to HHCS and PRW in identification and activation of evacuation centers • Establish evacuation centers as necessary and communicate their location to all EOC Sections, the PIO/JIC, and Communications Center.

EOC Unit/ Position	ESF	Wildfire Evacuation Responsibilities
Mass Care Branch – Animal Care Unit	11: *Animal Response*	• Normal Duties • Monitor and support implementation of evacuation plan • Coordinate with Animal Care Services to: o Provide resources to Community Safe Refuge Sites and other sites as needed to provide safe transportation for animals in need of confinement during an evacuation. o Shelter affected animals if necessary, using: ▪ Berkeley Animal Shelter ▪ Mutual aid animal shelter facilities ▪ Emergency animal sheltering facilities at evacuation centers (coordinate with Mass Care Branch - Shelter Unit) o Perform animal rescue, triage, medical treatment, transport, care, and domestic animal reunification o Mobilize additional ACS personnel, and other department trained volunteers.
Community Branch	16: *Evacuation*	• Normal Duties • Coordinate with Law Enforcement Branch, PIO/JIC, and external organizations to: o Communicate evacuation information and instructions through community networks o Coordinate with Construction and Engineering Branch and Liaison Officer to identify external resources (personnel, equipment and services) to assist with evacuation, including transportation of individuals unable to evacuate themselves
Plans/Intelligence Section		
Situation Analysis Unit	5: *Emergency Management* 16: *Evacuation*	• Normal Duties • Maintain up-to-date situation status for incident. Important evacuation information includes: o Hazard areas o Areas under evacuation order o Areas under “prepare to evacuate” order o Hazard impact to transportation system (blocked routes, condition of major transportation agencies/services, structural integrity of roads/bridges/overpasses, etc.) o Access to critical facilities o Designated routes for evacuation and/or responder ingress o Designated Community Safe Refuge Areas o Estimated number of evacuees

EOC Unit/ Position	ESF	Wildfire Evacuation Responsibilities
Resource Status Unit	7: *Logistics*	• Normal Duties
Access and Functional Needs Technical Specialist	5: *Emergency Management* 16: *Evacuation*	• Normal Duties • Coordinate with Liaison Officer and Operations Support Section identify external resources (personnel, equipment and services) to assist with evacuation of people with access and functional needs
Logistics Section		
Supply/Procurement Unit	7: *Logistics*	• Normal Duties

c) Local Policy Responsibilities

Policy Positions:

- Director of Emergency Services
- Policy Group
- City Council Liaison
- City Council

All of the above Policy positions are listed in the table below. The table identifies the Entity, its Wildfire Evacuation responsibilities, and the Emergency Support Functions associated with those responsibilities. "Normal Duties" is listed to indicate that the position should be activated to perform normal duties in support of wildfire evacuation. For additional details on normal duties for each position, see the City of Berkeley *Emergency Operations Plan*.

Entity	**ESF**	**Wildfire Evacuation Responsibilities**
City Manager/ Director of Emergency Services	5: *Emergency Management*	• Normal Duties
Policy Group	5: *Emergency Management*	• Normal Duties
City Council Liaison	5: *Emergency Management*	• Normal Duties
City Council	5: *Emergency Management*	• Normal duties as outlined in *City Council Emergency Response: Initial Actions* and *Ongoing Duties* o Receive and review verified information. o Share verified information to networks. o Collect information from networks. o Participate in Council meetings

d) Operational Area Responsibilities

Although the City of Berkeley has no authority to assign responsibilities to Operational Area Level agencies, many of these agencies are primarily responsible for providing certain services to the City of Berkeley.

Supporting Operational Area Level Agencies:

- Alameda County Regional Emergency Communications Center (ACRECC)
- Alameda County Sheriff's Office of Emergency Services and Homeland Security (AlCo OES)
- Alameda County Operational Area EOC (AlCo OA EOC)
- American Red Cross of the Bay Area – Alameda County (Red Cross)

Those Operational Area-level agencies and positions with responsibilities for wildfire evacuation are listed in the table below, along with the services they are responsible for providing in the event of a wildfire requiring evacuation.

OA Level Agency	Wildfire Evacuation Responsibilities
ACRECC	• Coordinate City of Berkeley's mutual aid requests for law enforcement, fire and rescue, and emergency medical services
AlCo OES	• Process City of Berkeley IPAWS activation requests • Activate AlCo OA EOC as appropriate to support City of Berkeley response activities • Connect Alameda County to State Office of Emergency Services Coastal Region
AlCo OA EOC	• Coordinate information and resources for Alameda County • Host Alameda County agencies and external OA-level agencies to ensure they are integrated into response
Red Cross	• Provide support and coordination for mass care needs arising from wildfire evacuation

V. ACTIVATION, NOTIFICATION AND RESPONSE ACTIONS

a. Activation

Within the City, the Director of Emergency Services or the Chief of Police have the overarching authority to initiate an evacuation. This plan may be activated by any member of the Fire Department or Police Department Command Staff, or any Fire Department Incident Commander when a wildfire event affecting the Berkeley population is anticipated or has occurred.

Two scenarios may activate this plan:

- Impending wildfire: If a wildfire occurs outside City boundaries, Fire Department and Police Department officials will monitor the situation to determine if activation of this plan is necessary to protect the Berkeley community. Officials may activate this plan even if fire has not reached Berkeley.
- Actual wildfire: If a wildfire occurs inside City boundaries, the Fire Department Incident Commander determine whether the event necessitates activation of this plan.

Scalable Activation

The level of activation will be determined according to the requirements of the event. Commanders will determine:

- Whether the necessary evacuation is Simple or Complex (see table below)
- Impacted agencies to engage at the Unified Command Post based on location of the fire and affected populations (see Section III.e *Partner Coordination*)

Wildfire Evacuation Type	**Examples**	**Coordinating Department**	**Activated Structures**
Simple	Structure fire in WUI area	Fire Department	• Incident Command Post
Complex	Structure fire that has expanded beyond initial occupancy and its immediate exposures Wildfire encroaching on Berkeley	Police and Fire Departments (Unified Command)	• Unified Command Post • Fire DOC • Police DOC • Public Works DOC • Emergency Operations Center

b. Notification

Under direction of the Unified Command Post the 9-1-1 Communications Center will issue notifications to all relevant supporting departments and agencies, and to any additional departments or agencies as required. The Office of Emergency Services will support notification efforts as staff are able.

Notification will be issued through the most appropriate communications channels and equipment for the event requirements, and will detail event information, reporting instructions, and any relevant coordination information.

c. Response Actions

Response actions listed below reference concepts that are detailed in Section III: *Concept of Operations*.

1. Establish Incident/Unified Command as appropriate[7]
    a. City representatives include Fire, Police, and Public Works
    b. UCP identifies any key departments/external agencies and requests representatives as appropriate at the UCP
2. Conduct Initial Assessment[8]
    a. UCP – Fire Command determines fire extent and anticipated spread
    b. UCP – Law Command determines roadway/traffic conditions
    c. UCP determines Zone(s) to Evacuate
        i. May sub-divide into "evacuate now" and "prepare to evacuate" areas
    d. UCP identifies key locations
        i. Response sites (inside/outside Evacuation Zones)
        ii. Critical facilities and facilities with vulnerable populations in Evacuation Zones
        iii. Community Safe Refuge Areas outside Evacuation Zones
3. Initial Community Notifications
    a. UCP directs 9-1-1 Communications Center to perform initial notifications to affected community members
4. Request resources
    a. UCP requests internal City resources via 9-1-1 Dispatch Center
    b. UCP requests mutual aid resources (fire, law enforcement, EMS) from ACRECC via 9-1-1 Dispatch Center
5. Develop Evacuation Plan
    a. UCP establishes Priority Transportation Routes
    b. If possible, UCP establishes designated responder-only ingress routes
    c. UCP determines which responders will be permitted into which areas
    d. UCP establishes supportive Traffic Control Plan
6. Implement Evacuation Plan
    a. UCP directs 9-1-1 Communications Center[9] to perform detailed community notifications with affected areas, recommended evacuation routes, and other instructions
    b. UCP directs access control to impacted areas
    c. UCP – Law Commander directs implementation of Traffic Control Plan
        i. Law Enforcement field responders facilitate traffic flow on major and collector streets
        ii. Public Works – Streets:
            1. Removes debris or other roadway obstructions to facilitate evacuation or ingress for emergency personnel
            2. Installs appropriate signage, traffic control devices, and barricades
            3. Changes traffic signals as requested by Police Department
        iii. As needed, private towing companies remove parked cars

[7] This section assumes a Complex Evacuation with Unified Command
[8] If activated, EOC will provide requested support for initial assessment.
[9] Office of Emergency Services staff will provide support if available.

   d. UCP receives and triages requests for service from within evacuation zones. Requests for service may come from:
      i. 9-1-1 Communications Center
      ii. Field Responders
      iii. Emergency Operations Center – Operations Support Section (if activated)
   e. UCP assigns available resources to:
      i. Door-to-door notifications
      ii. Drive-by notifications from apparatus
      iii. Requests for service
7. Monitor and update Evacuation Plan
   a. UCP-Fire Commander monitors fire activity to determine necessary changes to Initial Assessment and Zones to Evacuate
   b. UCP-Law Commander monitors evacuation progress
   c. UCP adjusts Evacuation Plan as necessary to integrate additional resources
8. EOC-driven support
   a. Activate and staff EOC
   b. Request Department support/DOC activation(s) as needed
   c. Maintain up-to-date situation status for the incident
   d. Coordinate support for field response
      i. For Unified Command Post
         1. Provide information as requested by UCP
            a. Maintain status of City and non-City roadways
            b. Monitor traffic status
      ii. Determine need for activation of ESF 6: *Mass Care and Recovery Support Annex*
         1. Establish Evacuation Center locations as needed
      iii. Coordinate with transportation providers to manage evacuee transportation from Community Safe Refuge Areas to mass care sites
      iv. Coordinate with BACS to provide animal response at Community Safe Refuge areas and mass care sites
   e. Support resource requests
      i. Receive and coordinate fulfillment of non-mutual-aid resource requests from:
         1. UCP
         2. Departments/DOCs
         3. Identify external resources (personnel, equipment and services) to assist with evacuation of people with access and functional needs
   f. Report to departments, field, and Policy level
   g. Identify and address Policy questions
   h. Coordinate with affected external partners
9. Unified Command Post Transition
   a. When fire threat is contained, end evacuation operations
   b. Transition UCP structure to address evacuation enforcement/reentry
      i. UCP may be demobilized with responsibility shifting to PD DOC and EOC
10. Evacuation enforcement

a. Police DOC directs ongoing protection of evacuated area via perimeter controls and/or ongoing patrols of evacuated area

11. Reentry
    a. EOC develops reentry plan in coordination with:
        i. Appropriate departments to address safety concerns
        ii. Policy Group and Director of Emergency Services to address policy concerns

d. Deactivation

This plan is deactivated when the fire threat is contained and evacuation operations are no longer in progress. Activities to address evacuees' mass care and shelter needs will be addressed as indicated in ESF 6: *Mass Care and Recovery Support Annex.* If necessary, the EOC will coordinate with City departments, external agencies and policymakers as needed to develop and implement a reentry plan for evacuated areas.

VI. ATTACHMENTS

a. **Possible Community Safe Refuge Areas for Wildfire Evacuation**
b. **Wildfire Evacuation Messaging**

Wildfire Evacuation Plan

Attachment A: Possible Community Safe Refuge Areas for Wildfire Evacuation

Name	Owner
Codornices Park	City
Cragmont Park	City
John Hinkel Park	City
Live Oak Park	City
MLK Jr Civic Center Park	City
North Berkeley Public Library	City
Cragmont School	BUSD
John Muir School Park	BUSD
King School Park	BUSD
Thousand Oaks School Park	BUSD
Claremont Hotel (Parking Lot, Tennis Courts, etc.)	Claremont Hotel
Summit Reservoir (South End)	EBMUD
Foothill Parking Lot	UC Berkeley
La Loma Parking Structure	UC Berkeley
Lawrence Hall of Science Parking Complex (East Lot, MSRI Parking Lot, Hill Terrace Parking Lot)	UC Berkeley
Prospect Court Lot	UC Berkeley

Community Safe Refuge Areas will be assessed for accessibility using Department of Justice ADA standards.

Wildfire Evacuation Plan

Attachment B: Wildfire Evacuation Messaging

Messages are formulated according to the Common Alerting Protocol (CAP). Messages are formatted into short and detailed versions to accommodate SMS text limits and email format.

Short Message (limited to 120 characters or less)

Per Fire Dept people in [DESCRIBE AFFECTED AREA/EVACUATION ZONE(S)] should evacuate now due to a [SEVERITY] fire.

Detailed Message (2,500 character limit, can include attachments)

This is AC Alert Berkeley at [TIME OF MESSAGE]. Due to a [SEVERITY] fire, the City of Berkeley Fire Department recommends that people in [DESCRIBE AFFECTED AREA IN DETAIL – USE N/S/E/W, EVACUATION ZONE(S), CROSS-STREETS AND IDENTIFIABLE LAND MARKERS] should evacuate now until [ENDPOINT].

[DETAILED RESPONSE INSTRUCTIONS IF AVAILABLE:

- WHERE TO EVACUATE – DESIGNATED COMMUNITY SAFE REFUGE AREAS
- RECOMMENDED ROUTES FOR CAR, FOOT, AND ASSISTIVE DEVICES
- Bring your pets.

For more information, check [INFORMATION SOURCES] every [FREQUENCY].

Additional notes:

- If possible, include a map of impacted areas and routes. Note that any publicly distributed map shall include a detailed written description of the map.

CITY OF BERKELEY

2014 LOCAL HAZARD MITIGATION PLAN

JUNE 1, 2014

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2014 Local Hazard Mitigation Plan

June 1, 2014

Access this Plan online at:
www.CityofBerkeley.info/Mitigation

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Executive Summary

Berkeley is a vibrant and unique community. But every aspect of the city – its economic prosperity, social and cultural diversity, and historical character – could be dramatically altered by a serious earthquake or fire. While we cannot predict or protect ourselves against every possible hazard that may strike the community, we can anticipate many impacts and take steps to reduce the harm they will cause. We can make sure that tomorrow's Berkeley continues to reflect our current values.

The City and community members have been working together for years to address certain aspects of the risk – such as strengthening structures, distributing disaster supply caches, and enforcing vegetation management measures to reduce fire risk. The 2004 Disaster Mitigation Plan formalized this process, ensuring that these activities continued to be explored and improved over time. Over many years, this constant focus on disasters has made Berkeley, its residents and businesses, much safer.

This 2014 Local Hazard Mitigation Plan continues this ongoing process to evaluate the risks that different hazards pose to Berkeley, and to engage the community in dialogue to identify the most important steps that the City and its partners should pursue to reduce these risks.

The federal Disaster Mitigation Act of 2000 called for all communities to prepare mitigation plans. The City adopted a plan that met the requirements of DMA 2000 on June 22, 2004. This is the 2014 update to that plan, which ensures that Berkeley will remain eligible to apply for mitigation grants before disasters, and to receive federal mitigation funding and additional State recovery funding after disasters.

Risks in Berkeley

A sound disaster resilience program must be founded on reliable information about the types and scale of damage that different hazards could cause. To develop the 2004 Disaster Mitigation plan, the City conducted detailed research on four major natural and two major "manmade" hazards present in Berkeley. These hazards were earthquake, wildland-urban interface fire, landslide, flood, hazardous materials release, and terrorism. Since that time, new maps and data depicting the extent and possible impacts from tsunami and climate change have become available. In 2011, the City added these hazards to the list.

As in 2004, earthquake and wildland-urban interface fire are the two hazards of greatest concern. These hazards have the potential for catastrophic impacts to Berkeley.

Hazards of Greatest Concern

Earthquake

We do not know when the next major earthquake will strike Berkeley, the United States Geological Survey calculated that there is a 63 percent chance that a 6.7 magnitude earthquake will strike the Bay Area by 2038, and a 31 percent chance that that earthquake will occur on the Hayward/Rogers Creek Fault system, which runs directly through Berkeley.[i] The 1994 Northridge earthquake was also magnitude 6.7, and caused $28 billion in losses.

A catastrophic earthquake on the Hayward Fault would cause very violent shaking and three types of ground failure in Berkeley. Liquefaction is likely in the westernmost parts of the city.

Liquefaction can destroy pavements and dislodge foundations. Surface fault rupture could occur along the Fault, causing displacements of up to several feet. Landslides are expected in the Berkeley hills during the next 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.

In a 6.9 magnitude earthquake on the Hayward Fault, the City estimates that over 600 housing units in Berkeley will be completely destroyed and 20,000 more will be damaged. One thousand to 4,000 families may need temporary shelter. Depending on the disaster scenario, one hundred people could be killed in Berkeley alone, and many more would be injured. Commercial buildings, utilities, and public roads will be disabled or destroyed. The earthquake could also spark numerous fires at a time when water systems may not be functioning. This plan estimates that building damage in Berkeley alone could exceed $1.8 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.

Wildland-Urban Interface Fire

Berkeley is vulnerable to a wind-driven fire starting along the city's eastern border. The fire risk facing the people and properties in the eastern hills is compounded by the area's mountainous topography, limited water supply, 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. The flatlands are densely-covered with old wooden buildings housing low-income and vulnerable populations, including isolated seniors, persons with disabilities and students.

The high risk of wildland-urban interface (WUI) fire in Berkeley was clearly demonstrated in the 1991 Tunnel Fire, which destroyed 62 homes in Berkeley and more than 3,000 in Oakland. In 1923, an even more devastating fire burned through Berkeley. It began in the open lands of Wildcat Canyon to the northeast and, swept by a hot September wind, penetrated residential north Berkeley and destroyed nearly 600 structures, including homes, apartments, fraternities and sororities, a church, a fire station and a library. The fire burned downhill all the way to Shattuck Avenue in central Berkeley[ii]. If a fire today burned that same area, 3,000 structures would be destroyed, with losses for buildings alone exceeding $3 billion. Destruction of contents in all of the homes and businesses burned could increase the losses by another $600 million. Depending on the speed of the fire spread, lives of Berkeley residents could also be lost. Many established small businesses, homes, and multi-family apartment buildings, particularly student housing, would be completely destroyed, changing the character of Berkeley forever.

Natural Hazards of Concern

This plan identified three additional natural hazards of concern: rainfall-induced landslide, flood, and tsunami. These hazards could cause significant damage and losses in Berkeley. However, unlike earthquake and WUI fire, their impacts are likely to be smaller, and confined to specific areas.

Berkeley has a number of deep-seated landslides that continuously move, with the rate of movement affected by rainfall and groundwater conditions. Significant localized areas of the

Berkeley hills face risk from landslide, and a major slide could endanger lives and impact scores of properties, utilities and infrastructure.

Floods also could damage property and cause significant losses in Berkeley. Flooding can occur when stormwater exceeds the capacity of a creek channel, or the capacity of the storm drain system. Creek flooding in Berkeley has the potential to affect about 675 structures, mainly in the western, industrial area of the city. It is unlikely that floodwaters will reach higher than three feet, but damages to homes, businesses, and their contents could total almost $150 million. With few properties covered by flood insurance, these costs would be borne primarily by Berkeley residents and businesses.

Tsunamis, though rare inside the San Francisco Bay, can occur from large offshore Subduction style earthquakes around the Pacific Rim. Small, local tsunamis can also result from offshore strike-slip Faults such as parts of the San Andreas Fault of the Peninsula and the Hayward Fault through San Pablo Bay. 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. 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.

Manmade Hazards of Concern

This plan addresses climate change, hazardous materials release, and terrorism as Berkeley's three manmade hazards of concern.

Like regions across the globe, the San Francisco Bay Area is experiencing and will continue to increasingly experience the impacts of the changing climate. By 2100, average temperatures in the San Francisco Bay Area will increase up to 11° F. In 2100, Berkeley will have 6-10 additional heat waves each year, which will disproportionately impact the elderly, children under five, and the low-income community members.

Climate change will also cause additional extreme rainfall events, which will lead to more flooding. San Francisco Bay sea-levels will rise up to 55" by 2100, impacting infrastructure and community members in west Berkeley. Climate change impacts will also exacerbate the natural hazards of concern outlined in this plan. Rising sea levels will increase Berkeley's exposure to earthquake liquefaction, tsunami inundation, and flooding. Increases in precipitation and severe storms will make flooding more frequent, and will increase the landslide risk in the hills. California's water security will be reduced, and drought will become a more persistent issue.

Over the last twenty 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. The City has identified fifteen facilities in Berkeley with sufficiently large quantities of toxic chemicals to pose a high risk to the community. Hazardous materials also travel through Berkeley by truck and rail. Natural hazards identified in the plan could trigger the release of hazardous materials.

It is not possible to estimate the probability of a terrorist attack. Experts prioritize terrorism readiness efforts by identifying critical sites and assessing these sites' vulnerability to terrorist

attack. City officials are currently working with State and regional groups to prevent and prepare for terrorist attacks.

Disaster Resilience

Managing risk requires government and its partners to identify and evaluate risks, and implement and maintain policies, practices and projects to reduce those risks. Many innovative Berkeley initiatives are increasing our community's disaster resilience:

- The City has strengthened its ability to serve the community during and after disasters by seismically upgrading or replacing buildings that house critical City functions. Since 2004, Berkeley has strengthened or replaced its City Hall, all seven fire stations, all five libraries, its public works maintenance building, and its animal shelter.
- The Berkeley Unified School District, supported by voter-approved bonds, has strengthened all public schools.
- Over 90% of Berkeley's 700 unreinforced masonry buildings have been retrofitted or demolished since a City mandate began in 1991.
- Berkeley was the first city in the nation to inventory the community's soft-story buildings. In December 2013, City Council adopted an ordinance requiring soft-story buildings with five or more units to be retrofitted within five years. .
- Berkeley has also developed innovative programs to encourage building owners to strengthen their own structures. The City has distributed over $9 million through the Transfer Tax Rebate Program, which reduces the real estate transfer tax to building owners who perform seismic safety work.
- Four different programs contribute to vegetation management citywide, removing thousands of tons of potential fire fuels each year.
- The City enforces several programs to reduce Berkeley's fire hazard in the hills. These include strict building and fire code provisions, as well as more restrictive local amendments for new and renovated construction, along with vegetation control inspections in high-risk properties.
- The Disaster Cache Program incentivizes community-building for disaster readiness. To date, the City has awarded 87 caches of disaster response equipment to neighborhoods, congregations, and UC Berkeley Panhellenic groups that have undertaken disaster readiness activities.
- The City recently hired two positions tasked specifically with increasing disaster readiness in Berkeley's vulnerable and underserved populations.
- Berkeley's 2009 Climate Action Plan has served as a model for jurisdictions across the nation. The Climate Action Plan also guides the City's new climate adaptation strategy.

These programs, and many others, place Berkeley as a leader in disaster management. Long-term maintenance and improvements to these programs will help to protect the Berkeley community in our next disaster.

Mitigation Strategy

Berkeley aims to be a resilient community that can survive, recover from, and thrive after a disaster, while maintaining its unique character and way of life. 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.

For many years, the City has pursued initiatives to identify and mitigate Berkeley's hazard vulnerabilities. In 2014, the City is continuing this effort: this plan outlines a five-year strategic plan to bring Berkeley closer to that vision. This plan identifies three disaster mitigation approaches to increase Berkeley's resilience:

1. The City will evaluate and strengthen all City-owned structures, particularly those needed for critical services, to ensure that the community can be served adequately after a disaster.
2. The City will establish and maintain incentive programs and standards to encourage local residents and businesses to upgrade the hazard-resistance of their own properties.
3. The City will actively engage other local and regional groups to collaboratively work towards mitigation actions that help maintain Berkeley's way of life and its ability to be fully functional after a disaster event.

This plan has four objectives for reducing disaster risk in Berkeley:

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, and their secondary impacts.

B. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.

C. Protect Berkeley's unique character and values from being compromised by hazard events.

D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.

Actions specified in the 2014 mitigation strategy were inspired by multiple elements of the City's General Plan, and specified through collaborative planning processes among City staff and key institutional partners. 2014 mitigation actions are presented in *high*, *medium*, and *low* priority categories. Generally, *high* and *medium* priority actions address Berkeley's hazards of greatest concern—earthquake and wildland-urban interface fire. *High* and *medium* priority actions can be completed in the five-year time frame covered by this strategy. Implementation of *medium* and *low* actions is dependent on outside sources of funding becoming available. Resource availability will strongly influence the pace of achievements.

High Priority Actions:

- Perform appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.
- Strengthen or replace City buildings in the identified prioritized order as funding is available.
- Implement Phase Two of the Soft-Story Retrofit Program, mandating retrofit of soft-story residences.
- Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.
- Reduce hazard vulnerabilities in Berkeley buildings.
- Reduce fire risk in existing development through fire code updates and enforcement.
- Reduce fire risk in existing development through vegetation management.
- Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.
- Ensure that the City provides leadership and coordination of the private sector, public institutions, and other public bodies in disaster mitigation.
- Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.
- Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.
- Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.

Medium Priority Actions:

- Develop an Energy Assurance Plan for City operations.
- Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.
- Rehabilitate the City's stormwater system to reduce local flooding caused by inadequate storm drainage.
- Define and mitigate Berkeley's tsunami hazard.
- Reduce Berkeley's vulnerability to extreme heat events and associated hazards.
- Reduce Berkeley's vulnerability to severe storms and associated hazards.
- Collaborate with local, State, regional and federal partners to increase the security of Berkeley's water supply from climate change impacts.
- Maintain City participation in the National Flood Insurance Program.
- Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.

Low Priority Actions:

- Mitigate the impacts of sea-level rise in Berkeley.
- Explore legislation to require hazardous materials stored in the flood zones to be elevated or otherwise protected from floodwaters.

Berkeley has developed effective processes to implement, track and update the status of its disaster mitigation activities. The City Manager's Office directs implementation and tracking of mitigation activities; funded actions will be inserted into departmental work plans each year.

Department heads task staff members with projects. Lead staff identified in each action will meet together at the beginning of each calendar year to address their progress on the actions that comprise Berkeley's mitigation strategy. Staff will also present progress on mitigation strategy implementation to the Disaster and Fire Safety Commission on an annual basis. Staff will conduct a complete review and update of the plan, including the hazard analysis and mitigation strategy, once every five years.

Summary of Changes to Section 3: Hazard Analysis

As part of the 2004 plan update, this 2014 plan includes an updated analysis of Berkeley's hazards and their potential impacts. Hazard vulnerabilities identified in Section 3 guide the mitigation strategy presented in Section 1.

General Changes and Updates

The 2014 plan contains numerous updates to facts, figures and descriptions. The City has incorporated the newest-available hazard data, including impact maps for particular scenarios. The City and its partners have provided additional descriptions, details and definitions to explain the science of these hazards and their potential impacts.

Advances in GIS mapping technology have enabled the City to present maps that help to visualize information. The City has overlaid multiple related hazards with Berkeley's buildings and infrastructure to demonstrate structural hazard exposure and vulnerabilities.

Institutional community partners have updated information regarding their vulnerabilities to the described hazards, as well as significant mitigation activities that they have completed, in progress, or planned for the coming five years.

Within the historical section for each hazard, the City has added information about any instances of the hazard affecting Berkeley since 2004. Throughout the plan, the City has updated 2004 financial loss estimates for inflation.

Appendix A describes Berkeley's progress on the hazard mitigation actions identified in 2004. It also identifies where and how the City incorporated select 2004 actions and activities into this 2014 plan.

Hazards Described in the 2014 Plan

The 2014 plan now specifically highlights Berkeley's two hazards of greatest concern as earthquake and wildland-urban interface (WUI) fire. These two hazards are underscored because of their history in Berkeley, our community's extensive exposure and many vulnerabilities to these hazards, and the cascading impacts that could result from one of these hazards.

For the first time, the plan identifies tsunami and climate change as hazards of concern.

Significant changes and updates to the analysis of each hazard are described below:

Earthquakes (Section 3.3)

- Three new Hayward Fault earthquake scenario maps illustrate the Bay Area's exposure to seismic shaking, and Berkeley's exposure to liquefaction and seismically-triggered landslides.
- A new map overlays the areas of Berkeley potentially exposed to liquefaction, fault rupture and earthquake-induced landslides. The City has overlaid Berkeley's vulnerable structures on this base map, demonstrating where vulnerable buildings have been constructed on ground that could possibly liquefy, rupture or slide in an earthquake.
- The City addresses seismically-triggered landslides, their cause and their potential impacts in additional detail. The 2014 plan also contains a new scenario map for seismically-triggered landslide.
- The 2014 plan addresses fire following earthquake in greater detail: the plan describes significant fires resulting from past earthquakes, causes of fire following earthquake, and how earthquake impacts can impede firefighting efforts and promote fire spread. The estimated number of fires following a scenario earthquake has been updated based on new scientific research, from five ignitions to 6-12[iii] ignitions in the first day.
- The seismic stability of City-owned and leased buildings has been updated to reflect significant retrofit efforts since 2004. (This information is provided in greater detail in *Appendix B: List of City Owned and Leased Buildings*.)
- The City has updated the plan to describe Berkeley's progress on mitigating earthquake vulnerabilities in soft-story buildings. Data gathered through the City's 2005 soft-story ordinance (Phase I) are used to describe the ordinance's impacts on retrofit activities, as well as the current number and locations of soft-story buildings in Berkeley.
- The City describes locations and seismic vulnerabilities to gas systems in greater detail. Pacific Gas & Electric natural gas transmission lines, and Kinder Morgan's jet fuel/diesel pipelines are overlaid on the seismic hazard planning zone map to illustrate their potential earthquake liquefaction exposure.
- Earthquake risk and loss estimates have been updated to include data from a 2008 catastrophic earthquake incident scenario. The 2008 report uses a more severe scenario earthquake than the City used to establish risk and loss estimates in 2004. The 2008 scenario also includes additional information about potential impacts to partner systems at a greater level of detail than was available for the 2004 plan.

Wildland-Urban Interface Fire (Section 3.4)

- This plan redefines Berkeley's 2004 "wildfire" hazard as the "wildland-urban interface" fire hazard. The "WUI" term more specifically describes the fire hazard present in the Berkeley hills, in which natural and built environments meet and intermix. This change of perspective and associated terminology aligns Berkeley's 2014 plan with the State of California Hazard Mitigation Plan.

- The 2014 plan describes the potential for a WUI fire to spread to Berkeley's flatlands, clarifying that WUI fire is a citywide concern. The 2014 plan provides additional detail on the particular vulnerabilities of Panoramic Hill residents and visitors.
- The City has provided information about Berkeley's four vegetation management programs reducing Berkeley's fire risk, and its partnership with the Berkeley Path Wanderers Association to maintain and improve the rustic paths in the hills, which also serve as pedestrian evacuation routes.

Rainfall-Triggered Landslide (Section 3.5)

- Rainfall-triggered landslide is addressed separately of earthquake-induced landslide. Additional information has been provided to describe rainfall-triggered landslide and debris flow, and Berkeley's exposure and vulnerabilities to historic or recent deep-seated landslides.

Floods (Section 3.6)

- The floods section has been rewritten for clarity. The 2014 plan also provides additional information about floods caused by storm drain overflow. Hydraulic models created in 2011 identify key intersections in Berkeley that are exposed to flooding from storm drain overflow.

Tsunami (Section 3.7)

- Tsunami is a newly-introduced hazard of concern for the 2014 plan. The tsunami section describes recent tsunami events and their impacts on Berkeley. It outlines the latest information about the tsunami hazard within the San Francisco Bay, and provides an inundation map showing Berkeley's tsunami exposure. The City identifies populations, businesses, roadways, City buildings and other infrastructure within the tsunami inundation zone, and discusses potential evacuation challenges.

Climate Change (Section 3.8)

- Climate change is a newly-introduced hazard of concern for the 2014 plan. The climate change section describes the anticipated impacts to Berkeley from climate change. It also outlines how climate change exacerbates other hazards identified in this plan. The City discusses potential impacts from sea-level rise on Berkeley's western coast, and maps areas in Berkeley that are vulnerable in 55-inch sea-level rise.

Hazardous Materials Release (Section 3.9)

- This plan provides greater detail regarding Berkeley's exposure and vulnerability to hazardous materials release. The City's classification system for Berkeley's hazardous materials sites is described.
- This section includes a map that visualizes sites with sufficiently large quantities of toxic chemicals to pose a high risk to the community, along with key transportation routes used for hazardous materials in Berkeley. This map also includes areas of Berkeley exposed to earthquake-induced ground failure and flooding. By layering this information, readers can visualize how Berkeley's natural hazards could cause a hazardous materials release.

Executive Summary

[1] Analyses by the US Geologic Survey (USGS) and California Earthquake Prediction Evaluation Council: http://pubs.usgs.gov/fs/2008/3027/fs2008-3027.pdf

[ii] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[iii] Estimation derived from Ch. 10, particularly Eqn. 10-1, of HAZUS Earthquake Tech Manual MR 4:

FEMA, 2003. Multi-hazard Loss Estimation Methodology, Earthquake Model, HAZUS-MH MR4 Technical Manual. Developed by: Department of Homeland Security, Federal Emergency Management Agency, Mitigation Division, Under a contract with: National Institute of Building Sciences Washington, D.C., p. 712.

1 Mitigation Strategy

Berkeley aims to be a disaster-resilient community that can survive, recover from, and thrive after a disaster while maintaining its unique character and way of life. 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.[i] Disaster mitigation is a foundational element of disaster resilience.

Section 1 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 Section 3: Hazard Analysis. It is based on existing authorities, policies, programs, and resources described in Section 4 of this plan, as well as Berkeley's ability to expand on and improve these existing mitigation tools.

1.1 *Disaster Mitigation Approaches and Objectives*

Berkeley will focus on three approaches to disaster mitigation to reach this level of resilience:

1. The City will evaluate and strengthen all City-owned structures, particularly those needed for critical services, to ensure that the community can be served adequately after a disaster.
2. The City will establish and maintain incentive programs and standards to encourage local residents and businesses to upgrade the hazard resistance of their own properties.
3. The City will actively engage other local and regional groups to collaboratively work towards mitigation actions that help maintain Berkeley's way of life and its ability to be fully functional after a disaster event.

Four objectives guide the mitigation strategy:

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, and their secondary impacts.
B. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.
C. Protect Berkeley's unique character and values from being compromised by hazard events.
D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.

1.1.1 Links to City Plans

This plan is part of an ongoing process to build Berkeley's disaster resilience. The Berkeley community has invested considerable financial investment in risk reduction activities, including planning for and implementing mitigation activities.

The City's long-standing commitment and approach to community safety and disaster resilience is demonstrated in the General Plan. The General Plan, revised in 2002, directly guides the objectives and actions in this plan. One of the General Plan's major goals is to make Berkeley a disaster-resilient community. Berkeley put significant effort into developing the City's Disaster Preparedness and Safety Element of the General Plan, and disaster issues are also addressed in other elements, including the Land Use, Environmental Management, Transportation and Urban Design and Preservation Elements. The objectives in this mitigation plan are guided by the major goals of the General Plan and the objectives of the Disaster Preparedness and Safety Element. Many of the actions in this plan are directly taken from the Disaster Preparedness and Safety Element. Section 1.2.4 *Details of Actions* identifies specific General Plan Policies guiding this mitigation strategy.

The Berkeley Climate Action Plan was written through a community-wide process and was adopted by City Council on June 2, 2009. The Plan outlines a vision, goals and policies to reduce community-wide greenhouse gas emissions by 33 percent below 2000 levels. Because climate change impacts can cause or exacerbate many of Berkeley's hazards of concern, the mitigation strategy has also been directly guided by the Climate Action Plan. Section 1.2.4 *Details of Actions* identifies the Climate Action Plan Policies guiding the mitigation strategy.

Section 1.2.4 *Details of Actions*, as well as Section 2: *Implementing, Monitoring and Updating the Plan* identify how the data, information, goals and actions from this mitigation plan are integrated into other planning mechanisms.

1.2 *Mitigation Actions*

This plan advocates 23 mitigation actions. Table 1.1 summarizes all of the actions, identifies the hazard(s) and mitigation objective(s) each action addresses, and indicates the assigned priority level of the action.

1.2.1 Identification of Actions

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 2004 mitigation plan, as well as Berkeley's progress since 2004 on these actions. This Team then revised these actions, created new actions, and established priorities to guide Berkley's mitigation strategy for the next five years. At a meeting in October 2013, staff presented the 2014 actions to Institutional Community Partners from utilities, educational institutions, community-based organizations and other cities and government agencies. Partners offered feedback and identified opportunities for collaboration to further strengthen these actions. Staff revised actions and incorporated them into the 2014 First Draft Plan Update, which went through further public review before adoption.

Additional detail on the process used to identify 2014 actions is provided in Appendix C: *Plan Development Process*.

1.2.2 Prioritization of Actions

The City's Interdepartmental Planning Team assigned 2014 actions a *High, Medium* or *Low* priority level. Eight key factors were used to determine each action's priority:

1. Support of goals and objectives
2. Cost/benefit relationship
3. Funding availability
4. Hazards addressed
5. Public and political support
6. Adverse environmental impact
7. Environmental benefit
8. Timeline for completion

Institutional Community Partners, community members, City staff, Council members, commissioners, and other stakeholders reviewed these categorizations in City staff meetings, the Institutional Community Partner Meeting, commission meetings, and a City Council meeting.

Additional detail on the structure used to prioritize actions is provided in Appendix E: *Prioritization Structure*.

1.2.3 Overview of Mitigation Actions

Actions supporting Berkeley's mitigation strategy are outlined in the tables that follow, grouped by their priority level.

Table 1.1 High-Priority Actions in mitigation strategy

Name	Action	Hazards
Building Assessment	Perform appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.	Earthquake Wildland-Urban Interface Fire Tsunami Landslide Floods Climate Change
Strengthen and Replace City Buildings	Strengthen or replace City buildings in the identified prioritized order as funding is available.	Earthquake Wildland-Urban Interface Fire Tsunami Landslide Floods Climate Change

Name	Action	Hazards
Soft-Story	Implement Phase Two of the Soft-Story Retrofit Program, mandating retrofit of soft-story residences.	Earthquake
URM	Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.	Earthquake
Buildings	Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.	Earthquake Wildland-Urban Interface Fire Landslide Floods
Fire Code	Reduce fire risk in existing development through fire code updates and enforcement.	Wildland-Urban Interface Fire
Vegetation Management	Reduce fire risk in existing development through vegetation management.	Wildland-Urban Interface Fire
Hazard Information	Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change
Partnerships	Ensure that the City provides leadership and coordinate with the private sector, public institutions, and other public bodies in disaster mitigation.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change
EBMUD	Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.	Earthquake Wildland-Urban Interface Fire

Name	Action	Hazards
Hills Evacuation	Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Earthquake Wildland-Urban Interface Fire
Climate Change Integration	Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.	Climate Change

Table 1.2 Medium-Priority Actions in mitigation strategy

Name	Action	Hazards
Energy Assurance	Develop an Energy Assurance Plan for City operations.	Earthquake Wildland-Urban Interface Fire Tsunami Landslide Floods Climate Change
Gas Safety	Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.	Earthquake Wildland-Urban Interface Fire Landslide Tsunami
Stormwater System	Rehabilitate the City's stormwater system to reduce local flooding caused by inadequate storm drainage.	Earthquake Floods Landslide Tsunami Climate Change
Tsunami	Define and mitigate Berkeley's tsunami hazard.	Tsunami
Extreme Heat	Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Climate Change
Severe Storms	Reduce Berkeley's vulnerability to severe storms and associated hazards.	Climate Change Flooding

Name	Action	Hazards
Water Security	Collaborate with local, State, regional and federal partners to increase the security of Berkeley's water supply from climate change impacts.	Climate Change
NFIP	Maintain City participation in the National Flood Insurance Program.	Floods
Streamline Rebuild	Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Earthquake Floods Landslide Tsunami

Table 1.3 Low-Priority Actions in mitigation strategy

Name	Action	Hazards
Sea-Level Rise	Mitigate the impacts of sea-level rise in Berkeley.	Climate Change
HazMat Floods	Explore local legislation to require hazardous materials stored in the flood zones to be elevated or otherwise protected from floodwaters.	Floods Climate Change

1.2.4 Details of Actions

Mitigation actions identified by the Berkeley community are presented in the following pages. Actions are presented per their high, medium- or low-priority designation.

The following information is provided for each action:

- *Action Title*: Short title to identify the action
- *Action*: Proposed action
- *Proposed Activities*: Specific projects or efforts that support the action
- *Related Natural Hazard(s)*: Lists hazards whose impacts would be mitigated by the action
- *Associated LHMP Objective(s)*: Mitigation objectives that the action supports
- *Related Policies from the General Plan or Climate Action Plan*: General Plan or Climate Action Plan policies that the action supports
- *Special Environmental Concerns*: Particular considerations that will be taken into account when the action is implemented
- *Lead Organization(s) and Staff Lead(s)*: City departments and divisions, along with particular City staff positions that will lead implementation of the action
- *Priority*: High, Medium or Low priority assigned to the action using criteria outlined in Appendix E: *Prioritization Structure*
- *Timeline*: Timeline and milestones to implement the action
- *Additional Resources Required*: Identifies if funding is not yet available to complete the action
- *Potential Funding Sources*: Identifies potential funding sources to complete the action. Includes all sources that could possibly fund any element of the action: staff time, vendor contracts, equipment purchase, etc. **Funding allocations are made through the Citywide budget process. Listing a specific potential funding source <u>does not</u> commit resources to the action.**
    - *Activity Type(s)*: If the action could be eligible for federal mitigation grant funding, identifies federally-defined activity type for grant purposes

Appendix A: *2004 Actions* documents progress on 2004 actions.

1.2.4.1 High-Priority Actions

2014 **Building Assessment**	**Perform appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.**
Proposed Activities	- First, complete analysis of structures supporting critical emergency response and recovery functions, and make recommendations for structural and nonstructural improvements. - 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. - Integrate unsafe structures into a prioritized program for retrofit or replacement. - Develop emergency guidelines for buildings with structural deficiencies.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Tsunami Landslide Floods Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. B. Increase City government's ability to serve the community during disaster response and recovery by mitigating risks to key buildings and infrastructure.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-10, Action B General Plan Policy S-20, Actions G and H General Plan Policy UD-7, Actions A and B General Plan Policy UD-12, Actions A and C
Lead Organization and Staff Lead	Public Works Department: Facilities Division Staff Lead: Facility Maintenance Superintendent
Priority	High

Timeline	Analysis of critical structures: December 2013 Analysis of remaining structures: Funding-dependent Emergency guideline development: Ongoing as identified
Additional Resources Required	Funding for analysis of remaining structures: Dependent upon progress of critical structure analysis Funding for emergency guideline development: consultant and staff time, dependent upon the number of identified buildings
Potential Funding Sources	Analysis of critical structures: multiple City funds Potential sources for other projects: City General Fund, grants, other City funds

2014 **Strengthen and Replace City Buildings**	**Strengthen or replace City buildings in the identified prioritized order as funding is available.**
Proposed Activities	- Seismically strengthen 2180 Milvia Civic Center - Replace the Center Street Garage - Seek funding to seismically strengthen or replace additional City buildings in a prioritized order
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Tsunami Landslide Floods Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. B. Increase City government's ability to serve the community during disaster response and recovery by mitigating risks to key buildings and infrastructure. C. Protect Berkeley's unique character and values from being compromised by hazard events.
Related Policies	General Plan Policy S-20, Action H

from the General Plan or Climate Action Plan	General Plan Policy UD-12, Actions A and C
Special Environmental Concerns	All construction activities recommended in this action will preserve historic character of buildings, take measures to control air quality and limit noise during construction.
Lead Organization and Staff Lead	Public Works Department – Engineering Division Staff Lead: Supervising Civil Engineer
Priority	High
Timeline	2180 Milvia Civic Center retrofit by 2019 Center Street Garage replacement by 2019 Funding identification: Ongoing
Additional Resources Required	2180 Milvia Civic Center retrofit: $1 million Center Street Garage replacement: $30 million (est.) Old City Hall retrofit: $30 million Veterans Memorial Building retrofit: $20 million
Potential Funding Sources	Legislative Pre-Disaster Mitigation grant funding Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP) General Fund City-Issued Bonds
Activity Type(s)	Mitigation: Structural Retrofitting of existing buildings Mitigation: Nonstructural retrofitting of existing buildings and facilities

2014 **Soft-Story**	**Implement Phase Two of the Soft-Story Retrofit Program, mandating retrofit of soft-story residences.**
Proposed Activities	- Develop and publish Framework Guidelines calibrating, delineating and detailing technical requirements to be used for building retrofits. - Inform impacted property owners of the requirement to retrofit their building - Designated project manager will: • Prepare handouts and correspondence • Respond to inquiries from owners, tenants, engineers, contractors and realtors about the mandatory program, compliance procedures and

	requirements - Investigate and adopt financial, procedural, and land use incentives to facilitate retrofit. • The Rent Board will review requests for pass-through of capital improvement expenses for seismic retrofits. They will determine on a case-by-case basis if rent increases to tenants can be approved. • Explore establishment of a loan program to assist landlords who cannot access financing to retrofit their buildings. - Review plan submittals for soft-story seismic retrofits - Issue permits and perform field inspections - Remove retrofitted buildings from the Soft-Story Inventory - Review appeals to accommodate unique circumstances preventing owners from meeting program requirements; consider time extensions, etc.
Related Natural Hazard(s)	Earthquake
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. C. Protect Berkeley's unique character and values from being compromised by hazard events.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-20, Actions B, C, D, E, and F General Plan Policy S-15, Action A
Special Environmental Concerns	All building upgrade activities will include efforts to minimize impacts to existing residential and commercial tenants, and historic resources.
Lead Organization and Staff Lead	Planning Department – Building and Safety Division Staff Lead: Program and Administration Manager
Priority	High
Timeline	January 2017: Deadline for soft-story owners to submit a permit application for retrofit January 2019: Final deadline for soft-story retrofit completion (2 years after permit application)

Additional Resources Required	Additional $20-30k required for structural engineering firm to develop Framework Guidelines
Potential Funding Sources	City General Fund Permit Service Center Enterprise Fund Rental Housing Safety Program Fund

2014 **URM**	**Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.**
Proposed Activities	- Begin by working 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. - Apply available legal remedies, including but not limited to citations, to owners who fail to comply with the URM ordinance. - Maintain program notification to building occupants and owners.
Related Natural Hazard(s)	Earthquake
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-20, Action A
Special Environmental Concerns	All building upgrade activities will include efforts to minimize impacts to existing residential and commercial tenants, and historic resources.
Lead Organization and Staff Lead	Planning Department - Building and Safety Division Staff Lead: Program and Administration Manager
Priority	High
Timeline	Engage all remaining URM building owners by January 2015 Complete all remaining URM retrofits/demolitions by

	January 2019
Additional Resources Required	No additional resources required
Potential Funding Sources	Permit Service Center Enterprise Fund Rental Housing Safety Program Fund

2014 Buildings	**Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.**
Proposed Activities	- 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. - Explain requirements and provide guidance to owners of potentially hazardous structures to facilitate retrofit.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. C. Protect Berkeley's unique character and values from being compromised by hazard events.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-15, Action A General Plan Policy S-20, Actions D and E General Plan Policy UD-7, Actions A and B General Plan Policy UD-12, Actions A and C
Special Environmental Concerns	All building upgrade activities will include efforts to minimize impacts to existing residential and commercial tenants, and historic resources.
Lead Organization and Staff Lead	Planning Department – Building and Safety Division Staff lead: Building Official
Priority	High

Timeline	Enactment of 2013 Building Code: January 1, 2014 Enactment of 2016 Building Code: January 1, 2017 Technical assistance: Ongoing
Additional Resources Required	No additional resources required
Potential Funding Sources	Permit Service Center Enterprise Fund

2014 **Fire Code**	**Reduce fire risk in existing development through fire code updates and enforcement.**
Proposed Activities	- Periodically update and adopt the Berkeley Fire Code with local amendments to incorporate the latest knowledge and design standards to protect people and property against known risks in both structural and non-structural building and site components. - Maintain Fire Department efforts to reduce fire risk through inspections: • Annual inspections in all Fire Zones • Hazardous Fire Area inspections • Multi-unit-residential building inspections in all Fire Zones - Create a standard for written vegetation management plans for major construction projects in Fire Zones 2 and 3. - Evaluate inspection procedures and adjust inspection cycle annually based on changing climatic conditions.
Related Natural Hazard(s)	Wildland-Urban Interface Fire
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. C. Protect Berkeley's unique character and values from being compromised by hazard events.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-21: Fire Preventative Design Standards, Action A General Plan Policy S-23: Property Maintenance, Action B General Plan Policy UD-7, Actions A and B

	General Plan Policy UD-12, Actions A and C
	Climate Action Plan – Adaptation, Goal 1D, Action 3
Lead Organization and Staff Lead	Fire Department – Division of Fire Prevention Staff Lead: Deputy Fire Chief (Fire Marshal)
Priority	High
Timeline	Fire Code Adoption: Complete by January 2014 and January 2017
	Inspections: Ongoing
	Vegetation Management Standard: 1-2 years
	Inspection system evaluation: Ongoing
Additional Resources Required	No additional resources required
Potential Funding Sources	City General Fund

2014 **Vegetation Management**	**Reduce fire risk in existing development through vegetation management.**
Proposed Activities	- Maintain Fire Fuel Chipper Program - Maintain Fire Fuel Abatement Program on Public Land - Maintain Fire Fuel Debris Bin Program - Maintain Weekly Curbside Plant Debris Collection - Pursue external funding to increase education and awareness of vegetation management standards for fire fuel reduction
Related Natural Hazard(s)	Wildland-Urban Interface Fire
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-23, Action A.
Special Environmental	All activities occurring in biologically sensitive areas will include measures to protect sensitive habitats and species.

Concerns	
Lead Organization and Staff Lead	Department of Parks Recreation and Waterfront – Parks Division Fire Fuel Chipper Program Staff Lead: Senior Forestry Supervisor Fire Fuel Abatement Program on Public Land Staff Lead: Senior Landscape Supervisor Department of Public Works – Zero Waste Division (Fire Fuel Debris Bin Program and Weekly Curbside Plant Debris Collection) Staff Lead: Zero Waste Manager Fire Department – Division of Support Services (Funding for education) Staff Lead: Deputy Fire Chief (Fire Marshal)
Priority	High
Timeline	Ongoing
Additional Resources Required	Fire Fuel Chipper Program: Additional resources required, amount to be determined Fire Fuel Abatement Program on Public Land: Additional resources required, amount to be determined Fire Fuel Debris Bin Program and Weekly Curbside Plant Debris Collection: No additional resources required
Potential Funding Sources	City General Fund Refuse Fee City Parks Tax Fund 450 Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP) Assistance to Firefighters Grant
Activity Type(s)	Mitigation: Hazardous Fuels Reduction

2014 **Hazard Information**	**Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.**
Proposed Activities	- 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. - Partner with the Association of Bay Area Governments to incorporate Berkeley's vulnerabilities onto regionally-managed hazard maps. - Publicize financial and technical assistance resources for risk reduction.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. B. Increase City government's ability to serve the community during disaster response and recovery by mitigating risks to key buildings and infrastructure. C. Protect Berkeley's unique character and values from being compromised by hazard events. D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-13: Hazards Identification, Action A General Plan Policy S-19: Risk Analysis, Action A General Plan Policy UD-12, Actions A and C Climate Action Plan: Adaptation Action A
Lead Organization and Staff Lead	Fire Department – Office of Emergency Services Lead Staff: Emergency Services Coordinator Office of Energy and Sustainable Development (Climate Change Hazards) Lead Staff: Climate Action Coordinator
Priority	High

Timeline	Ongoing
Additional Resources Required	No additional resources required
Potential Funding Sources	General Fund Measure GG Special Revenue Fund

2014 **Partnerships**	**Ensure that the City provides leadership and coordinate with the private sector, public institutions, and other public bodies in disaster mitigation.**
Proposed Activities	- Support and encourage efforts undertaken by key lifeline providers to plan for and finance seismic retrofit and other disaster-resistance measures, including: • Utility providers • Transportation agencies • Communication providers • Healthcare facilities - Coordinate with and encourage mitigation actions of: • Institutions serving the Berkeley community • Berkeley organizations and nonprofits • Other partners whose actions affect the Berkeley community
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. B. Increase City government's ability to serve the community during disaster response and recovery by mitigating risks to key buildings and infrastructure. C. Protect Berkeley's unique character and values from being compromised by hazard events. D. Encourage mitigation activities to increase the

	disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-5 The City's Role in Leadership and Coordination, Actions A and B General Plan Policy UD-7, Actions A and B General Plan Policy UD-12, Actions A and C General Plan Policy S-12 Utility and Transportation Systems, Action A
Lead Organization and Staff Lead	City Manager's Office (Advocacy) Staff Lead: Deputy City Manager Fire Department – Office of Emergency Services (Coordination) Staff Lead: Office of Emergency Services Captain
Priority	High
Timeline	Ongoing
Additional Resources Required	To be determined
Potential Funding Sources	City General Fund Measure GG Special Revenue Fund

2014 **EBMUD**	**Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.**
Proposed Activities	- Coordinate with EBMUD regarding plans to install a new 48-inch pipeline parallel to the existing north-south water main in 2015-2016. - Explore project approaches with EBMUD to expedite replacement of problem pipelines in Berkeley neighborhoods exposed to wildland-urban interface fire and seismic ground failure. - Coordinate with EBMUD to ensure that pipeline replacement projects and upgrades are coordinated with the City's five-year street paving program.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and

	businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-12: Utility and Transportation Systems, Action A
Special Environmental Concerns	All activities occurring in biologically sensitive areas will include measures to protect sensitive habitats and species.
Lead Organization and Staff Lead	Department of Public Works – Engineering Division Staff Lead: City Engineer
Priority	High
Timeline	Ongoing
Additional Resources Required	No additional funding required
Potential Funding Sources	City General Fund and Other City Funds Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP)
Activity Type(s)	Mitigation: Infrastructure Retrofit

2014 **Hills Evacuation**	**Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.**
Proposed Activities	- Ensure that all public pathways and associated signage are maintained to identify and provide safe and accessible pedestrian evacuation routes from the hill areas. - Update City maps of all emergency access and evacuation routes to include pedestrian pathways. - Coordinate with UC Berkeley and Berkeley Lab to ensure that evacuation route options account for paths on UC and Berkeley Lab property. - Publicize up-to-date maps of all emergency access and evacuation routes.

Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-1 Response Planning, Action B General Plan Policy S-22 Fire Fighting Infrastructure, Action A General Plan Policy T-28 Emergency Access, Actions B and C
Special Environmental Concerns	All activities occurring in biologically sensitive areas will include measures to protect sensitive habitats and species.
Lead Organization and Staff Lead	Department of Public Works – Engineering Division (Maintenance) Public Works Staff Lead: Associate Civil Engineer Information Technology GIS Division (Mapping) IT Staff Lead: GIS Coordinator Fire Department Office of Emergency Services (Outreach) Fire-OES Staff Lead: Emergency Services Coordinator
Priority	High
Timeline	Maintenance: Ongoing Mapping: 1 year to include pathways in public maps, then ongoing updates Publicizing Maps: Ongoing
Additional Resources Required	No additional resources required
Potential Funding Sources	City General Fund Measure GG Special Revenue Fund

2014 **Climate Change Integration**	**Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.**
Proposed Activities	- Determine staffing needs to monitor research and oversee integration of climate change adaptation into City operations and services - Develop and implement a process to integrate adaptation planning into City operations. Activities include: • Integrate climate change adaptation actions into the Citywide Work Plan • Integrate climate change adaptation considerations into templates for staff reports to City Council and City commissions • Train City staff on the basic science and impacts of climate change and on climate adaptation strategies • Develop a staff recognition and award program to encourage staff to integrate climate change considerations into City projects and programs
Related Natural Hazard(s)	Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	• Climate Action Plan – Adaptation, Goal 1A • Climate Action Plan – Community Outreach and Empowerment, Goal 1A • Climate Action Plan – Implementation, Monitoring and Reporting, Goals 2, 3 and 4
Lead Organization and Staff Lead	City Manager's Office through Sustainability Working Group (Process Management) Staff Lead: Deputy City Manager Planning Department – Office of Energy and Sustainable Development (Support) Staff Lead: Climate Action Coordinator
Priority	Medium
Timeline	Staffing: 2-3 years

	Work Plan Integration: 1 year Council/Commission Report Integration: 1 year Funding Mechanisms: 2-3 years Staff Training: 2-3 years
Additional Resources Required	To be determined
Potential Funding Sources	City General Fund Permit Service Center Enterprise Fund

1.2.4.2 Medium-Priority Actions

2014 **Energy Assurance**	**Develop an Energy Assurance Plan for City operations.**

Proposed Activities	- Develop a plan to assist the City of Berkeley to prepare for, respond to, and recover from disasters that include energy emergencies.
	  • Identify the key City facilities that support emergency operations.
	  • Estimate those facilities' energy supply and demand during emergencies to assess those facilities' vulnerabilities to power loss.
	  • Identify potential actions to mitigate those vulnerabilities (e.g., photovoltaic-supplemented emergency generation, energy efficiency activities, and/or mobile charging stations).
	- Integrate energy assurance actions into Citywide planning processes.

Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.

	B. Increase City government's ability to serve the community during disaster response and recovery by mitigating risks to key buildings and infrastructure.
Related Policies from the General Plan or Climate Action Plan	General Plan - Disaster Preparedness and Safety Element: Objective 1 General Plan Policy S-8: Continuity of Operations Climate Action Plan – Chapter 4, Goal 5: Increase Energy Efficiency and Renewable Energy Use in Public Buildings – Policies 5a and 5b
Lead Organization and Staff Lead	Fire Department – Office of Emergency Services (Plan Development and Gap Analysis) Staff Lead: Emergency Services Coordinator Planning Department – Office of Energy and Sustainable Development (Energy Profile) Staff Lead: Sustainability Outreach Specialist Department of Public Works – Facilities Division (City Infrastructure) Staff Lead: Facility Maintenance Superintendent
Priority	Medium
Timeline	Plan Development: 1 year Project implementation: To be determined
Additional Resources Required	No additional resources required to develop plan. Resources required to implement plan proposals is to be determined.
Potential Funding Sources	City General Fund Measure GG Special Revenue Fund Various State funds

2014 **Gas Safety**	**Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.**
Proposed Activities	- Work with the Public Utilities Commission, utilities, and oil companies to strengthen, relocate, or otherwise safeguard natural gas and other pipelines where they extend through areas of high liquefaction potential, cross potentially active faults, or traverse potential landslide areas, or areas that may settle differentially during an

	earthquake. - Establish 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.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Tsunami
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-12, Action C
Special Environmental Concerns	All activities occurring in biologically sensitive areas will include measures to protect sensitive habitats and species.
Lead Organization and Staff Lead	Fire Department – Office of Emergency Services Staff Lead: Office of Emergency Services Captain (Coordination) Staff Lead: Associate Management Analyst (Shutoff Valve Program)
Priority	Medium
Timeline	Coordination: Ongoing Gas Valve Shutoff Program: July 2014
Additional Resources Required	No additional resources required
Potential Funding Sources	City General Fund Measure GG Special Revenue Fund

2014 **Stormwater System**	**Rehabilitate the City's stormwater system to reduce local flooding caused by inadequate storm drainage.**
Proposed Activities	- Complete the hydraulic analysis of watersheds in the city to predict areas of insufficient capacity. - Seek funding to perform system capacity and disaster resistance improvements.
Related Natural Hazard(s)	Earthquake Floods Landslide Tsunami Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-26, Actions B and C
Special Environmental Concerns	Any non-emergency construction work on the storm drain system will take steps to minimize impacts to riparian habitat.
Lead Organization and Staff Lead	Public Works Department – Engineering Division Staff Lead: Associate Civil Engineer
Priority	Medium
Timeline	Complete the hydraulic analysis: funding-dependent System improvements: funding-dependent
Additional Resources Required	Complete the hydraulic analysis: $200,000 System improvements: $208 million
Potential Funding Sources	City General Fund, bonds Urban Greening Project Grants (Prop. 84) Stormwater–Flooding Management Projects Grants (Prop. 1E) Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP)
Activity Type(s)	Mitigation: Infrastructure Retrofit

2014	**Define and mitigate Berkeley's tsunami hazard.**
Tsunami	
Proposed Activities	- Collaborate with the California Office of Emergency Services to define Berkeley's different areas of inundation for different tsunami scenarios. - Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to document and explore potential tsunami hazard mitigation measures for Berkeley's maritime communities.
Related Natural Hazard(s)	Tsunami
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-13: Hazards Identification General Plan Policy S-19: Risk Analysis, Action A
Special Environmental Concerns	All activities occurring in biologically sensitive areas will include measures to protect sensitive habitats and species.
Lead Organization and Staff Lead	Fire Department – Office of Emergency Services (Scenarios) Staff Lead: Emergency Services Coordinator Parks, Recreation and Waterfront Department – Marina Division (Mitigation Measures) Staff Lead: Waterfront Manager
Priority	Medium
Timeline	Scenarios: 2 years Mitigation Measures: To be determined
Additional Resources Required	Scenarios: No additional resources required Mitigation Measures: To be determined
Potential Funding Sources	City General Fund Measure GG Special Revenue Fund

2014 **Extreme Heat**	**Reduce Berkeley's vulnerability to extreme heat events and associated hazards.**
Proposed Activities	- 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 into City operations and services. - Create and maintain shading by sustaining municipal tree planting efforts and continuing to maintain the health of existing trees. - 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.
Related Natural Hazard(s)	Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	Climate Action Plan - Adaptation Goal 1, Policies A and D General Plan Policy EM-29: Street and Park Trees
Lead Organization and Staff Lead	Planning Department – Office of Energy and Sustainable Development (Monitor Impacts) Staff Lead: Climate Action Coordinator Department of Parks, Recreation and Waterfront – Parks Division (Tree Planting) Staff Lead: Parks Superintendent
Priority	Medium
Timeline	Other Activities: Ongoing
Additional Resources Required	Scientific monitoring: No additional resources required Tree planting: Dependent on State Grant
Potential Funding Sources	City General Fund State Grant City Parks Tax Fund 450

2014 **Severe Storms**	**Reduce Berkeley's vulnerability to severe storms and associated hazards.**
Proposed Activities	- Support and monitor research on climate change impacts on local rainfall patterns and incidences of severe storms. - Integrate considerations of severe storms into City operations and services: • Use development review to ensure that new development does not contribute to an increase in flood potential. • Complete the hydraulic analysis of watersheds in the city to predict areas of insufficient capacity. • Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio-filtration systems such as greenscapes. • Continue to encourage use of permeable surfaces and other techniques as appropriate in both greenscape and hardscape areas for retention and infiltration of stormwater. • Continue to encourage the development of green roofs by providing local outreach and guidelines consistent with the Building Code.
Related Natural Hazard(s)	Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	Climate Action Plan - Adaptation Goal 1, Policies A and C General Plan Policy S-27 New Development
Special Environmental Concerns	Public infrastructure improvements will utilize appropriate environmental review processes.
Lead Organization and Staff Lead	Planning Department – Office of Energy and Sustainable Development Staff Lead: Climate Action Coordinator (Monitor Research) Staff Lead: Sustainability Outreach Specialist (Green Roof outreach)

	Planning Department – Land Use Planning Division (Development Review) Staff Lead: Division Director Department of Public Works – Engineering Division (Watershed Management Plan, Permeable Surfaces, Public Improvements) Staff Lead: Supervising Civil Engineer
Priority	Medium
Timeline	Ongoing
Additional Resources Required	To be determined
Potential Funding Sources	City General Fund Permit Service Center Enterprise Fund Measure M Bond Funds Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP)
Activity Type(s)	Mitigation: Infrastructure Retrofit

2014 **Water Security**	**Collaborate with local, State, regional and federal partners to increase the security of Berkeley's water supply from climate change impacts.**
Proposed Activities	- Support efforts by the U.S. Forest Service and its partners to improve water security through restoration of the Headwaters Forest and Mokelumne River. - Encourage water recycling and gray water use through the distribution of outreach materials and local guidelines that are consistent with the Building Code. - Encourage the use of water conservation technologies and techniques in the design of new buildings and landscapes, such as waterless urinals and cisterns, through the development of local guidelines that are consistent with the Building Code. - Partner with East Bay Municipal Utility District (EBMUD) to provide and market incentives for residents, businesses and institutions to conserve water. - Partner with agencies such as EBMUD and StopWaste.org 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.
Related Natural Hazard(s)	Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.
Related Policies from the General Plan or Climate Action Plan	Climate Action Plan - Adaptation Goal 1, Policy B General Plan Policy EM-25: Groundwater General Plan Policy EM-26: Water Conservation General Plan Policy EM-31: Landscaping
Lead Organization and Staff Lead	City Manager's Office via Sustainability Working Group (Partner Support) Staff Lead: Deputy City Manager Planning Department – Office of Energy and Sustainable Development Staff Lead: Climate Action Coordinator (Community Awareness) Staff Lead: Sustainability Outreach Specialist (Water Recycling/Incentives) Staff Lead: Sustainability Coordinator (Guidelines and Landscaping)
Priority	Medium
Timeline	Ongoing
Additional Resources Required	No additional resources required
Potential Funding Sources	City General Fund Permit Service Center Enterprise Fund

2014 **NFIP**	**Maintain City participation in the National Flood Insurance Program.**
Proposed Activities	- Continue to update and revise flood maps for the City. - Continue to incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards.
Related Natural Hazard(s)	Floods
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards. B. Increase City government's ability to serve the community during disaster response and recovery by mitigating risks to key buildings and infrastructure. D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-28 Flood Insurance, Actions B and C
Special Environmental Concerns	All activities occurring in biologically sensitive areas will include measures to protect sensitive habitats and species. Any non-emergency construction work on the storm drain system will take steps to minimize impacts to riparian habitat. All activities will take steps to minimize impacts to historic resources to the extent feasible.
Lead Organization and Staff Lead	Public Works – Engineering Division Staff Lead: Supervising Civil Engineer
Priority	Medium
Timeline	Ongoing
Additional Resources Required	No additional resources required

2014 **Streamline Rebuild**	**Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.**
Proposed Activities	- Explore a Zoning Amendment to BMC 23C.04.100 that streamlines the Zoning permitting process to allow industrial and commercial buildings, and multiple-family dwellings to rebuild by right following disasters. Consider different treatment for buildings in high-risk areas, such as: • Imposing higher standards of building construction for rebuilding • Excluding buildings in these areas from the amendment - 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. - Define the process for the City to accept and file this documentation. - Outreach to property owners about this documentation process.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami
Associated LHMP Objective(s)	C. Protect Berkeley's unique character and values from being compromised by hazard events
Related Policies from the General Plan or Climate Action Plan	General Plan Policy LU-26: Neighborhood Commercial Areas General Plan Policy LU-27: Avenue Commercial Areas General Plan S-9: Pre-Event Planning, Action B General Plan policy UD-7, Action C
Lead Organization and Staff Lead	Planning Department – Land Use Planning Division Staff Lead: Division Director
Priority	Medium
Timeline	1 year
Additional	To be determined

Resources Required	
Potential Funding Sources	City General Fund Permit Service Center Enterprise Fund

1.2.4.3 Low-Priority Actions

2014 **Sea-Level Rise**	**Mitigate the impacts of sea-level rise in Berkeley.**
Proposed Activities	- Monitor and participate in regional and State-level research on projected sea-level rise in Berkeley and the region. - Develop guidelines, regulations, and development review procedures to protect new and existing public and private developments and infrastructure from floods due to expected sea-level rise.
Related Natural Hazard(s)	Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	Climate Action Plan, Adaptation Policies A and C General Plan Goal 6: Make Berkeley a disaster-resistant community that can survive, recover from, and thrive after a disaster – Utilize Disaster-Resistant Land Use Planning General Plan Policy S-27: New Development General Plan Policy S-14: Land Use Regulation, Action E
Special Environmental Concerns	Policy changes to development regulations in areas exposed to sea-level rise will take steps to minimize impacts to coastal habitat and historic resources.
Lead Organization and Staff Lead	Planning Department – Office of Energy and Sustainable Development (Monitor Research/Integrate Considerations) Staff Lead: Climate Action Coordinator Planning Department – Land Use Planning Division (Development Regulations) Staff Lead: Division Director
Priority	Low

Timeline	To be determined
Additional Resources Required	To be determined
Potential Funding Sources	City General Fund Permit Service Center Enterprise Fund

2014 **HazMat Floods**	**Explore local legislation to require hazardous materials stored in the flood zones to be elevated or otherwise protected from floodwaters.**

Proposed Activities:	- Conduct cost/benefit evaluation to determine if hazardous materials should be elevated/protected in existing development in flood hazard zones:
	  • Assess potential impacts from hazardous materials release due to flooding
	  • Consult with federal, State and regional partners to identify legislative best practices and lessons learned
	  • Work with Berkeley Building Official to identify engineering solutions and potential permitting requirements for hazardous materials
	  • Identify potential costs to hazardous materials owners
	- If cost/benefit evaluation is positive, work with City Manager's Office and City Council to determine and implement path forward.
	- If cost/benefit is not positive, consider alternative methods of compliance such relocation or modification of business activities.

Related Natural Hazard(s)	Floods Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-13 Hazards Identification, Action A
Special	All activities occurring in biologically sensitive areas will

Environmental Concerns:	include measures to protect sensitive habitats and species.
Lead Organization and Staff Lead:	Planning Department – Toxics Management Division Staff Lead: Hazardous Materials Specialist II
Priority:	Low
Timeline:	Complete assessment of existing legislation: January 2014 Complete Cost-benefit evaluation for assessment by City Manager's Office: To be determined
Additional Resources Required:	To be determined
Potential Funding Sources:	Existing Certified Unified Program Agency (CUPA) Funding for emergency planning.

[i] This mitigation plan does not focus on disaster preparedness actions, which are undertaken to facilitate response to a disaster once it has occurred. Preparedness actions include planning response mechanisms, purchasing equipment to use in emergency response, or conducting drills. The City has strong plans and programs focused on emergency response and disaster preparedness activities, such as the Community Emergency Response Team program and the Emergency Operations Plan. These plans and programs are coordinated with, but separate from, this mitigation plan.

2 Implementing, Monitoring and Updating the Plan

This Plan will be well-integrated into the City's existing plans and planning mechanisms. Upon its adoption, it will be an appendix to the City's Disaster Preparedness and Safety Element of the City's General Plan.

On June 25, 2013, the City Council adopted the FY 2014 and FY 2015 Biennial Budget, which includes the Citywide Work Plan. Many actions outlined in this Mitigation Strategy have already been integrated into the Citywide Work Plan.

For upcoming budget cycles, the City's newly-established Chief Resilience Officer (CRO) position in the City Manager's Office[i] will be responsible for working with Department leaders to further incorporate funded actions from this Mitigation Strategy into the Citywide Work Plan. 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.

Additionally, 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.

Implementation of many of these actions will be dependent on outside funding sources.

2.1 *Implementing Actions and Reporting on Progress*

The CRO will coordinate monitoring, evaluation and updates to the mitigation plan on an annual basis within the five-year cycle. Lead staff identified in each action will meet with the CRO at the beginning of each calendar year to address the City's overall progress on this Mitigation Strategy. In these meetings, staff will:

- Provide qualitative and quantitative performance data related to actions
- Identify any necessary changes to existing Plan actions
- Identify new Plan actions to be incorporated into the Strategy

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 mitigation strategy implementation to this group on an annual basis.

The City will maintain the www.CityofBerkeley.info/Mitigation website and the Mitigation@CityofBerkeley.info email address. Community members will be able to submit feedback during the implementation of this plan through this website and email address. Additionally, 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 as one means of reporting implementation progress to the community.

2.2 *Updating the Plan*

Per federal regulations, this Plan must be updated once every five years. To ensure future compliance with these regulations, the 2018 mitigation strategy meeting will commence the comprehensive process to create the 2019 Plan update. This process will be similar to the annual

mitigation strategy update process defined above, but will be expanded to address all sections of the Plan:

1. City staff will consult with scientists and hazard experts to conduct a thorough evaluation and update of this Plan's hazard analysis. The update will include any new scientific research about Berkeley's hazards, the city's exposure and vulnerabilities, as well as a thorough review of all loss estimates.
2. City staff will measure and report progress on actions since the Plan's inception.
3. Items 1 and 2 together will inform the assessment of the updated mitigation strategy.
    - City staff will assess incomplete actions to determine if they should be removed, retained or rewritten
    - City staff will propose new actions for the updated Plan.
4. City staff will perform another community review process, including input opportunities for institutional community partners and individual members of the public.
5. City staff will incorporate appropriate public feedback and will conduct an outreach and adoption process, involving City commissions and City Council.

[i] The hiring process for the Chief Resilience Officer is currently underway and will be complete by July 1, 2014.

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3 Hazard Analysis

To become disaster resilient, a community must first understand the existing hazards and their potential impacts. Berkeley is exposed to a number of natural and human-caused hazards that vary in their intensity and impacts on the city. This mitigation plan addresses five high-probability natural hazards: earthquake, wildland-urban interface (WUI) fire, flood, landslide, and tsunami. Each of these hazards can occur independently or in combination, and can also trigger secondary hazards.

Although this plan is focused on natural hazards, three human-caused hazards of concern are also discussed: hazardous materials release, climate change,[1] and terrorism. They are included because of their likelihood of occurrence and the magnitude of their potential consequences.

For each of the natural hazards above, this plan describes:

1. The hazard itself;
2. Geographic areas of Berkeley that are exposed to the hazard;
3. Vulnerabilities to the hazard within each exposed area;
4. Cascading hazards created by the primary hazard; and
5. Probable damage and other impacts from the hazard.

The best available technical methods were used to estimate possible losses caused by various hazards. The City's detailed GIS databases, which include carefully gathered information about building types, natural features, and important property uses, were extensively used to characterize the city's hazards. HAZUS, an earthquake loss estimation program developed by FEMA, was used to estimate damage to buildings, economic losses, deaths and injuries, and shelter requirements after an earthquake. For other hazards, past calamitous events or studies by local specialists were used to estimate possible impacts to the community. The regional hazard mitigation plan developed by the Association of Bay Area Governments in 2010 contains additional information and analysis relevant to the city and informed portions of this update.

3.1 *Identification of Hazards*

3.1.1 Natural Hazards

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 Commission[2]. 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.

In 2014, tsunami was added to the mitigation plan. Newly-available maps and information for tsunamis now allow us to identify potential tsunami impacts, and to consider related mitigation actions.

3.1.2 Manmade Hazards

The focus of this mitigation plan is on natural hazards as emphasized in the Disaster Mitigation Act of 2000 (DMA 2000).[3] However, the plan addresses three manmade hazards—climate change, hazardous materials release and terrorism.

Climate change was specifically identified as a hazard of concern in the City's 2009 Climate Action Plan, and in 2014, climate change has been added to the mitigation plan. Newly-available maps and information now allow us to identify potential climate change impacts, and to consider related mitigation actions.

Hazardous materials release is addressed in this mitigation plan as a potential impact from a natural hazard. Terrorism is identified as a hazard of concern but is not analyzed in-depth. Other manmade hazards that could occur in Berkeley, such as ground water contamination, are not included in this plan, but may be addressed by other City programs in ongoing regulatory processes, such as activities of the Toxics Management Division.

The worst potential disaster that Berkeley could face involves multiple hazards being realized at the same time. A major earthquake could trigger significant landslides, spark fires and release toxic chemicals. If an earthquake occurred during the rainy winter season, landslides would be worsened and flooding could occur, exacerbated by damaged creek culverts and storm drains. City staff conducts planning and training to respond to challenging, multi-hazard events such as these. In addition to looking at each hazard individually, this plan explores how the hazards interact, and how mitigation activities for each hazard impact the overall disaster risk in Berkeley.

3.1.3 Public Health Impacts of Identified Hazards

The City's Public Health and Environmental Health Divisions have provided guidance on the public health impacts associated with hazards included in this plan. For example, drinking water quality is likely to be impaired after a major earthquake or flood, and air quality can be affected by a fire. Impure water and air have public health effects, and providing accurate and timely information and precautionary measures is a public health function.

The Public Health Division participated in the Bay Area Regional Risk-Based Assessment of public health impacts of a variety of hazards. The assessment for Berkeley

focused on the health impacts of a severe or moderate earthquake, a wildland/urban interface fire, and a moderate influenza pandemic. In addition to evaluating these categories of risk, the assessment focused on three sub-populations considered most vulnerable in a disaster: 1) seniors and homebound individuals with disabilities, 2) individuals with mental/behavioral health illness, and 3) UC Berkeley students in multi-unit residential housing. The assessment helps to inform our public health emergency preparedness and mitigation efforts. It also helped to engage our partners with recommendations for improving their own preparedness plans as they serve these most vulnerable populations.

3.1.4 Hazards Not Considered in the Plan

Other natural hazards that are extremely rare in Berkeley are not included in this plan; these include severe storms, which can produce prolonged low temperatures, heavy rainfall and hail; severe heat; high winds; 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 shelters it from prolonged storms and extremes of cold and heat. 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.

Naturally-occurring communicable disease outbreaks (e.g. a flu pandemic; SARS) do pose a significant risk to the Berkeley community, but are not addressed in this plan. Mitigation activities for communicable disease are not yet well-defined, but they could include, for example, measures to assure a high baseline level of immunization in the community, both for routine childhood immunizations and for annual seasonal flu vaccination. The City's Public Health Division leads Berkeley's communicable disease and public health emergency preparedness planning, in conjunction with State and Bay Area local health departments.

3.2 *Components of the Hazards Analysis*

The analysis of hazards in this plan has the following components:

- Historical Events. Within recent history the city has experienced the effects of all hazards addressed in this plan. Descriptions of the impacts of these disasters help illustrate some of the types of damage they can cause.

- Hazard. Describes the ways that each hazard can damage the community, and maps the locations in Berkeley that are particularly prone to specific hazards, such as the "100-year" floodplain. Areas that could experience secondary hazards, such as liquefaction following earthquakes, are also discussed.

- Exposure and Vulnerability. This plan identifies the people, buildings and infrastructure that exist in hazard zones. Vulnerability refers to the susceptibility

to physical injury, harm, damage, or economic loss of the exposed people, buildings and infrastructure. City elements exposed to each hazard are listed and mapped, and their vulnerability is discussed.

- Risk and Loss Estimates. The expected damage to be caused by future hazard events is estimated quantitatively, when possible. For most hazards, specific figures are estimated for the damage and losses that could occur. Consequences of damage on city residents and visitors are explored.

SECTION A: HAZARDS OF GREATEST CONCERN

Earthquakes and wildland-urban interface (WUI) fires are the hazards of greatest concern to Berkeley. Both of these hazards have a relatively high likelihood of occurrence and the potential for widespread damage within the city and the greater east bay region. Berkeley is committed to reducing the impact of these hazards on the city, and therefore they are the primary focus of the mitigation actions identified in Section 4 of this plan.

3.3 *Earthquakes*

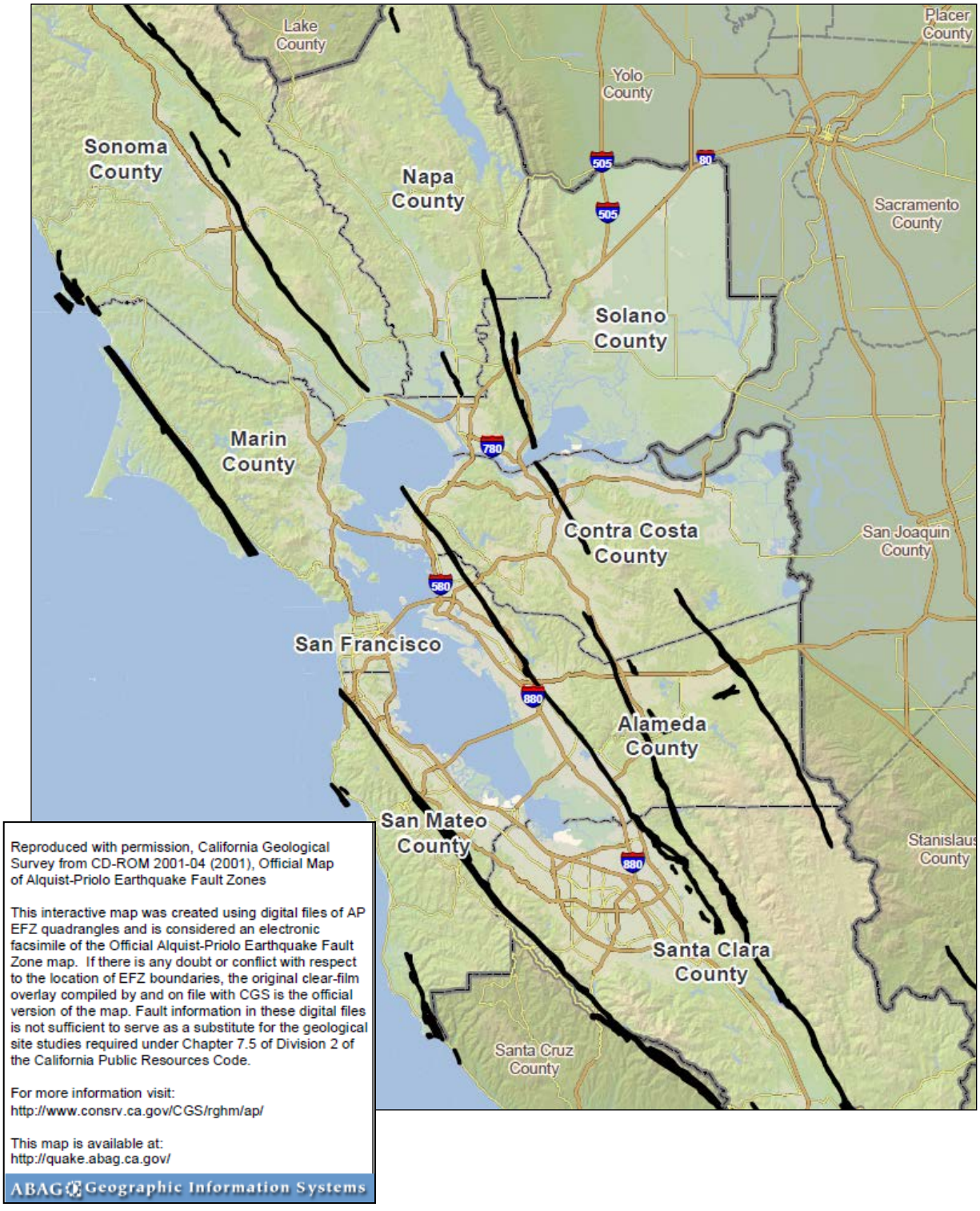
3.3.1 Historical Earthquakes

Destructive earthquakes struck the Bay Area in 1838, 1868, 1898, 1906, 1911 and 1989. Impacts of the earlier earthquakes in Berkeley are not well documented, but the damage of the 1989 Loma Prieta earthquake is fresh in the memory of many Berkeley residents. 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.

3.3.2 Earthquake Hazard

Map 3.1 shows the city of Berkeley and its proximity to the region's key faults, which are identified using red lines. The Hayward fault, of particular concern, stretches from the middle of San Pablo Bay, runs directly beneath Berkeley, and terminates in Hayward. A large earthquake could occur on any of these faults, or on smaller or as-yet unidentified faults, such as those that caused the 1989 magnitude 6.9 Loma Prieta and the 2001 magnitude 5.1 Napa earthquakes. Most of these events would affect the City of Berkeley.

Map 3.1 Regional faults and their location with respect to Berkeley



As of 2008, there is a sixty-three percent chance that an earthquake of magnitude 6.7 or greater will strike the Bay Area at least once over the next thirty years, and a thirty-one percent chance that an event of this magnitude would occur on the Hayward/Rodgers Creek fault system during that time.[4] This means that current Berkeley residents are likely to experience a severe earthquake during their lifetime. To provide a historical context, the 1994 Northridge earthquake, which caused an economic loss of $40 billion dollars,[5] was a magnitude 6.7 earthquake. This strength of earthquake in the Bay Area would produce strong shaking and ground failure throughout the region, causing significant damage in nearly every Bay Area city and county.

3.3.2.1 Ground Shaking

The most significant physical characteristic of a major earthquake is 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 underlying a city, 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.

Weak soils, such as bay mud and fill at the city's waterfront, also experience strong shaking in earthquakes, even from distant quakes. According to the USGS, as seismic waves pass from rock to soil, they slow down but get bigger. Hence a soft, loose soil may shake more intensely than hard rock at the same distance from the same earthquake. An extreme example for this type of amplification was in the Marina district of San Francisco during the 1989 Loma Prieta earthquake. That earthquake was 100 kilometers (60 miles) from San Francisco, and most of the Bay Area escaped serious damage. However, some sites on landfill or soft soils, like San Francisco's Marina district, experienced significant shaking.

Magnitude and Intensity[6]

Two commonly-used scales represent different earthquake characteristics: magnitude and intensity.

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.

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.

Map 3.2 shows the different levels of intensity anticipated across the Bay Area for a magnitude 7.3 Hayward fault earthquake. The map shows that the most intense shaking will be felt along the East Bay, stretching from Pinole to Milpitas, as well as in the North Bay from Novato to Vallejo.

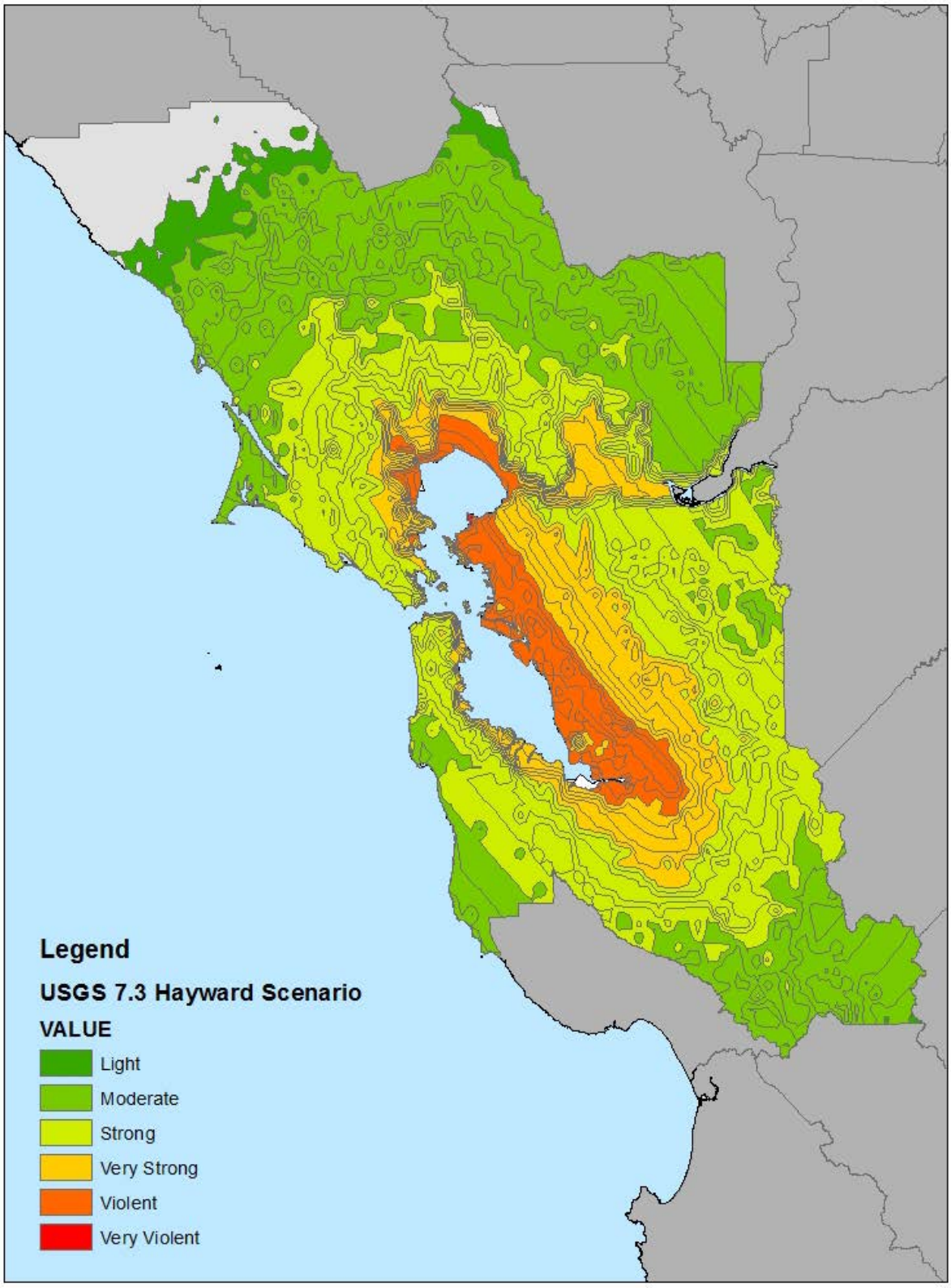
Map 3.2 depicts Berkeley in orange, indicating that in this scenario, Berkeley will experience violent shaking, associated with MMI Level IX:

- Considerable damage in specially-designed structures
- Well-designed frame structures thrown out of plumb
- Great damage in substantial buildings, with partial collapse
- Buildings shifted off foundations.

Comparatively, Map 3.2 depicts western San Francisco in light green, indicating that in this scenario, shaking will be strong in western San Francisco. Strong shaking is associated with MMI Level VII:

- Negligible damage in buildings of good design and construction
- Slight to moderate damage in well-built ordinary structures
- Considerable damage in poorly-built or badly-designed structures
- Some chimneys broken.

Map 3.2 Modified Mercalli Intensity for Magnitude 7.3 Scenario Earthquake on the Hayward fault



3.3.2.2 Ground Failure

Earthquakes can cause the ground to fail in several ways: through surface fault rupture, liquefaction and seismically-triggered landslides.

The State of California is required by two Acts of the State Legislature[7] to establish and map three Seismic Hazard Planning Zones, depicting areas within the state with the potential to experience these types of ground failure[8]. Map 3.3 shows areas of Berkeley deemed by the State to be part of the Earthquake Fault Planning Zone, the Earthquake-Induced Landslide Planning Zone and the Liquefaction Planning Zone.

Seismic Hazard Planning Zones, also known as Zones of Required Investigation, are regulatory maps that depict areas identified as having a high potential for earthquake-triggered ground failure caused by fault rupture, landsliding or soil liquefaction. These maps are used to guide land use planning and construction permitting for projects that fall within the area. Applicants for permits who are in one of the zones are required to have site-specific geotechnical investigations and use engineering measures to mitigate the hazard.

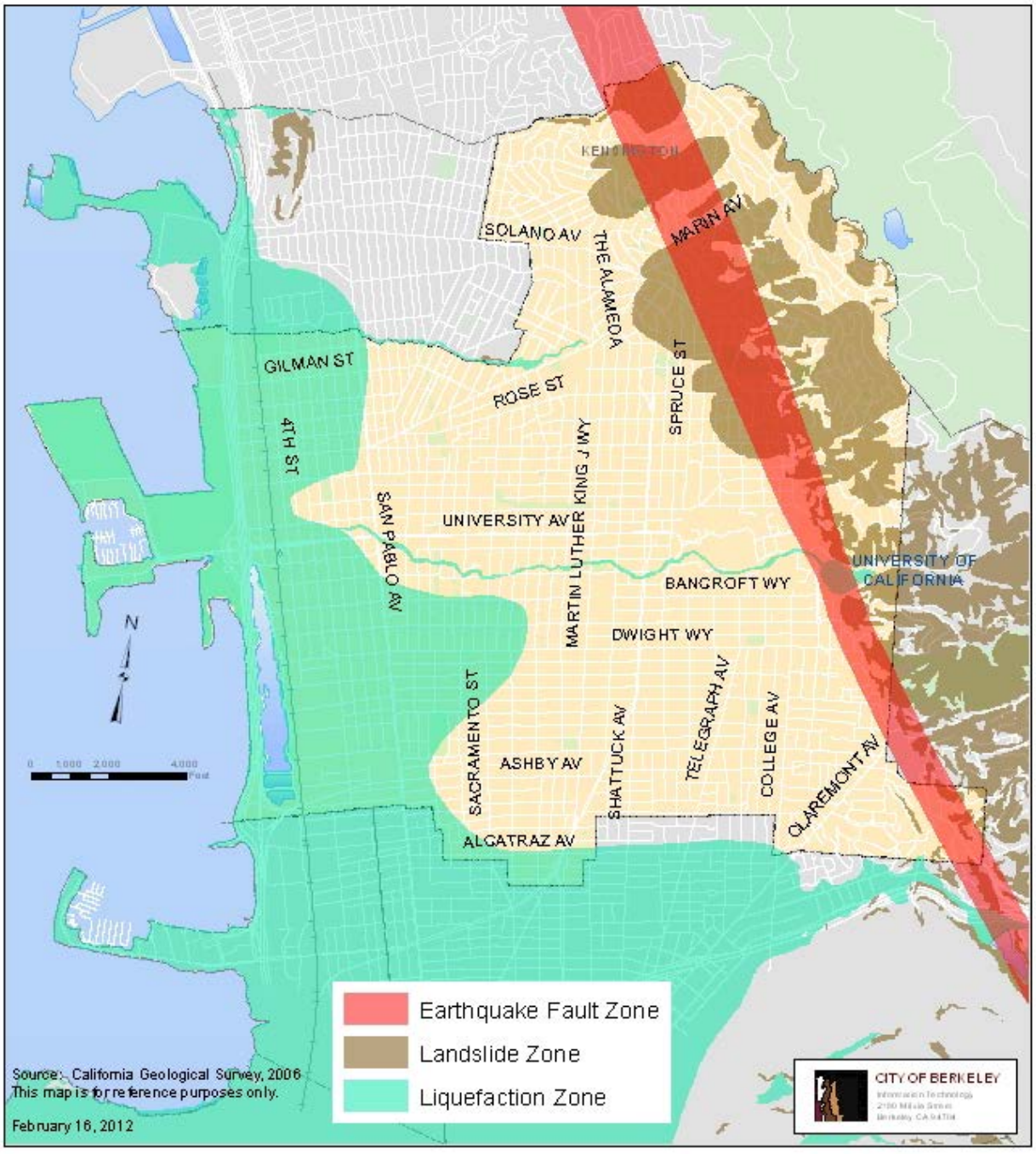
Unlike Map 3.2, these Seismic Hazard Planning Zones do <u>not</u> show effects of a particular earthquake scenario, but rather, consideration of all future earthquakes affecting the area. They are used:

- To support land use decisions by identifying areas where future earthquake-induced ground failure is more likely to occur, and

- To determine whether approval of more in-depth site-specific hazard investigation and mitigation may be required for certain projects during the construction permitting process.[9]

Each type of ground failure is discussed in detail below. Particular impacts of each type of ground failure in Berkeley are discussed in relevant sections throughout Section 3.3.3: *Exposure and Vulnerability*.

Map 3.3 Berkeley Seismic Hazard Planning Zones



3.3.2.2.1 Surface Fault Rupture

Surface fault rupture occurs when movement on a fault deep within the earth breaks through to the surface. After an earthquake, one side of a fault can shift by several feet vertically and horizontally from its previous location, causing splits in any structures or pipelines crossing the area.

The Earthquake Fault Planning Zone in Berkeley is indicated in red on Map 3.3. The Zone includes an area approximately ¼-mile wide along the Hayward fault, which runs in the northwest-southeast direction along the base of the hills in the eastern portion of the city.

Fault rupture may not occur in every earthquake, but when it does, it is likely to be concentrated in a narrow zone, with small parallel surface ruptures occurring over a wider area. If fault rupture occurs, potential impacts include damage to:

- Underground and aboveground utilities (electricity, water, sewer) and communications conduits that cross the fault
- Gas lines that cross the fault, causing fire ignitions
- Important east-west streets, making travel between the hills and flatland areas difficult where displacements are large
- The Solano Tunnel, which is an important transportation connection in the north-south direction
- Buildings, due to ground displacement.

3.3.2.2.2 Seismically-Triggered Landslides

Rainfall-triggered landslides are described in detail in Section 3.5.

Seismically-triggered landslides can result in significant property damage, injury and loss of life. Berkeley expects to experience landslides during the next earthquake, particularly if the earthquake occurs during the rainy winter months. While rainy weather or earthquakes could cause small landslide events that would impact a few homes, strong earthquake shaking coincident with wet, saturated hills presents a worst-case scenario. Movement could range from a few inches to tens of feet, but ground surface displacements as small as a few inches are enough to break typical foundations. Even small aftershocks could continue to cause slides for weeks and months after a quake, blocking roads and damaging homes. Even small landslide displacements caused by earthquake shaking can open surface cracks, which allow subsequent rainfall to infiltrate the slide mass and cause instability long after the earthquake.

In Berkeley, the potential for landslide from seismic activity is high in the hill areas and along creek banks. Areas of Berkeley that are exposed to seismically-triggered landslides are displayed in increasing levels of detail on the three maps described below.

The California Geological Survey has identified the areas of Berkeley with potential to experience earthquake-induced landslide. These areas are shown in brown on Map 3.3. These areas are identified by combining information on rock or soil strength, slope gradient (steepness), and anticipated future shaking levels. All areas underlain by known active or dormant landslides are included in the zone. Map 3.3 indicates that significant portions of the Berkeley hills have the potential to experience earthquake-induced landslide.

The US Geological Survey has also mapped Berkeley's earthquake-induced landslide hazard potential[10], shown in Map 3.4. Unlike Map 3.3, which considers areas of potential landslides from all potential earthquakes, Map 3.4 is a scenario map: it considers effects of a singular 7.1 magnitude earthquake on the Hayward fault.

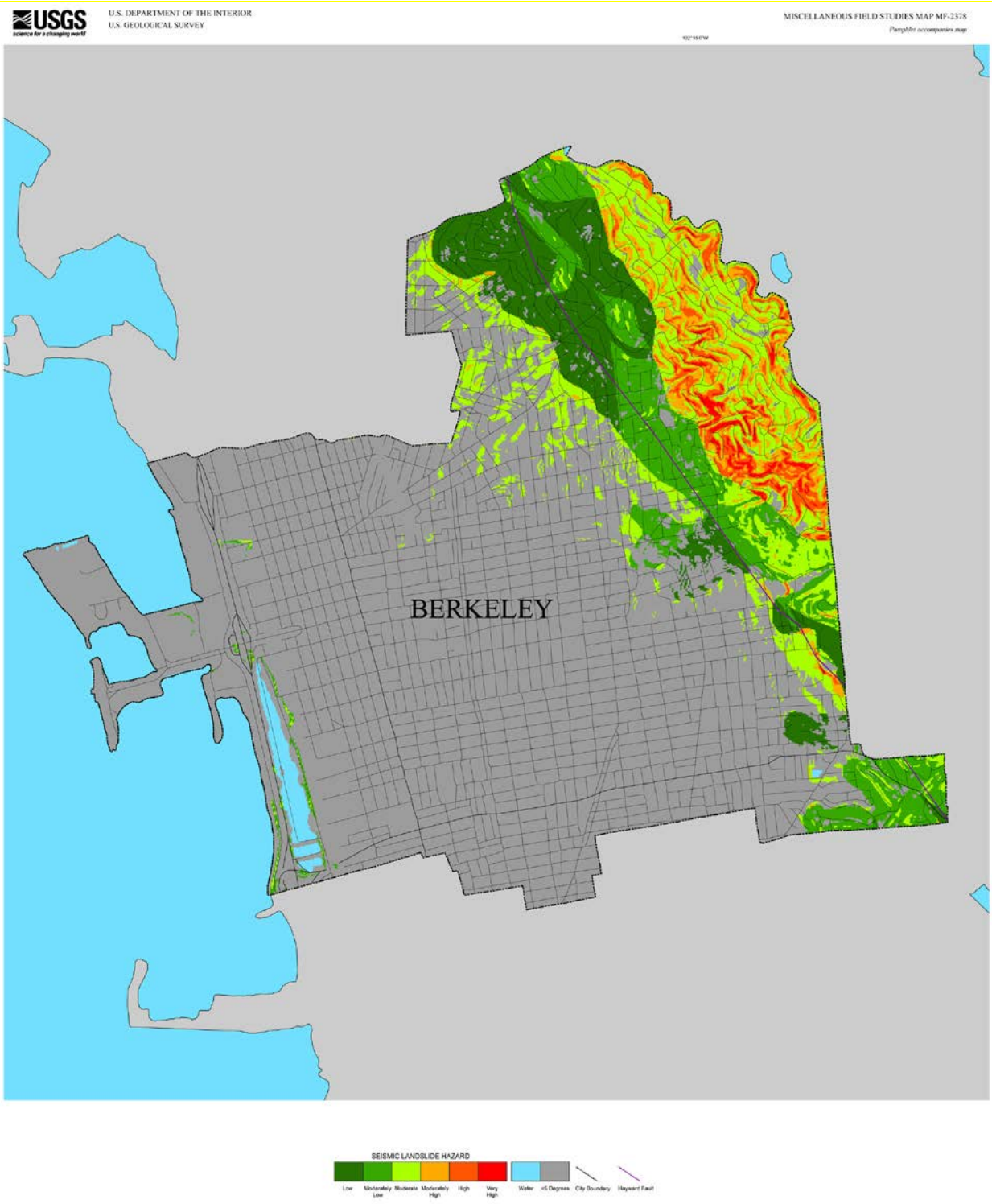
Map 3.4 is based on estimates of rock strength and slope gradient, and uses a methodology developed by Jibson et al. (1998) following the 1994 Northridge earthquake in southern California. [11]

Like Map 3.3, Map 3.4 shows that significant portions of the Berkeley hills have potential to experience earthquake-induced landslide. Map 3.4 not only identifies all the areas of potential landslide after a 7.1 Hayward fault earthquake, it also uses colors to identify the differing landslide potentials of each area:

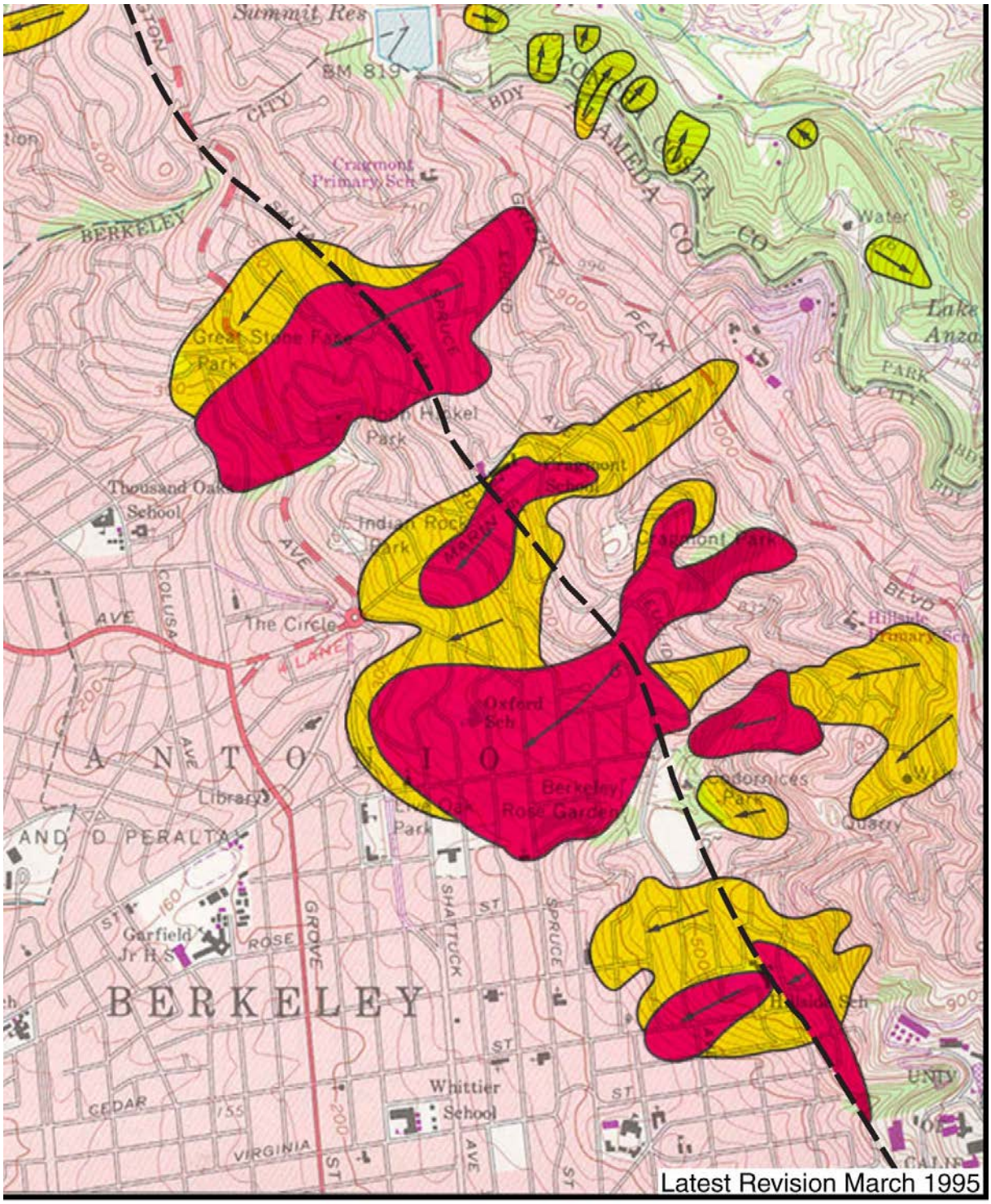
- Very high (red)
- High (dark orange)
- Moderately high (light orange)
- Moderate (yellow-green)
- Moderately low (light green)
- Low (dark green)

Map 3.5, created by Alan Kropp and Associates, focuses on a specific area in the northern part of the Berkeley hills. This map illustrates this area in particular because the area 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.

Map 3.4 Landslide hazard for 7.1 Hayward fault earthquake scenario[12]



Map 3.5 Active and potentially-active landslides in Berkeley hills (developed by Alan Kropp Associates and used with permission)



There are few generally-accepted methods to estimate damage from landslides caused by earthquakes.

Earthquake-induced slides may occur at the time of a major earthquake, or in subsequent aftershocks or rainstorms. Residents may have some warning that slides are imminent, helping to reduce damage and casualties. Landslide consequences would be seen primarily in the hills areas of Berkeley, and would likely include:

- Damage to structures, primarily residences. Damage homes could vary considerably, depending on their location and the quality of their foundations, and if there are any retaining walls. Some houses could be entirely destroyed or moved down the hill, while others could see minimal, repairable damage.

- Gas line rupture, igniting multiple fires

- Water line rupture, reducing water supply to fight fires

- Rupture of other underground and aboveground utility and communication systems

- Distortion of major and minor roads. This would make access difficult or impossible for firefighters and other emergency responders. It would also make egress difficult for residents of impacted areas.

In an earthquake-induced landslide in Berkeley, a worst-case scenario could cause approximately five to ten percent of all susceptible areas to slide. This would impact about 300 structures, primarily residences. The total value of these structures could be about $200 million.[13] A single landslide-triggering event impacting all 300 structures is unlikely, but possible. Smaller slides affecting a handful of structures are more probable.

3.3.2.2.3 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. Structures located on liquefiable soils can sink, tip unevenly, or even collapse. Pipelines and paving can tear apart.

Map 3.3 depicts in green the areas in Berkeley where soil types and groundwater conditions are susceptible to liquefaction. The State deems these areas to be a Zone of Required Investigation, meaning that special investigation and reporting requirements exist for construction or transfer of property in this Zone, per both the Seismic Hazards Mapping Act and Natural Hazards Disclosure Act. [5]

The Liquefaction Hazard Planning Zone exists primarily to the west of San Pablo Avenue in low-lying areas adjacent to the San Francisco Bay, and also extends one half mile east

around Dwight Way to about Jefferson Avenue and along Alcatraz Avenue. There is also a potential for liquefaction along major creeks such as Strawberry and Codornices creeks.

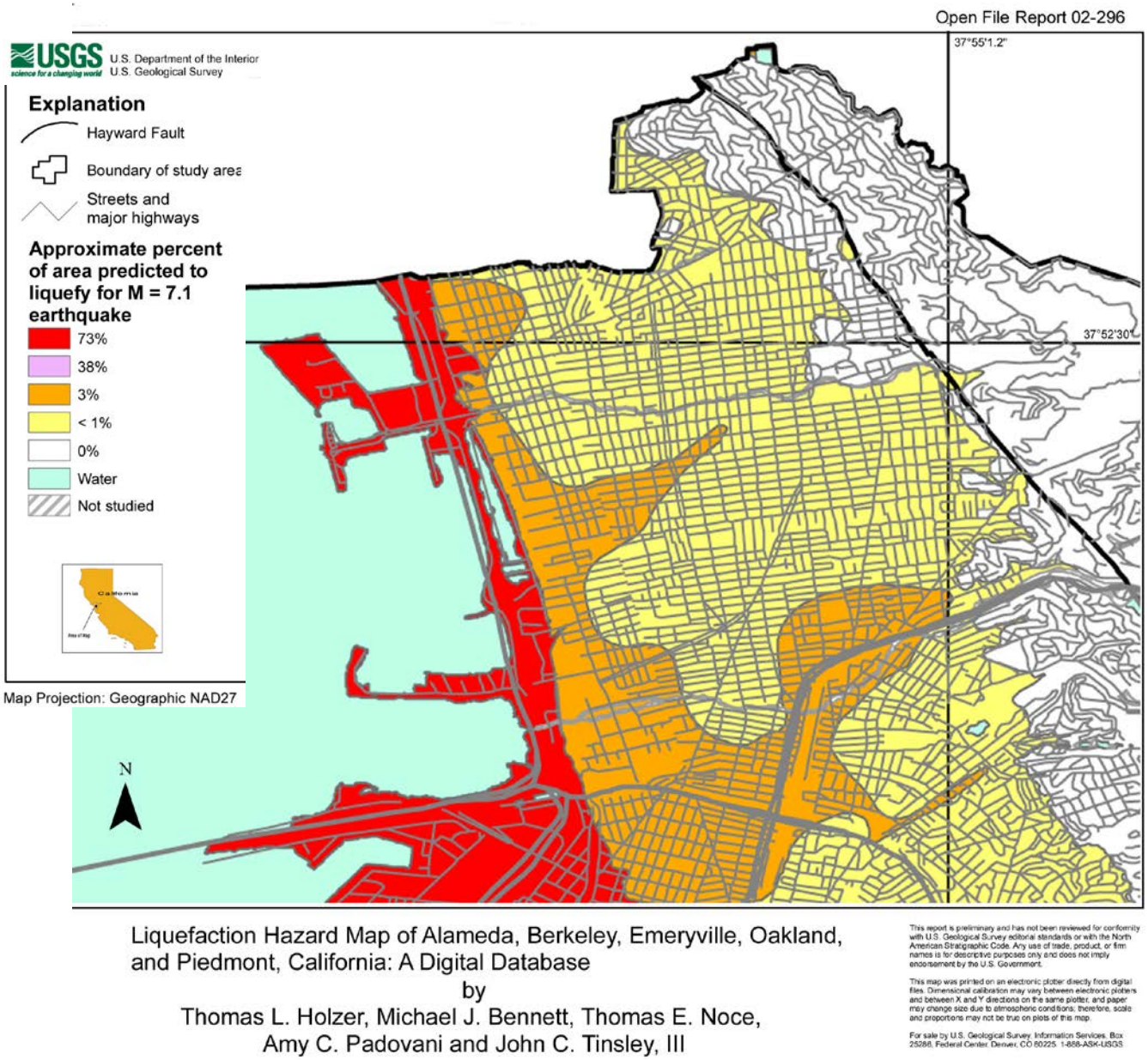
In an earthquake, liquefiable soils need to be shaken hard and long enough in order to trigger liquefaction. An earthquake on the Hayward fault is the most likely to cause significant liquefaction within the city.

Map 3.6 considers the liquefaction predicted to occur in Berkeley in a magnitude 7.1 earthquake on the Hayward fault. The map divides Berkeley into three areas with different liquefaction potentials, and describes the approximate percentage of each area that is predicated to liquefy in this earthquake scenario. This map can also be interpreted as the likelihood that any particular location within that area will experience liquefaction.

In this scenario, depicted on Map 3.6, the liquefaction hazard is most pronounced along the western edge of the City: seventy-three percent of the area west of the Union Pacific railroad tracks and Interstate 80 is expected to experience varying degrees of liquefaction. This liquefaction potential drops radically just east of the railroad tracks, where only three percent of the area colored in orange is expected to liquefy. The potential drops even further for the majority of central and eastern Berkeley (colored in yellow), where less than one percent of the land is predicted to liquefy. Maps 3.3 and 3.6 show slightly different extents of liquefaction across the city because the approach and data used to develop each map were different and the purpose of the maps is different: Map 3.3 is regulatory while Map 3.6 depicts one possible scenario of liquefaction resulting from a likely earthquake scenario.

Sea level rise resulting from climate change may raise the water table in Berkeley and increase the areas of Berkeley that are susceptible to liquefaction.[14]

Map 3.6 Liquefaction Scenario Map



3.3.2.3 Fire Following Earthquake

Significant portions of the following section were originally developed for the City of San Francisco through the Community Action Plan for San Francisco (CAPSS)[15]. While the report was developed for San Francisco, many of the findings are relevant to Berkeley. Both cities have potential for high earthquake shaking, which increases the risk of post-earthquake fire ignitions. Both cities also have dense multi-family housing, which facilitates fire spread.

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. There are many examples from around the world of fire following earthquake:

Earthquake	**Impacts of Earthquake-Caused Fire**
1995 Kobe Earthquake	More than 100 fires broke out following the 1995 Kobe earthquake, during which broken water mains left the fire department helpless, and fires destroyed more than 7,000 buildings. Fire was also a major contributor to the death toll.
1994 Northridge Earthquake	More than 100 fires broke out following the 1994 Northridge earthquake, severely impacting area fire departments, even though it largely affected only the edge of greater Los Angeles.
1989 Loma Prieta Earthquake	Thirty-six fires broke out in San Francisco. Natural gas line rupture was responsible for some of the fire ignitions. Failure of the city's electrical systems may have actually reduced the number of fire ignitions. Fires in the Marina District claimed four structures in the area, but lack of wind that night assisted in preventing the fires from spreading. Overall, the shaking experienced in the Loma Prieta earthquake was moderate, as the epicenter was 70 miles away.
1906 Great Earthquake	The earthquake was followed by a firestorm that lasted for three days, and in that time swept over an area of over 3.5 square miles.[16] It is estimated that 80 percent of San Francisco's property value was lost in the fire.

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

In the 1994 Northridge earthquake in Los Angeles, over half of the ignitions were due to electrical systems, and about a quarter were fueled by gas.

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.

Earthquakes can also damage the systems we have in place to stop fires. Earthquake shaking 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, fire doors).

Post-earthquake fires can also spread quickly due to spilled flammable chemicals.

Fires also spread more quickly after major earthquakes because earthquakes damage the infrastructure needed to fight fires. Earthquake shaking and ground failure due to liquefaction, surface fault rupture and landslide can simultaneously:

- Break water mains, causing a drop in water pressure
- Damage electrical systems necessary to provide energy to pump water
- Damage communication infrastructure
- Impede transportation routes with debris or landslides
- Jam firehouse doors, preventing apparatus from responding.

Soft-story and unreinforced masonry buildings are more prone to earthquake damage (see Section 3.3), and thus are 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. Even buildings that survive earthquake shaking can succumb to fire, including those buildings that have been seismically retrofitted.

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. Earthquakes in places with this type of construction have caused the two largest peacetime urban fires in history: in 1923 in Tokyo; and in 1906 in San Francisco, where 80% of the 28,000 destroyed buildings were lost due to fire.

Risk and Loss Estimates

The Berkeley Fire Department today is a well-prepared, professional organization that trains for earthquake-caused fires. However, after the next large earthquake, there are likely to be more fires than Berkeley's firefighters can respond to at one time. Compounding this challenge, fire personnel will not only be fighting fires, but will also be responding to needs for search and rescue and emergency medical services. Firefighters in nearby cities will be struggling to address response needs in their own jurisdictions, and State and federal resources may not be able to help the City for many hours. The 1991 East Bay Hills Fire destroyed 3,354 structures in only a few hours and overwhelmed the capacity of local fire departments, even though neighboring departments were available to assist.

Fires in Berkeley could burn out of control, and may threaten entire neighborhoods. Fire damage will add to the city's overall earthquake damage, making recovery more difficult and lengthy by increasing the number and severity of damaged buildings, lengthening the time required to repair and replace damaged buildings, displacing residents, and weakening neighborhoods.

3.3.3 Exposure and Vulnerability

This section describes Berkeley's built environment and its earthquake vulnerabilities. It contains three parts:

- Buildings
- Infrastructure (systems for utilities, transportation and communications)
- Critical response facilities

This section describes earthquake vulnerabilities for each component of the built environment. In some instances, a system's earthquake vulnerability could potentially create a secondary hazard (e.g., if earthquake shaking were to result in a hazardous materials spill.)

Much of Berkeley's built environment is owned and operated by other public and private entities and is not under the City's direct authority. The City works with other public agencies and companies on disaster planning, and this section includes information about some of the activities that the City's key community partners are undertaking to mitigate the hazards that may impact or originate on their own property.

Buildings

According to the State of California's Multi-Hazard Mitigation Plan, damage due to ground shaking produces over 98 percent of all building losses in typical earthquakes. Buildings are also vulnerable to ground displacements associated with primary fault rupture, liquefaction and landslides.

This section first addresses the earthquake exposure and vulnerability for City-controlled buildings. Secondly, it describes earthquake exposure and vulnerability for buildings *not* controlled by the City, including private residences and commercial buildings.

Retrofitting vs. New Construction

Building codes are continually improved, incorporating new knowledge about building methods that effectively resist seismic forces.

Buildings built using older techniques can be especially vulnerable to earthquake damage. Buildings are usually retrofitted with the goal of reducing loss of life, but damage can still be expected in many retrofitted buildings. Building retrofit is often preferable to building replacement, as retrofitting an existing building can be more cost-effective and environmentally-friendly, while preserving historic architecture.

New building construction is expected to perform better than retrofitted buildings in an earthquake. However, the goal of the building code is to reduce loss of life in an earthquake, not to ensure the continued use of the building. This means that a large

earthquake will damage even new buildings, which may remain unusable for long periods of time.

City-Owned Buildings

The City of Berkeley owns or leases approximately 156 buildings. These buildings 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. Three of these buildings are known to be seismically vulnerable. There is no identified funding source to retrofit the buildings below:

- *Old City Hall, 2134 Martin Luther King, Jr. Way*

  This building, used for offices and assemblies, including City Council meetings, is a potential collapse hazard that needs to be retrofitted. It is also a recognized historic building. The Berkeley Unified School District has moved its administrative offices to a new building.

- *Veterans' Memorial Building, 1931 Center Street*

  This historically landmarked building, used for public assembly, as a homeless shelter, and for daytime homeless services, is a potential collapse hazard that needs to be retrofitted. The homeless shelter operating in the building currently houses about 50 people per night. During the day, the Dorothy Day House, Berkeley Food and Housing Project, Options Recovery, and Building Opportunities for Self Sufficiency (BOSS) use the building for their homeless service programs.

- *Center Street Garage, 2025 and 2033 Center Street*

  This building is vulnerable to significant damage or collapse in an earthquake. It is used for City and public parking. A retrofit would be prohibitively expensive, so the City is looking at replacement alternatives.

With the exception of Fire Station No. 7, no significant City buildings are located in the fault rupture or earthquake-induced landslide planning zones. Constructed in 2006, the Fire Station No. 7 is in Fire Zone 2 and incorporates state-of-the-art hazard-resistant construction.

However, a number of City buildings need to be assessed to determine their level of vulnerability to seismic events. Some may pose some risks to life and emergency operations. A listing of the City's buildings and known information about their disaster risk appears in Appendix B: *List of City Owned and Leased Buildings*.

Notable Mitigation Activities

The City strengthened important buildings for emergency response and recovery, including the Martin Luther King, Jr. Civic Center Building (City Hall), the Main Library, and all seven of the City's fire stations. Since then, the City has continued its program to strengthen or replace key at-risk structures:

Ratcliff Building, 1326 Allston Way

In 2012, seismic retrofit work was completed for the Ratcliff Building, also known as the Facility Maintenance Building. This work was made possible by a pre-disaster mitigation program grant for $2.89 million, provided in 2006 by the State Office of Emergency Services and the Federal Emergency Management Agency. This building houses the City's Public Works Department Operations Center, the location at which the department's field response activities will be coordinated during a disaster. This retrofit will enable the department to better respond during and after seismic events.

Dona Spring Animal Shelter, 1 Bolivar Drive

The City's new animal shelter opened in November 2012, replacing the old shelter at 2013 Second Street. The new building is a steel-frame structure on a concrete mat slab, and was designed to governing seismic standards. The two-story building is approximately 11,700 square feet, and was funded through bonds and other sources.

The building has many features, including a medical suite for onsite spaying and neutering of shelter animals, facilities for protecting healthy animals and caring for sick ones, and indoor-outdoor kennels. This new facility supports the City's Animal Care Services Division in providing services to community members and their pets during and after disaster events.

Branch Libraries

In November 2008, City of Berkeley voters approved Bond Measure FF, a $26 million measure limited to the renovation, construction, and seismic and disabled access improvements at the City's four neighborhood branch libraries. Libraries function as community gathering spaces before, during and after disasters. Seismic retrofit work will help the City to make these spaces available to the community, especially at times when community members need each other most.

A description of the renovations completed or underway for each library is detailed below:

- *North Branch Library, 1170 The Alameda*

The North Branch Library, constructed in 1936, reopened in April 2012, following significant renovations. Through this effort, the building was seismically retrofitted to governing standards; a fire sprinkler system was added, and the library's mechanical, electrical, and telecommunication systems were upgraded. The building was upgraded to full ADA compliance, and historic features were preserved. A dedicated community meeting room was added; these changes nearly doubled the library's square footage to 9390 square feet.

- *Claremont Branch Library, 2940 Benvenue Ave*

The Claremont Branch Library, originally constructed in 1924, was renovated and reopened in May 2012. Through this effort, the building was seismically retrofitted to governing standards; a fire sprinkler system was added, and the library's mechanical, electrical, and telecommunication systems were upgraded. The building was upgraded to full ADA compliance. 340 square feet were added for a new square footage of 7,640 square feet. The project achieved LEED Silver certification.

- *West Branch Library, 1125 University Avenue*

The West Branch Library was constructed in 1923, and has been replaced by an all new building measuring 9,400 square feet. The building complies with today's seismic standards and will be fully ADA accessible. It uses a net-zero energy design with roof-mounted photovoltaic panels and use of natural light and ventilation.

- *South Branch/Tool Lending Library, 1901 Russell Street*

The South Branch/Tool Lending Library was constructed in 1961, and was replaced in 2013 by a new single-story building measuring 8,656 square feet. It meets governing seismic codes and is fully ADA accessible. Photovoltaic panels will offset energy grid draws. The new building was designed as a LEED Gold Certificate project.

Privately-Owned and Other Structures

Berkeley has about 43,636 housing units[17], serving the city's population of 112,580[18]. 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.

Older houses constructed with a crawl space or aboveground basement below the first floor can have several weaknesses, because older building codes were inadequate to resist seismic forces, or because codes were not followed properly. The bottom of the wood frame exterior walls may not be adequately bolted to the foundation, meaning the house can slide off the foundation during strong shaking. The foundation itself may be constructed of weak or deteriorated materials, like brick or very old concrete. Also, the wall that encloses the crawl space, known as a cripple wall, may be weak and vulnerable to collapse due to inadequate bracing and deterioration of wood members from termite attack and dry rot. Hillside houses can suffer from any of these weaknesses, but have increased risks of failure to cripple walls and poorly braced extra-tall walls along the sloping sides.

A number of City incentive programs and educational efforts promote seismic strengthening activities. The Transfer Tax Rebate Program reduces the real estate transfer tax by one-third for homeowners who perform qualifying seismic safety work on their homes. Since July 2002, the City has distributed over $9 million to homeowners through the program, as outlined in Table 3.1 below.

Table 3.1 Transfer Tax Rebate Program

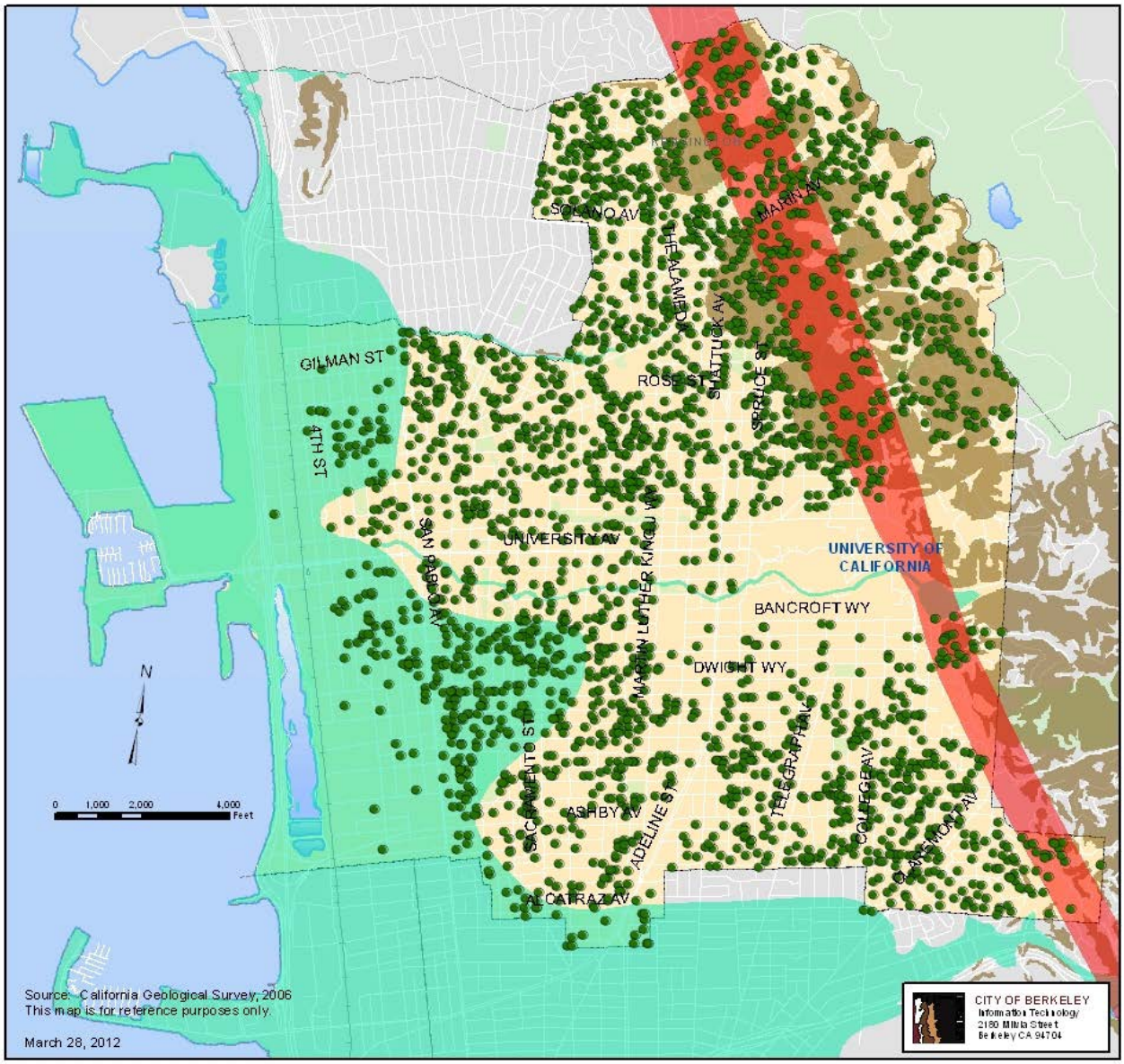
Fiscal Year	Property Transfer Rebates	Total Funds Issued
2003	382	$1,133,047
2004	467	$ 1,539,738
2005	385	$ 1,459,510
2006	262	$ 1,168,654
2007	144	$ 611,433
2008	152	$ 681,002
2009	138	$ 533,061
2010	150	$ 592,539
2011	157	$ 593,974
Total (FY 2003-2011[A])	**2,237**	**$ 8,312,958**

The City's adoption of Standard Plan Set A[19] 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.

Through these and other efforts, more than 2,500[20] (12 percent) of single-family homes have been strengthened to various degrees since this plan was first adopted in 2004. These upgrades include both structural and nonstructural mitigation measures. Map 3.7 shows the locations of these upgraded homes, as of 2011, which are distributed across all residential neighborhoods.

[A] Program totals for Fiscal Years 2012 and 2013 are not included in Table 3.1. Property owners have up to two years to take advantage of the program, and numbers are not yet finalized.

Map 3.7 Single-Family Homes with structural and nonstructural mitigation work from 2004 -2011



- Single-Family Homes with structural and nonstructural mitigation work, 2004 -2011

Earthquake Fault Zone
Landslide Zone
Liquefaction Zone

Soft-Story Housing

A soft-story building is a multi-story building in which one level is significantly more flexible than the floors above it and the floors, or foundation, below it. In Berkeley, this weakness tends to occur in multi-family structures with openings for parking or commercial spaces and few interior partitions at the ground floor. These openings result in a significantly more flexible ground floor than in the stories above. When subjected to earthquake forces, this weak first story can be severely damaged and shift out of plumb or even collapse.

Many of the city's more affordable units are located in this type of structure. An Association of Bay Area Governments study in 2003 estimated that nearly two-thirds (sixty-six percent) of uninhabitable housing in the Bay Area would be from wood-frame multifamily residences after a large earthquake on the Hayward fault, whereas less than nine percent of uninhabitable housing would be in single-family homes[21]. This is of concern because in many instances, multifamily units, which disproportionately house the poor, minorities, elderly and university students, take longer to repair and reoccupy than single-family units[22].

Notable Mitigation Activities

On December 3, 2013 City Council adopted Ordinance No. 7,318-N.S. amending Berkeley Municipal Code Chapter 19.39 to require property owners of soft, weak or open front buildings with five or more dwelling units to retrofit their buildings within the next five years. Owners have three years to apply for a building permit and two years to complete the work after submitting their permit application. The law applies to buildings constructed prior to 1978 and takes effect January 4, 2014. This is the second phase of the Soft Story Program.

Under the first phase of the soft story program, a City ordinance passed in 2005 required owners of soft-story buildings with five or more units to hire professional engineers to evaluate their buildings' seismic vulnerability and to submit evaluation reports to the City. The initial soft-story inventory included 321 buildings. The 2005 ordinance has a 94% compliance rate. As shown in Table 3.2, of the 321 buildings on the inventory, 51 were removed from the list due to reconsideration; 112 were retrofitted; owners of 140 buildings complied with the Phase I ordinance building assessment requirement and submitted an engineering evaluation report; and owners of 18 buildings did not submit an evaluation report.

Buildings removed from the list either proved they did not have a soft story condition, had fewer than five residential units, or were a hotel or commercial building, unaffected by the ordinance.

Table 3.2 describes the status of the 321 buildings identified as soft-story in 2005.

Table 3.2 Berkeley Soft-Story Building Status

Number of buildings	Percent*	Status
112	35	Retrofitted; removed from the soft-story inventory
51	16	Reconsidered; removed from soft-story inventory
140	44	Confirmed to be soft-story via engineering evaluation report; remain on soft-story inventory
18	6	Noncompliant; remain on soft-story inventory
321	*100%*	*Total buildings identified as soft-story in 2005*

*Due to rounding, percentages do not add up to 100 percent.

Despite their owners' compliance with the ordinance, the 140 soft-story buildings in Berkeley that have not been retrofitted are still considered hazardous in an earthquake, as well as the 18 buildings that are out of compliance with the ordinance. These buildings contain 1,611 residential units.

Map 3.8 shows the locations of retrofitted and unretrofitted soft-story structures relative to the seismic hazard planning zones. Green dots indicate locations of soft-story buildings that have been retrofitted or are in the process of being retrofitted. Red dots indicate locations of potentially-hazardous soft story buildings. These buildings include buildings with reviewed seismic engineering and evaluation reports under review by the Building and Safety Division, and buildings which have not yet submitted the evaluations reports.

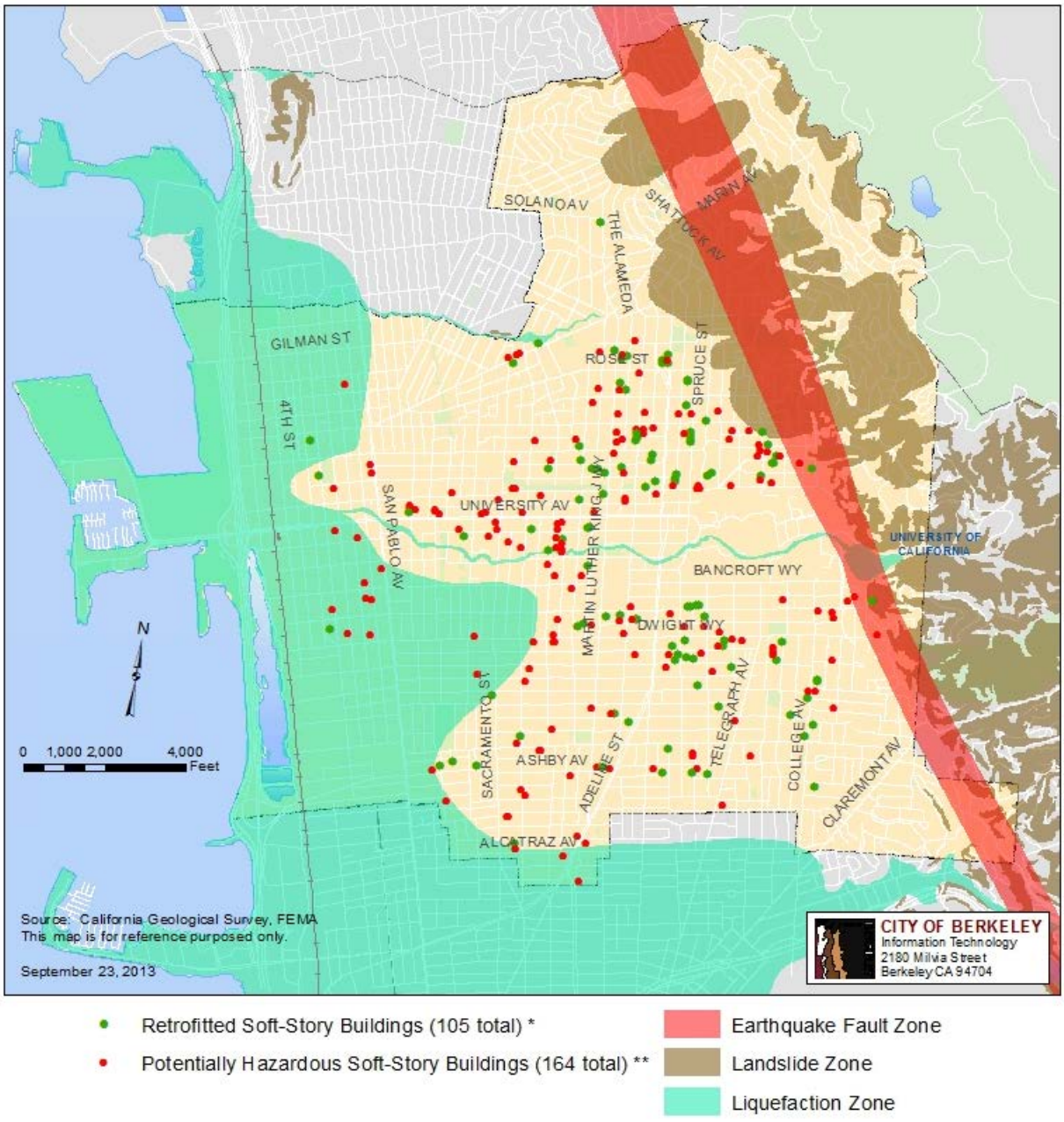
According to Map 3.8, there are 19 potentially-hazardous soft-story buildings within the liquefaction hazard planning zone. These buildings may be especially susceptible to sinking, tipping unevenly or collapsing in an earthquake.

Map 3.8 also shows that the two soft-story buildings in the earthquake-induced landslide hazard planning zone have been retrofitted.

Map 3.8 shows that two potentially-hazardous buildings are within the fault rupture planning zone, meaning that these buildings may be especially vulnerable to damage if fault rupture occurs during a major earthquake.

The remaining buildings do not lie in an earthquake hazard planning zone. However, according to Map 3.2, all of these buildings will still be subject to violent shaking in a magnitude 7.3 Hayward fault earthquake. Soft-story retrofitting will improve these buildings' safety but cannot completely address their earthquake vulnerability.

Map 3.8 Retrofitted and Unretrofitted Soft-Story Buildings



*Includes retrofitted soft-story buildings and soft-story buildings in process of retrofit.
**Includes buildings with reviewed seismic engineering evaluation reports confirming the soft story status, buildings with seismic engineering evaluation reports under review by the Building and Safety Division, and buildings which have not yet submitted the evaluation reports.

Commercial and Industrial Structures

Unreinforced Masonry Structures

Unreinforced masonry (URM) buildings are constructed of brick, block, tile, stone, or other types of masonry and have no or inadequate reinforcement to keep them from structural collapse in earthquakes. Most URM buildings have features that can threaten lives during earthquakes. These include unreinforced masonry parapets, unreinforced masonry exterior and interior walls, chimneys, and high brick veneers. The walls, floors and roofs are often not tied together or are weakly connected. When earthquakes occur, inadequate connections in these buildings can allow masonry to fall. Floors and roofs can collapse, placing occupants and pedestrians in harm's way.

The URM building type was discontinued many decades ago due to the buildings' high vulnerability to earthquake damage. Existing URM buildings can be retrofitted to reduce the life safety hazard they pose to occupants and pedestrians. Following strong earthquakes, retrofitted URM buildings are likely to remain stable, but they may still sustain moderate or greater damage, including possible collapse. Earthquake-damaged URM buildings would be expected to be replaced, as the cost of extensive repairs may exceed economically justifiable limits for these older buildings.

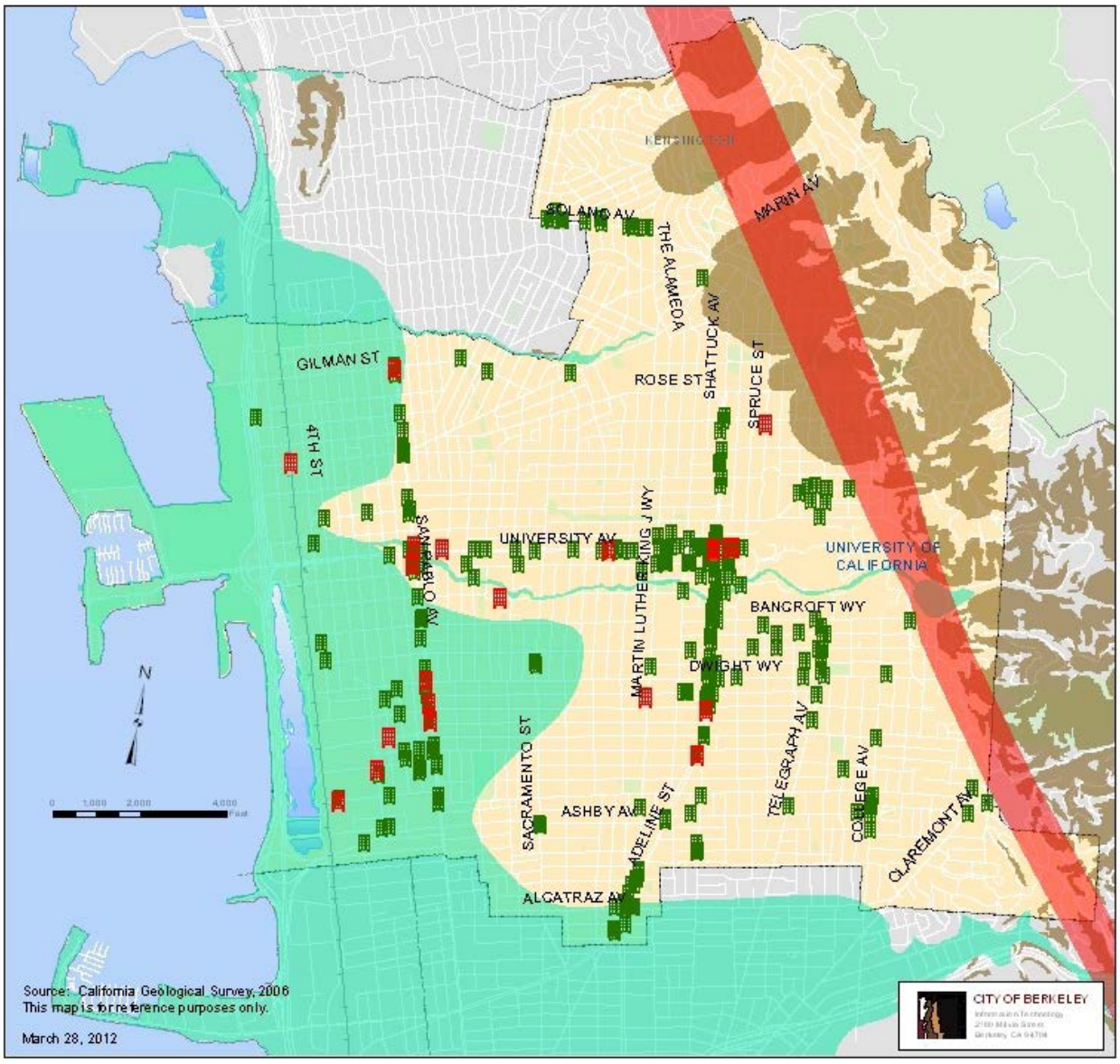
Notable Mitigation Activities

In 1989, in response to State law, the City of Berkeley compiled an inventory of URM buildings. Berkeley identified about 700 URM structures constructed before 1956, used for both commercial and residential purposes. In 1991, the City adopted Unreinforced Masonry Ordinance 6088-N.S. The ordinance mandated that all URM buildings on the inventory be seismically retrofitted to the established minimum performance standards on a schedule determined by the designated risk category of each building.

The program has brought considerable increases in safety. As of 2012, over 90% of the URMs on the City's Hazardous Buildings Inventory have been seismically retrofitted, demolished, or demonstrated to have adequate reinforcement. Nineteen remaining URM buildings have not yet had significant action taken to reduce their risk.

Map 3.9 shows locations of both retrofitted and yet-to-be retrofitted URM structures. Green building icons indicate URM structures that have been retrofitted or are in the process of being retrofitted. Red building icons indicate URM buildings that have not yet been retrofitted or are otherwise out of compliance with the URM retrofit program. These buildings are most frequently located in Berkeley's commercial corridors, along Shattuck, San Pablo, University and Solano Avenues. None of these buildings sits in the earthquake-induced landslide or fault rupture hazard planning zones (indicated on Map 3.9 in brown and red, respectively). However, many of these structures are within the liquefaction hazard planning zone, indicated in green. This means that in addition to damage from earthquake shaking, many of these buildings may sink, tip unevenly or collapse due to potential liquefaction.

Map 3.9 Retrofitted and Unretrofitted Unreinforced Masonry Buildings



* Includes all buildings that are out of compliance with the Unreinforced Masonry Safety Program.
** Includes URM buildings that have been retrofitted or are in the process of being retrofitted.

Tilt-Up Concrete Construction

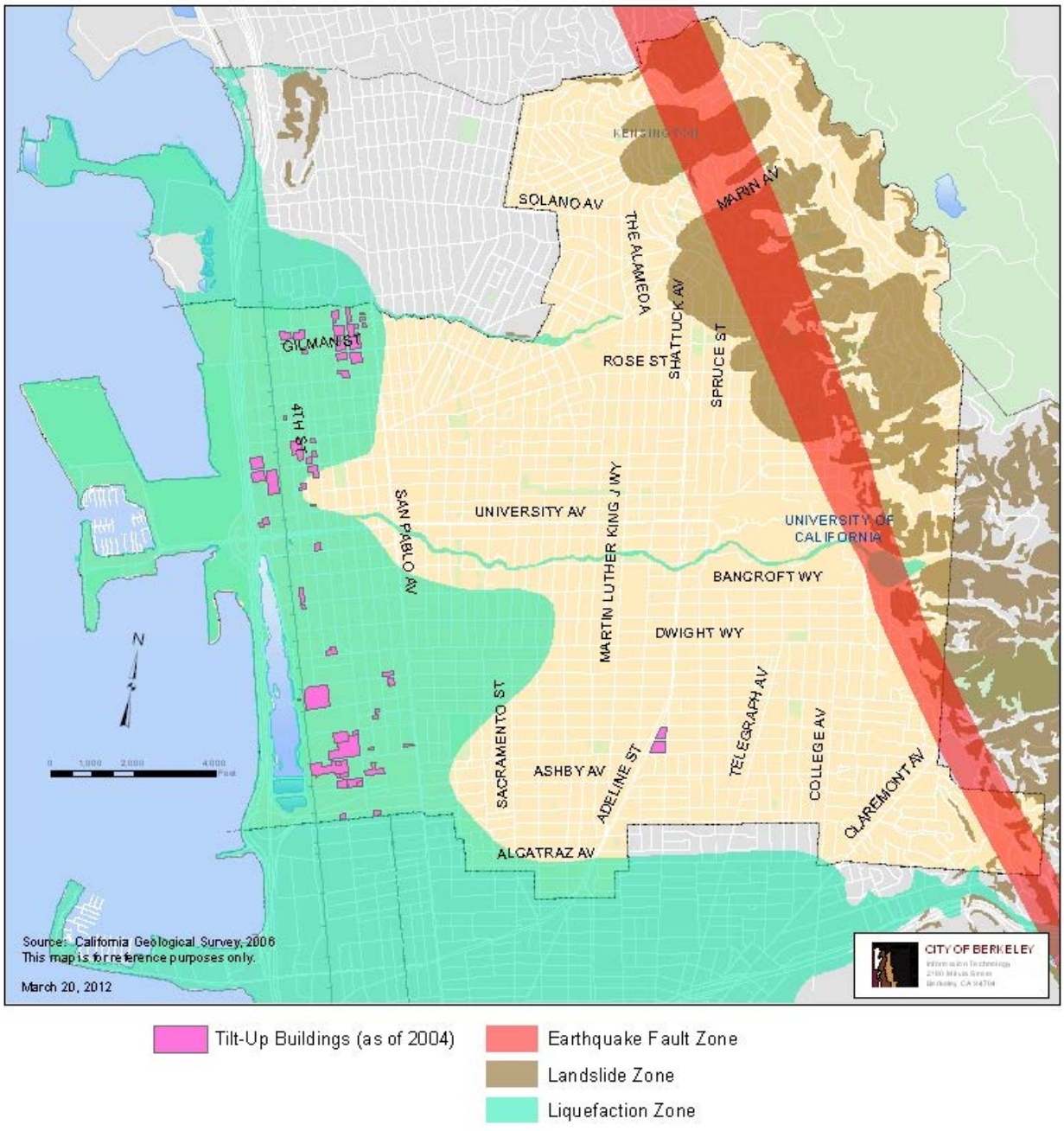
Tilt-up buildings are typically one- or two-story commercial buildings constructed of concrete walls that are poured horizontally, tilted into vertical positions, and connected to each other and to roofs. If the connections between the walls and roofs are weak, the walls can pull away from roofs and collapse during ground shaking.

Tilt-up buildings built before the mid 1970's are of particular concern. A 1996 survey of buildings in the city identified 59 structures of this type.

Map 3.10 shows the locations of tilt-up concrete buildings relative to seismic hazard planning zones. Nearly all of the buildings are in the liquefaction planning zone, meaning that they could sink, tip unevenly or collapse if liquefaction occurs. However, none of these buildings sits in the fault rupture or earthquake-induced landslide hazard planning zones, and thus will not be exposed to these hazards in an earthquake.

There is currently no ordinance to require retrofit of these buildings.

Map 3.10 Potentially Hazardous Tilt-Up Concrete Buildings



Infrastructure

This section examines the earthquake exposure and vulnerability of Berkeley's infrastructure. It is organized into three components: utilities, transportation and communications.

Infrastructure described in this section provides 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 from a major earthquake.

Many of these systems are also significant because their failure in an earthquake could create secondary hazards, compounding the challenge to Berkeley's disaster response and recovery activities.

Much of the City-owned infrastructure was built before World War II when the city was growing and modernizing. After over 90 years in service, much of the infrastructure requires extensive maintenance, repair or enhancements.

Electrical, natural gas, petroleum, telecommunications, and potable water supply infrastructures are not under the City's control, but rather are owned and managed by other quasi-governmental, private or special district entities.

The following three sections (Utilities, Transportation and Communications) describe these key infrastructure systems and their vulnerabilities, demonstrated by the earthquake hazard exposure depicted on Maps 3.11 and 3.12. These sections also outline how these vulnerabilities may create secondary hazards following an earthquake. Included in each section are the City's key partners and their mitigation activities.

The Department of Public Works has an up-to-date database describing elements, characteristics and conditions of all roads, storm drains, and sewer pipelines. The database includes specific information on these systems and their conditions for maintenance and management purposes. This type of information will also facilitate Public Assistance applications after a disaster, as federal repair guidelines attempt to apportion damage due to the hazard event and damage from normal wear and tear. Disputes over existing element conditions can lead to additional expense and delays in making needed repairs.

Utility Systems: Earthquake Exposure and Vulnerability

The table below shows owners of key utility system infrastructure in Berkeley.

Table 3.3 Key Berkeley Utility Systems

Owner/Manager	**Infrastructure**
City of Berkeley	• Storm drains • Retaining walls in right-of-way • Sanitary sewer collection system that links to the EBMUD system • Creeks, open channels and creek culverts in right-of-way and on City property • Street Lights and traffic lights on poles or utility poles and above- and below-ground conduits supplied from the PG&E system • Transfer Center, city waste disposal and recycling, located at Second and Gilman streets
EBMUD	• Potable and fire suppression water supply system consisting of pipelines, pumping plants, flow/pressure control facilities, and storage tanks and reservoirs owned by the East Bay Municipal Utility District • Sanitary sewer transmission pipeline (EBMUD wastewater interceptor) and pumping station
PG&E	• Electric distribution system, including substations, mains, laterals and meters, owned by the Pacific Gas and Electric Company • Natural gas distribution system, including main pipelines, lateral pipelines and meters
AT&T, Comcast and others	• Telecommunications aerial and underground conduits
Kinder Morgan Corporation	• Aviation fuel and multi-product pipelines buried under the right-of-way of the Union Pacific railroad tracks
Various	• 376 sites in the city storing more than 55 gallons, 200 cu ft or 500 lbs accumulated hazardous materials and hazardous waste

Liquefaction is a significant contributor to utility failure after an earthquake. When soil liquefies, the effective stress of a soil is reduced to essentially zero, which corresponds to a complete loss of shear strength or shear resistance. Sloping ground and ground next to creeks and the Bay may slide on a liquefied soil layer, opening large cracks or fissures in the ground. This can cause significant damage to infrastructure lines such as water,

natural gas, sewage, storm, electrical and telecommunications systems installed in the affected ground. Buried tanks, pipelines, conduits, and manholes may float in the liquefied soil due to their buoyancy.

Landslides, liquefaction, or subsidence caused by earthquakes may subject pipelines to significant displacement, causing the pipelines to develop leaks or breaks.

The following systems are described in further detail:

- Water System
- Sanitary Sewer System
- Storm Drain System
- Natural Gas and Electricity Systems
- Aviation Fuel Pipeline
- Hazardous Materials Management

Water System: Earthquake Exposure and Vulnerability

Key Partner: East Bay Municipal Utility District (EBMUD)[23]

The East Bay Municipal Utility District (EBMUD) provides drinking water to approximately 1.3 million people and sewer services to 640,000 in the East Bay. After an earthquake, EBMUD is responsible for maintaining and providing water and sewer services to its customers, including water for post-earthquake fire suppression. Much of the water for the East Bay comes through the Claremont Tunnel. This water is stored in a network of reservoirs throughout the Berkeley Hills and is distributed to customers through underground pipelines. EBMUD was created in 1923, and the age and extent of its system makes it particularly vulnerable to damage in earthquakes. EBMUD has studied the impacts of earthquake shaking, liquefaction, landslides and fault rupture on most of its infrastructure.

Following a major seismic event:

- Earthquake-induced landslides in the Berkeley hills could impact water lines, reducing water available for firefighting
- If fault rupture occurs, water lines within the fault rupture planning zone could be broken

The 1994 Northridge earthquake led to significant disruption of the water supply system of Los Angeles. Several communities were without water for as long as two weeks and boil water orders were in effect for a few communities for two weeks as a precautionary measure.

- Liquefaction in the western part of the city could impact water service

It could take seven days or more to restore basic services to nearly 80% of customers, depending on the severity of the earthquake. EBMUD crews will likely begin working to repair the system immediately after an event. Full service, however, may not be restored for six months.

Depending on the severity of earth movement, water and sewer lines may break, and the safety of the drinking water supply may be compromised. In addition, without power, sewer lift pumps will fail, leading to major sewage overflows. For this reason, the City's Environmental Health and Public Health Divisions may issue precautionary drinking water advisories, either in collaboration with water utilities or independently. These advisories may be in place until the drinking water system is confirmed safe.[24]

Key Partner's Notable Mitigation Activities

EBMUD has taken aggressive steps to strengthen its systems. In 1994, EBMUD allocated $189 million for seismic upgrades that were completed by 2006. Steps to provide system redundancy included building a new connector pipeline at the southern end of the EBMUD service area, purchasing flexible joints and hoses to temporarily reroute water flows, anchoring local water storage reservoirs, and upgrading pumping plants.[25] EBMUD has worked with PG&E to identify portions of the electricity grid critical to the water supply. The Berkeley Fire Department has worked with EBMUD to better understand the water distribution system and EBMUD emergency response capabilities in order to develop alternate water sources for firefighting should EBMUD's supply become unavailable.

The Claremont Tunnel crosses the Hayward fault 130 feet below Tunnel Road in Berkeley. It could experience severe displacements of 7.5 feet in a magnitude 7.0 earthquake on the Hayward fault.[26] EBMUD completed a seismic retrofit of the Claremont Tunnel in February 2007, which included constructing a bypass tunnel where the Claremont Tunnel intersects the Hayward fault. The bypass tunnel is capable of absorbing an 8-1/2 foot offset at the Hayward fault while maintaining flow capacit.

There are two reservoirs with dams in or near the city that have been evaluated for their seismic safety as part of EBMUD's dam safety program. Both reservoirs are safe for continued operation and do not pose a life safety risk. Claremont Reservoir holds about 8 million gallons and is located on Claremont Avenue in southeast Berkeley. In 2006, Claremont Reservoir dam was evaluated for seismic risk. The study concluded the dam will perform satisfactorily based on a magnitude earthquake of 7.25 on the Hayward fault. Summit Reservoir, at Berkeley's northeast border, has been evaluated for seismic risk and meets the stringent state safety requirements of the Division of State Dams; however, it is in need of replacement. It will be replaced with one 3.5 million gallon water tank within the footprint of the existing reservoir basin. Summit Reservoir construction is estimated to start in 2014 and is estimated to take two years to complete.

Sanitary Sewer System: Earthquake Exposure and Vulnerability

The City's sanitary sewer system is made up of pipelines with large diameter (six inches to 120 inches). Some of the large diameter pipes provide temporary storage when the EBMUD wastewater interceptor[27] system cannot accept flows. The amount of storage time provided by these large diameter pipes depends on the inflow rate and the ability of downstream segments to accommodate flow. Failure of the EBMUD interceptor system or the City's sanitary sewer system could cause sewage to back up beyond the Berkeley sanitary sewer system's storage capacity. When the volume of effluent is larger than the sanitary sewer system's storage capacity, it will overflow through manhole covers onto city streets and into the storm drain system and creeks that flow to the Bay.

The table below outlines the total length of Berkeley's sanitary sewer system, as well as the length and percentage of the system that lies within each hazard planning zone depicted on Map 3.3.

Table 3.4 Sanitary Sewer System

Infrastructure Element	Total Length	Length in Hazard Areas		
		Earthquake-Induced Landslide Planning Zone	Fault Rupture Planning Zone	Liquefaction Planning Zone
Sanitary sewer	259 miles	50 miles (19%)	29 miles (11%)	53 miles (20%)

The Berkeley hills have a high landslide risk, which could particularly impact the sanitary sewer system.

If fault rupture occurs, it could critically damage portions of the sanitary sewer system that are within the Fault Rupture Planning Zone.

The liquefaction hazard is more acute on the west side of the city. Liquefaction-caused earth movements will affect underground infrastructure, including a high proportion of the sanitary sewer system. Liquefied areas may move laterally, breaking Berkeley's underground sanitary sewer pipelines. Liquefied areas could also compromise EBMUD's wastewater interceptor line, adjacent to Interstate 80. Damage to either system would interrupt the systems' ability to convey sewage.

Storm Drain System: Earthquake Exposure and Vulnerability

Areas of the city's storm drainage system are known to be extremely weak and at risk of collapse. 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. The weaknesses of this system are described in more detail in Section 3.6, which addresses floods.

The table below outlines the total length of Berkeley's storm drain system, as well as the length and percentage of the system that lies within each hazard planning zone depicted on Map 3.3.

Table 3.5 Storm Drain System

Infrastructure Element	Total Length	Length in Hazard Areas		
		Earthquake-Induced Landslide Planning Zone	Fault Rupture Planning Zone	Liquefaction Planning Zone
Storm Drains	101 miles	15 miles (15%)	9 miles (9%)	29 miles (29%)

Earthquake-caused ground failure could change the horizontal alignment of pipes so that storm drains would not function.

The Berkeley hills have a high landslide risk, which could block or damage storm drains.

If it occurs, fault rupture could damage portions of the storm drainage system within the Fault Rupture Planning Zone.

The liquefaction hazard is more acute on the west side of the city. Liquefied areas may move laterally, breaking underground storm pipelines and affecting other underground infrastructure and creeks.

Electricity and Natural Gas Systems: Earthquake Exposure and Vulnerability

Electricity

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. Electrical switches and transformers in the distribution system can be damaged, as can equipment at substations and transmission lines, possibly leading to system wide loss of these utilities. Photovoltaic (solar) panels, which can collect energy and deliver it back to the grid, are reliant on the electric grid being functional.

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

Underground systems are particularly prone to damage from ground failure in earthquakes and landslides. Natural gas line rupture is one of the chief causes of post-earthquake fires, as discussed in Section 3.3.2.3: *Fire Following Earthquake.* Additionally, rupture compromises this lifeline unless redundant connections unaffected

by the earthquake are available. Underground damage is harder to detect and repair, and the length of service losses may be greater than for aboveground systems.

This plan is focused on natural hazards and their impacts. This plan addresses gas pipeline rupture as a secondary hazard to earthquake liquefaction, earthquake-induced landslides and surface fault rupture.

The term “gas pipeline” includes:

- Transmission pipelines, which carry natural gas across long distances, usually to and from compressors or to a distribution center or storage facility. Transmission lines are large steel pipes (10" to 42" in diameter) that are federally-regulated. They carry unodorized gas at a pressure of approximately 60-900 psi.

- Distribution pipelines (“gas mains”), which are the middle step between high-pressure transmission lines and low-pressure service lines. Distribution pipelines are small- to medium-sized pipes (.25" to 24" in diameter) that are federally-regulated and carry odorized gas at intermediate pressure levels, from 2 to 60 psi.

- Service pipelines, which connect to meters to deliver natural gas to individual customers. These narrow pipes are usually less than 2” in diameter, and carry odorized gas at low pressures, such as 6 psi.

Like electricity infrastructure, service and distribution pipelines exist throughout Berkeley. In a 7.3 magnitude earthquake along the Hayward fault, service and distribution pipelines will be exposed to violent shaking, as well as to liquefaction in the western part of Berkeley, earthquake-induced landslides in the Berkeley hills, and potential fault rupture along the fault line. All three of these hazards can rupture service and distribution lines, igniting and fueling and multiple fires.

In addition to service and distribution lines, transmission pipelines are also vulnerable to ground failure in a major earthquake. Map 3.11 uses blue lines to identify PG&E’s natural gas transmission lines. Per Map 3.11, significant portions of PG&E natural gas transmission lines lie in Berkeley’s Liquefaction Hazard Planning Zone. This zone identifies where future liquefaction is more likely to occur, but does not show effects of a particular earthquake scenario. In an earthquake, these soils need to be shaken hard and long enough in order to trigger liquefaction. If liquefaction does occur, pipelines located in liquefiable soils can tear apart. Residents or business owners in the direct proximity of such a pipeline could be heavily affected by a rupture.

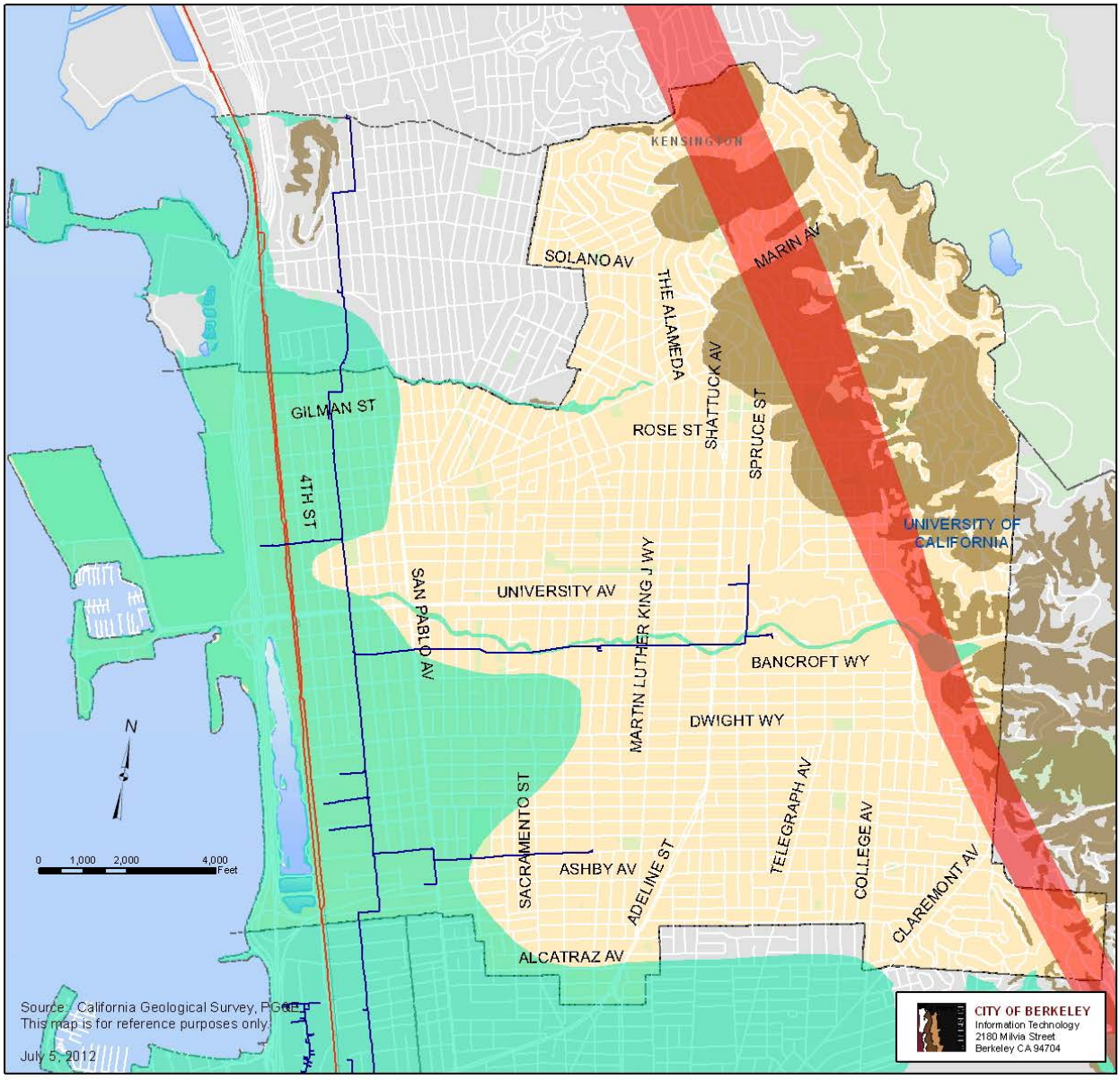
The natural gas transmission line runs the length of Berkeley (north-south direction) under Seventh Street. Nearly all of this stretch of transmission line lies within the Liquefaction Hazard Planning Zone.

- The Seventh Street transmission line branches out to the West in four locations, all of which lie in the Liquefaction Hazard Planning Zone: 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, portions of which lie in the Liquefaction Hazard Planning Zone. The first is at Heinz Avenue, continuing onto Russell Street after passing San Pablo Avenue. The Liquefaction Hazard Zone extends east until Mabel Street. The transmission line ends where Russell Street crosses McGee Avenue. The second is at Allston Way. The Liquefaction Hazard Planning Zone extends to the Allston's intersection with San Pablo 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 3.11 Seismic Hazard Planning Zones, Gas Transmission Pipelines and Jet Fuel Line



Earthquake Fault Zone
Landslide Zone
Liquefaction Zone
Gas Transmission Lines
Jet Fuel Line

Key Partner: Pacific Gas and Electric Company (PG&E)[28]

Pacific Gas and Electric (PG&E) provides electricity and natural gas to 15 million people in northern and central California. They have a staff of 20,000 prepared to respond to restore electrical service after disasters and storms. They also have a well-established priority system for restoring power to emergency services before other community needs. PG&E recognizes that large earthquakes may damage key facilities and that electric power might be lost for limited periods of time. The potential for a loss of power means that emergency and critical uses should have dedicated emergency power sources.

Natural gas is subject to damage and disruption in areas with soil failure, for example landslide and liquefaction. Broken lines can create fires if ignited until the fuel supply is exhausted. The repair of damaged underground lines will take time. Following the Loma Prieta earthquake it took about 30 days to repair damaged lines in the San Francisco Marina.

Key Partner's Notable Mitigation Activities

PG&E has assessed the seismic vulnerability of many elements of its system and has taken steps to improve its functionality after an earthquake, such as replacing bushings on high voltage lines, anchoring substation equipment and replacing old gas lines with more flexible alternatives.

As a consequence of the San Bruno rupture, the National Transportation Safety Board (NTSB) has issued a number of recommendations to State and federal administrations and institutions to improve the safety of pipeline networks as well as to upgrade the integrity management program and emergency response system[29].

As a result, PG&E has proposed $2.2 billion in pipeline upgrades through 2014 and outlined a Pipeline Safety Enhancement Plan to modernize its gas transmissions operations over the next several years. As part of this plan and in direct response to the recommendations issued by the NTSB, PG&E has begun improving its network by automating shutoff valves, with more automatic shutoff valves planned for Berkeley; updating its emergency response plan to reflect industry best practices; and implementing data management systems intended to ensure its pipeline records are traceable, verifiable and complete.

Additionally, PG&E has created a First Responders Safety website, which provides secure access to maps and information about natural gas transmission lines, natural gas storage facilities, and shut-off valves. The City's Information Technology department has incorporated this information into its GIS maps. Berkeley first responders have attended PG&E's First Responder Workshops to learn more about components of natural gas and electric utility infrastructure, as well as how to respond to natural gas hazards and avoid dangers presented by migrating natural gas and secondary ignition sources.

Aviation Fuel Pipeline

Map 3.11 shows in red lines 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. Per Map 3.11, soils in this area are potentially susceptible to liquefaction. Like with the PG&E natural gas transmission lines, rupture of these aviation fuel lines during an earthquake could spark and feed a dangerous fire.

Key Partner: Kinder Morgan Corporation[30]

Two aviation and multi-purpose pipelines run along the railroad tracks from Richmond to the Oakland Airport, through western Berkeley. The pipes are made of high-pressure welded steel, installed primarily in the 1960s, although a few segments were installed in the 1950s. The company has not conducted a study of the impacts of an earthquake on the Hayward fault. This type of pipeline, however, is known to have performed well, due to its ductile nature, in earthquakes elsewhere in the world. Kinder Morgan has focused on developing procedures to respond immediately after a disaster to shut down the pipeline. Each pipeline has automatic, remote control and other manual valves along its length and the flow can be shut down within minutes. Kinder-Morgan reported that after the 1989 Loma Prieta earthquake, these pipelines were shut down and monitored for leaks, breaks and changes in pressure. No damage was found.

Hazardous Materials Management

The shaking and ground failure that can accompany earthquakes could cause hazardous materials release. The City carefully tracks and regulates hazardous materials in both public and private structures through its Toxics Management Division. There are 376 sites in the city that store more than 55 gallons, 200 cu ft or 500 lbs accumulated hazardous materials and hazardous waste.[31] The majority of these sites are automobile-related facilities (e.g., facilities with motor oil), and medical facilities. To minimize the risk of release during an earthquake, the City requires engineering studies for facilities having extremely hazardous substances. These studies are discussed in more detail in Section 3.9: *Hazardous Materials Release*.

Transportation System Earthquake Vulnerabilities

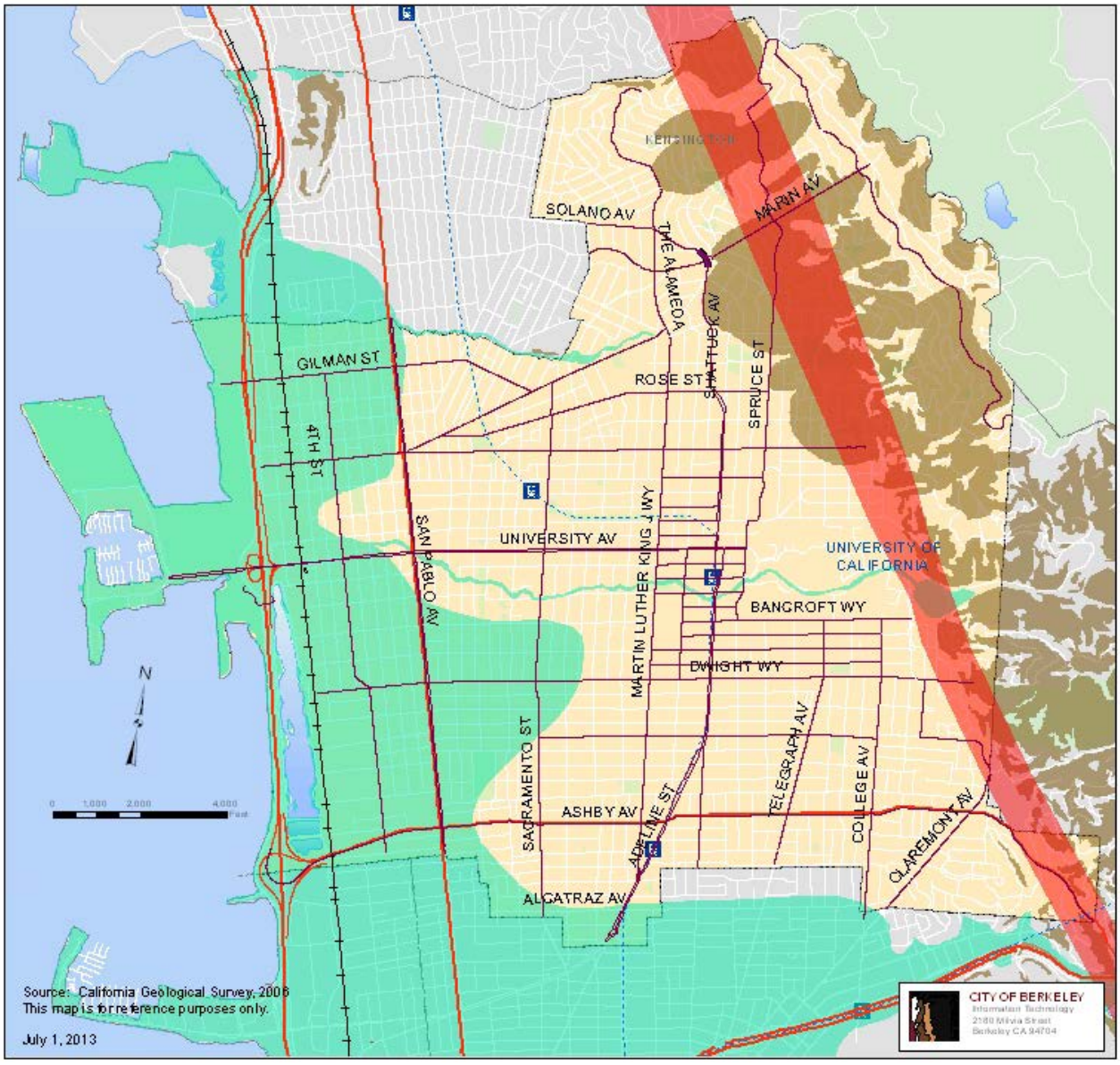
The table below shows key transportation system infrastructure in Berkeley, along with the agencies responsible for the systems.

Table 3.6 Key Berkeley Transportation Systems

Owner/Manager	Infrastructure
City of Berkeley	• Roads, curbs, paths and sidewalks • Traffic lights on poles, and above and below ground conduits supplied from the PG&E system • Traffic circles and islands • Sutter Street Solano Avenue tunnel • I-80 Pedestrian Bridge • University Avenue interchange approach structure and railroad crossing
Caltrans	• US Interstates 80 and 580 and freeway access structures at Ashby, University and Gilman streets in Berkeley, and at Powell and Buchanan streets in Emeryville and Albany owned by the State Department of Transportation • Tunnel Road/Ashby (State Route 13), and San Pablo Avenue (State Route 123)
Bay Area Rapid Transit District	• BART system, consisting of four miles of underground rails and three stations, at Adeline/Ashby, Center Street, and North Berkeley
Union Pacific	• Train tracks
Amtrak	• University Avenue passenger stop

Map 3.12 shows the location of major transportation infrastructure relative to seismic hazard planning zones. Designated evacuation routes[32] are indicated with purple lines. The Union Pacific railroad is indicated with a black hatched line along Berkeley's western shoreline. Interstate 80 and California State Highways 13 and 123 are indicated in red, running along Berkeley's western shoreline and traversing the southern end of Berkeley, respectively. The Bay Area Rapid Transit (BART) tracks are indicated in blue dashed lines, with station icons for the system's three Berkeley stations and the El Cerrito Plaza station in the City of El Cerrito provided for context. The Solano Tunnel, which provides a key north-south connection to vehicles in the eastern portion of the City, is indicated with a thick purple line.

Map 3.12 Seismic Hazard Planning Zones and Transportation Infrastructure



Railroad
State Highways
Emergency Access and Evacuation Routes
BART Stations
Solano Tunnel
Earthquake Fault Zone
Landslide Zone
Liquefaction Zone

Map 3.12 shows the potential exposure of all Berkeley's key transportation infrastructure to potential liquefaction, fault rupture and seismically-triggered landslides. The table below calculates the exposure of City-owned transportation infrastructure to each of these hazards.

Table 3.7 Curbs, Streets and the Solano Tunnel

Infrastructure Element	**Total Length**	**Length in Hazard Areas**		
		Earthquake-Induced Landslide Planning Zone	Fault Rupture Planning Zone	Liquefaction Planning Zone
Curbs	354 miles	44 miles (12%)	31 miles (9%)	93 miles (26%)
Streets	257 miles	42 miles (16%)	26 miles (10%)	68 miles (27%)
Solano Tunnel	0.09 miles	0 miles (0%)	0 miles (0%)	0 miles (0%)

Map 3.12 and Table 3.7 together indentify key areas of exposure within Berkeley's transportation infrastructure.

Over one quarter of all City streets are in the liquefaction hazard planning zone, meaning that vehicle movement in the western part of the city is likely to be impacted by liquefaction-caused earth movements in a major earthquake. This movement will also affect aboveground infrastructure (streets, curbs and sidewalks.) Transportation infrastructure west of Interstate 80 is especially vulnerable to liquefaction. Per Map 3.6, in a 7.1 Hayward Fault earthquake, 73 percent of this area is expected to liquefy. Transportation infrastructure in the area could be severely damaged. Additionally, emergency services vehicles may not be able to access the area, at least until the University Avenue overpass is inspected for damage.

One-quarter of City curbs are located in the Liquefaction Hazard Planning Zone. Curbs serve as water barriers to property when it rains, curbs function as part of the drainage system. If curbs are impacted by ground failure from an earthquake, they lose their ability to function in this way.

To the city's east, 16% 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 hills residents.

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.

The Solano Tunnel is an important connection in the north-south direction. It is not located in a hazard planning zone. However, it is situated in the direct proximity of the Fault Rupture Planning Zone, as well as the Earthquake-Induced Landslide Planning Zone. Should one of these hazards occur, access to Solano Tunnel could be limited or even impossible.

Key Transportation Partners

Partner-run transportation systems have varying levels of exposure to seismic hazards.

Map 3.12 shows that Interstate 80 sits entirely in the liquefaction hazard planning zone. Additionally, the liquefaction scenario map (Map 3.6) shows that in a 7.1 magnitude earthquake on the Hayward fault, 73% of the ground underneath Berkeley portions of Interstate 80 is predicted to liquefy. This is a major thoroughfare for Berkeley and the Bay Area overall.

Caltrans[33]

Caltrans is responsible for constructing and maintaining the statewide highway system. The 1989 Loma Prieta earthquake caused significant damage to Caltrans structures, such as bridges, overpasses and on-ramps. As a result, Caltrans launched a comprehensive review of earthquake safety on highways throughout the state. A program to retrofit all vulnerable structures was started and the two overpass structures in Berkeley, at Ashby and University Avenues, have already been strengthened. These retrofits were designed to prevent collapse in a major earthquake, but will not guarantee that these structures can be used after an earthquake. Depending on damage levels, demolition may be required. Caltrans also strengthened the City-owned approach ramps to the overpass on University Avenue to the same standards. Caltrans emergency response teams are trained to inspect their facilities and manage some elements of traffic flow after a major earthquake.

The City owns a portion of a structure at University Avenue that provides access to the state-owned interchange structure connecting to Interstate 80. The City portion of this structure extends over the railroad tracks and west to ground level. Caltrans owns the eastern portion. Caltrans retrofitted both the state-owned and City-owned structures in recent years to high standards of safety.

Bay Area Rapid Transit District (BART)[34]

The Bay Area Rapid Transit District (BART) provides an important public transportation link between Berkeley, San Francisco, and other Bay Area locations to 360,000 riders daily. 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, and these tunnels are generally considered low risk by BART engineers.

According to Map 3.12, within Berkeley, the BART system is not exposed to ground failure from earthquakes. However, Map 3.2 shows that BART infrastructure in Berkeley will be subject to violent shaking in a 7.3 magnitude Hayward fault earthquake.

Key Partner's Notable Mitigation Activities

In 2002 BART completed a study of the earthquake vulnerability of the entire system, analyzing multiple earthquakes, predicting damage, and assessing cost-effectiveness of retrofits. Upgrades to the system are being funded by $980 million in General Obligation Bonds, authorized by voters in Alameda, Contra Costa, and San Francisco counties, supplemented with an additional $240 million from other sources. Since 2008, retrofit has been completed on many elevated tracks, stations, parking structures, and rail yards. Work to upgrade the Transbay Tube seismic joints was completed in 2010. BART is continuing to secure the Transbay Tube to a higher level of strength against future large earthquakes. The current effort is expected to be completed in 2014. Evaluations of several other areas of the Tube are ongoing and further retrofits may be constructed in the future. At this time, those retrofits are expected to be completed in approximately 2018.

As part of the vulnerability study, BART determined that the Berkeley Hills Tunnel which crosses the Hayward fault may be damaged in an earthquake on that fault, cutting a key commuting link. Initial evaluations determined that retrofit or replacement of this tunnel were not viable options. BART continues to study the feasibility of adequately strengthening the tunnel but as yet there is not a retrofit solution that can appropriately achieve this goal. Therefore there are no current plans to perform retrofit construction on the tunnel. BART will however be prepared with materials and crews to respond quickly to any damage that may occur in an earthquake.

BART's investment in earthquake retrofit is strengthened by its earthquake early warning system, which can help prevent train derailments in the system by slowing or stopping trains upon notification of an earthquake. Currently, BART has a system in place, which is activated when an earthquake larger than magnitude 4 or 5 is experienced within the BART system. BART is working with UC Berkeley and others to implement a statewide earthquake early warning system. This system would issue notification to operators such as BART upon detection of P-waves.[35] Upon notification, BART would automatically slow or stop trains within the system. The length of advance warning depends on how far away the earthquake originates.

Communications System Earthquake Vulnerabilities

The table below shows key communications system infrastructure in Berkeley, along with the companies responsible for the systems.

Table 3.8 Key Berkeley Communications Systems

Owner/Manager	Infrastructure
AT&T	• Land line telephone distribution system that shares poles with PG&E in some locations and is located underground in other locations
Comcast and other companies	• Cable systems that share poles with PG&E in some locations and are located underground in other locations
Verizon, Sprint PCS, Nextel and other companies	• Cellular telephone antennae distributed throughout the city

Communications infrastructure is spread throughout Berkeley, and thus is exposed to all earthquake ground failure hazards.

Telephone and cable communications systems are almost entirely aboveground in Berkeley. Earthquake shaking can topple or break utility poles, and falling trees or collapsing structures can damage utility lines.

Additionally, Berkeley's underground utilities include communications conduits. Underground systems are particularly vulnerable to damage from ground failure in earthquakes. Displacement on the Hayward fault could rupture these systems, compromising these lifelines unless redundant connections unaffected by the earthquake are available. Ground movement due to liquefaction in the west and landslides in the east will also severely impact these systems. Liquefied areas may move laterally, breaking underground cables and damaging communication lines. Landslides can damage underground and aboveground communications infrastructure during earthquakes, or in separate slides that can occur for weeks or months following an event.

Underground damage is harder to detect and repair and the length of service losses may be greater than for aboveground systems.

Key Communications Partners

AT&T[36]

AT&T provides and maintains telephone service to Berkeley residents, along with internet access, Uverse Television Service, mobile telephone service, and other business services. The telephone wires, conduits, coaxial cables and fiber optic lines have been tested and designed to be highly resistant to earthquake shaking, and easy to reroute

should problems occur. For example, slack is provided in underground cables to permit earth movement without damage. All AT&T facilities have batteries that can run for four hours without electrical service, and many diesel generators are available to supplement the batteries if needed. Minimal water is required to keep the electrical equipment from overheating. AT&T expects some telephone outages, including mobile phone service, after a major earthquake, and service restoration would take hours to days, depending on location and the situation. A major earthquake could impact service in a 50 square mile radius. The central office in Berkeley, with major equipment, has been seismically strengthened, but it is possible that neighboring buildings that have structural deficiencies could collapse into this building and cause damage. If the central office building was completely destroyed, portable equipment and trailers could quickly reestablish service. AT&T is prepared to set up additional phone lines open to the public at a central location if major service losses occur.

The AT&T Network Disaster Recovery (NDR) team has managers, engineers, and technicians who receive special training in physical recovery of AT&T's network. Members participate in several recovery exercises each year to test, refine, and strengthen AT&T's business continuity and disaster response services in order to minimize network downtime.

AT&T's Network Disaster Recovery organization is responsible for the rapid recovery of service at AT&T sites following a catastrophic event.

In the case of an event or disaster the NDR has three primary goals:

1. Route noninvolved telecommunications traffic around an affected area
2. Give the affected area communications access to the rest of the world
3. Recover communications service to a normal condition as quickly as possible through restoration and repair

AT&T won Frost & Sullivan's 2010 Product Leader Leadership of the Year Award for Business Continuity and Disaster Recovery Services in North America.

Verizon Wireless[37]

Verizon Wireless serves its individual, government and business customers with voice and/or data services via Verizon's wireless cellular network.

Verizon has designed and built its network with day-to-day reliability and disaster resilience in mind. Since inception, all Verizon Wireless facilities in California have been built to the most stringent California building codes. Verizon also follows an internal Network Equipment Building System standard. Since 2004, Verizon has hardened its network by moving two of its Bay Area switching facilities to newly-constructed facilities. These facilities meet or surpass all then-current earthquake standards; they also provide additional redundancy with respect to capacity for battery back-up, generators,

fuel and HVAC. The facilities also have increased security through design and alarming capabilities. All major transport facilities (i.e., the links between switching facilities, network hubs, the internet, etc.) are fully redundant either through SONET Ring architecture or diverse path routing.

Verizon Wireless has worked with the City to place all 13 of its Berkeley cell site facilities. In the Verizon Wireless Northern California network, about two-thirds of all sites have permanent generators. This represents an approximately 250 percent since increase since 2004. In Berkeley in particular, cell site facilities have relatively few generators, with only 2 of the 13 sites so equipped.

In a disaster, Verizon's basic service mission does not change. However, it is understood that the network may be damaged from the impacts of a disaster, such as an earthquake, and that the demand on the network will simultaneously rise. In this case, the mission of Verizon Wireless will be to:

1. Restore and/or enhance the network as quickly as possible, to the greatest extent possible.

2. Assist with local communities' wireless communications needs to the greatest extent possible to enhance public safety and relief or rescue efforts.

Verizon's local network group trains and drills for disaster events, and local personnel have aided recovery efforts for other disasters outside the area, such as Hurricanes Katrina and Sandy. In the event of a disaster, Verizon makes the resources of the entire company available locally.

Comcast[38]

Comcast provides the following services to the Berkeley community:

- Voice (wireline telephone service)

- Video (television)

- Data (high-speed Internet, Wi-Fi hotspots, cellular backhaul services)

- Home security/home automation

Comcast's distribution telephony network depends on other communications providers. If supporting providers' networks are operational, Comcast will maintain connectivity to all its customers. If an individual network fails, Comcast will lose its connection to the customers using that particular network.

To protect its infrastructure in earthquakes and other disasters, Comcast has hardened all its sites. Additionally, all sites are connected via redundant fiber networks to maintain service to greater service areas. Major metro fiber routes are backed up by redundant routes and failover technologies.

After a catastrophic earthquake, due to facility redundancy of backbone/regional networks, Comcast expects that transport of major traffic should continue. However, local serving areas are more likely to experience gaps in service due to lessened redundancy between headend facilities[39] and customer homes.

In the event of a power outage, Comcast will use battery backup to maintain service for up to eight hours. Comcast monitors its power supplies, and in the event of the backup batteries being depleted, generators are in place to maintain service.

Comcast's ability to recover from facility damage after an earthquake will be determined by its ability to access headend locations, as well as to refuel generators if commercial power is lost. Customers may experience a total loss of video service, and total loss or severe network congestion of voice and data services. Comcast also provides cellular backhaul services[40] for Verizon Wireless. Impacts to Comcast's infrastructure could potentially impact Verizon's service to its customers.

Critical Response Facilities

In addition to the infrastructure mentioned above, a key network of facilities supports disaster response activities. This network includes facilities owned by the City, as well as others owned by the City's key partners. Map 3.13 shows the locations of these facilities relative to seismic hazard planning zones. Because these facilities serve the whole Berkeley community on a day-to-day basis, they are positioned throughout the City.

Recognizing that these facilities will need to be as usable as possible following a catastrophic earthquake, the City has put major effort into ensuring seismic stability of these buildings:

- The Public Safety Building was built in 2000 to essential services standards. This facility houses the Police Department Headquarters and 9-1-1 Communication Center, the Fire Department Headquarters, and the City's primary Emergency Operations Center.

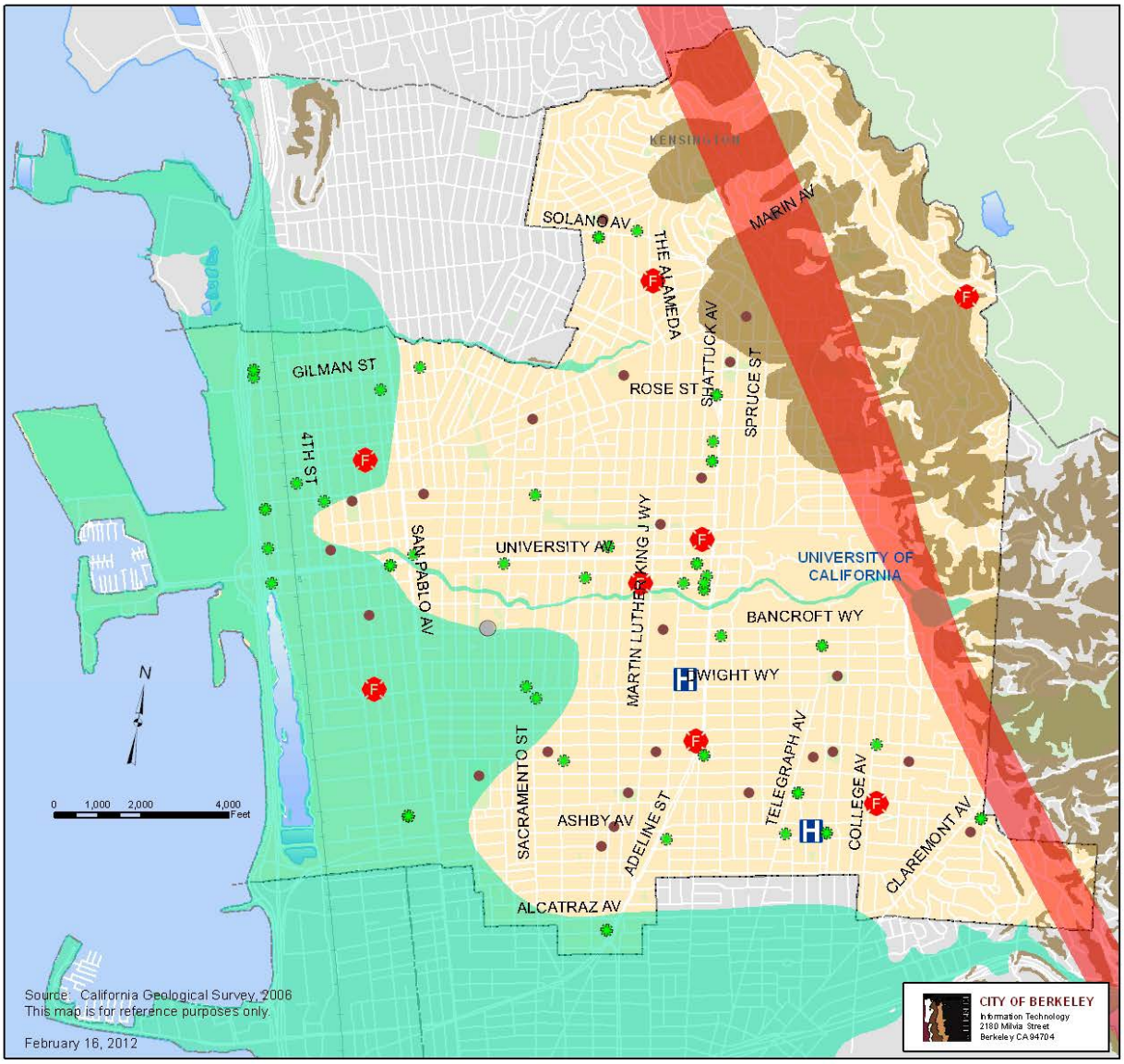
- The City's seven fire stations have all been retrofitted or built to essential services standards.

- City libraries serve as community gathering points both prior to and following disasters. The City's Main Library, which underwent a complete retrofit in 2002, is planned for use as a disaster volunteer reception center. In 2009, the Branch Library Improvement program began work to renovate the City's four branch libraries for seismic safety.

- 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.

- City recreation centers and senior centers are considered potential disaster shelter sites. All of these sites need to be evaluated for their seismic resistance and vulnerabilities. Appendix B: *List of City Owned and Leased Buildings* details construction history and condition of City facilities.

Map 3.13 Seismic Hazard Planning Zones and Critical Facilities



Key Critical Response Facility Partner: Hospitals

Hospitals are not operated or owned by City government, but they are critical to disaster response: Following an earthquake, hospitals must be able to care for not only their existing patients, but also a surge of new patients who are injured in the earthquake.

In 1973 as a direct result of the devastation caused by the 1971 San Fernando earthquake (65 deaths and a hospital collapse), the State Legislature passed the Alfred E. Alquist Seismic Safety Act. The Act requires every hospital in California with acute care patient facilities to be built to higher standards than other buildings so they can be reoccupied after major earthquakes. Eleven years later, following the 1994 Northridge earthquake, Senate Bill 1953 expanded the scope of the 1973 Act, requiring:

- By 2002, all critical non-structural components in surgery and emergency medical rooms be retrofitted;
- By 2013, all hospital buildings built before 1973 be replaced or retrofitted so they can reliably survive earthquakes without collapsing or posing threats of significant loss of life; and
- By 2030, all existing hospitals (including those built after 1973) be seismically evaluated and retrofitted, if needed, so they are reasonably capable of providing services to the public after disasters.

The Office of Statewide Health Planning and Development develops and regulates seismic performance standards for hospitals.

Alta Bates Summit Medical Center[41]
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 rehabilitation 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.[42] 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.[43] Four buildings at the Herrick Campus contain acute care facilities and are considered to be a significant risk to life safety. [44] The acute care functions housed in these buildings are all being relocated into seismically compliant portion of the Herrick campus prior to the end of 2013.

UC Berkeley Tang Center
The Tang Center is a fully-accredited ambulatory health facility serving the students, faculty and staff of the University of California, Berkeley. The Center provides medical

care, including primary and specialty services, supported by a pharmacy, high complexity CLIA-certified lab, physical therapy, immunization/travel services, a medical records department, radiology services and advice nurse access. The Center also offers counseling, social services and psychiatric care to support students' academic success.

The Tang Center's disaster response role depends on the needs at the time of the event. In a localized emergency, the Center may provide for members of the campus by addressing mental health needs, distributing vaccinations, assisting with relocation, or by providing other support services. In a catastrophic earthquake, the Tang Center will use available resources to triage and care for campus persons, but the Center will require additional resources to care for large numbers of people who may present. By providing care on campus, the Center will help to reduce demand on local emergency rooms from people who do not need tertiary care.

The Center coordinates its disaster readiness activities with both the City of Berkeley's Public Health Division and the Alameda County Public Health Department. Relationships between these entities have been built over many years, establishing the understandings and relationships that will support effective disaster response.

In 1993, the Tang Center was constructed to an essential facilities standard, due to both its health-related mission and its then-designation as a backup Emergency Operations Center for the campus.[45] Since then, the Center has taken nonstructural mitigation steps to reduce the risk of injury to patients and staff during an earthquake, and to speed the Center's ability to return to function following an earthquake.

To secure access to electronic health records, the Center moved its clinical management system to a hardened data server on campus, and is arranging a "hot" standby server out of the area.

The Center has located shipping containers adjacent to the building to store to medical supplies to support basic triage immediately following a major earthquake.

This fall, the Center and the City's Public Health Division successfully tested their two-way communications capability via the California Health Alert Network. They also participate in planning and drills for various emergency scenarios, including loss of water and power.

Currently, the groups are developing a Memorandum of Understanding to store a cache of State disaster medical supplies on campus.

Lifelong[46]

LifeLong delivers comprehensive medical, dental, mental health and social services to help low-income people of all ages in Contra Costa, Marin and Alameda Counties. LifeLong currently operates 11 primary care health centers, two dental clinics, two school-based health centers and six supportive housing sites. In 2012, LifeLong served over 43,000 patients in 224,193 encounters.

LifeLong's programs and services are designed to give everyone a chance to live a healthy life, including individuals and families who are struggling to get by. As a safety-net provider of health services, LifeLong aims to address gaps and promote wellness throughout the communities it serves. Services are designed for people who have difficulty accessing care through traditional paths, due to factors such as lack of insurance, homelessness, or cultural and linguistic barriers.

Lifelong's Berkeley facilities and their services to the community are described in the table below:

Table 3.9 LifeLong Berkeley Healthcare Facilities

Name	Service Type	Community Members Served
Berkeley Primary Care	Primary Care Health Center	2,500+ patients/month
LifeLong West Berkeley	Primary Care Health Center	3,000+ patients/month
Over 60 Health Center	Primary Care Health Center	1,800+ patients/month
LifeLong Dental Care	Dental Clinic	700+ patients/month

Following a disaster, LifeLong plans to coordinate with local hospitals to provide care to an anticipated surge of patients. LifeLong expects that an influx of new patients from surrounding neighborhoods will seek care at its sites, and that in the event of a disaster it will need to perform more basic first aid and trauma management at its facilities. To this end, LifeLong plans to care for the "walking wounded and worried well," while sending its urgent care patients to hospitals.

Notable Mitigation Activities

Many facilities were seismically retrofitted prior to 2004, to help make facilities ready to provide care following an earthquake. Currently, the LifeLong West Berkeley Health Center is undergoing major renovation to expand and enhance service to patients. This construction includes both structural and nonstructural mitigation efforts.

LifeLong actively coordinates with local government on disaster readiness activities. LifeLong participates in Alameda County's regular disaster preparedness meetings, and is working with the County on an MOU that would identify LifeLong a County partner in disaster response. LifeLong also exercises communication capabilities with the City during Statewide disaster drills.

Additionally, LifeLong works to increase disaster readiness through community groups. Through the Heart 2 Heart (H2H) program, LifeLong worked with the City and other partners to help the McGee Avenue Baptist Church to become eligible for a disaster equipment cache, which was awarded by the City. H2H is currently collaborating with other community groups in the Oregon Park neighborhood on disaster readiness

activities. Most recently, LifeLong awarded an H2H mini-grant to the Collaborating Agencies Responding to Disasters (CARD) organization.

Key Critical Response Facility Partner: Public Schools

Public schools are not operated or owned by City government, but they are critical to disaster response: they may be used for temporary sheltering of people displaced from their homes following an earthquake. Schools also support disaster recovery, providing a welcome return to normal routines for children, and childcare so that parents can rejoin the workforce.

Unlike laws and regulations for privately-owned buildings, there is a statewide approach to retrofitting and upgrade of existing schools, which must meet special earthquake design standards. The Division of the State Architect is the review agency for the design and construction of public K-12 school facilities in California. The Field Act, originally passed in 1933, 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.

Up until June 30, 2006, community colleges had to comply with the Field Act. In 2006, Assembly Bill 127 was passed, giving community colleges the option of choosing to design and construct under local building codes or under the Field Act.[47]

Only some charter school buildings are subject to Field Act provisions. Many school and building officials are unclear about the rules that apply when the Field Act does not.[48]

Berkeley Unified School District[49]

The Berkeley Unified School District, a special local government district, manages primary and secondary education and educational facilities, including all public schools in the city. City government provides police and fire services to the District, but has limited authority over these structures.

In 1989, shortly after the Loma Prieta earthquake, the District hired engineers to evaluate the structural safety of the buildings. Engineers found significant problems at many schools. The District's Board took swift action. Within a year, the District closed a number of schools, took precautionary measures at ones that remained open, and developed a plan of action to correct safety problems within the District as a whole.

Local voters have approved several bond measures to renovate and modernize city schools. In June 1992, local voters approved a bond measure to raise taxes to provide $158 million to renovate and modernize the city's schools. In November 2000, voters approved another supplemental bond measure for the safety program totaling an additional $116.5 million. In the years since voters approved the original tax measure, all of the schools identified by the engineers have been seismically strengthened or demolished and replaced.

Notable Mitigation Activities
As of 2013, all District pre-K, K-12, adult, transportation, and administration buildings requiring retrofit under the Field Act and subsequently adopted State safety laws have been retrofitted.

In November 2010, Berkeley voters approved Measure I, funding improvements to school safety and facilities. Seismic work funded by the measure includes:

- Demolition of the Old Gymnasium at Berkeley High School.
- Replacement of the unreinforced masonry building at the BUSD corporation yard that functions as its maintenance facility (due to begin work in 2016).

In 2012, the District moved its administrative offices out of the seismically-unsafe Old City Hall and into a newly-renovated building on Bonar and University.

In addition, as the building code becomes more stringent, Berkeley continues to improve the seismic safety of its schools. For example, Berkeley plans to do a voluntary upgrade of the Jefferson Elementary School over the next two years.

Berkeley City College[50]

Berkeley City College is a community college serving about 4,500 students in downtown Berkeley. It recently constructed a new building on Center Street to serve as its permanent home. This building, funded by two local bond measures, is a state-of-the-art facility meeting the latest seismic and fire safety codes. The building's primary Emergency Operations Center (EOC) is located in the Auditorium, Room 021 and Atrium. Its secondary EOC is located in the Learning Resources Center. The EOC will be connected to the Alameda County Sheriff and the Peralta Community College district headquarters through short-wave radio.

UC Berkeley Campus

UC Berkeley is a major institution separate from the City but located at its core. 36,000 students, 2,100 faculty and over 11,000 staff work or study on campus.[51] The Hayward fault runs through the eastern half of the UC Berkeley campus, and beginning in the early 1970's, the University began earthquake vulnerability studies and retrofit projects, championed by senior University officials. In the early part of 1997, the campus reassessed the condition of its buildings and began an effort to comprehensively address its seismic risk. The SAFER Program (Seismic Action Plan for Facilities Enhancement and Renewal) was launched through Chancellor Robert Berdahl and Vice Provost Nicholas Jewell. A 1997 structural survey of existing campus buildings revealed that about 27 percent of the building space could perform poorly in a major local or regional earthquake.[52] These findings led to SAFER effectively becoming a physical renewal plan for UC Berkeley's built environment. Since 1997, $500 million worth of seismic improvements have been made to campus buildings and, as of early 2006, work has been completed or started on 72 percent of the square footage identified as needing seismic improvement.[53] The seismic improvement work completed at UC Berkeley has reduced

by half the life safety risks for students, faculty, and staff and has cut the risks of potential earthquake-caused economic losses by 25 percent.[54] Planners and executive staff also devoted attention to a wide range of disaster preparedness efforts, ranging from emergency preparedness to facilities and lifeline planning, along with a robust financing strategy.[55]

The City and the University have independent disaster planning programs. However, their risks are inextricably intertwined. A significant portion of UC Berkeley students, faculty and staff live in the city and rely on Berkeley's private industries, housing, and infrastructure. The city's condition after a disaster directly impacts the ability of the University students, faculty and staff to continue their work. Likewise, the city depends on the jobs, commerce, and income created by the University. This means that the viability of University labs, research and other facilities after a disaster has a large influence on the current way of life. The University depends on the City's fire, search and rescue, and hazardous materials emergency services for the campus. Therefore, the risk of fire and catastrophic building collapses on campus directly impacts the capacity of the City's emergency responders. It is in the mutual interest of both the City and the University to coordinate disaster readiness efforts.

Berkeley Lab[56]

Berkeley Lab serves as a host for and employer of 4,200 scientists, engineers, support staff and students, and some 2,000 participating guests annually.

Berkeley Lab is located northeast of the UC Berkeley campus, on hill slopes adjacent to parkland. Parts of the Lab are located in the planning zones for fault rupture and earthquake-induced landslide. However, geologic investigations have indicated that the campus is not vulnerable to fault rupture, and buildings are not vulnerable to landslides.[57]

Berkeley Lab has an in-house, ongoing program to regularly review and update information on the seismic condition of its buildings. Several buildings have been strengthened in the last two decades due to the findings of these assessments. Non-structural mitigation safety measures are part of Berkeley Lab policies and procedures, and are inspected regularly.

The Lab's emergency management function is administered through the Berkeley Lab Emergency Services Program. The mission of the Lab's Emergency Services Program is to prepare for, respond to, recover from, and mitigate all natural or manmade hazards to Berkeley Lab.

Berkeley Businesses

Businesses are vital to the economy of the city and provide jobs to city residents. Ensuring that businesses and employers can return to normal function quickly will in turn ensure that the city recovers quickly from a disaster.

Table 3.10 Ten Largest Berkeley Employers

Employer	Number of Employees
University of California, Berkeley (Oct. 2012)	21,809
Berkeley Lab (website)	4,200
Alta Bates Medical Center (2012)	2,621
City of Berkeley[58]	1,301
Berkeley Unified School District	1,194
Bayer Corporation	1,350
Kaiser Permanente Medical Group	819
Berkeley Bowl[59] (2011)	768
Berkeley YMCA	358
Berkeley City College	281

3.3.4 Earthquake 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.

However, 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
For the 2004 version of this plan, a magnitude 6.9 scenario earthquake on the Hayward fault underneath Berkeley was simulated using HAZUS.[60] These 2004 loss estimates have been combined with impact descriptions from newer HAZUS scenarios for a larger earthquake.[61] Together, these scenario descriptions create a broad picture of the impact to Berkeley from a catastrophic earthquake. HAZUS predicts:

- 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.

- In the first day following the earthquake[62], fires could ignite in six to twelve[63] different locations around the city. The City's Fire Department is equipped to respond to one two-alarm fire or two single-alarm fires simultaneously. 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 $30 to $60 million[64] of damage to structures in Berkeley.

- 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. "Traditional" household waste volumes will also increase due to large amounts of spoiled food resulting from power outages and other debris from residential cleaning. Equipment beyond the current capacity of the region's private waste management companies will be needed to clear debris. Transportation routes will need to be cleared and restored to move debris out of damaged areas. Before heading to landfill or recycling areas, debris must be sorted at separate facilities. A key challenge will be the disposal of large amounts of contaminated, electronic, and hazardous materials waste. Landfill space is scattered throughout the region.

Buildings

Over $1.8 billion[65] 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.

From 3,000 to 12,000 households will be displaced from their homes after the quake. About 200 more families will be forced to leave their homes due to fire damage. This represents up to a quarter of households in the city. 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.

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.

Infrastructure

Sanitary Sewer System

Interceptors (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.

Water System

Water service is likely to stop functioning in up to 70% of Berkeley homes within 12 hours of the earthquake, when local reservoirs and tanks drain and are not resupplied. Although most water service will be restored within 10 days[66], water outages will last up to 50 days, with residents needing to purchase bottled water or collect water from tanker trucks at central locations.

EBMUD serves Alameda County and has strengthened its water treatment plants and major aqueducts. Of particular concern, however, are underground pipes, which distribute water from larger aqueducts to customers. The buried pipes will be particularly vulnerable to breakage in areas of major liquefaction such as in Richmond and Oakland along the Bay. EBMUD's Claremont Tunnel has been seismically retrofitted and is not likely to be vulnerable to landslide. It may incur fault offset of up to 7.5 feet immediately but this effect has been incorporated into the mitigation design.[67]

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. The majority of electrical power in the region is transmitted by Pacific Gas & Electric Company (PG&E). Most of PG&E's electrical substations in the Bay Area were built in

the 1900s and 1920s. Although mitigation efforts have been made, significant damage to these buildings is expected. Underground cables that cross liquefiable and weak soils are vulnerable. Immediately after the earthquake, PG&E is likely to initiate power shedding to balance the grid, followed by a progressive blackout of the Bay Area to prevent cascading power failure.

Damaged sections in the transmission and distribution system will need to be repaired or bypassed. Before electrical circuits are energized, inspections for gas leaks in impacted areas will be necessary. Under the normal circumstances, it takes 2 to 3 days to restore a transmission system. Impeded accessibility as well as workforce shortages will, at the minimum, double restoration times.

Natural Gas

PG&E is the provider of natural gas in the Bay Area. Across the Bay Area, ground failure is expected to damage the network of pipes beneath city streets. Hundreds of breaks in mains, valves, and service connections will occur. Broken gas mains could fuel street fires. Structural fires will occur as a result of broken service connections.

Restoration of service across the Bay Area could take as long as two months for customers because individual connections will need to be inspected and appliances re-lighted. Most gas shutoffs are expected to be initiated by cautious customers.

Hazardous Materials Management

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 accidents following an earthquake.

Transportation

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.

The Caldecott Tunnel provides the central link between Contra Costa and Alameda, carries Highway 24, as well as main electrical and gas, transmission lines beneath the roadway. Adjacent, separate tunnels are used for BART and water pipelines. The Claremont Tunnel (EBMUD) has been retrofitted. The BART tunnel is vulnerable to closure due to landslide. If the utilities or mass transit below the roads are damaged, Highway 24 will be closed for months for reconstruction.

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. Additional ferries and bus lines could be established within a week to provide substitutes for BART.

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. As yet, retrofit or replacement of this tunnel is not a viable option and BART has instead developed plans to quickly return this section to service. Depending on the amount of damage sustained, the line could return to partial service within weeks of an earthquake with full replacement potentially taking several years to complete. This will cause inconvenience to many Berkeley residents and may change employment patterns. Temporary transport options, such as buses and increased use of individual cars, are likely to be more polluting than BART. In general, the traffic on all Berkeley roads and highways will probably increase for at least two years following the earthquake. Since 2008, retrofits have been completed on many elevated tracks, stations, parking structures and rail yards. At this time, all retrofits are expected to be completed by approximately 2018.

Communications

AT&T
Telephone services, including mobile phone and internet, will be down for days to a week.

An overload of post-earthquake calls in the region will make phoning difficult. Carriers will block the calls coming into the region to relieve circuit overloading. Outbound calls, as well as text messaging, are likely to be available. The region's telecommunications companies will prioritize calls to allow emergency responders to communicate by phone.

Customers located in areas subject to severe ground shaking and high probability of ground failure may lose land-based connections to the telephone system. Access for repairs in those areas will be a major problem.

The cellular phone system relies on the integrity of antennas that are mostly located on building tops. Cell phone calls typically connect to the same landline systems that will be hampered by the expected overload of calls.

UC Berkeley
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 dormitory 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. 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.

Businesses
Additional losses to income will likely occur due to Berkeley business closures, estimated at $265 million.[68]

Rebuilding

Based on experiences in New Orleans and other 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 up-ended 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.

An event similar to this scenario is likely to occur in the next few decades. Earthquakes causing significantly more or less damage are also possible.

3.4 *Wildland-Urban Interface Fire*

There are two primary types of wildfires: "wildland" fire and "wildland-urban interface" (WUI) fire. WUI fires occur where the natural landscape and urban-built environment meet or intermix. There may be a distinct boundary between the built and natural areas, or development or infrastructure may be intermixed in the natural area. WUI fires primarily cause damage to the natural and built environment, as well as injury and death of people and animals.

3.4.1 Historical Wildland-Urban Interface Fires

Berkeley has significant WUI fire history, most recently in the October 20, 1991 Tunnel Fire. This fire in the Oakland/Berkeley hills was declared the most destructive wildland-urban interface fire in United States history. It started the day before as a vegetation fire in the drought-dried hills east of Oakland. It was reignited and whipped into firestorm proportions by 20-30 mph winds, gusting to 60 mph, and spread within minutes 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. Sixty-two single-family homes[69] were destroyed in Berkeley. Ten thousand people were evacuated from the hills areas. Most of the 25 people killed in the blaze were trying to evacuate when they were killed. FEMA estimated the damage at $1.5 billion in 1991 (approximately $2.5 billion in 2013 dollars[70]).

The 1991 firestorm also caused $3 million of damage to Berkeley's public infrastructure[71]. The 2,000-degree fire affected utility systems, including power, gas, telephone and water. Ten key water tanks were drained at the peak of the fire as a result of unprecedented demand from firefighting units, fire prevention measures by homeowners (e.g. wetting roofs with garden hoses), and broken water service connections in burned homes. Early in the fire, burning power lines and melting underground services resulted in a loss of power, which affected water system pumping plants. A total of eight pumping plants, which refilled the water tanks being used by fire fighters, lost power by the first afternoon. Although these were restored by evening, the capacity of the water system pumps was far less than the amount of water used by firefighters and spilled by broken connections.

Total damages in the city of Berkeley, including loss of private structures, loss and damage of public infrastructure, and the cost of City services, are estimated at $61 million.[72]

The day of the 1991 fire, the Bay Area experienced high temperatures of 80-90 degrees, and unusually hot, dry winds blowing from the east, rather than the normal, moisture-laden western winds from the ocean. This type of wind, referred to as Foehn or Diablo winds, occurs only eight to ten days per year, generally in fall. These winds, combined with the high temperature, low humidity, and built-up dry fuel load created the "critical fire weather" that resulted in the Tunnel Fire. The firefighters were helped when on the second day, the winds shifted to the west and cooler temperatures and fog rolled in.

Historically, major fires have occurred in the wildland-urban interface under virtually the same critical fire conditions. The table below identifies significant WUI fires in Berkeley history.

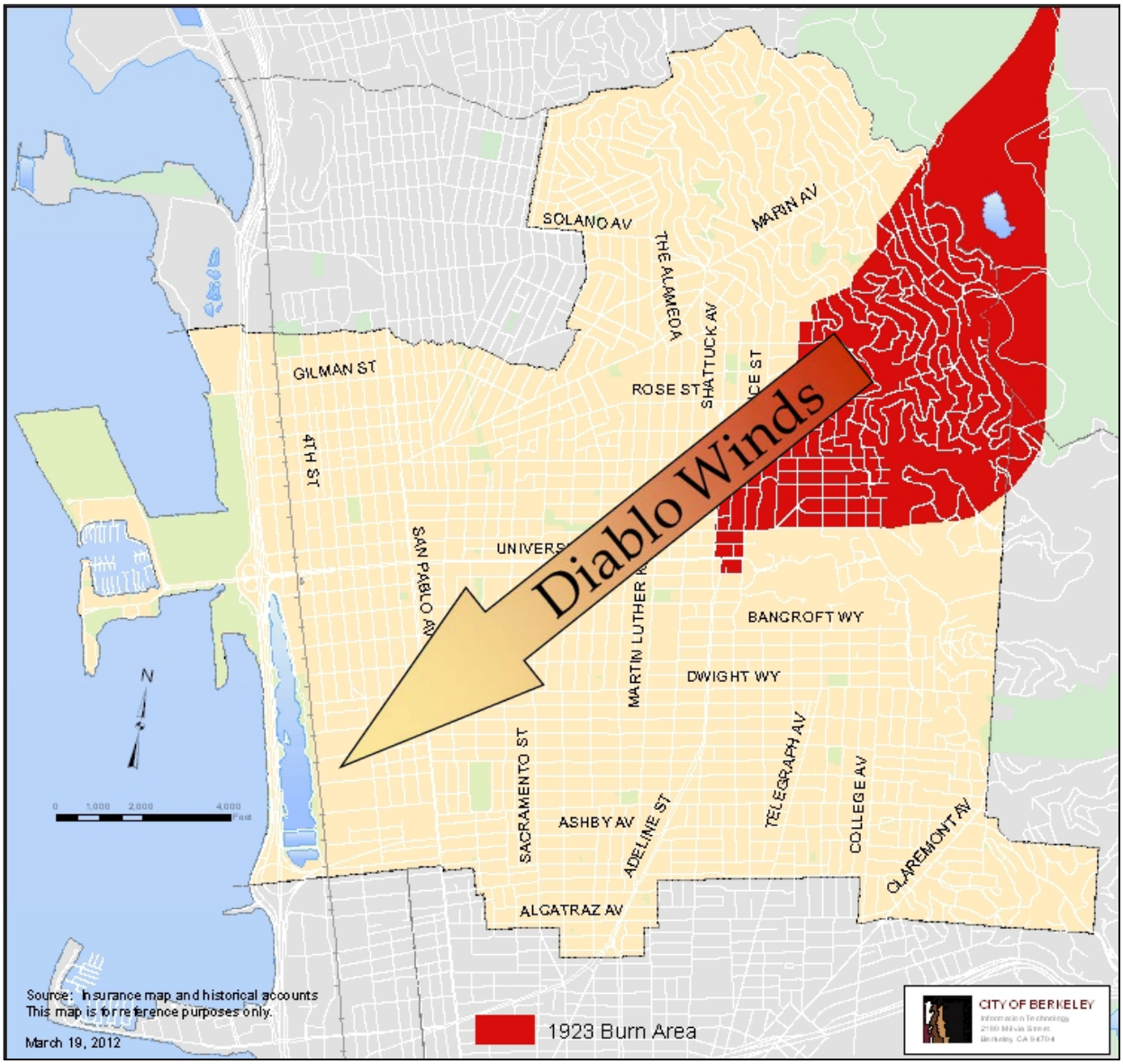
Table 3.11 History of Major Wildland-Urban Interface Fires in the Oakland/Berkeley Area[73]

September 17, 1923	Berkeley Fire	568 structures
September 22, 1970	Fish Canyon Fire (Oakland)	39 structures
December 14, 1980	Wildcat Canyon Fire (Berkeley)	5 structures
October 20, 1991	Tunnel Fire (Oakland/ Berkeley)	3,354 dwellings; 25 lives lost

The Berkeley Fire of 1923 began in the open lands of Wildcat Canyon to the northeast and, swept by a hot September Diablo wind, penetrated residential north Berkeley and destroyed nearly 600 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. 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. Historical analysis of newspaper reports after the fire indicates that significant acreage was burned in both Strawberry and Claremont Canyons. Because there were few, if any structures in these areas, the full scope of the fire has been underreported in subsequent years. 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[74].

Map 3.14 depicts in red the area burned by the 1923 fire. It also overlays the Diablo wind pattern to demonstrate how the fire could have spread into the Berkeley flatlands, had it not been for the change in wind direction.

Map 3.14 Area burned by 1923 Berkeley Fire



3.4.2 Wildland-Urban Interface Fire Hazard

The City of Berkeley faces an ongoing threat from a very likely wildland fire along its hillsides, where wildland and residential areas intermix. Wildland-urban interface (WUI) fires can be sparked by both human activity and natural causes. Once ignited, these fires can be difficult to contain when they occur during extreme fire weather conditions. A WUI fire can move with breathtaking speed, expanding to one square mile in under an hour, and consuming hundreds of structures in an hour.

Hot, dry, windy weather often coincides with WUI fires. WUI fire spread is affected by wind speed and direction, fuel and topography. Dry, dense vegetation feeds fires, including some residential landscaping. Wooden homes also serve as fuel for fire. Tall trees, present throughout Berkeley, can harbor canopy fires at the treetops that contribute to fire spread and are particularly difficult to fight. Fire spreads uphill quickly.

Fires burn buildings and threaten infrastructure. The intense heat associated with a firestorm can deteriorate concrete and asphalt pavement, curbs, sidewalks, and drainage structures. Other infrastructure that burns includes aboveground wiring for electricity, telephone and cable, and poles for lights and street signals.

In addition to impacts on the natural and built environment, fire has impacts to public health. Fires can result injuries and death from burns and smoke inhalation. Air pollution from fires can cause eye and respiratory illnesses, and can exacerbate asthma, allergies, chronic obstructive pulmonary disease, and other cardiovascular diseases.

Secondary Hazards: Landslide and Flooding
WUI fires can increase an area's risk of landslide and flooding. Fire season in the Bay Area is late summer to fall. 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. When winter rains come, this leads 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,[75] [76] making it a secondary hazard that must be mitigated immediately after a fire.

3.4.3 Exposure and Vulnerability

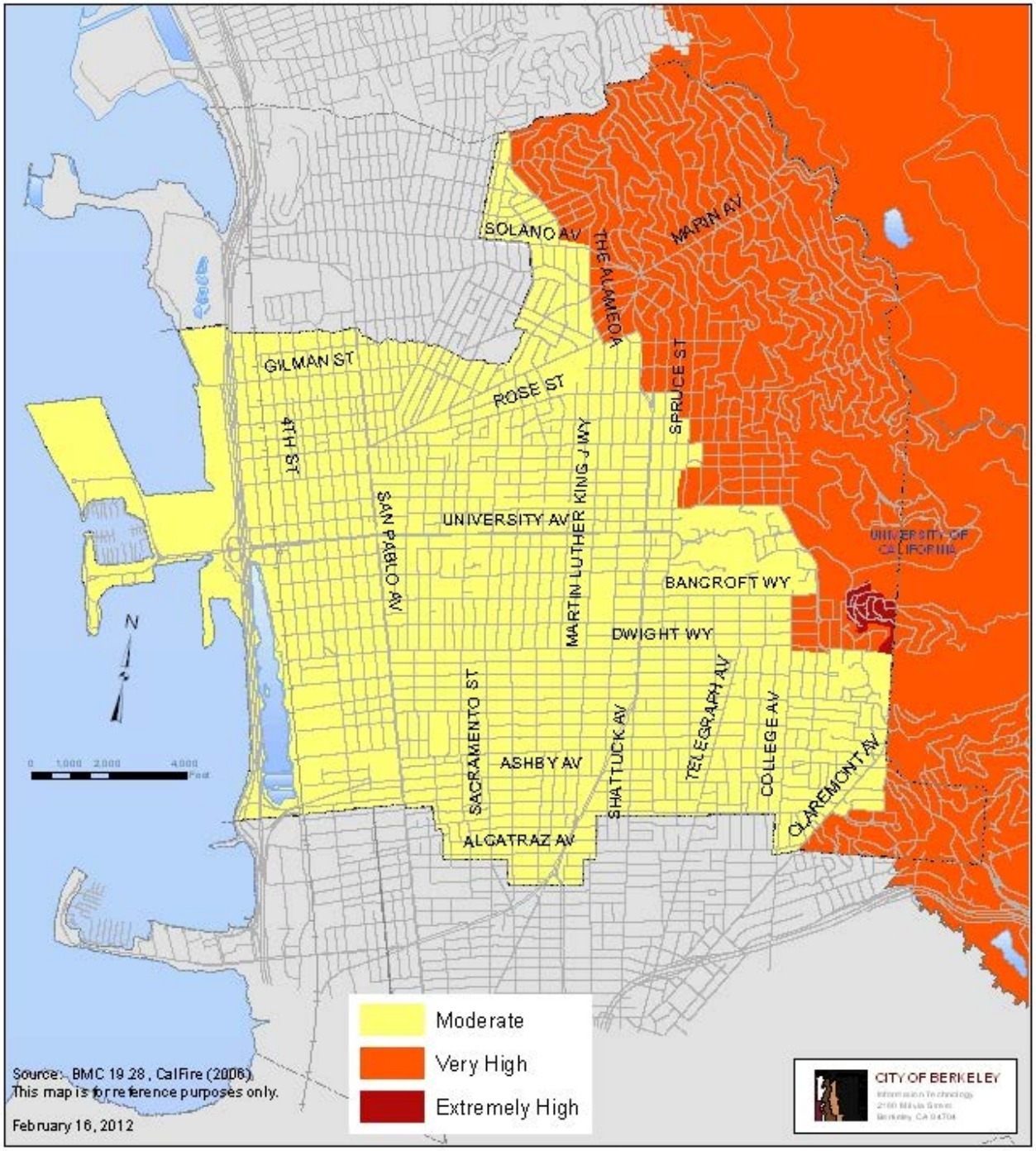
Berkeley is most vulnerable to a wind-driven fire incident originating in an area adjacent to the City's eastern border, in land owned by UC Berkeley, Berkeley Lab, the East Bay Regional Park District, the City of Oakland or Contra Costa County. The WUI fire risk facing Berkeley's wildland-urban interface area is compounded by the area's mountainous topography, its limited water supply, its minimal access and egress routes, and its location, overlaid upon the Hayward Fault. These factors have all contributed to the area's significant WUI fire history. Given the right wind conditions, a fire in one of these areas could quickly enter and encroach itself in Berkeley.

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. Currently, the Berkeley Fire Department currently has divided the city into Fire Zones 1, 2, and 3, designated in order of ascending fire risk. These zones are shown in Map 3.13: *City-designated and Calfire hazardous fire zones.*

Fire Zone 3 is the Panoramic Hill area specifically; Fire Zone 2 covers the remainder of the city's eastern hills; Fire Zone 1 covers the rest of the City west of the hills. Fire Zones 2 and 3 currently include about 8,300 properties. 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.

Map 3.15 City-designated and Calfire hazardous fire zones



While much of the concern for fire is placed on the hills, Berkeley's flatlands are at risk as well. The flatlands are densely covered with old wooden buildings that have narrow side yards and dense vegetation. Most of these houses are old and not built with modern, fire-resistant materials. They have a high risk of damage in an earthquake, which could spark multiple ignitions, for example, by damaging gas/electric lines.

Panoramic Hill Area

The Panoramic Hill area (labeled as the "Extremely High" Fire Zone on Map 3.13) has the greatest WUI fire vulnerability.

It is a wildland-urban interface area located on a hill above Memorial Stadium, between Strawberry Canyon to the north and Claremont Canyon Nature Preserve to the south. The ample vegetation in both canyons adds to the neighborhood's WUI fire risk. Many of the homes in this area have wood shake and shingle roofs and are surrounded by brush-type vegetation. Panoramic Hill also 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.

The neighborhood lies in both Berkeley and Oakland. There are about 280 dwelling units on Panoramic Hill, including 215 dwelling units in the Berkeley part of the neighborhood. There are approximately 520 residents in the area, including close to 100 in Oakland. The area is surrounded by the Berkeley Lab, the University of California, Berkeley (Clark Kerr campus) and the East Bay Regional Park District.

The Hill's limited water supply, access/egress routes, and its exposure to fault rupture further exacerbate the area's WUI fire risk above that of Fire Zone 2.

Water Supply Limitations

Water supply to the Panoramic area is limited to one undersized water main. If the main is damaged by an earthquake or landslide, any area beyond the point of the break will be without water service. This is different from other areas in the hills and flatlands, where the "gridded" structure of the water system allows for more redundancy in the event of a water main break. In Panoramic Hill, an earthquake could spark a fire, which could be fueled by damaged gas lines. Damage to the area's one water main from an earthquake or resulting landslide could limit residents' and professionals' ability to suppress the fire. This sequence of events could devastate the neighborhood and grow into a firestorm, threatening other parts of the city and neighboring jurisdictions.

Access and Egress

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.

History demonstrates that endangered residents in the path of a major fire will attempt to leave the area via private vehicles crammed with personal belongings. When there is another major hill area fire or an earthquake, emergency access and egress on the substandard road will be highly constrained. People trying to leave a dangerous condition will conflict with emergency personnel trying to address it or trying to reach others who need help to leave. Further, an earthquake-induced landslide impacting Panoramic Way could also block any vehicles from entering or leaving the area.

Exposure to Fault Rupture

Further intensifying the neighborhood's vulnerability, the Hayward Fault runs under Panoramic Way, just before it crosses the parking lot and bisects the Memorial Stadium. In a Hayward Fault earthquake, the Panoramic Hill area will likely be isolated from the City's emergency services, all of which lie on the other side of the fault to the West (with the exception of Fire Station 7, which lies north of the UC Berkeley campus).

Notable Mitigation Activities

The City, working together with key partners, is using a comprehensive strategy to aggressively mitigate Berkeley's WUI fire hazard. These approaches include prevention through development regulations; natural resource protection through vegetation management; improvement of access and egress routes; and infrastructure maintenance and improvements to support first responders' efforts to reduce fire spread.

Prevention

The City enforces several programs to reduce Berkeley's fire hazard, especially the WUI fire hazard in the hills. These include strict building and fire code provisions, as well as more restrictive local amendments[77] for new and renovated construction, and vegetation control inspections in high-risk properties.

Panoramic Hill Area Development Regulations

Following the 1970 Fish Canyon Fire, the Planning Department established the Berkeley portion of the area as an ES-R (Environmental Safety-Residential) zone. This action limited the use of land and the size and occupancy of residential structures in the area. The ES-R regulations are the most stringent residential standards in the Berkeley Zoning code.

The City has continued to adopt strict standards that curtail development on Panoramic Hill, so that as few additional people as possible are placed at risk until the area's underlying infrastructure issues are addressed. In 2008, City Council adopted a moratorium on development on the hill. In May 2010, the Council repealed the moratorium, passing an ordinance that blocks establishment of any residential units on the Hill. The restriction remains in effect until Council adopts a Specific Plan for the area's land use. The Specific Plan must include:

- Proposals for water, wastewater and storm water systems
- Proposals for a circulation system adequate to accommodate projected traffic, and to provide for emergency access to the area
- An action plan and finance measures necessary to carry out the Specific Plan.

Because the neighborhood resides in both Berkeley and Oakland, in 2006, the Alameda County Local Agency Formation Commission (LAFCo) expanded Berkeley's Sphere of Influence to include the Oakland part of Panoramic Hill. LAFCo acted to do so despite opposition letters from the City Manager of the City of Berkeley and City Administrator from City of Oakland. LAFCo's action means that the City of Berkeley is now officially charged with planning for all of Panoramic Hill, including those areas currently in Oakland. While Berkeley must consider the entire Hill in its planning documents, it only gains zoning authority if those portions of the Hill in Oakland are annexed to the City of Berkeley – a long and complicated process requiring agreement of both Cities.

Since it is highly unlikely that there will be City funds available to undertake the planning and then the design and construction necessary to address the area's infrastructure deficiencies in the foreseeable future, existing land and homeowners in Berkeley and Oakland will likely need to collaborate to provide the necessary funding for a Specific Plan. Grant funding may also be available to undertake some of the necessary planning, design and construction.

Natural Resource Protection

The Hazardous Fire Area Inspection Program is in place for a subset of properties within Fire Zones 2 and 3. Each year, Fire Department personnel inspect over 1,200 parcels in Fire Zones 2 and 3. Additionally, personnel conduct complaint-driven inspections in all three of the City's Fire Zones.

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. The Program serves properties in the hills from June through September each year. From 2005 to 2011, over 200 tons of vegetation was collected and recycled, on average, each year.[78]
- The Fire Fuel Debris Bin Program is coordinated by the Department of Public Works' Solid Waste Division, which delivers and removes 30 yard roll-off boxes from requesting neighborhoods. This effort yields an average of 20 tons of plant debris per year.[79]
- Additionally, 14,000 tons of residential plant debris is collected each year through weekly curbside collection. In 2007, the City switched curbside plant debris collection from every other week to weekly. This program enhancement doubled residents' capacity to help reduce the buildup of vegetation year-round.[80]

- A fire fuel abatement program on public land. From mid-June to mid-August each year, an average of 125 tons of debris is removed from 95 public sites, including parks, pathways and medians. This effort is a joint effort of the City and the East Bay Conservation Corps.[81]

Access and Egress
Key Partner: Berkeley Path Wanderers Association

Berkeley Path Wanderers Association (BPWA) is an all-volunteer nonprofit organization concerned with Berkeley paths. In the city's many steep neighborhoods with winding roads, these paths take the shortest, most direct routes, mimicking city block grids that do not exist. In addition to producing a community recreation asset, these pathways can assist evacuation and firefighting efforts in the hills.

Since 1998, BPWA has built and maintained rustic paths using wood ties secured to the ground with rebar, replaced wooden ties and rebar when necessary, cleared overgrown vegetation, and conducted annual weeding. The group also cleans and clears historic cement paths. The City's Department of Public Works performs more heavy maintenance, such as cement work and hand rail installation and replacement.

Since 2004, BPWA has improved 21 paths in the hills north of the UC Berkeley campus. Most of the paths offer more expeditious evacuation routes than the surrounding city streets. The table below shows some of the BPWA paths that significantly reduce pedestrian evacuation distances.

Table 3.12 Noteworthy BPWA Paths

Path Name	**Distance**	**Distance without Path**
Acacia Walk	0.1 miles	0.4 miles
Atlas Path	<0.07 miles	0.2 miles
Bret Harte path	< 0.1 miles	0.2 miles
Glendale Path	0.2 miles	0.6 miles
Northgate Path	< 0.1 miles	0.4 miles
Upper Covert Path	< 0.1 miles	0.5 miles
Wilson Walk	< 0.03 miles	0.4 miles
Yosemite Steps	0.1 miles	0.4 miles

The BPWA does not maintain paths on UC Berkeley land, but is exploring ways to work with UC Berkeley to improve pedestrian transitions between UC and adjacent neighborhoods.

In addition to maintaining paths, the group raises awareness of the paths for use as both escape routes for residents and as access routes for emergency personnel. BPWA performs outreach through a published map, their newsletter, free public meetings, and free guided walks. In 2008, the BPWA sponsored an earthquake walk attended by 75 people. The group toured part of the Hayward fault, observing houses, schools, playgrounds and walkways that have been built atop the fault, and discussing mitigation activities undertaken in the area.

Notable Mitigation Activity

Using a FEMA grant award, in 2005 the City, the BPWA and Boy Scout Troops 4 and 19 partnered to build Glendale Path, a vital three-block-long evacuation route between the intersections of Fairlawn Drive/Arcade Avenue and Campus Drive/Glendale Avenue. By City streets, the evacuation route descends 160 feet over .6 miles. The Glendale Path shortens the evacuation distance by almost half a mile, significantly shortening evacuation time for pedestrians in the area. The path includes:

- Wood-tie steps and a switchback stairway by BPWA;
- Wooden steps and stepping stones constructed as part of three Eagle Scout projects;
- Cement stairs and handrails by the City.

The path was dedicated in August 2007, when the third and lowest portion was completed.

Improving Firefighting Readiness

Early suppression efforts prevent many WUI fires from growing out of control. Since the 1991 fire, the City has continued to build firefighting infrastructure to enable firefighters to reduce fire spread.

In 2006, the City constructed a new fire station on Shasta Road, just north of the UC Berkeley campus in the hills. This station, in addition to being in the wildland-urban interface, is the only City fire station east of the Hayward fault.

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. This capacity was based on calculations of water volumes required to fight the fire front presented in the 1991 blaze, assuming that some capacity will be available from EBMUD sources, in light of system upgrades.

Since the 1991 fire, the Berkeley Fire Department has been also working to strengthen its wildland firefighting skills and to prevent conflagrations. Firefighters remain in a constant state of readiness to respond to a wind-driven WUI fire in the hills, which could transition into a fast-moving urban firestorm in the flatlands. Additionally, the City has built cooperative relationships with neighboring fire departments to put out vegetation

fires before they grow into multi-jurisdictional problems. Mutual response agreements among the City and its neighboring jurisdictions have increased the fire resources that respond to the reporting jurisdiction.

This cooperation has been assisted through formal efforts, such as the inter-jurisdictional Hills Emergency Forum (HEF), started after the 1991 fire. HEF exists to coordinate the collection, assessment and sharing of information on East Bay Hills fire hazards, and to provide a forum for building interagency consensus on the development of fire safety standards and codes, incident response and management protocols, public education programs, multi-jurisdictional training, and fuel reduction strategies.

Key Partner: East Bay Municipal Utilities District[82]

EBMUD has completed various maintenance based pipeline improvements throughout the City of Berkeley that have improved the available flows and water distribution system on a localized basis. EBMUD's Berryman Reservoir was replaced in 2012 with a new seismically designed 2.6 million gallon storage facility. EBMUD recently purchased three new portable generators (two 400 kilowatt and one 750 kilowatt generator) for use at water treatment and distribution facilities. These improvements improve the water supply reliability, but there remains a high likelihood of outages for pumping stations, reservoirs, and pipeline during a major seismic disaster.

Key Partner: UC Berkeley

UC Berkeley campus lands include approximately 800 acres of wildland in the East Bay hills that border on residential neighborhoods in Berkeley and Oakland. The combination of an accumulation of dense nonnative vegetation and increased urbanization has created a wildland-urban interface (WUI) condition posing an extreme threat to lives and property. From 1923 to 1991, 14 major fires have occurred in this area, including the 1991 Tunnel Fire that destroyed more than 3,354 dwellings and claimed 25 lives.

UC Berkeley depends on the City for fire services, but does not fall under City fire preparedness ordinances. The University has an established Campus Fire Mitigation Committee to develop and oversee a program to manage the WUI fire hazard. The goal is to manage vegetation to ensure that the vulnerable areas are WUI fire-defensible by improving accessibility for fire crews, creating and maintaining escape routes, and lessening the rate of fire spread and/or reducing the potential for embers to ignite adjacent neighborhood. The University has made repeated efforts since 1974-75 to eliminate the vast groves of eucalyptus trees on its property. Earlier efforts were unsuccessful, as the felled trees regrew from their cut stumps. UC efforts since 2001 have emphasized the use of herbicides to kill the eucalyptus trees after felling, along with an integrated management approach to prevent the millions of viable eucalyptus seeds from germinating. The University's goal is to convert its eucalyptus- and pine-forested areas to oak/bay woodland, scrubland, grassland or other floral communities historically found in the East Bay hills. In 2006, UC Berkeley opened the Center for Fire Research and Outreach to encourage and facilitate collaboration on fire-related research questions and provide a central point for wildfire information.[83]

Key Partner: Berkeley Lab[84]

The Berkeley Lab maintains generators and reserve water tanks to back up utility services in many of its buildings. Water is supplied from the East Bay Municipal Utility District's Shasta and Berkeley View Reservoirs. The Berkeley Lab water delivery system is designed to provide service to many portions of the site from either one of these two sources. In addition, Berkeley Lab operates and maintains three 200,000-gallon water storage tanks onsite for emergency water supply. The water conveyance system is looped such that a pipe rupture from one source of water will not result in loss of firefighting water. Only multiple breaks in the system will result in loss of firefighting water.[85]

Berkeley Lab has an ongoing contract with Alameda County Fire Department (ACFD), which staffs Fire Station 19 on the Lab site. ACFD participates in the California Master Mutual Aid Agreement, whereby supplementary fire support can be requested through the local mutual aid coordinator in the event of an emergency. Additionally, Berkeley Lab maintains an automatic aid agreement with the City of Berkeley. ACFD also has trained staff and resources to address life-safety concerns and spill containment for hazardous materials releases. The Lab has an active drill and exercise program, and conducts major exercises regularly.

3.4.4 Wildland-Urban Interface Fire Risk and Loss Estimates

The 1923 fire was the worst 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 recent 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 3.12 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 structures of Berkeley using the City's Geographic Information System, we find that, today, over 3,000 structures are located in the footprint of the 1923 fire. These structures include single-family homes, multi-family residences (many of which house UC Berkeley students), and stores, restaurants, and offices central to downtown Berkeley.

If a fire occurred today that burned the same area, the loss to structures could exceed $3 billion.[86] Destruction of contents in all of the homes and businesses burned could add another $617 million[87] to fire losses. The losses of electricity poles and lines to PG&E, for example, could be enormous. 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 could be devastating. Thousands of families could be homeless following such an event, losing all of their possessions. Many more could need short-term shelter while the fire was burning. 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 northeast Berkeley could be completely changed.

SECTION B: HAZARDS OF CONCERN

Rain-induced landslides, flooding, tsunami and climate change are hazards of concern for Berkeley, because of their potential to severely impact specific areas of the city. Section 4 of this plan identifies mitigation actions to reduce the impact of each of these hazards. Climate change is addressed in further detail in Berkeley's Climate Action Plan.

3.5 *Rainfall-Triggered Landslides*

Seismically-triggered landslides are discussed in detail in Section 3.3.2.2.2.

3.5.1 Historical Rainfall-Triggered Landslides

Berkeley's most significant recent landslide occurred in North Berkeley during the winter of 1997-98, when soil became oversaturated from heavy rains brought by the El Nino weather system. One home was significantly damaged and had to be demolished. Two additional homes were yellow-tagged, meaning they were of questionable safety, but residents were able to reoccupy these homes after the hillside was stabilized. No one was hurt. Other recent landslide experiences are limited to minor slides blocking roads, such as the collapse of the Euclid Road retaining wall in 1996.

3.5.2 Rainfall-Triggered Landslide Hazard

Landslides are natural geologic phenomena that range from slow moving, deep-seated slumps to rapid, shallow debris flows. Landslide risk can be exacerbated by development. Grading for roads, home construction and landscaping 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.

Landslides are most frequently triggered in periods of high rainfall, and are likely to continue occurring in Berkeley. The hazard is greater in steeply-sloped areas, although slides may occur on slopes of 15 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 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 3.5) 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.

3.5.3 Exposure and Vulnerability

There are a number of deep-seated landslides that continuously move, with the rate of movement affected by rainfall and groundwater conditions. These active landslides are shown in red on Map 3.5. 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. In addition, there are many more deep-seated landslides that are not currently moving, but have moved in historic time or in recent geologic time. The more significant of these are shown in yellow on Map 3.5. These "dormant" landslides could be reactivated by changing surface or subsurface conditions.

Areas of the community situated on historic or recent deep-seated landslides are most vulnerable to landslide hazards. Vulnerabilities in these areas include hundreds of homes, roads, sidewalks, underground utilities (water, sewer lines, storm drains, natural gas lines, conduits) and aboveground utilities (electricity, telecommunications, cable).

For debris flows, hazard areas are typically at the base of steep hillsides, near the mouths of steep hillside drainages, and in or around the mouths of canyons that drain steep terrain[88]. In Berkeley, several collector streets that are critical for emergency access and evacuation are located in areas susceptible to landslides.

Key Mitigation Activities

Regardless of triggering mechanism, landslide hazard mitigation techniques are the same. Landslide hazard can be reduced through grading, soil strengthening, geotechnical engineering components, drainage, control of runoff, and landscape methods. In new development, the City regulates the issuance of permits and inspects new development activities. However, most Berkeley hillside development predates current best practices and codes and therefore remains vulnerable to the threat of landslides. The City maintains major retaining structures in the right-of-way that help to control landslide risk in key areas.

3.5.4 Landslide Risk and Loss Estimates

There are few generally-accepted methods to estimate damage from landslides caused by rain. However, many of Berkeley's hillside homes are located in areas that could slide under the right circumstances. According to a USGS report[89], approximately 6,000 structures are located in areas at moderate to high risk of landslides.

3.6 *Floods*

3.6.1 Historical Floods

Berkeley's most recent flooding occurred in 2004 - 2005 in the Codornices, Strawberry, Potter, and Schoolhouse Watersheds. Flooding also occurred during the 1997 - 1998 El Niño season. The problems caused by the El Niño winters in the 1990s totaled millions of dollars in emergency response and recovery efforts.

In the early 1960s, the Strawberry and Codornices Creeks overflowed, causing nuisance flooding in streets and intersections. A few buildings were flooded, including some on the University of California, Berkeley campus.

3.6.2 Flood Hazard

Berkeley faces a moderate flood hazard, primarily from local creek flooding and storm drain overflow.

Creek Flooding

Like in many urban areas, Berkeley's creeks are difficult to follow. Long stretches of Berkeley's creeks are completely contained by culverts, and open stretches of creeks are often segmented by shorter culverts and bridges.

Codornices, Strawberry and several other creeks flow year-round. However, most Berkeley creeks only flow in narrow channels for a short time after rainfall. When storm runoff exceeds a channel's capacity, the excess water flows into city streets.

Storm Drain Overflow

The City's storm drain pipe infrastructure is designed to intercept, collect storm water runoff from the public right-of-way, and convey it, either directly to the Bay, or to nearby watercourses that ultimately discharge to the Bay. Nuisance flooding may accompany heavy rainfall without flooding from any nearby creeks, due to either an event that exceeds the capacity of storm drain infrastructure, and/or that damages that infrastructure.

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, which produces two inches of rainfall over a 6-hour period. Using this 10-year design storm standard is considered the most cost-effective design practice,[90] and provides guidance for computing flows and for sizing infrastructure (such as pipes, curbs and gutters, and valley gutters).

Age

Much of Berkeley's storm drain infrastructure is over 90 years old and is past its useful life expectancy. Concrete pipes have eroded or separated over the years. In some

locations, soil is being sucked into the pipelines, causing washouts. Berkeley's Watershed Management Plan (see *Notable Mitigation Activities)* includes an inspection program to identify the pipe segments that may be in danger of collapse during earthquakes and/or storms with high rainfall, but the Plan has not been funded. Additionally, maintenance reduces the frequency of flooding during rainfall that is less than a 10-year storm.

Flooding Factors

Factors that induce flooding in Berkeley are:

- Winter storms with heavy rainfall: Heavy rainfall increases the load on Berkeley's creeks and storm drains. Water may also pond in basements from street drainage or from high ground water during extremely wet seasons.

- Constricted or blocked flow ways: Berkeley has little record of overflows, but has experienced flood damage from blocked culverts. Intensified storm drain system maintenance efforts have reduced flooding. Patrols are sent out before storm events to ensure that drains are clear of leaves or other substances.

- Bay tides: Outfalls in Berkeley go directly to the Bay. When the Bay level rises, flooding is more likely.

- Power outage: A significant number of building owners in Berkeley rely on electric sump pumps to keep their homes or businesses free from water during the rainy season. Any protracted power outage during the rainy season would lead to water damage in many structures' basements because of the failure of these pumps.

- Climate change and its effects: Climate change increases the likelihood of flooding in Berkeley through earlier melting of Sierra snowpack, an increase in extreme rainfall events and sea-level rise. (See Section 3.8: Climate Change.)

Public Health Impacts[91]

Flooding may result in contamination of potable water, wastewater, and irrigation systems, which may negatively affect the quality of water supply, resulting in an increase of water- and food-borne diseases.[92] [93] Intense rainstorms and flooding can contaminate food crops through overflows from sewage treatment plants into fresh water sources and through increases in water-borne parasites, such as Cryptosporidium and Giardia, found in drinking water. Heavy storm water runoff can contaminate the ocean, lakes, and other bodies of water with other bacteria.[94]

3.6.3 Exposure and Vulnerability

Berkeley's flooding exposure has been identified from two sources: creek flooding and storm drain overflow.

Creek Flooding Exposure

Flood flows in Berkeley are not of great depth. The maximum flood depth associated with a 100-year flood from creeks is expected to be two-feet-deep, mostly near creek channels. However, surface runoff can flow into streets and intersections. A flood of one to two feet in depth could inundate the first floors and basements of a number of houses in the city, and a significant area of the city's western industrial portion. This type of flooding is unlikely to damage structures, but could significantly damage first floor and basement finishes, contents and appliances in these buildings.

Map 3.16 is the current Digital Flood Insurance Rate Map (DFIRM). Blue-striped flood boundaries on the DFIRM represent the 100-year flood, which has a one percent probability of occurring in a given year. Gray-striped boundaries represent the 500-year flood, which has a 0.2 percent probability of occurring in any given year.[95]

If the 100-year flood occurred in Berkeley, it would impact approximately 675 structures to various degrees. The majority of these structures would be inundated by one foot or less of water. Approximately 200 structures, however, could flood with up to two feet of water. None of these structures are Repetitive Loss Properties as defined by the National Flood Insurance Program.[96]

National Flood Insurance Program

The National Flood Insurance Program (NFIP) makes federally-backed flood insurance available to homeowners, renters, and business owners in participating communities. 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.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-year flood;
- New floodplain development must not aggravate existing flood problems or increase damage to other properties;
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

Areas of special flood hazard in Berkeley are identified by the FEMA "Flood Insurance Study, Alameda County, California and Incorporated Areas," dated August 3, 2009. The study presents water surface elevations for floods of various magnitudes, including the one-percent annual chance flood (100-year flood) and the 0.2-percent annual chance flood (the 500-year flood). The boundaries of the 100- and 500-year floodplains in Berkeley are shown on the Flood Boundary and Floodway Maps and the Flood Insurance Rate Maps (Map 3.16), dated August 3, 2009.

Berkeley's Flood Zone Development Ordinance regulates development in areas identified in the Flood Insurance Study and Flood Insurance Rate Maps. To file insurance claims with FEMA for flood damage, owners of parcels in this area must have FEMA flood insurance, and these parcels' lowest base floor elevation must be 2 feet above the 100-year flood level. 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.

In 2012, the U.S. Congress passed the Flood Insurance Reform Act of 2012 which calls on FEMA and other agencies to make a number of changes to the way the NFIP is run. As the law is implemented, some of these changes have already occurred, and others will be implemented in the coming months. Key provisions of the legislation will require the NFIP to raise rates to reflect true flood risk, make the program more financially stable, and change how Flood Insurance Rate Map updates impact policyholders. The changes will mean premium rate increases for some, but not all, policyholders over time. Beginning in May 2013, preliminary data will be phased into an online search tool where the City and community members can view any proposed changes to the flood maps and voice their opinion before they are finalized.

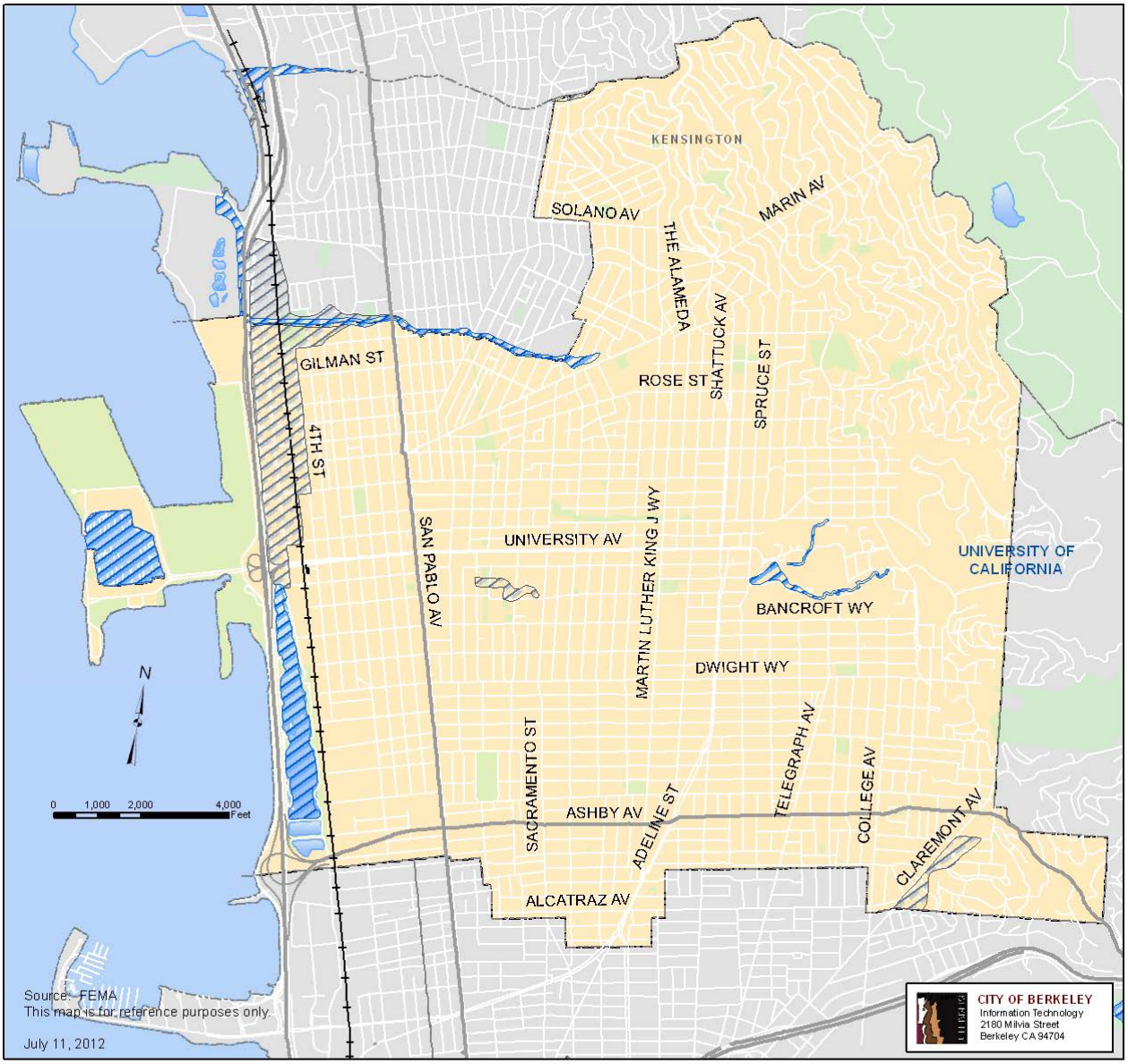
As part of its effort to comply with the requirements of the NFIP, Berkeley has adopted various floodplain management measures. For example, Berkeley requires one foot of freeboard on all development at risk from bay floodwater. Thanks to the foresight of the storm water system planners in the 1920s, and also 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.

The City of Berkeley will maintain participation in the National Flood Insurance Program under the Public Works Department's Engineering Division. The Supervising Civil Engineer will work with FEMA and other partners to continue 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.

Notable Mitigation Activities

In September 2009, the City updated Berkeley Municipal Code Chapter 17.12: *Flood Zone Development Ordinance* to ensure 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. It establishes the Director of the Public Works Department as the Floodplain Administrator for the City; addresses standards for construction, utilities, subdivisions, manufactured homes and recreational vehicles.

Map 3.16 Digital Flood Insurance Rate Map



FEMA Flood Hazard Areas

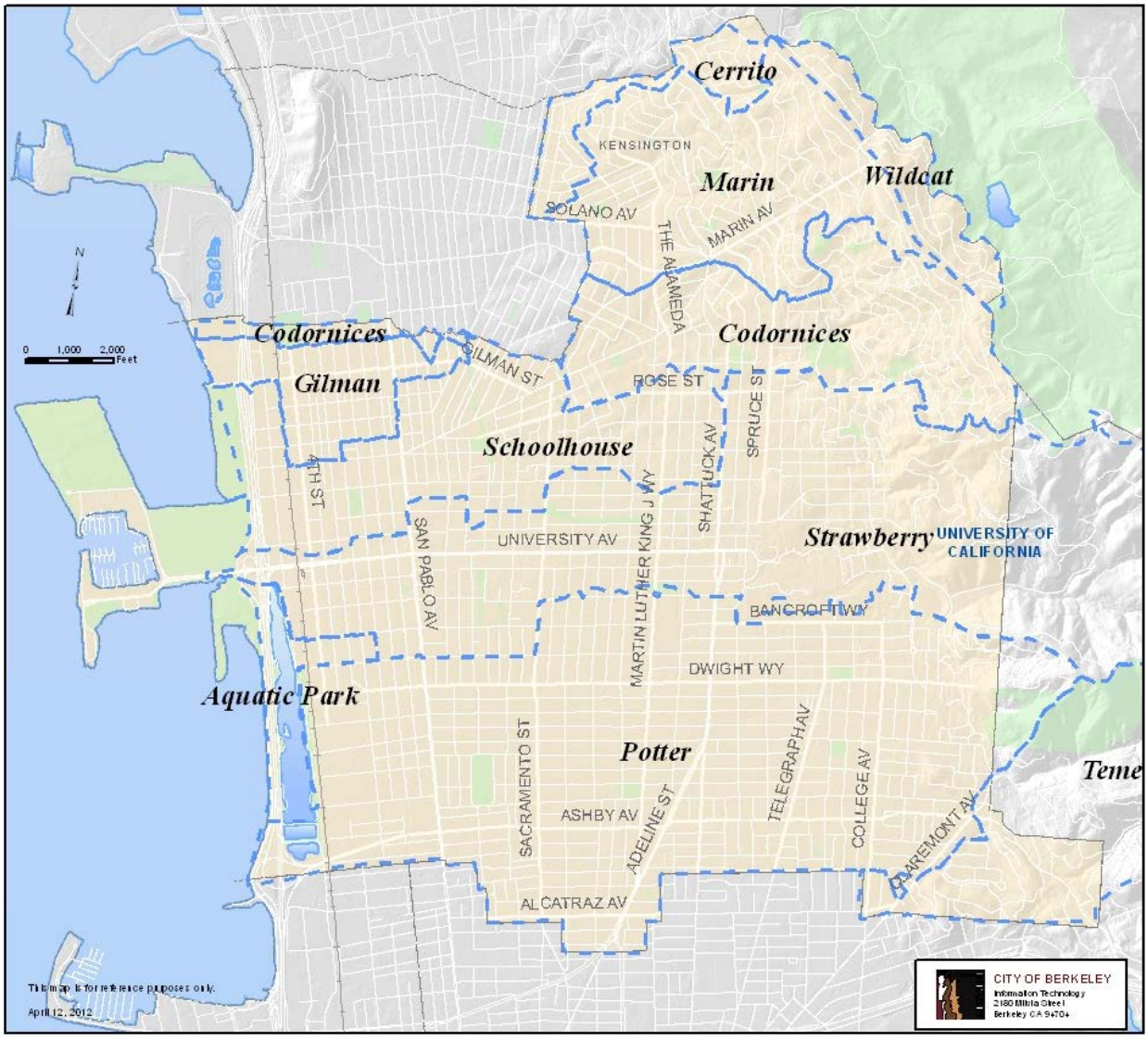
100-Year Flood Area

500-Year Flood Area

Storm Drain Overflow Exposure

In 2011, the Engineering Division of the City's Public Works Department developed hydraulic models for two of the City's ten watersheds, represented in Map 3.17. The Potter and Codornices Watersheds were selected because they represent the full range of the urban drainage spectrum in Berkeley.[97] The modeling identified locations of predicted overflows.

Map 3.17 Berkeley Area Watersheds



Potter Watershed

The Potter Watershed is the largest in the City. It experiences localized flooding in many areas, and contributes runoff to the Aquatic Park Lagoons. Localized flooding can be expected in varying degrees in the following locations:

- San Pablo Avenue between Ward and Murray
- California Street between Woolsey and Harmon
- Woolsey Street between California and Adeline
- Woolsey Street at Dana
- Ashby Avenue between California and King
- Martin Luther King, Jr. Way between Russell and Woolsey
- Parker Street between Seventh and Fourth
- Fulton Street at Derby
- Ellsworth Street between Blake and Parker
- Telegraph Avenue between Ashby and Woolsey
- Telegraph Avenue at Stuart
- College Avenue at Dwight

Many of these locations were confirmed as chronic nuisance flooding sites by PW Maintenance staff and correspond well with City experiences during the storms of February 25, 2004 and the El Nino events of the 2005-06 rainy season.

Additionally, tidal effects from the Bay compound Potter Watershed's flooding problems as far upland as Adeline/Woolsey. This is due to the water surface of the Bay effectively reducing the discharge ability of the storm drain trunk line. Thus 10-year frequency storms in combination with high tides will cause flooding in the Potter Watershed.

Codornices Watershed

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. Localized flooding can be expected in varying degrees (including surface ponding at street sags) in the following locations:

- Second Street, Creek corridor to Gilman
- Railroad tracks, Creek corridor to Gilman and to Albany

- Gilman Street between Sixth and Second
- Codornices Creek at Sixth, at most street crossings east of San Pablo, at Glen
- Ninth Street between Harrison and Creek Corridor
- Monterey Ave between Posen and Hopkins
- Hopkins Street at Carlotta
- The Alameda between Napa and Yolo
- Sonoma Ave between Fresno and Hopkins
- Spruce Street, Eunice to Creek corridor
- Euclid Ave, Cragmont to Codornices Park
- Cragmont, Euclid to Regal
- Various locations on LaLoma, Glendale, Campus Drive, Queens, Shasta Road

Seventy-five percent of expected flooding is predicted to occur in the Creek Corridor at Second Street. This model result is confirmed by chronic flooding at the site.

The City plans to develop hydraulic models of the remaining eight watersheds within Berkeley.

Hazardous Materials

Many of the structures in or near the flood zone have hazardous materials on their properties. The hazardous materials at the sites include many chemicals that could harm health or the environment. The City has no regulations requiring hazardous materials be stored above expected flood levels in existing properties, but there may be adequate warning time for companies to protect or elevate these materials when the next flood occurs. Of the 436 sites regulated by the City's Toxics Management Division (See Section 3.9: *Hazardous Materials Release*), none reside in the 100-year floodplain; 41 reside in the 500-year floodplain.[98]

Watershed Management Plan

In October 2012, Council adopted the Watershed Management Plan (WMP). The mission of the WMP is to promote a healthier balance between the urban environment and the natural ecosystem, including the San Francisco Bay. One of the WMP's four goals is to reduce urban flooding, with associated objectives as follows:

- Maintain and operate appropriately sized storm drain pipe infrastructure.
- Reduce peak runoff volumes and velocities.

- Keep storm water inlets free of obstructions.
- Collect/analyze data to better understand issues and plan accordingly.

To this end, the WMP recommends analysis and rehabilitation of existing storm drain pipes, along with landscape-based retrofits within the public right-of-way or open space areas. Studies have indicated that when these landscape-based retrofits are combined with other traditional approaches, a number of WMP goals can be met for a capital cost similar to merely upsizing storm drain pipes to convey flow. The WMP's unfunded capital needs citywide are $208 million.

Implementation of the WMP will depend on available funding and would require 30+ years due to its cost and scope.

3.6.4 Flood Risk and Loss Estimates

FEMA has developed standard loss curves to determine the percent of replacement value of damage caused by various heights of 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.

Berkeley structures in the floodplain vary in size, ranging from single-family homes to large, industrial workspaces. Basements are uncommon, and few structures in these areas are multi-story. This analysis assumes that all structures are one story with no basement, which may overestimate the actual losses that could occur during flooding. Structures that have more than one story generally experience less overall damage than one-story structures, because upper story contents and structural elements remain free from damage. Structures with basements, however, experience more damage, as basements flood before any other portion of a structure.

The estimated losses to properties in Berkeley from a 100-year flood total $148 million.[99] Approximately $62 million is damage to the building structures, including walls, finishes, etc. $86 million is losses to contents, including damage to furniture in homes and equipment and inventory in commercial and industrial properties. 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. Some of these losses could be avoided if property owners were able to protect 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. Remediation activities like sandbagging require property owners to have adequate warning time and manpower.

Due to the small watersheds and paved, urban environment, floodwaters in Berkeley are likely to both rise and recede quickly. This means residents and business owners may have 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.

It is possible that key underpasses and roads accessing Interstate 80 could be inaccessible during high floodwaters. This could cause significant traffic problems regionally.

Because much of Berkeley's industrial area is located in the floodplain, some hazardous materials could spill during flooding. The most dangerous hazardous materials are protected by berms and secured against spilling in earthquakes, which may prevent spills in floods as well. Any spills would complicate cleanup efforts.

3.7 *Tsunami*

3.7.1 Historical Tsunamis

The most recent tsunami to impact 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[100]. The tsunami surge entered the Berkeley marina, causing $158,000 of damage to docks and boats.

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 Great 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.

3.7.2 Tsunami Hazard

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.

The 2013 Science Application for Risk Reduction (SAFRR) Tsunami Scenario[101] outlines multiple mechanisms of tsunami damage, which are described below:

- Buildings affected by tsunamis can be damaged by either the inflow or outflow of water, which can affect building finishes, carpets, carpets, electrical wiring, computers and other contents. Tsunamis may deposit soil or other water-borne debris in or around buildings. Tsunamis can erode soil around the building, especially at corners. In more severe cases, the pressure of the moving water can damage a building's structural components, and can even displace the entire building. Additionally, buoyancy can lift and move a building off its foundation.
- Tsunami damage to coastal infrastructure can release complex debris, crude oil, various fuel types and other petroleum products, cargo, and diverse other pollutants into nearby coastal marine environments and onshore in the inundation zone.

- Fires often occur within the inundation zone of a tsunami. Ignitions can occur when spilled liquid fuels mingle with waterborne debris, which can spark when jostled.
- Tsunamis can damage roads though erosion ("scour") of the land beneath the roadway, especially if the roadway is on a levee or embankment.
- Tsunamis can damage railroad embankments and tracks, which can be submerged, washed out-of-line, or washed out completely. Rolling stock can be overturned or derailed.
- Deaths are possible if individuals choose not to evacuate hazardous areas, do not understand tsunami warnings, or are unable to evacuate for various reasons. Injuries and illness can result from contact with tsunami surges, such as drowning and/or trauma from being struck by debris in the tsunami flow. Post-tsunami, mold can develop in inundated houses, buildings, and debris piles. Secondary infections can result from injuries or from living conditions following the disasters, such as an increase in pneumonia from water aspiration, as well as cellulitis from exposure of breaks in the skin to contaminated water.
- Physical damages, debris, and contamination can have short- and longer-term impacts on the environment and the health of coastal marine and terrestrial ecosystems. Marine habitats in intertidal zones, marshes, sloughs, and lagoons can be damaged by erosion or sedimentation, and can receive an influx of debris, metal and organic contaminants, and sewage-related pathogens. Debris and re-exposed contaminated sediments could pose chronic toxicity threats to ecosystems.

3.7.3 Exposure and Vulnerability

Given the known history of tsunamis within the San Francisco Bay, tsunamis are considered to be possible, but the severity of their impacts on Berkeley cannot be determined at this time.[102]

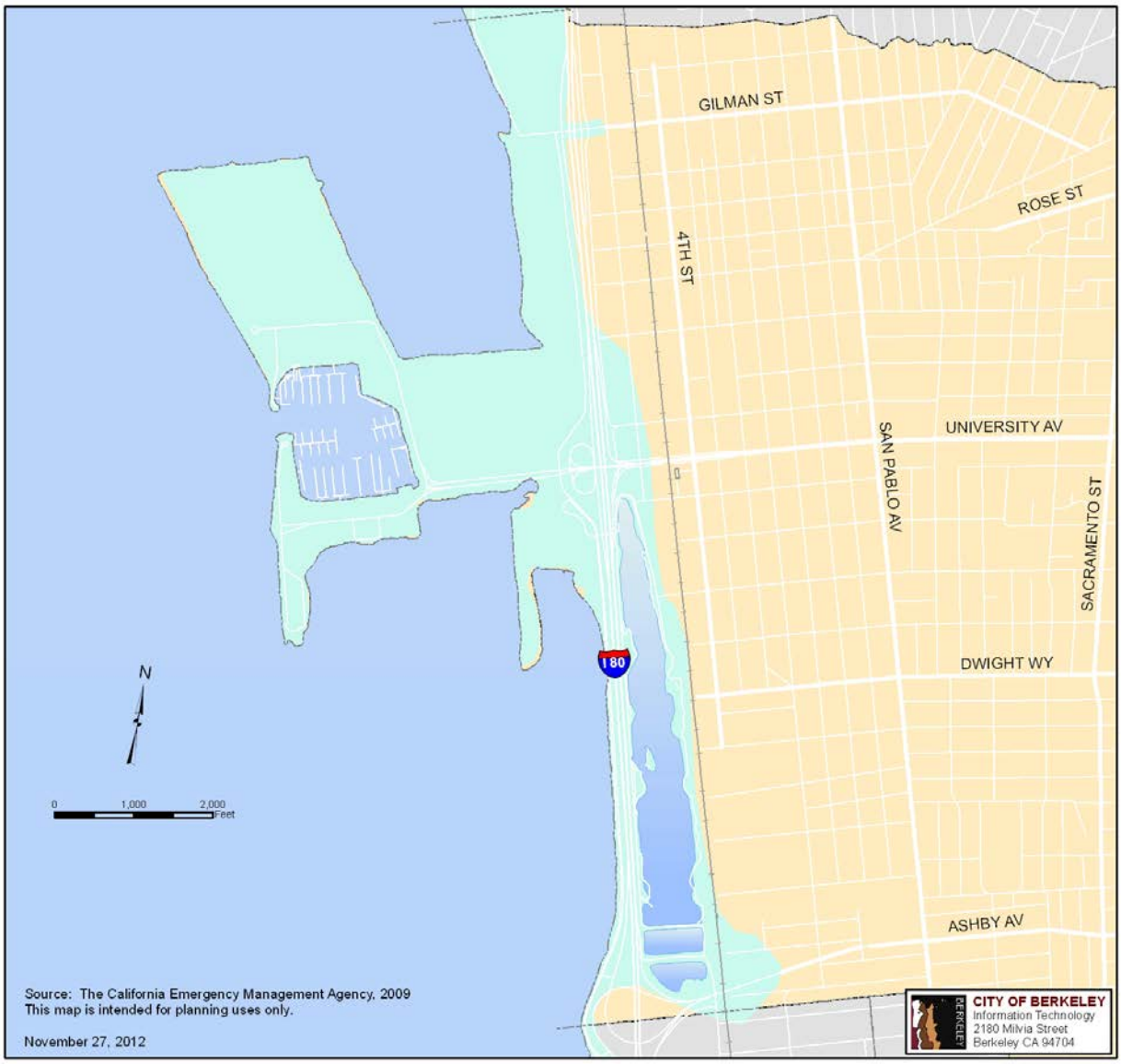
In December 2010, the California Emergency Management Agency released the first ever tsunami inundation map within the San Francisco Bay, shown in Map 3.18. This map is based on current sea levels and land elevation. This map shows in light blue the area of potential tsunami inundation in Berkeley. It does not reflect the inundation area from any singular tsunami. Rather, it depicts the worst-case scenario run-up heights from all potential tsunami sources across the Pacific Rim. 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. According to Map 3.18, 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 the western edge of Interstate 80. At Virginia Street, the edge of the zone crosses Interstate 80 and stretches as far east as Second Street. The edge of the zone runs south along Second Street and the eastern edge of Aquatic Park to Ashby/CA-13. In this area, the edge of the zone extends further east to Fifth Street and Hollis.

According to Map 3.18, 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, and Aquatic Park.

Sea-level rise associated with climate change will increase the zone of potential inundation, but the future boundaries of the zone are not yet clear.

Map 3.18 Berkeley Tsunami Inundation



USGS Exposure Study[103]

A USGS study of community exposure to tsunami hazards in California found that in Berkeley:

- Approximately 47 residents (23 households) live in the tsunami inundation zone.
    - Eight of the residents are over 65 and one is under five. Elderly and young residents as well as those in group homes may have a particular challenge evacuating from tsunamis.
    - Seven of the households are non-institutionalized group quarters, 20 households are owner-occupied, and 3 are rented.

The study also found that:

- 77 businesses and 4 government offices with 1,664 employees are located in the tsunami inundation zone.
    - 80% of these businesses are estimated to have high visitor potential, including the DoubleTree hotel. Visitors may not be aware of what to do in case of a tsunami warning.

While this study examined the Berkeley Marina, its information on residents at the Marina and surrounding park area is not as detailed or accurate as City of Berkeley data.

Berkeley Marina
Of primary concern to the City is the Marina, which is primarily used for recreational purposes, with relatively few homes or businesses. Despite the area's low density, the area's people, infrastructure, and businesses will be vulnerable to a tsunami:

- Marina residents: The Berkeley Marina has 1,000 boat slips. Approximately 200 residents live onboard boats in these slips. An additional estimated 25 live on board houseboats, and regulations permit people to periodically spend the night on their boats.
- Marina businesses and visitors: A number of Marina restaurants, such as Skates on the Bay and HS Lordships, often have large numbers of customers. The DoubleTree Hotel has 387 rooms, and regularly hosts events with 500-600 attendees, potentially making it the City's most densely-populated location with tsunami exposure.
- Infrastructure and roadways: Inundation maps show overtopping of parking areas and inundation of 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. It is unlikely that the overpass itself would be inundated due to its height and its limited extent beyond Second Street. However, if water extends to Second Street, the access ramps on either end of the overpass would be covered, making the overpass impassable.

Evacuation Challenges

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 overcrossing[104]

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.

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: all of the above listed routes lie within the tsunami inundation zone.

3.7.4 Tsunami Risk and Loss Estimates

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 3.18, which is intended to be used for evacuation planning purposes only.

The 2013 SAFRR tsunami scenario[105] 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 one-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.

City of Berkeley Assets

The most significant financial losses to the City of Berkeley in the event of a tsunami would be inundation of the following structures, which are listed below with their estimated replacement costs:

Structure	Estimated Replacement Value
City Animal Shelter[106]	$7.8 million
Marina Boat Docks	$25 million
Berkeley Yacht Club	$1.6 million
Shorebird Nature Center	$1 million
Marina Corporation Yard	$790,000
Marina Administration Building	$1,000,000

Other City- and privately-owned facilities of significant value 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.

Further research is needed to fully assess Berkeley's tsunami hazard, including the following:

- Definition of Berkeley's different areas of inundation for different tsunami scenarios;
- Vulnerabilities of each evacuation route to tsunami inundation;
- 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.

3.8 *Climate Change*

Climate change is a global issue with local impacts. Like regions across the globe, the San Francisco Bay Area is experiencing and will continue to increasingly experience the impacts of the changing climate, including rising temperatures and sea-level rise. These impacts affect our natural environment, our built infrastructure, and the health and safety of the people in our community, especially people of color and the poor.[107] The impacts of climate change also exacerbate every one of this plan's natural hazards of concern, including flooding[108], wildland fire,[109] and landslides.[110]

This section identifies the main impacts of climate change, which Berkeley is experiencing or is projected to experience in the future. This section also describes how climate change exacerbates each of this plan's natural hazards of concern. Where possible, the information provided here is specific to Berkeley, the Bay Area, and/or the state of California. For each climate impact, associated historical events, hazard description, exposure and vulnerability analysis, and risk and loss estimates are presented as available.

A discussion of local climate impacts, and recommendations for mitigating those impacts, are also included in the Berkeley Climate Action Plan (CAP). The CAP was adopted by the Berkeley City Council in 2009, and is designed to guide community-wide efforts to achieve deep and sustained reductions in global warming emissions, and to help the community prepare for the impacts of the changing climate. Additional information on the CAP and its implementation is included at the end of this section. Ongoing updates on the CAP are available at www.CityofBerkeley.info/climate.

3.8.1 Direct and Secondary Climate Change Impacts

Human activities have and continue to release large quantities of GHG emissions into the atmosphere. The majority of the emissions come from burning fossil fuels to create energy, although other activities, such as deforestation and solid waste disposal, also play a role. GHG emissions trap heat in the atmosphere and cause the planet to warm. This is known as the greenhouse effect. The greenhouse effect is a natural phenomenon, but it is being exacerbated by a dangerous buildup of GHG emissions in the atmosphere. This dangerous buildup of emissions is changing the climate.

Temperature/Heat Events

Climate change is already happening. The earth is warming. Earth's average temperature has increased by over 1° F over the past century. Average temperatures in California increased 1.7°F between 1895 and 2011.[111] Because global emissions will likely continue to increase for some time, scientists predict under a range of scenarios that it is likely that average global surface temperature will rise between about 3.6° and 10.8° F by the end of the century.[112] For the Bay Area in particular, scientists estimate that average temperatures will increase between 3.5-11° F by century's end, compared to the average temperature during the historical period 1961 - 1990.[113]

The U.S. Environmental Protection Agency defines extreme heat events as "periods of summertime weather that are substantially hotter and/or more humid than typical for a

given location at that time of year."[114] As a result of increasing temperatures, scientists expect that by 2050, Berkeley will experience 1-2 more heat waves each year.[115] By 2100, scientists expect 6-10 additional heat waves per year.[116] Public health impacts associated with these heat events include premature death, cardiovascular stress and failure, and heat-related illnesses such as heat stroke, heat exhaustion, and kidney stones.[117] The elderly and children under five are the most likely to suffer from heat-related illnesses and heat events.[118] Research indicates that communities of color and the poor also suffer more during extreme heat events because of lack of access to air conditioning, or to cars that allow them to escape the heat.[119] Across California, the highest risk of heat-related illness actually occurs in the usually cooler regions found in coastal counties. Because of a lack of acclimatization, the largest mortality rate increases in California are expected in coastal cities.[120]

In addition to public health impacts, heat events increase demands on infrastructure and lead to a need for additional infrastructure maintenance, particularly for roadways.[121]

Precipitation and Drought

In California, no consistent trend is detected to date in the overall amount of precipitation. For the Bay Area, a moderate decline in annual rainfall is projected: 1 to 3 inches by 2050 and 4 to 5 inches by 2090.[122]

If GHG emissions continue to increase, more precipitation is projected to fall as rain instead of snow, and the snow that does fall will melt earlier.[123] This has significant implications for the Sierra Nevada spring snowpack. The water distribution system for the state, including Berkeley and many other parts of the Bay Area, depends on the snowpack for water during the dry spring and summer months. Rising temperatures and more precipitation falling as rain instead of snow could reduce the snowpack by as much as 70 to 90 percent by century's end.[124] A shrinking snowpack poses significant challenges for water managers and for all communities that depend on this vital source of the state's water. The loss of snowpack also poses challenges for hydropower generation, which is a significant portion of the state's energy supply mix.

While the Bay Area can expect moderately less rainfall overall, climate change causes more extreme rainfall events. These intense rainstorms may cause flooding, which is discussed further below.

Sea-Level Rise

Warmer temperatures associated with climate change are causing global sea levels to rise through two processes:

1. Warmer temperatures are increasing the amount of ice melt from the world's glaciers and ice caps. This melted ice increases the volume of water in the ocean.

2. In a process termed "thermal expansion," warmer temperatures cause ocean water to increase in volume.

Sea-level rise is an ongoing challenge for communities surrounding the San Francisco Bay. It is estimated that the Bay has already risen approximately 7.9 inches during the

past century.[125] San Francisco Bay sea levels are projected to rise considerably in the coming decades. Relative to their 2000 levels, it is estimated that by 2050, sea level rise will range from 11-19 inches; and by 2100, sea level rise will range from 30 - 55 inches.[126]

The National Oceanic and Atmospheric Administration (NOAA) developed a web-based Sea Level Rise and Coastal Flooding Impacts Viewer[127] that enables users to identify lands that are vulnerable to various levels of sea-level rise. The Viewer depicts sea-level rise in 12-inch increments. According to the Viewer, at 12 inches of sea-level rise, low-lying areas around Berkeley Aquatic Park are potentially vulnerable to inundation. At 48 - 60 inches of sea-level rise, other areas become vulnerable to inundation, including land around the Berkeley Marina and infrastructure east of the highway along 2nd Street.[128]

It is possible that key underpasses and roads accessing Highway 80 could flood more often or be permanently inundated as sea-level rises, impacting transportation on this major regional artery. Other infrastructure that is vulnerable to inundation includes Berkeley's stormwater pipes and the East Bay Municipal Utility District's wastewater treatment plant, located near the Bay Bridge trouch-down. The combination of sea-level rise, storm surges, and high tides pose significant risk to low-lying infrastructure around the San Francisco Bay.

More comprehensive vulnerability assessments are necessary to clearly define the structures and infrastructure that will be affected with particular levels of sea-level rise.

More generally, sea-level rise means that beaches and shoreline habitats will be permanently inundated, erosion will increase, and levees and storm walls will have to endure increasing loads and may be susceptible to overtopping. Traditional measures for addressing sea-level rise, such as the use of levees and storm walls, may no longer be adequate or financially feasible.

The groundwater table and stream water levels will also rise, increasing areas subject to flooding. These changes will have impacts on the natural environment. According to the San Francisco Bay Conservation and Development Commission[129], these changes are "expected to substantially alter the Bay ecosystem by inundating or eroding wetlands and transitional habitats, altering species composition, changing freshwater inflow, and impairing water quality. Changes in salinity from reduced freshwater inflow may adversely affect fish, wildlife and other aquatic organisms in intertidal and subtidal habitats. The highly developed Bay shoreline constrains the ability of tidal marshes to migrate landward, while the declining sediment supply in the Bay reduces the ability of tidal marshes to grow upward as sea-level rises." With many miles of natural shoreline in Berkeley, these impacts on habitats are of significant concern.

Also, as with many other climate change impacts, sea-level rise may disproportionately affect those in our community that can least afford to plan for or respond to it. For example, low income residents would likely face greater difficulty relocating should their home or neighborhood be impacted by flooding.

Map 3.19 Berkeley Shoreline Areas Prone to Sea Level Rise[130]

Source: NOAA Sea Level Rise and Coastal Flooding Impacts Viewer

The above map depicts areas in Berkeley (and surrounding areas) potentially vulnerable to inundation from 48 inches of sea-level rise. Levels represent inundation at high tide. Areas that are hydrologically connected are shown in shades of blue, where darker blue shows a greater depth. Areas in green are at or below sea level at 48 inches of sea-level rise. They are determined solely by how well the elevation data captures the area's hydraulics.

A more detailed analysis of these areas is required to determine the susceptibility to flooding.

Food-, Water-, and Vector-Borne Diseases[131]

Climate change may also accelerate the incidence and geographic distribution of diseases and conditions that are transmitted through food, water, and animals such as deer, birds, mice, and insects. Increases in air temperature and change in precipitation may expand the territory of many pests. In California, three vector-borne diseases are of particular concern: West Nile virus, human hanta virus, and Lyme disease. Salmonella and other bacteria-related food poisoning also grow more rapidly in warm environments, causing gastrointestinal distress and, in severe cases, death.

3.8.2 Climate Change Impacts to Natural Hazards of Concern

Climate change is expected to exacerbate the natural hazards of concern identified in this plan. The ways that climate change affects Berkeley's natural hazards of concern are described below.

Earthquake (Section 3.3)

Sea-level rise will cause the groundwater table and stream water levels to rise, increasing the areas subject to liquefaction risks in the event of an earthquake.

Wildland-Urban Interface Fires (Section 3.4)
The incidences of large wildfires in California could more than double by century's end,[132] and higher summer temperatures will likely lengthen the fire season in our region.[133] Due to Berkeley's biophysical setting, climate, and other jurisdictional characteristics, scientists project little change to Berkeley's fire risk.[134] However, development that expands Berkeley's wildland urban interface area may increase the vulnerability to property losses due to wildfire.[135]

Landslides (Sections 3.3 and 3.5)

Increases in the intensity and frequency of winter storms will lead to more frequent landslides in the Berkeley hills.

Floods (Section 3.6)

Climate change will increase the frequency of flood events, and will expand the areas of Berkeley that are subject to flooding. A confluence of factors contributes to these changes:

- More extreme rainfall events; [136]
- Frequent and more hazardous storms, combined with a sea-level rise and high tides, can lead to more frequent and amplified storm surge events;
- Outfalls in Berkeley go directly to the Bay, and are influenced by tidal effects. As the sea level rises, it will require less rain to cause upstream flooding.

These factors will likely cause more frequent and extensive flooding events long before sea-level rise leads to permanent inundation of the shoreline.[137] FEMA's National Flood Insurance Rate Maps are currently being revised to account for areas that may become flood zones in the future due to sea-level rise.[138] Potential public health impacts of flooding include contamination of potable water, wastewater, and irrigation systems, resulting in an increase of water- and food-borne diseases.[139] [140]

Tsunami (Section 3.7)

Rising sea levels will extend tsunami inundation areas in Berkeley, putting more people and property at risk.

Notable Climate Change Mitigation and Adaptation Activities

The Berkeley Climate Action Plan provides policy and project recommendations designed to advance community-wide efforts to reduce, or mitigate, global warming emissions and to prepare for and adapt to the climate change impacts identified above.

CAP recommendations are implemented through the efforts of several City departments and community stakeholders. Outlined below are examples of specific CAP recommendations related to both mitigating global warming emissions and adapting to climate change impacts, and some explanation of how each of the identified recommendations is being implemented.[141]

Water Efficiency and Recycling

The CAP recommends proactive efforts mitigate the impacts of climate change on precipitation and the region's water supply, including the following:

In preparation for the impacts of climate change on the region's water resources, partner with local, regional, and State agencies to encourage water conservation and efficiency and expand and diversify the water supply (see CAP, Adapting to a Changing Climate, Goal 1, Policy B).

Water efficiency and reuse reduces global warming emissions and helps the community prepare for potential future water resource constraints. The City is advancing water efficiency and water recycling efforts in several ways. For example, in 2010 the City developed its *Guide to Conserving Water through Rainwater Harvesting and Graywater Reuse for Outdoor Use*. The purpose of the guide is to give homeowners the information they need to install effective, safe, and legal rainwater and/or graywater irrigation systems. Rainwater and graywater systems can help residents save water (and money) by reducing demand for potable water.

The City also provides in-person assistance to buildings committed to achieving a high level of green building, including installing water-efficient technologies to increase indoor and outdoor water efficiency.

Key Partner: United States Forest Service[142]

The U.S. Forest Service is charged with sustaining the health and productivity of the nation's forests for the benefit of the public. A primary reason that national forests were set aside a century ago was to protect the source of water for a growing nation. Water is the most important product of our public forests. In California, the Forest Service manages 20.8 million acres for the good of the public, and fully half of the state's water supply arises from those national forests. When people turn on the tap or the garden hose in Berkeley, they are using water from the Eldorado and the Stanislaus National Forests.

Ninety percent of the water that East Bay Municipal Utility District (EBMUD) conveys to Berkeley customers comes from the Mokelumne River in the Sierra foothills. The Mokelumne is fed by tributaries high in the Sierra Nevada mountains on 352,000 acres of the Eldorado and Stanislaus National Forests. The forests and meadows of these two national forests collect, filter, and store this water in the form of snowpack and groundwater. The storage capacity of the healthy ecosystem has helped make it possible for EBMUD to deliver clean, high quality water throughout the year, even throughout the annual summer droughts. However, that is already changing.

Climate change is a major threat to the health of these headwater forests, and their capacity to provide these vital storage and filtration services to East Bay residents into the future. The Sierra Nevada is predicted to receive more of its annual precipitation in the form of rain instead of snow, and the snowpack will melt earlier in the year. Both of these effects will make spring runoff occur earlier in the year and make it more challenging for EBMUD to physically store enough clean water to provide to Berkeley residents and businesses throughout the annual summer droughts.

There is a pressing need to restore the headwater forests of the Mokelumne River to a more resilient and healthy state, so they can withstand future stresses of climate change, benefit from regular forest fires, and continue to store and filter water for downstream users. These forests can be rehabilitated by mechanically removing small-diameter trees and by using prescribed fire to clear out underbrush. Fire scientists and modelers are currently working to determine areas at highest risk of severe wildfire in the upper Mokelumne River watershed so that restoration efforts have the highest positive impact.

If the upper Mokelumne Watershed is returned to a healthy state and the headwater forests are not allowed to become overly dense, Berkeley residents and businesses and other EBMUD customers will likely continue to enjoy high quality, reliable, and low-cost water throughout the 21st century, even in the face of climate change. If the upper watershed is not managed so that it can fulfill its natural hydrologic functions, EBMUD will eventually need to consider manmade, "gray infrastructure" storage and filtration options, such as additional dams, reservoirs, and filters, at a cost to water ratepayers, in order to ensure future water supplies.

Mitigating Impacts of Flooding and Coastal Erosion

The CAP recommends proactive efforts to prepare for potential flooding associated with climate change impacts, including:

In preparation for rising sea levels and more severe storms, partner with local, regional, and State agencies to reduce the property damage associated with flooding and coastal erosion (see CAP, Adapting to a Changing Climate, Goal 1, Policy C).

West Berkeley is particularly low-lying and potentially vulnerable to sea-level rise, especially when rising seas are compounded with severe storms. For all City-owned development projects, the City reviews and works to mitigate any risk from coastal flooding. The City will continue to analyze the latest data on the risk of sea-level rise in Berkeley, and to address the risk to new and existing infrastructure as necessary.

The City's urban forestry program mitigates global warming emissions through a process called carbon sequestration. It also mitigates the impacts of climate change, such as flooding and extreme heat events. For example, one of the benefits of the City's ongoing urban forestry program is stormwater management. Trees store rainwater, reducing runoff and delaying peak flows. Tree roots also loosen the soil around the base of the tree and increase water penetration. Berkeley's urban forest also helps to mitigate the impacts of extreme heat events by shading buildings and paved and dark-colored surfaces, such as roads and parking lots that absorb and store heat.

Another strategy designed to assist with stormwater management is installation of green roofs. As part of the City's education and outreach efforts, the City developed a Permit Guide to Living Roofs, which is designed to assist residents and businesses to understand the benefits and permitting requirements associated with installing a green roof. A green roof, also known as a "living roof" or "vegetated roof," is a planted rooftop garden that offers an attractive and energy-saving alternative to a conventional rooftop. One of the many benefits of green roofs is that they help filter and retain rainwater onsite.

In order to ensure accountability and progress on its emissions reduction and climate adaptation efforts, the City regularly reports on the status and outcomes of CAP implementation (see www.CityofBerkeley.info/climateprogress). Effectively monitoring and reporting progress and working to engage the community in advancing CAP-related actions is fundamental to achieving the CAP goals. Actions outlined in this plan are designed to be consistent with CAP goals.

SECTION C: ADDITIONAL HAZARDS

The focus of this mitigation plan is on natural hazards as emphasized in the Disaster Mitigation Act of 2000 (DMA 2000).[143] Hazardous materials release is addressed in this mitigation plan as a potential impact from a natural hazard. Terrorism is identified as a hazard of concern but is not analyzed in-depth.

3.9 *Hazardous Materials Release*

Because this plan is concerned with natural disasters, hazardous materials release is considered primarily as a secondary impact of the hazards presented in Sections 3.3 – 3.7. This section will identify how the natural hazards discussed in the plan can trigger the release of hazardous materials, as well as the potential impacts of those hazardous materials releases.

3.9.1 Historical Hazardous Materials Releases

Berkeley has not recently experienced significant hazardous materials releases secondary to a natural disaster. 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.[144] 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.[145]

3.9.2 Hazardous Materials Release Hazard

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 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.

3.9.3 Exposure and Vulnerability

Hazardous Materials Sites

There are 436 facilities[146] within Berkeley that are regulated by TMD.[147] 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 436 facilities in Berkeley are Level 3 automotive- or medically-related facilities with limited quantities of hazardous materials.

Fifteen Hazard Level 1 facilities hold sufficiently large quantities of toxic chemicals to pose a high risk to the community.[148] TMD works directly with each of these sites to make sure they meet stringent safety requirements. Facilities in Table 3.13 are at the highest risk level.

Table 3.13 Berkeley industrial sites with large quantities of extremely hazardous substances

Site	Location
Alta Bates Summit Medical Center	2450 Ashby Avenue
Atlas Welding Supply, Inc.	1224 Sixth Street
Bayer Healthcare LLC	800 Dwight Way
Electro Coatings, Inc.	893 Carleton Street
Howlett Machine Works	746 Folger Avenue
Henkel Corporation	742 Grayson Street
PE-Berkeley, Inc.	1 Frank Schlessinger Drive
Pacific Coast Chemicals Co.	2424 Fourth Street
Precision Technical Coatings Inc.	1220 Fourth Street
UC Berkeley Environmental Health & Safety	University Hall (Oxford at University)
XOMA Corporation	804 Heinz
Berkeley Lab	1 Cyclotron Road
TPMG Regional Lab (Kaiser)	1725 Eastshore Highway
Davlin Coatings	700 Allston Way
DSM	2810 Seventh Street

Hazardous Materials Sources Outside of Berkeley

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 Transportation

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 (see Map 3.11 *Seismic Hazard Planning Zones, Gas Transmission Lines and Jet Fuel Line*)

Transportation accidents have occurred with trucks carrying dangerous materials. These accidents will undoubtedly occur in the future.[149] 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 recently 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, the railroad and through pipelines.

Links to Berkeley's Hazards of Concern

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.

Map 3.20 identifies the locations of Hazard Level 1 Industrial Sites, along with key hazardous materials transportation routes, in relation to earthquake and flooding hazard exposure areas. Level 1 industrial sites are identified as building icons on the map. The Union Pacific Railroad is identified as a black hatched line. Interstate 80 and State Highways 24 and 13/Ashby Avenue are identified with red lines. Gilman Street, San Pablo Avenue and University Avenue, and Seventh/Sixth Streets between Ashby Avenue and University Avenue are identified in maroon, as key hazardous materials transportation routes.

Map 3.20 shows that eleven Hazard Level 1 Industrial Sites are located in west Berkeley, which is potentially susceptible to liquefaction in an earthquake. While business owners are required to secure and isolate hazardous chemicals, this may not prevent spills from causing fires or health hazards after an earthquake.

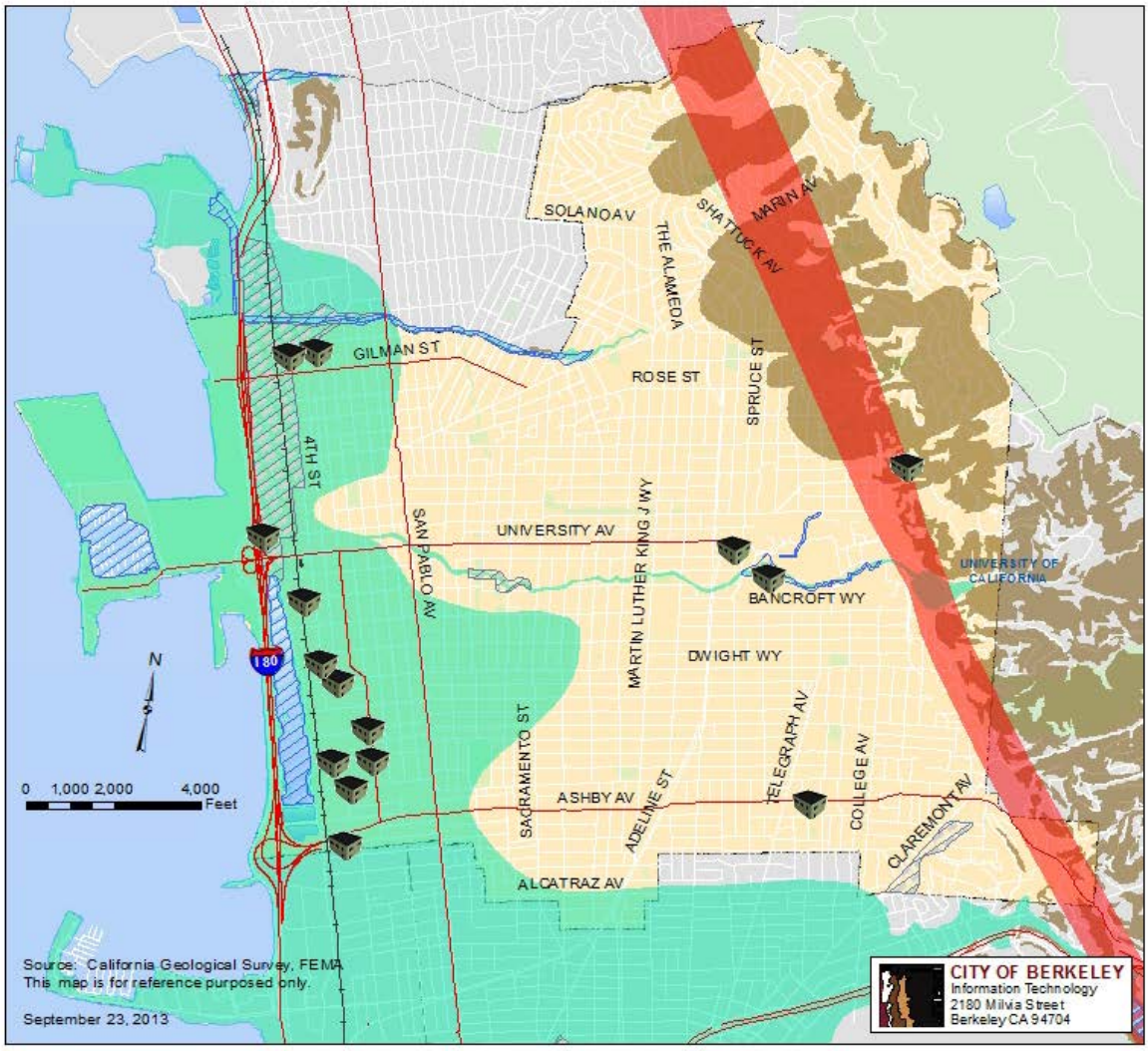
This map shows that the Berkeley Lab sits in the planning zone for earthquake-induced landslides and fault rupture; however, hazardous materials at the Lab are not considered vulnerable to these hazards.

Flooding could cause hazardous materials release. The City has very limited requirements for elevation and security of hazardous materials, although some must be surrounded by berms to contain any spills. The Berkeley Municipal Code[150] requires development in

flood-prone areas to be protected against flood damage at the time of initial construction. This requirement applies to future businesses but does not address existing facilities.

Map 3.20 shows that none of these sites sits in the 100-year flooding zone. However, three sites sit in or closely border the 500-year flooding zone, meaning in an unlikely flood, without proper elevation or floodproofing, these facilities could release hazardous materials.

Map 3.20 Level 1 Hazardous Materials Facilities, Transportation Systems and Primary Natural Hazards



Notable Mitigation Activities

The State of California requires engineering studies for facilities exceeding threshold quantities of extremely hazardous substances (EHS).[151] EHS regulations may also require mechanical and structural improvements to the respective facilities. Implementing State laws over the past twenty years has resulted in the decline of the number of EHS-regulated facilities in Berkeley by over 90 percent.

The City's Toxics Management Division regulates use and management of non-radioactive[152] hazardous materials at UC Berkeley and Berkeley Lab.[153] Both of these sites provide lists of the substances used in campus research to the TMD, which makes the information available to the Berkeley Fire Department in accordance with California Health and Safety Code. The TMD also makes these chemical types and volumes publicly available as part of its Community Right-to-Know program; however, locations of these chemicals are not disclosed to the public.

Key Hazardous Materials Partners

University of California at Berkeley

Hazardous materials are dispersed throughout many laboratories on the UC Berkeley campus, which has comprehensive programs to secure hazardous materials during and after disasters. The UC Berkeley campus relies on the City for fire and search and rescue services.

Berkeley Lab[154]

Berkeley Lab is a member of the national laboratory system supported by the U.S. Department of Energy through its Office of Science. It is managed by the University of California (UC) and is charged with conducting unclassified research across a wide range of scientific disciplines such as genomics, physical biosciences, life sciences, fundamental physics, accelerator physics and engineering, energy conservation technology, and materials science. The Laboratory's research is conducted in close collaboration with many UC campuses, especially UC Berkeley, UC San Francisco, and UC Davis.

Berkeley Lab contains significant amounts of hazardous substances. The Lab meets stringent federal requirements on environmental management and control of hazardous materials. The Berkeley Lab site map and Community Right to Know chemical information are available online.[155]

Bayer Corporation[156]

Bayer's headquarters for biotechnology manufacturing is located in Berkeley and employs over 1,200 workers. Bayer has been proactive in managing its disaster risk, focusing on both reducing risks to buildings and equipment and preparing for a robust emergency response. The entire site has been assessed for earthquake risk; buildings and other structures are currently being retrofitted on a risk-basis. Seven buildings have been

structurally strengthened to date, including the ammonia-based refrigeration facility. New buildings have been designed to exceed code requirements.

Bayer also trains its own emergency response team each year with the following capabilities:

- Industrial Firefighting
- Hazardous Materials Response (including 'level A' response)
- Emergency Medical Technicians
- Confined space rescue
- Rescue Systems-1 training

Bayer has a type-1 fire engine to bolster City's fire suppression capabilities. Bayer conducts at least annual joint training sessions with the Berkeley Fire Department, which allows the two groups to understand the capabilities of each other's organizations. Bayer has created plans and entered into contracts with vendors in order to mitigate the damage associated with earthquakes or other disasters. Internal and community-based communications plans are being updated to assure timely communications in the event of a range of emergencies.

3.9.4 Hazardous Materials Release Risk and Loss Estimates

Because of the uncertain nature of industrial accidents, loss estimates are not presented in this plan. City staff uses the CAMEO/ALOHA software suite to plan for and respond to chemical emergencies.

3.10 *Terrorism*

The City considers terrorism to be a hazard of concern. However, because this plan is concerned with natural disasters, an in-depth analysis of terrorism is not included, and mitigation actions for terrorism will not be identified.

It is not possible to estimate the probability of a terrorist attack. Experts prioritize terrorism readiness efforts by identifying critical sites and assessing these sites' vulnerability to terrorist attack. Critical sites include those that are essential to the functioning of the City, that contain critical assets, or which would cause significant impacts if attacked (e.g., a chlorine gas release). Vulnerability of these sites is determined subjectively by considering factors such as visibility (e.g., does the public know this facility exists in this location?), accessibility (e.g., is it easy for the public to access this site?) and occupancy (e.g., is there a potential for mass casualties at this site?)

City officials are currently working with State and regional groups to prevent and prepare for terrorist attacks. This effort involves the City's Police, Fire, Public Works, Public Health and Toxics Management groups. This team has identified critical sites in the city and their vulnerability. The City is now working to refine these assessments and create an updated plan to assess the City's needs and improve its capability to prevent and respond to terrorism. The City also participates in the federal BioWatch program, designed to allow early detection of release of bioterrorism agents in the City.

The City's emergency response teams actively train to detect Pre-Incident indicators for all types of terrorist events including, but not limited to, bomb scenarios, hostage situations, infrastructure damage and a multitude of other terror-associated threats. Since any terrorist event has the potential to significantly impact the city and the region, City emergency response teams regularly conduct training with emergency response teams from neighboring jurisdictions to ensure seamless integration of resources and personnel should such a need arise.

Buildings and other structures constructed to resist earthquakes and fires usually have qualities that also limit damage from blasts and resist fire spread and spread of noxious fumes in the event of a terrorist attack.

3.11 *Hazard Analysis and Actions Summary*

This section links this plan's hazard analysis to its mitigation actions. First, this section summarizes the relative likelihood and severity of impact of each of the hazards identified in Sections 3.3 – 3.8. Next, Berkeley's key vulnerabilities to each hazard are summarized. Last, these vulnerabilities are linked to the mitigation actions outlined in Section 1.

3.11.1 Hazard Analysis Summary

Sections 3.3 – 3.8 present hazards in Berkeley, describing their likelihood and detailing their potential consequences. 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.

Table 3.14 Summary of Hazard Analysis

Hazard	Likelihood[157]	Severity of Impact[158]
Earthquake	Likely	Catastrophic
Wildland-Urban Interface Fire	Likely	Catastrophic
Rainfall-Triggered Landslide	Likely	Moderate
Floods	Likely	Minor
Tsunami	Possible	Unknown*
Climate Change	Likely	Unknown*

**Consequence levels for climate change and tsunami have not been assigned values, as adequate information to make this determination is not yet available.*

Hazardous materials release is described only as a cascading impact of a natural hazard. Because this plan focuses on natural hazards as emphasized in DMA 2000, likelihood and consequence levels for hazardous materials release and terrorism are not defined.

3.11.2 Vulnerabilities and Actions Summary

For each hazard presented in Sections 3.3 – 3.8, the following table summarizes Berkeley's key vulnerabilities, along with the mitigation actions identified in Section 1 to reduce these vulnerabilities. For each hazard, the following information is identified:

- The *Category*, in gray, identifies the category of vulnerability being described. If the City of Berkeley does not own or control the category, the responsible entity is included.

- *Vulnerability* describes the vulnerability.
- *Mitigation Action(s)* provides the title(s) of mitigation action(s) identified to reduce the described vulnerability.

This chart identifies both primary and cascading vulnerabilities. Primary vulnerabilities are directly related to the primary natural hazard, such as building vulnerabilities to earthquake shaking. Cascading vulnerabilities are listed in *italicized text*. Cascading vulnerabilities result from primary vulnerabilities. For example, structures that are not seismically sound have increased vulnerability to fire following earthquake. This structure demonstrates how mitigating primary vulnerabilities can also mitigate cascading impacts.

This table highlights key vulnerabilities identified through this planning process; but it is not all-inclusive.

Table 3.15 Summary of Vulnerabilities and Actions

Vulnerability	**Mitigation Action(s)**
Earthquake (Including shaking, surface fault rupture, liquefaction, seismically-triggered landslides, and fire following earthquake)	
Structures	
City buildings vulnerable to collapse from exposure to earthquake shaking: Old City Hall Veterans Memorial Building Center Street Garage	Strengthen and Replace City Buildings
Un-assessed City buildings may be vulnerable to earthquake shaking and ground failure (See Appendix B for reference)	Building Assessment
158 unretrofitted soft-story buildings with 1,611 units vulnerable to damage/collapse from exposure to earthquake shaking	Soft-Story
19 unretrofitted unreinforced masonry (URM) buildings vulnerable to collapse from exposure to earthquake shaking. 274 retrofitted URM buildings vulnerable to moderate or greater damage from exposure to earthquake shaking	URM

Vulnerability	**Mitigation Action(s)**
Buildings vulnerable to damage from exposure to liquefaction, landslide-induced earthquake and fault rupture Approximately 6,000 structures vulnerable to damage/destruction from exposure to landslide	Single-Family Residences
Concrete tilt-up buildings vulnerable to collapse from exposure to earthquake shaking (specific number unknown, nearly all in west Berkeley, many may also be exposed to ground failure from liquefaction)	
If buildings are damaged/collapse from exposure to earthquake shaking or ground failure: • *Buildings are more vulnerable to gas line rupture at service connections* • *Buildings are more vulnerable to fire following earthquake* • *People more vulnerable to injury/death from exposure to building damage/collapse* • *People are more vulnerable to illness from exposure to asbestos or encapsulated asbestos, which may dislodge in an earthquake*	Buildings Soft-Story URM Gas Safety Partnerships
Water system (EBMUD)	
Water pipes vulnerable to rupture from exposure to liquefaction, landslide-induced earthquake and fault rupture	EBMUD Partnerships
If water pipes rupture due to earthquake shaking or ground failure, structures more vulnerability to damage/destruction from fire following earthquake	
Sanitary Sewer System	
Sanitary sewer system vulnerable to blockage/pipe rupture/damage from exposure to liquefaction, landslide-induced earthquake and fault rupture	
If sanitary sewer system is blocked/ruptured/damage from seismic ground failure, roads and buildings more vulnerable to sinkhole	

Vulnerability	Mitigation Action(s)
Storm Drain System	
Storm drain system vulnerable to blockage/rupture/other damage from exposure to liquefaction, landslide-induced earthquake and fault rupture	Stormwater System
Electricity System (PG&E)	
Utility poles vulnerable to toppling from exposure to earthquake shaking and from exposure to liquefaction, landslide-induced earthquake and fault rupture Aboveground utility lines vulnerable from exposure to falling trees and structure collapse from earthquake shaking and from exposure to liquefaction, landslide-induced earthquake and fault rupture PG&E Electrical substations vulnerable to damage from exposure to earthquake shaking and from exposure to liquefaction, landslide-induced earthquake and fault rupture Underground cables vulnerable to rupture from exposure to liquefaction, landslide-induced earthquake and fault rupture	Partnerships
If power is lost, there will be many impacts to vulnerable City and private infrastructure.	Energy Assurance
Natural Gas System (PG&E)	
Gas transmission pipeline, distribution lines and service lines and valves in west Berkeley vulnerable rupture from exposure to liquefaction Gas distribution lines, service lines and valves vulnerable to rupture from exposure to earthquake-induced landslides and fault rupture	Gas Safety
If gas system ruptures occur, fire following earthquake is more likely, and: • *Infrastructure/buildings are more vulnerable to damage/destruction* • *People are more vulnerable to injury/death*	
Aviation Fuel Pipeline (Kinder Morgan)	
Exposed to liquefaction (specific vulnerability unknown)	Partnerships

Vulnerability	Mitigation Action(s)
Railroad (Union Pacific)	
Railroad infrastructure vulnerable to damage from exposure to earthquake shaking and liquefaction (specific vulnerability unknown)	Partnerships
If railroad infrastructure is damaged due to earthquake shaking and/or liquefaction: • *Trains more vulnerable to accidents* • *People more vulnerable to illness/injury from exposure to hazardous materials, if trains carrying hazardous materials*	
Highways and Interstate (Caltrans)	
Interstate 80 vulnerable to damage from exposure to liquefaction Parts of Highways 13 and 24 vulnerable to damage from exposure to liquefaction Overpasses at Ashby and University Avenues vulnerable to damage from exposure to earthquake shaking (but are not expected to collapse)	Partnerships
If roads are damaged from earthquake shaking and/or liquefaction: • *People in vehicles more vulnerable to injury/death in accidents* • *People vulnerable to injury/death from exposure to hazardous materials, if transportation accidents occur involving vehicles carrying hazardous materials*	
Streets/Curbs/Solano Tunnel	
Solano Tunnel vulnerable to isolation if fault rupture or earthquake-induced landslide in surrounding areas cause road blocks Streets and curbs vulnerable to damage from exposure to liquefaction, fault rupture and earthquake-induced landslides	

Vulnerability	Mitigation Action(s)
If significant street damage impedes access by emergency responders to fight fires, perform rescues, access utilities or perform other emergency response actions: • *People vulnerable to additional injuries/death* • *Structures and infrastructure vulnerable to additional damage*	Hills evacuation
Communication Infrastructure (AT&T, Verizon, Comcast and other providers)	
Land line telephone distribution system and cable system use utility poles, which are vulnerable to toppling from exposure to earthquake shaking and ground failure Underground communication lines vulnerable to rupture from exposure to earthquake-induced landslides, fault rupture and liquefaction Mobile phone system antennae vulnerable to: • Damage from earthquake shaking • Power outage from damage to electrical infrastructure (vulnerability increased if generators not onsite)	Partnerships
If communication systems are damaged due to earthquake shaking and ground failure: • *Cellular voice communication may be unusable due to earthquake impacts, combined with high demand. Voice communication is more vulnerable than SMS text messaging systems.* • *Cable customers may experience a total loss of video service, and total loss or severe network congestion of voice and data services.*	
Healthcare Facilities (Alta Bates Summit)	
Five Alta Bates Campus buildings vulnerable to damage from exposure to earthquake shaking Four buildings on the Herrick campus are vulnerable to major damage from earthquake shaking	Partnerships
People in and around four buildings on the Herrick campus are vulnerable to injury/death from exposure to seismic building damage	

Vulnerability	Mitigation Action(s)
Structures (Berkeley Unified School District)	
Unreinforced Masonry Building at BUSD Corporation Yard vulnerable to damage from earthquake shaking	Partnerships
People in and around Unreinforced Masonry Building at BUSD Corporation Yard are vulnerable to injury/death from exposure to seismic building damage	
Transportation Infrastructure (BART)	
BART tracks in Berkeley vulnerable to damage from earthquake shaking	Partnerships
Hazardous Materials	
If earthquake shaking causes lab spills, storage tank failures and/or industrial equipment problems, people in Berkeley vulnerable to injury/death from exposure to hazardous materials release	
Wildland-Urban Interface Fire	
Structures	
8,300 properties in Fire Zones 2 and 3 vulnerable to damage/destruction from exposure to WUI fire	Vegetation Management Fire Code
215 dwelling units in Fire Zone 3 - Panoramic Hill area (280 including Oakland units) especially vulnerable to damage/destruction from exposure to WUI fire, due to undersized water main and limited access routes for firefighters	
Wooden buildings with narrow side yards and dense vegetation in Fire Zone 1 vulnerable to damage/destruction from exposure to a WUI fire beginning in Fire Zone 2 or 3	
People	
Residents and firefighters in Fire Zone 2 vulnerable to injury/death from exposure to WUI fire	Vegetation Management Hills Evacuation Fire Code
520 residents in Panoramic Hill area (620 including Oakland residents) especially vulnerable to injury and death from exposure to WUI fire, due to limited access/egress routes	

Vulnerability	**Mitigation Action(s)**
Berkeley residents and visitors vulnerable to eye and respiratory illnesses from exposure to air pollution caused by large WUI fires	
Electricity system (PG&E)	
If exposed to extreme heat from WUI fire: • Utility poles vulnerable to toppling • Aboveground utility lines vulnerable to burning • Underground cables vulnerable to melting	Vegetation Management Partnerships
Natural Gas System (PG&E)	
Gas service connections vulnerable to rupture in buildings exposed to WUI fire	Vegetation Management Partnerships
Structures, Infrastructure and People/Natural Gas System (PG&E)	
People, structures and infrastructure in areas exposed to gas line rupture vulnerable to additional fire exposure	Vegetation Management Partnerships Gas Safety
Communication Infrastructure (AT&T)	
Land line telephone distribution system uses utility poles, which are vulnerable to toppling if exposed to heat from WUI fire	Vegetation Management Partnerships
Streets and curbs	
Streets and curbs in Fire Zones 2 and 3 vulnerable to damage/destruction from exposure to WUI fire	Vegetation Management
Storm drain system	
Drainage structures in Fire Zones 2 and 3 vulnerable to damage/destruction from exposure to WUI fire	Vegetation Management

Vulnerability	Mitigation Action(s)
Structures and Infrastructure	
Structures and infrastructure in fire-burned areas in Fire Zones 2 and 3 vulnerable to damage/destruction from exposure to landslide and flooding	Vegetation Management
Rainfall-triggered landslides	
Structures and Infrastructure	
Approximately 6,000 structures vulnerable to damage/destruction from exposure to landslide	Single-Family Residences
Water system (EBMUD)	
Water pipes vulnerable to rupture from exposure to landslide	Partnerships
Sanitary Sewer System	
Sanitary sewer system pipes vulnerable to rupture from exposure to landslide	
Storm Drain System	
Storm drain system vulnerable to blockage/rupture/other damage from exposure to landslide	
Electricity System (PG&E)	
Utility poles and aboveground utility lines vulnerable to toppling from exposure to landslide Underground cables vulnerable to rupture from exposure to landslide	Partnerships
Natural Gas System (PG&E)	
Gas distribution and service lines and valves in Berkeley hills vulnerable to rupture from exposure to landslide	Partnerships Gas Safety

Vulnerability	Mitigation Action(s)
Floods	
Structures	
475 structures vulnerable to damage to first floor and basement finishes, contents and appliances from exposure to up to 1 foot of flooding. 200 additional structures, also primarily in the City's west, are vulnerable to damage from exposure from up to two feet of flooding.	Stormwater System NFIP Severe Storms
Streets, Structures and Infrastructure	
Streets, structures and infrastructure in the Potter Watershed are vulnerable to damage from exposure to localized flooding in the following locations: • San Pablo Avenue between Ward and Murray • California Street between Woolsey and Harmon • Woolsey Street between California and Adeline • Woolsey Street at Dana • Ashby Avenue between California and King • Martin Luther King, Jr. Way between Russell and Woolsey • Parker Street between Seventh and Fourth • Fulton Street at Derby • Ellsworth Street between Blake and Parker • Telegraph Avenue between Ashby and Woolsey • Telegraph Avenue at Stuart • College Avenue at Dwight	Stormwater System NFIP Severe Storms

Vulnerability	Mitigation Action(s)
Streets, structures and infrastructure in the Cordonices Watershed are vulnerable to damage from exposure to localized flooding in the following locations: • Second Street, Creek corridor to Gilman • Railroad tracks, Creek corridor to Gilman and to Albany • Gilman Street between Sixth and Second • Codornices Creek at Sixth, at most street crossings east of San Pablo, at Glen • Ninth Street between Harrison and Creek Corridor • Monterey Ave between Posen and Hopkins • Hopkins Street at Carlotta • The Alameda between Napa and Yolo • Sonoma Ave between Fresno and Hopkins • Spruce Street, Eunice to Creek corridor • Euclid Ave, Cragmont to Codornices Park • Cragmont, Euclid to Regal • Various locations on La Loma, Glendale, Campus Drive, Queens, Shasta Road	
Hazardous Materials	
People and environment exposed to potential flood-induced hazardous materials release from 41 toxics sites within the 500-year floodplain. Specific vulnerability unknown.	Stormwater System NFIP HazMat Floods Severe Storms
Transportation	
Regional transit vulnerable to severe traffic impacts from exposure to flooding at key underpasses and roads accessing Interstate 80	Stormwater System NFIP Severe Storms

Vulnerability	Mitigation Action(s)
Tsunami	
Structures	
City buildings exposed to tsunami inundation: • Dona Spring Animal Shelter • Marina Boat Docks • Berkeley Yacht Club • Shorebird Nature Center • Marina Corporation Yard • Marina Administration Building The extent of each building's vulnerability is unknown.	Tsunami
Privately-owned structures in the Marina and on the western edge of Berkeley exposed to tsunami inundation. The extent of each building's vulnerability is unknown.	
People	
Estimated 23 traditional households and over 225 individual Marina boat residents are exposed to tsunami inundation. Specific vulnerability is unknown.	Tsunami
Estimated that staff/customers at 77 businesses are exposed to tsunami inundation. Staff and guests at the DoubleTree hotel alone may account for 600+ people. Estimated that 1,664 employees at four government offices are exposed to tsunami inundation. Specific vulnerability unknown.	

Vulnerability	**Mitigation Action(s)**
Streets	
Key roads exposed to tsunami inundation: 1. Ramps to University Avenue Bridge 2. Frontage road north to Gilman Street 3. Frontage road south to Ashby Avenue/CA-13 4. Interstate 80 5. Ramps to I-80 Bicycle/Pedestrian overcrossing Specific vulnerability is unknown.	Tsunami
Boats	
1,000 boats in Marina slips exposed to tsunami inundation. Specific vulnerability unknown.	Tsunami
Climate Change	
People	
Elderly and children under 5 (especially poor) will be vulnerable to public health impacts of heat-related events (premature death, cardiovascular stress and failure, and heat-related illnesses such as heat stroke, heat exhaustion, and kidney stones) from increased exposure to heat waves. *People vulnerable to increased incidences of West Nile virus, human hanta virus, and Lyme disease from increased exposure to disease vectors, caused by increases in air temperature and changes in precipitation.*	Extreme Heat Climate Change Integration

Vulnerability	Mitigation Action(s)
People, structures and infrastructure	
Buildings and infrastructure in low-lying areas around Berkeley Aquatic Park, as well as land around the Berkeley Marina and infrastructure east of the highway along 2nd Street, are exposed to sea level rise. Specific vulnerability is unknown. *Sea-level rise will cause the groundwater table and stream water levels to rise, increasing the people, structures and infrastructure exposed to liquefaction in an earthquake. Specific increase in vulnerability unknown.* *Rising sea levels will increase the people, structures and infrastructure exposed to tsunami inundation. Specific increase in vulnerability unknown.*	Sea-Level Rise Climate Change Integration
Increases in the intensity and frequency of winter storms due to climate change will increase exposure to landslides for people, structures and infrastructure in the Berkeley hills. Specific increase in vulnerability unknown.	Climate Change Integration
Structures and infrastructure	
More structures and infrastructure will become vulnerable to damage from exposure to flooding, and flooding events will also become more frequent. This is due to: • *Rise in groundwater table and stream water levels* • *More extreme rainfall events and more hazardous storms* • *Sea level rise causing more upstream flooding.*	Severe Storms Climate Change Integration
Environment	
Wetlands and transitional habitats vulnerable to inundation/erosion from sea level rise. Species composition vulnerable to alteration following sea level rise. Freshwater inflow vulnerable to change from sea level rise. Water quality vulnerable to sea level rise. Fish, wildlife and other aquatic organisms in intertidal and subtidal habitats vulnerable to changes in salinity from reduced freshwater inflow due to sea level rise.	Water Security Climate Change Integration

3.12 *Endnotes*

[1] Human action directly influences the probability that climate change will occur. Climate change is referenced as a natural hazard here because of its potential to exacerbate natural hazards described in this plan.

Chapter Three: Analysis of Hazards in Berkeley

[2] Documentation is on file at the Berkeley Planning Department

[3] Public Law 106-390

[4] Analyses by the US Geologic Survey (USGS) and California Earthquake Prediction Evaluation Council: http://pubs.usgs.gov/fs/2008/3027/fs2008-3027.pdf

[5] Southern California Earthquake Center. *A Comparison of the February 28, 2001, Nisqually, Washington, and January 17, 1994, Northridge, California Earthquakes*. http://www.scec.org/news/01news/feature010313.html

[6] Information adapted from the United States Geological Survey: http://earthquake.usgs.gov/learn/topics/mag_vs_int.php

[7] The Alquist-Priolo Earthquake Fault Zoning Act of 1972 was passed by the legislature as a result of the 1971 San Fernando earthquake in southern California, which damaged numerous homes, commercial buildings, and other structures. This Act is intended to prevent the construction of most structures intended for human occupancy across active faults. The Act was not retroactive; therefore, structures intended for human occupancy built before 1972 within the fault zone may be impacted by surface fault rupture.

The Act requires that the California Geological Survey (CGS) designate zones approximately ¼-mile wide along known active faults (known as Alquist-Priolo Earthquake Fault Zones). To comply with this Act, the City regulates most development projects within the zones, except for single-family wood-frame and steel-frame dwellings up to two stories not part of a development of four units or more, or projects not involving structures intended for human occupancy. Alternations and additions to non-residential property that exceed 50% of the property value are also covered by this Act. Cities can be more restrictive than state law requires. Before a permit can be issued within a fault zone, site-specific geologic reports must be prepared to demonstrate that proposed buildings will not be constructed across active faults. Typically, structures intended for human occupancy cannot be placed within 50 feet of an active fault trace.

The Seismic Hazards Mapping Act of 1990 requires the preparation of site-specific geotechnical reports for development proposals in areas identified as Zones of Required Investigation for earthquake-induced landslides or liquefaction as designated by CGS. Cities and Counties are also required to incorporate the Official Seismic Hazard Zone Maps into the Safety Elements of their General Plans. The Seismic Hazards Mapping Act requires sellers of real property to disclose to buyers if property is within a Zone of Required Investigation. Cities and counties containing Zones of Required Investigation are required to enforce the preparation of these reports and condition project approval on

the incorporation of necessary mitigation measures related to site remediation, structure and foundation design, and/or avoidance.

Effective June 1, 1998, the Natural Hazards Disclosure Act requires that sellers of real property and their agents provide prospective buyers with a "Natural Hazard Disclosure Statement" when the property is being sold lies within one or more State-mapped hazard areas, including Earthquake Fault Zones and Zones of Required Investigation.

[8] California Geological Survey Regulatory Maps can be viewed at http://www.quake.ca.gov/gmaps/WH/regulatorymaps.htm

[9] Charles Real, California Geological Survey

[10] U.S. Geological Survey, Miscellaneous Field Studies Map MF-2378. http://pubs.usgs.gov/mf/2001/2378/

[11] Jibson, R.W., Harp, E.L., and Michael, J.A., 1998, A Method for Producing Digital Probabilistic Seismic Landslide Hazard Maps: An Example from the Los Angeles, California area: U.S. Geological Survey Open-File Report 98-113, 17 p., 2 pl., http://www.csulb.edu/~rodrigue/quake/jibson.html

[12] Miles, Scott B., Keefer, David K. 2001, Seismic Landslide Hazard for the City of Berkeley, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2378, USGS. 2001. http://pubs.usgs.gov/mf/2001/2378/

[13] Estimated each structure at 1,900 square feet and multiplied by $350/sq ft replacement cost. $350/sq ft is the Berkeley Fire Department's formula for building replacement cost.

[14] Yasuhara K., Komine H., Murakami S., Chen G., Mitani Y. (2010) Effects of climate change on geo-disasters in coastal zones. Journal of Global Environmental Engineering, JSCE 15, 15–23.

[15] ATC 52-1. 2010. San Francisco Department of Building Inspection, Community Action Plan for Seismic Safety (CAPSS) Project. *Here Today Here Tomorrow: The Road to Earthquake Resilience in San Francisco.* http://www.sfgsa.org/modules/showdocument.aspx?documentid=9753.

[16] http://www.sfmuseum.org/conflag/underwriters.html

[17] City of Berkeley Budget Book FY2012-2013,Community Profile Data

[18] 2010 American Community Survey.

[19] The City has adopted Standard Plan Set A for wood frame homes of two stories or less that provides typical details and other guidance. This plan set simplifies the design of cripple wall retrofits for many homes in Berkeley.

[20] Information per Building and Safety Division as of March 2012.

[21] Association of Bay Area Governments, 2003. *Preventing the Nightmare. Note: The remaining uninhabitable housing losses come from mobile homes, unreinforced masonry buildings and non-wood frame multi-family residences.*

[22] See "Post Earthquake Housing Issue Paper B" published by the Association of Bay Area Governments. Study of this issue is ongoing, but after the Loma Prieta earthquake, red-tagged multifamily units in San Francisco took longer to repair and reoccupy than single-family homes. In San Fernando, after the Northridge earthquake, after 2 years, multi-family units showed significantly slower rates of repair than single-family homes.

[23] Information provided by Bill Cain, Elizabeth Bialek, Jose Rios, Janetta Johnson, Mike Ambrose, Michelle Blackwell, EBMUD.

[24] Information provided by Manuel Ramirez, City Environmental Health Division Manager, and Dr. Janet Berreman, City Health Officer, as of November 2012

[25] EBMUD Press Release, February 27, 2007, "Claremont Tunnel Earthquake Retrofit Completed, Mandatory Rationing Alert System Ended."

[26] EBMUD Claremont Corridor Seismic Improvements Project Environmental Impact Statement, State clearinghouse #2003022140.

[27] Interceptors are sewer pipes, as large as 10 feet in diameter, which form the backbone of the wastewater transport system.

[28] Information provided by Stuart Nishenko, Senior Seismologist, and PG&E

[29] National Transportation Safety Board, 2011. *Pipeline Accident Report: Pacific Gas and Electric Company Natural Gas Transmission Pipeline Rupture and Fire San Bruno, California, September 9, 2010*, Washington D.C.

[30] Information provided by Nicole Stewart, Area Manager Brisbane Terminal & Richmond Station of the Kinder Morgan Corporation, as of March 2012.

[31] Nabil Al-Hadithy, City Toxics Management Division, as of March 2012.

[32] Evacuation routes are designated in the City's General Plan, Transportation Element policy T-28: Emergency Access.

[33] Information provided by Craig Whitman, Office of Earthquake Engineers, Steve Prey, Energy Conservation Program Coordinator, and Robert Braga (January 2012), Branch Chief Maintenance Services/Emergency Management: Planning & Training, all at Caltrans.

[34] BART information provided by Tracy Johnson, Seismic Engineering Manager, BART, June 2013. BART earthquake early warning system information provided by John McPartland, BART Board of Directors.

[35] P-waves are non-destructive, earthquake-generated waves. They travel faster than secondary waves (S-waves), which create the strong shaking responsible for structural damage in earthquakes.

[36] Information provided by Lori Kingshott, Universal Account Manager for AT&T, in March 2012.

[37] Information provided by Ken Fattlar, Director of Network Operations for Verizon Wireless in Northern California, in April 2013.

[38] Bryan Byrd, Comcast, Director, Communications, June 2013

[39] A "headend" is a master facility for receiving television signals for processing and distribution over a cable television system.

[40] In a hierarchical telecommunications network, the "backhaul" portion of the network comprises the intermediate links between the core network, or backbone network and the small sub-networks at the "edge" of the entire hierarchical network.

[41] Carl Scheuerman, Director of Regulatory Affairs, Sutter Health Facility Planning & Development, personal communication February 23, 2012

[42] 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.

[43] 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.

[44] 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.

[45] The Tang Center is no longer considered to be an alternate Emergency Operations Center site for the UC Berkeley campus.

[46] Janice Edwards, Communications Manager/Project Manager, LifeLong Medical

[47] California Seismic Safety Commission. *The Field Act and Public School Construction: A 2007 Perspective.* February 2007.

[48] California Seismic Safety Commission. *Seismic Safety in California's Schools: Findings and Recommendations on Seismic Safety Policies and Requirements for Public, Private, and Charter Schools.* December 2004.

[49] Lew Jones, Berkeley Unified School District Maintenance Department Director, March 2013

[50] Shirley Slaughter, Berkeley City College Business Officer and Safety Committee Chair, March 2012.

[51] Figures are from the UC Berkeley website and the Berkeley Downtown Association.

[52] Camerio, Mary. "The Economic Benefits of a Disaster Resistant University: Earthquake Loss Estimation for UC Berkeley." April 12 2000, Institute of Urban Design and Regional Development.

[53] See http://www.berkeley.edu/administration/facilities/safer/index.html for more information on UC Berkeley's SAFER program.

[54] www.berkeley.edu/administration/facilities/safer/

[55] Office of the Vice Provost and the Disaster Resistant University Steering Committee. Strategic Plan for Loss Reduction and Risk Management: University of California, Berkeley. Working Paper 2000-03. University of California, Berkeley, July 2000.

[56] Information provided by Sara Wynne, Emergency Services Specialist, Berkeley Lab, as of March 2012.

[57] Per July 8, 2010 "Geologic Hazard Mitigation" presentation, available at

http://www.lbl.gov/Community/CAG/docManager/1000000031/WDM_July%208_Geotech.pdf

[58] As of October 2013; includes budgeted, career and at-will, positions only (including Library and Rent Board)

[59] Includes both Adeline/Shattuck and Heinz Avenue stores

[60] 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.

[61] 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.

[62] 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.

Risk, S. P. A. "Enhancements in HAZUS-MH Fire Following Earthquake, Task 3: Updated Ignition Equation pp. 74pp. *SPA Risk LLC, Berkeley CA. Principal Investigator C. Scawthorn. Prepared for PBS&J and the National Institute of Building Sciences, San Francisco* (2009).

[63] Estimation derived from Ch. 10, particularly Eqn. 10-1, of HAZUS Earthquake Tech Manual MR 4:

FEMA, 2003. Multi-hazard Loss Estimation Methodology, Earthquake Model, HAZUS-MH MR4 Technical Manual. Developed by: Department of Homeland Security, Federal Emergency Management Agency, Mitigation Division, Under a contract with: National Institute of Building Sciences Washington, D.C., p. 712.

[64] In 2004, estimate was $20 million damage from 5 estimated fires. This plan estimates 6-12 fires. If $4 million/ignition assumed, $24 million - $48 million damage is estimated in 2004 dollars. This figure was then updated for 2013 to $30 million - $60 million using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[65] In 2004, estimate was $1.5 billion. Updated for 2013 using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[66] Information provided by Bill Cain, EBMUD

[67] Information provided by Bill Cain, EBMUD

[68] In 2004, estimate was $215 million. Updated for 2013 using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[69] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[70] Updated for 2013 using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[71] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[72] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[73] United States Fire Administration. *The East Bay Hills Fire, Oakland-Berkeley, California (October 19-22, 1991): Report 60 of the Major Fires Investigation Project.*

[74] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[75] California Department of Public Health. 2008. Public Health Climate Change Adaptation Strategy for California. http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf

[76] Pacific Institute. (2010). A Review of Social and Economic Factors that Increase Vulnerability to Climate Change Impacts in California.

[77] 2010 CBC Chapter 7A: Materials and Construction Methods for Exterior Wildfire Exposure, and 2010 CRC Section R327: Materials and Construction Methods for Exterior Wildfire Exposure

[78] Per Dan Gallagher, Senior Forestry Supervisor, City of Berkeley: The Fire Fuel Chipper Program collected green waste vegetation in the following amounts in the following years:

- 2005: 264.35 tons
- 2006: 237.59 tons
- 2007: 189.06 tons
- 2008: 175.16 tons
- 2009: 167.17 tons
- 2010: 161.31 tons
- 2011: 187.24 tons

[79] Information provided by Andrew Schneider, Recycling Program Manager, City of Berkeley, as of March 2012.

[80] Information provided by Andrew Schneider, Recycling Program Manager, City of Berkeley, as of March 2012.

[81] Information provided by Doug McDonald, Senior Landscape Supervisor, City of Berkeley as of March 2012.

[82] East Bay Municipal Utility District Staff: William R. Kirkpatrick, Manager, Water Distribution Planning Division (WDPD); Michael Ambrose, Manager of Regulatory Compliance; Jose L. Rios, Senior Civil Engineer in WDPD; Tim McGowan, Associate Civil Engineer in WDPD, via David Rehnstrom, Senior Civil Engineer; Heidi Oiol, Associate Civil Engineer in Wastewater Engineering Division, via Vincent De Lange, Senior Civil Engineer

[83] http://firecenter.berkeley.edu/

[84] Information provided by Sara Wynne, Emergency Services Specialist, Berkeley Lab, as of March 2012.

[85] Per Section IV.M.2.1 of Berkeley Lab's 2007 Long Range Development Plan Environmental Impact Report.

[86] Total square footage of buildings in burn area is 9,386,281 square feet. That number was multiplied by $350/square foot, the Berkeley Fire Department's formula for building replacement cost, resulting in $3.3 billion.

[87] In 2004, estimate was $500 million. Updated for 2013 using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[88] Ellen et al. "Map showing principal debris-flow source areas in Alameda County, California." USGS Open-File Report 97-745 E.

[89] Pike et al. "Map and map database of susceptibility to slope failure by sliding and earth flow in the Oakland area, California." USGS MF-2385.

[90] The City uses a 10-year design storm as representation of a rainfall event that reflects local conditions. Design storms are defined by their duration, total rainfall depth, and temporal patterns. A 10-year storm has a probability of 0.1 or 10% of being equaled or exceeded in any one year.

[91] California Adaptation Planning Guide, July 2012.

[92] Confalonieri, U., and B. Menne. 2007. Human health. Climate Change 2007. Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, O. F. C. M. L. Parry, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson, eds. Cambridge, UK.: Cambridge University Press 391–431.

[93] USGCRP. 2009. Global Climate Change Impacts in the United States: A State of Knowledge Report from the U.S. Global Change Research Program, T. R. Karl, J. M. Melillo, and T. C. Peterson, eds. New York: Cambridge.

[94] California Adaptation Planning Guide, July 2012.

[95] The DFIRM map was created by the Federal Emergency Management Agency (FEMA) for the National Flood Insurance Program. Data current as of 2009.

[96] 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. Data from FEMA, current as of March 2011.

[97] 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.

[98] Information based on 2009 mapping of 100- and 500-year flood plain identified in Federal Emergency Management Agency (FEMA) for the National Flood Insurance Program. Data current as of 2009, overlayed with the City's May 2012 inventory of facilities regulated by the Toxics Management Division.

[99] In the 2004 plan, flood losses were estimated using the following calculations:

	Three Feet Flood Waters			One Foot Flood Waters			*Totals*
	Value	% Damage	Damage	Value	% Damage	Damage	
Structures	$70 mill	27%	$19 mill	$250 mill	14%	$35 mill	$54 mill
Contents*	$35 mill	40%	$14 mill	$250 mill	21%	$53 mill	$67 mill
Totals	$105 mill		$33 mill	$500 mill		$88 mill	**$121 mill**

*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.

In 2013, loss estimates quoted in the narrative were updated using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[100] Wilson, R., Ewing, L., Dengler, L., Boldt, E., Evans,T., Miller, K., Nicolini, T., and Ritchie, A. Effects of the February 27, 2010 Chilean Tsunami on the Harbors, Ports, and the Maritime Community in California With Comparison to Preliminary Evaluation of March 11, 2011 Tsunami. Proceedings from ASCE Coasts, Oceans, Ports, and Rivers Institute Conference, Alaska, June 2011.

[101] The SAFRR Tsunami Modeling Working Group, 2013, Modeling for the SAFRR Tsunami Scenario—Generation, propagation, inundation, and currents in ports and harbors, chap. D 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, 136 p., http://pubs.usgs.gov/of/2013/1170/d/.

[102] A team of scientists from California Geological Survey, US Geological Survey and the California Office of Emergency Services are in the process of developing a methodology for estimating tsunami hazard to the west coast. In 2013 they expect to begin two pilot studies to test the methodology in Crescent City and Huntington Beach. Following validation of the pilot studies, probabilities for the rest of the state will be developed.

[103]Wood, N., Ratliff, J., and Peters, J., 2013, Community exposure to tsunami hazards in California: U.S. Geological Survey Scientific Investigations Report 2012-5222, 49p.

[104] Overcrossing provides non-automobile access between the residential and business districts on the east side of I-80 and the Berkeley waterfront, Bay Trail and Eastshore State Park (Addison St and Bolivar Drive) to the west of the freeway (West Frontage Road and University Avenue).

[105] The SAFRR Tsunami Modeling Working Group, 2013, Modeling for the SAFRR Tsunami Scenario—Generation, propagation, inundation, and currents in ports and harbors, chap. D 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, 136 p., http://pubs.usgs.gov/of/2013/1170/d/.

[106] The Dona Spring animal shelter, opened in 2012, is built above the 100-year flood plain but is still in the tsunami inundation zone

[107] Morello-Frosch, R; Pastor, M; Sadd, J; Shonkoff, S. The Climate Gap: Inequalities in How Climate Change Hurts Americans & How to Close the Gap. May 2009.

[108] Moser, S, Ekstrom, J. and Franco, G. 2012.Our Changing Climate 2012. California Climate Change Center. http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf

[109] McKenzie, D.; Heinsch, F.A.; Heilman, W.E. 2011. Wildland Fire and Climate Change. (January 17, 2011). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. http://www.fs.fed.us/ccrc/topics/wildland-fire.shtml

[110] Moser, S, Ekstrom, J. and Franco, G. 2012.Our Changing Climate 2012. California Climate Change Center. http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf

[111] Moser, S, Ekstrom, J. and Franco, G. 2012.Our Changing Climate 2012. California Climate Change Center. http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf

[112] *Climate Change Scenarios for the San Francisco Region*, July 2012. California Climate Change Center.

[113] Ibid.

[114] U.S. EPA. 2006. *Excessive Heat Events Guidebook*. EPA 430-B-06-005. U.S. Environmental Protection Agency, Washington, DC.

[115] Heat wave is defined as five days over 72°F to 77°F. Source: Public Interest Energy Research, 2011. Cal-Adapt. Retrieved from http://cal-adapt.org.

[116] Public Interest Energy Research, 2011. Cal-Adapt. Retrieved from http://cal-adapt.org.

[117] California Adaptation Planning Guide, July 2012.

[118] English et al. (2007). Executive Summary, Heat-Related Illness and Mortality Information for the Public Health Network in California.

[119] Morello-Frosch, R; Pastor, M; Sadd, J; Shonkoff, S. The Climate Gap: Inequalities in How Climate Change Hurts Americans & How to Close the Gap. May 2009.

[120] California Natural Resources Agency. (2009). 2009 California Climate Adaptation Strategy. Retrieved from: http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf.

[121] California Adaptation Planning Guide, July 2012.

[122] Public Interest Energy Research, 2011. Cal-Adapt. Retrieved from http://cal-adapt.org.

[123] Our Changing Climate 2012. California Climate Change Center.

[124] Moser, S, Ekstrom, J. and Franco, G. 2012.Our Changing Climate 2012. California Climate Change Center. http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf.

[125] *Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on the Shoreline*. October 6, 2011. San Francisco Bay Conservation and Development Commission.

[126] *Climate Change Scenarios for the San Francisco Region*. July 2012. Prepared for the California Energy Commission by Scripps Institution of Oceanography, University of California San Diego.

[127] See http://www.csc.noaa.gov/digitalcoast/tools/slrviewer.

[128] See http://www.csc.noaa.gov/digitalcoast/tools/slrviewer. Website viewed on April 8, 2013.

[129] San Francisco Bay Conservation and Development Commission, 2011, p. 5

[130] The data in the map do not consider natural processes such as erosion or marsh migration that will be affected by future sea level rise. There is not 100% confidence in the elevation data and/or mapping process. It is important not to focus on the exact extent of inundation, but rather to examine the level of confidence that the extent of inundation is accurate. The data may not completely capture the area's hydrology, such as canals, ditches, and stormwater infrastructure.

[131] California Adaptation Planning Guide, July 2012.

[132] Moser, S, Ekstrom, J. and Franco, G. 2012.Our Changing Climate 2012. California Climate Change Center. http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf.

[133] McKenzie, D.; Heinsch, F.A.; Heilman, W.E. 2011. Wildland Fire and Climate Change. (January 17, 2011). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. http://www.fs.fed.us/ccrc/topics/wildland-fire.shtml.

[134] Public Interest Energy Research, 2011. Cal-Adapt. Retrieved from http://cal-adapt.org.

[135] A. L. Westerling & B. P. Bryant. Climate change and wildfire in California. 2008. http://tenaya.ucsd.edu/tioga/pdffiles/Westerling_wildfire_jan2008.pdf

[136] U.S. Global Change Research Program

[137] *Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on the Shoreline*. October 6, 2011. San Francisco Bay Conservation and Development Commission

[138] http://www.flseagrant.org/coastalplanning/sea-level-rise-and-climate-change-to-be-considered-in-flood-mapping/

[139] Confalonieri, U., and B. Menne. 2007. Human health. Climate Change 2007. Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, O. F. C. M. L. Parry, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson, eds. Cambridge, UK.: Cambridge University Press 391–431.

[140] USGCRP. 2009. Global Climate Change Impacts in the United States: A State of Knowledge Report from the U.S. Global Change Research Program, T. R. Karl, J. M. Melillo, and T. C. Peterson, eds. New York: Cambridge.

[141] Recommendations related to mitigating climate change impacts are contained in Climate Action Plan Chapter 5 (p. 101).

[142] Amanda Cundiff, Regional Partnership Office, U.S. Forest Service

[143] Public Law 106-390

[144] Both of these accident sites no longer store anhydrous ammonia.

[145] UC Berkeley and Berkeley Lab have since evaluated their storm water systems as potential hazardous materials conduits to the creeks.

[146] Of the 436 facilities indicated, 380 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 Carrie Estadt, City Toxics Management Division, May 2012).

[147] 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.

[148] City Toxics Management Division, as of September 2013.

[149] 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.

[150] Berkeley Municipal Code Section 17.12.030.C.2 requires uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction. This requirement applies to future businesses but does address existing facilities. BMC 17.12.030 does not recognize areas exposed to sea-level rise in the flood exposure area.

[151] Per Nabil Al-Hadithy (March 2012), the engineering study is a Risk Management Plan, which includes safety information, process hazard analysis/hazard review, operating procedures, training, maintenance, compliance audits and incident investigations, along with documents and records showing that the facility is implementing the program. Scenarios for release including earthquake, operator error and fire are studied and corrections are made. The technical severity of these studies depends on the quantity and type of hazardous substances at the facility.

[152] The City has limited regulatory authority over radioactive material use and management. Radioactive materials are managed by the federal Department of Energy and Nuclear Regulatory Commission.

[153] Per Nabil Al-Hadithy, Toxics Management Division, City of Berkeley: Per the State's Unified Hazardous Waste and Hazardous Materials Management Regulatory Program, the City's Toxics Management Division is the agency responsible for administering six of the State's hazardous materials and waste programs for Berkeley. The City of Berkeley regulates both UC Berkley and Berkeley Lab for the following six State programs:

> 1. Hazardous Materials Release Response Plans and Inventories (HMBP) Program, Health and Safety Code, Division 20, Chapter 6.95, Article 1, with supplemental regulations in California Code of Regulations Title 19, Sections 2620-2732.
>
> 2. California Accidental Release Prevention (CalARP) Program, Health and Safety Code, Division 20, Chapter 6.95, Article 2, with supplemental regulations in California Code of Regulations, Title 19, Sections 2735-2785.
>
> 3. Underground Storage Tank (UST) Program, Health and Safety Code, Division 20, Chapter 6.7, with accompanying regulations in the California Code of Regulations, Title 23.

4. Aboveground Petroleum Storage Act Requirement for Spill Prevention, Control and Countermeasure (SPCC) Plans, Health and Safety Code, Division 20, Chapter 6.67, Section 25270-25270.13.

5. Hazardous Waste Generator and Onsite Hazardous Waste Treatment (tiered permitting) Programs, Health and Safety Code, Division 20, Chapter 6.5, with accompanying regulations in the California Code of Regulations, Title 22.

6. California Fire Code: Hazardous Materials Management Plans (HMMP) and Hazardous Materials Inventory Statements, California Code of Regulations, Title 27, Division 2, Chapter 4.5.

The Toxics Management Division also enforces City codes regarding hazardous materials and waste. These codes are often more stringent than CUPA codes.

[154] Information provided by Sara Wynne, Emergency Services Specialist, Berkeley Lab, as of March 2012.

[155] Site Map and Community Right-to-Know Information available at : http://www.lbl.gov/ehs/esg/Reports/assets/HazardousMaterialsBusinessPlanMainSite2013_web.pdf

[156] Information provided by James C. Breitlow, CHMM, REA, Bayer Corporation - Health, Environment, Safety and Security.

[157] Using a structure outlined by Saunders, Beban and Kilvington (3 July 2013 draft), 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

[158] Using a structure outlined by Saunders, Beban and Kilvington (3 July 2013 draft), 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*

4. Current Mitigation Programs and Resources

This section identifies the regulatory authorities, policies, programs and funding structures that support the Berkeley community's hazard mitigation efforts.

Section 4.1 describes the public works resources supporting mitigation efforts. Section 4.2 describes emergency management structures in Berkeley. Section 4.3 describes taxing authorities in Berkeley. Section 4.4 describes the City of Berkeley budget. Section 4.5 describes the resources supporting mitigation efforts for City buildings and systems. Section 4.6 describes the resources supporting mitigation of privately-owned buildings. Section 4.3 describes the regulatory authorities, policies and programs supporting fire risk reduction in Berkeley. Section 4.7 highlights State and federal requirements related to hazard mitigation, and describes how Berkeley complies with these requirements. The timeline in section 4.8 identifies key mitigation activities and disaster events that impacted Berkeley's mitigation programs and resources.

4.1 *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 rights-of-way.

Public Works Divisions and staffing allocations (measured in Full Time Equivalent (FTE) positions) are as follows:

- Office of the Director (6 FTE)
- Operations, Deputy Director (137 FTE)
- Engineering (33.75 FTE)
- Zero Waste (87 FTE)
- Transportation (13 FTE)
- Administrative & Fiscal Services (10 FTE)

Significant objectives expected to be accomplished by the department during FY 2014 include executing Sewer System Asset Management Implementation Plan and implementing computerized maintenance management system for sewers; beginning construction for accelerated street rehabilitation; initiating implementation of the Watershed Management Plan; contracting with Project Manager and develop design and financial plan for Center Street Garage replacement; and completing building assessment for all City buildings under the Public Works and Parks, Recreation & Waterfront Departments, and developing a long-term Capital Improvement Program.

Four publicly-staffed commissions provide community oversight over Public Works activities:

- Commission on Disability
- Community Environmental Advisory Commission Public Works Commission

- Transportation Commission
- Zero Waste Commission

4.2 *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 four 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 provides community oversight over emergency management activities. The 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.

4.3 *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 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.

Sales tax is 9.75 cents on every dollar. Of that, the State gets 7 cents, Alameda County gets 1.75 cents, and the City gets a penny. Berkeley's sales tax revenue has decreased during the economic downturn, but is expected to remain steady going forward because of the City's efforts to retain its diverse retail mix.

The decline in property transfer tax is an example of the impact of the economy on City budgets. 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 (note the $9.2 million drop from FY 2007 to FY 2009). To protect City services from this volatility, much of this revenue is used for one-time infrastructure needs, such as streets and transportation projects.

4.4 *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 2014 & FY 2015 Biennial Budget was adopted

on June 25, 2013. It includes a combination of $3 million in recurring General Fund expenditure reductions and new revenues in FY 2014, which allowed the FY 2014 & FY 2015 Biennial Budget to balance, assuming costs and revenues remain as projected.

The City's General Fund is $146 Million. The balance of the City's budget is made up of special funds ($172 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:

- 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.
- 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.
- 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.

Over the past few years, staff and the Council have implemented reductions that minimized cuts to services, while at the same time controlling costs in response to declining revenues. These strategies included reducing the size of the City organization each year over the last five years, and that approach is to continue into FY 2014. The cumulative effect of these reductions is the elimination of over 200 full time equivalent (FTE) positions throughout the City.

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:

- Focusing on the long-term fiscal health of the City by adopting a two-year budget and conducting multi-year planning;
- Building a prudent reserve;
- Developing long-term strategies to reduce unfunded liabilities;
- Controlling labor costs while minimizing layoffs;
- Allocating one-time revenue for one-time expenses;
- Requiring enterprise and grant funds to balance and new programs to pay for themselves; and
- Any new expenditure requires either additional revenue or expenditure reductions.

The City also used the "fix it first" approach in developing the budget, through which current capital improvements are funded before funding new projects.

4.5 *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 2004, the City has strengthened the historic Ratcliff building, an effort supported by a FEMA grant. The Ratcliff building is home to the Public Works Department Operations Center, which will be a key facility supporting the City's response to disasters. In 2006, the City constructed a new Fire Station 7, which is the only fire station east of the Hayward Fault. The City has also constructed a new animal shelter.

Additionally, the City has strengthened or rebuilt all seven of the City's fire stations, all public school buildings, the Civic Center (which houses many key government functions), the Public Safety Building, and all libraries. The City is currently 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.

4.6 *Privately-Owned Buildings*

The City offers a comprehensive suite of programs to encourage the community to strengthen buildings to be more hazard-resistant.

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.

City Transfer Tax Rebate Program. 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. The process begins once the homeowner makes seismic safety improvements. 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 $9 million to homeowners through this program.

Home Rehabilitation Loan Program. The Senior and Disabled Home Rehabilitation Loan Program assists very-low-income senior and disabled homeowners in repairing their homes, to eliminate conditions that pose a threat to their health and safety, and to help preserve the City housing stock. Qualified borrowers can receive interest-free loans of up to $35,000. Financial assistance is in the form of a deferred payment loan that is due and payable upon the sale or transfer of title to the property.

Technical Assistance. The City has developed more options and technical standards to seismically strengthen single-family homes and multi-unit apartment buildings. The City has

adopted International Building Code standards for seismic strengthening of wood-frame buildings. In addition, the City has implemented ABAG Standard Plan Set A as a guide that provides typical details and other recommendations for wood-frame homes of two stories or less. This plan set assists building owners and their contractors in the preparation of permit documentation and assists the City's plan checkers in their review of permit submittals. . The City has its own URM ordinance tailored specifically to Berkeley, which has structural engineering and prescriptive guidelines providing technical assistance for design professionals. The City has published guidelines for Transfer Tax Reductions to clarify the types of voluntary seismic strengthening work that qualify for a Transfer Tax Rebate.

Soft-Story Building Program. On December 3, 2013, City Council adopted Ordinance No. 7,318-N.S. amending Berkeley Municipal Code Chapter 19.39 to require property owners of soft, weak or open front buildings with five or more dwelling units to retrofit their buildings within the next five years. Owners have three years to apply for a building permit and two years to complete the work after submitting their permit application. The law applies to buildings constructed prior to 1978 and takes effect January 4, 2014. This is the second phase of the Soft Story Program.

Soft story buildings are characterized as wood-frame buildings with more than one story, typically with extensive ground story windows, garage doors, or open-air spaces such as parking with little or no enclosing solid wall, that lead to a relatively soft or weak lateral load resisting system in the lower story.

Under the first phase of the soft story program, since 2005, soft-story building owners have been required to submit an engineering evaluation report identifying their building's weaknesses and ways to remedy those weaknesses, to post an earthquake warning sign and notify their tenants of the building's potentially hazardous condition. Since 2005, thirty-five percent of soft-story building owners voluntarily retrofitted their buildings.

Unreinforced Masonry Building Program. The City instituted an Unreinforced Masonry (URM) Safety program that created an inventory of URM buildings and mandated retrofits by deadlines based on the use of the buildings. Since the program's original inception in 1991, over 90 percent of URMs on the City's Hazardous Building Inventory have been seismically retrofitted, demolished or demonstrated to have adequate reinforcement.

4.7 *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; improvement of access and egress routes; and infrastructure maintenance and improvements to support first responders' efforts to reduce fire spread.

Hazardous Fire Area Zones. 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. 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 and have the strictest fire prevention standards for issues such as building materials for new structures. The City also enforces vegetation management measures in these areas.

Fire Inspections. The Berkeley Fire Department annually inspects designated high fire risk zones for hazards such as excess vegetation. The Fire Department inspects over 1,200 parcels in Fire Zones 2 and 3, in addition to complaint-driven inspections throughout the City. Residents must clear combustible brush and vegetation adjacent to building property lines and roadsides. Tree branches must be cleared from any chimney, stovepipe or overhang over a building. All leaves, needles, and dead vegetation must be swept from roofs. This program is done in cooperation with the East Bay Regional Park District, which has programs to limit combustible material in the wildland-urban interface zone on its property.

Vegetation Management Programs. The City runs a number of vegetation management programs to reduce fuel loads. These programs include:

- The Fire Fuel Chipper Program, a popular yard waste collection service: The program serves properties in the hills from June through September each year. From 2005 to 2011, over 200 tons of vegetation was collected and recycled, on average, each year.[i]
- The Fire Fuel Debris Bin Program is coordinated by the Department of Public Works' Solid Waste Division The program delivers and removes 30 yard roll-off boxes from requesting neighborhoods, an effort effort yielding an average of 20 tons of plant debris per year.[ii]
- Additionally, 14,000 tons of residential plant debris is collected each year through weekly curbside collection. In 2007, the City switched curbside plant debris collection from every other week to weekly. This program enhancement doubled residents' capacity to help reduce the buildup of vegetation year-round.[iii]
- A fire fuel abatement program on public land: From mid-June to mid-August each year, an average of 125 tons of debris are removed from 95 public sites, including parks, pathways and medians. This effort is a joint effort of the City and the East Bay Conservation Corps.[iv]

4.8 *Community Readiness*

Community Emergency Response Team (CERT) Program. CERT classes are offered free through the Fire Department to all Berkeley residents and those who work in Berkeley. Trained volunteers can help douse small fires, conduct light search and rescue, help with first aid, and communicate with City emergency responders. Neighborhoods have organized response teams and conducted drills with City emergency responders. The 2013 CERT Citywide Exercise had over 900 community participants. Scale of activities ranged from basic phone contact with out-of-area emergency contacts and listening to emergency broadcasts from the City, to in-depth setup of neighborhood incident command posts to organize and conduct simulated CERT light search and rescue operations and practice emergency radio communications.

Neighborhood Caches. The Disaster Cache Program incentivizes community-building for disaster readiness. To date, the City has awarded 87 caches of disaster response equipment to neighborhoods, congregations, and UC Berkeley Panhellenic groups that have undertaken disaster readiness activities.

Community Oversight. The Disaster and Fire Safety Commission closely monitors the City's disaster readiness efforts. Members are safety advocates appointed by the Mayor and City Council.

4.9 *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. Table 4.1 highlights important State laws related to hazards, and describes how Berkeley complies with these laws.

Table 4.1 State Mitigation Requirement and Berkeley Implementation

Statewide Requirements	Berkeley Implementation
Mandatory Building Code. The State requires all communities to enforce the 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.	Berkeley enforces the State building code with additional local provisions for seismic and fire safety. The City has adopted the 2010 California Building Code and 2010 California Residential Code, including the WUI fire standards for analysis and retrofit. Berkeley's application of WUI fire standards exceeds current State requirements.
Essential Services Buildings. State law requires that new essential services buildings, such as police, fire, and emergency operation and communications centers, meet a higher safety standard than other buildings. The standards include backup utilities and design and construction checks by inspectors following State guidelines.	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.
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.	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 2014 update continues to use the General Plan as a strategic guide.

Statewide Requirements	Berkeley Implementation
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 of hazards on development and the resulting consequences for the environment. On occasion, certain emergency safety projects are exempted from the CEQA process.	The City of Berkeley complies with State CEQA requirements.
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.	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. Section 3.3 of this mitigation plan replicates these maps. Because of the well-defined surface expression of this fault, it is reasonable to expect ground surface rupture in this area during future earthquakes.
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.	Liquefaction and seismically-induced landslide risk maps are available in Section 3.3 of this plan. The City enforces State requirements by requiring site-specific investigations and feasible mitigation measures.
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).	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.

Statewide Requirements	Berkeley Implementation
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.	There is one acute care hospital in Berkeley, Alta Bates, owned and operated by the Sutter Health Corporation. The corporation is planning compliance renovations for the site.
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.	Berkeley identified 700 URMs and designated a mandatory retrofit ordinance. To date, over 90 percent have been retrofitted, demolished or demonstrated to have adequate reinforcement.
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.	The City of Berkeley complies with this State law.
Dam Inundation Maps. Owners of dams and reservoirs are required to maintain their facilities according to standards of the Division of the Safety of Dams, and to file maps depicting areas that might be flooded if the reservoir suffered a catastrophic failure.	Per the East Bay Municipal Utility District: The Berryman Reservoir has been drained and decommissioned. The Claremont Reservoir will perform satisfactorily based on a magnitude earthquake of 7.25 on the Hayward Fault. The Summit Reservoir meets the stringent state safety requirements of the Division of State Dams; however, it will be replaced with a 3.5 million gallon water tank within the footprint of the existing reservoir basin by 2016.

Statewide Requirements	Berkeley Implementation
Emergency Response Plans. In the wake of the 1991 Tunnel Fire, the State requires that all jurisdictions practice the Standardized Emergency Management System (SEMS), a uniform approach to disaster response based on the fire service's Incident Command System (ICS).	The City complies with all State requirements.
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.

4.10 *Berkeley Mitigation Activities and Key Events*

The timeline in the table below identifies key mitigation activities and disaster events that impact Berkeley's mitigation programs and resources. The table includes events occurring on the State or federal level, as well as major disasters outside of Berkeley. These events impacted Berkeley's mitigation programs and resources by developing public awareness or making statewide or national changes to the mitigation landscape.

Table 4.2 Timeline of Berkeley Mitigation Activities and Key Events

Date	Event	Notes
1868	UC Berkeley campus established	
1868	Hayward Earthquake	Impacts on Berkeley are unknown
1878	City of Berkeley incorporated	
1870	South Hall constructed with steel straps to resist earthquakes	An early example of seismic-resistant design.
1898	Mare Island Earthquake	Impacts on Berkeley are unknown
1906	Great Earthquake	Damage in Berkeley was significantly smaller than damage in San Francisco. Berkeley supported an influx of refugees from San Francisco.
1911	Damaging earthquake near San Jose	Impacts in Berkeley are unknown
1923	Berkeley Fire	Major wildland-urban interface fire burned 600 buildings and stopped at Shattuck Avenue.
1927	City of Berkeley adopts Uniform Building Code (UBC)	Community conforms to building regulations and safety codes.
1928	City of Berkeley adopts Ordinance 1,480-N.S.	Creates and establishes fire zones in the City of Berkeley. *Repealed and Amended in 1958.*

Date	Event	Notes
1933	Field Act Passed	Regulates design, construction and renovation of K-12 public schools in California
1933-1935	UBC updated	Masonry buildings must be reinforced, and mortar standards and seismic zones considering soils introduced.
1949	UBC updated	Standards introduced to strengthen tall buildings.
1958	City of Berkeley adopts Ordinance 3,663-N.S.	Reestablishes fire zones in the City of Berkeley based on Fire Zone Maps of 1958. *Repealed and Amended in 1976.*
1959	UBC updated	Calculation methods improve to better represent different types of structures.
1962	Flood	Damages build awareness about need for mitigation.
1970	Enacted floodplain ordinance	Flood Insurance Rate Maps were developed for the community.
1970	Fish Canyon Fire	Burns 39 structures; results in City Planning Department establishing Environmental Safety-Residential zone, which limits land use and occupancy size of residential structures in the area
1972	State Legislature passes Alquist-Priolo Earthquake Fault Zoning Act	Regulates development along earthquake faults in California
1973-76	UBC updated	Ductile elements introduced into reinforced concrete buildings to prevent catastrophic failure and improvements to wood frame design.

Date	Event	Notes
1975	UC Regent's policy on seismic safety adopted	Conducted first assessment of seismic safety of buildings at UC Berkeley. Launched early retrofit projects.
1976	City of Berkeley adopts Ordinance 4,886-N.S.	Reestablishes fire zones in the City of Berkeley based on Fire Zone Maps of 1976.
1978	Berkeley begins participation in National Flood Insurance Program	City currently in good standing with NFIP
1980	Grass fire in hills consumed several Berkeley houses	City regulated building materials in hills.
1986	Private Schools Building Act passed	Act intended to protect private school children like the Field Act did for public school children. However, differences between the two acts mean that private school buildings are not as safe as public school buildings.
1988	UBC updated	Soft and weak stories addressed and wood frame construction improved.
June/July 1989	Disaster Council established	Established monitoring and advocacy.
October 1989	Loma Prieta Earthquake	Magnitude 6.9 earthquake causes some damage to buildings in Berkeley. New cracks found in MLK Jr Civic Center building. Regionally, resulted in 62 deaths and major damage. Significant transportation system impacts.
December 1989	URM inventory established	700 URMs identified and owners notified of required retrofit.
1989	Berkeley Unified School District hires engineers to evaluate structural safety of buildings	Significant problems fount; District closes many schools and develops plan to correct safety problems

Date	Event	Notes
1990	Seismic Hazards Mapping Act passed	Regulates development, requires mapping and real estate disclosure in earthquake-induced landslide and liquefaction zones.
Mid- 1991	Fee waiver program established	Waives permit fees on residential seismic safety projects. **Program ended due to budget constraints in early 2000s.**
October 1991	Tunnel Fire	62 homes burned in Berkeley, more burned in neighboring Oakland. 25 deaths total and $1.5 billion total damage.
1991	Hills Emergency Forum established	Planning and coordination body formed to address East Bay fire hazards
December 1991	Established mandatory URM retrofit program	To date over 90% of URMs have improved seismic resistance
June 1992	Measure A approved	$158 million made available for school safety programs.
November 1992	Measure G approved	$55 million made available for municipal safety improvements.
1993	UC Berkeley Tang Center constructed	Facility constructed to essential facilities standard, to be ready to provide key support to Berkeley healthcare system in a disaster
1994	EBMUD allocates $189 million for seismic upgrades	Upgrades completed in 2006
1994	Northridge Earthquake	6.7 magnitude earthquake causes $28 billion in losses
March 1995	Seismic Technical Advisory Group convened	Assured City has appropriate technical information to make informed seismic safety policy decisions.

Date	Event	Notes
July 1996	Tilt-up building inventory developed	59 tilt-up structures identified.
November 1996	Measure S approved	$45 million made available for seismic retrofit of City buildings.
August 1997	The University of California's SAFER Program established	10-point action plan for the University's $1.2 billion reconstruction program. A review of UC Berkeley's buildings found that 27% need to be seismically upgraded.
1997	UBC updated	Requirements increased for buildings close to active faults.
Winter 1997-1998	Landslide in North Berkeley	1 home significantly damaged and has to be demolished
1998	Natural Hazards Disclosure Act passed	Requires sellers of property to provide "Natural Hazards Disclosure Statement" if property lies within State-mapped hazard area.
December 1999	Award from FEMA	Berkeley designated Project Impact Model Community of the Year.
July 2000	Tsukamoto Public Safety building complete	The City's hazard-resistant essential services building is constructed. It houses the City's primary Emergency Operations Center, emergency communications center and Police Department and Fire Department headquarters.
November 2000	Measures AA and Q approved	$116.5 million for school safety program; Tax measure for safety efforts.
2001	Martin Luther King Jr. Civic Center retrofit completed	Building housing key City government functions is base isolated for seismic safety.
2001	Magnitude 5.1 Napa earthquake	

Date	Event	Notes
2001	Soft-story buildings inventoried	City partners with UC Berkeley and outside experts; uses FEMA grant to inventory soft-story units
2002	Award from Disaster Resistant California	Berkeley rewarded for demonstrating significant commitment to pre-disaster mitigation.
2002	Main Library retrofit completed	Main library identified as location for City's emergency volunteer center
February 2003	Completion of the CGS hazard maps.	New buildings are required to meet strict design and construction standards if they are located in potential liquefaction or landslide areas.
2003	Award by California OES	Berkeley designated model community.
2003	New General Plan adopted	General Plan's Disaster Preparedness and Safety Element guides the 2004 and 2014 Local Hazard Mitigation Plans
2004-2005	Flooding in Codornices, Strawberry, Potter and Schoolhouse watersheds	
2005	City adopts soft-story ordinance	Berkeley requires owners of soft-story buildings with 5 or more units to conduct engineering studies and take other measures.
2006	Assembly Bill 127 passes	Provides California Community Colleges with the option to comply with local building codes in lieu of the Field Act
2006	All fire stations seismically safe	Berkeley completes the reconstruction of Fire Station 7. The other six were seismically upgraded in previous years.

Date	Event	Notes
2006	Disaster Council and Fire Safety Council combined	Continued monitoring and advocacy.
2006	EBMUD evaluates Claremont Reservoir Dam for seismic risk	Study concludes that dam will perform satisfactorily in 7.25 magnitude earthquake on Hayward Fault
2006	UC Berkeley opens Center for Fire Research and Outreach	Center focused on wildfire information and collaboration
2006	Alameda County Local Agency Formation Commission expands Berkeley's Sphere of Influence on Panoramic Hill to include Oakland	Action performed despite opposition letters from Berkeley and Oakland. Berkeley/Oakland homeowners will need to collaborate to fund a Specific Plan.
2007	Glendale Path completed	City, Path Wanderers and Boy Scouts partnered to use FEMA funding for pedestrian evacuation route in the Berkeley hills
February 2007	EBMUD Claremont Tunnel retrofit complete	
2008	Neighborhood disaster supply cache program begins	To date, the City has awarded 87 caches of disaster response equipment to neighborhoods, congregations, and UC Berkeley Panhellenic groups that have undertaken disaster readiness activities.
2008	Council adopts moratorium on development in Panoramic Hill	Moratorium repealed in 2010 and replaced with ordinance
September 2009	City updates Municipal Code Chapter 17.12 *Flood Zone Development Ordinance*	Update ensures Berkeley's continued compliance with National Flood Insurance Program
2009	City Council adopts Climate Action Plan	Climate Action Plan guides Berkeley's efforts to reduce carbon emissions and engage in climate adaptation planning

Date	Event	Notes
2009	Branch Library Improvement Program begins	By 2013, 3 of 4 branch libraries have completed retrofits for seismic safety
2010	BART completes work to upgrade Transbay Tube seismic joints	
2010	Berkeley voters approve Measure I	Funds improvements to school safety, including seismic work
2010	Aboveground Water Supply System operational	Portable system can pump water from any source to fight fires if tanks drained or pipelines damaged
2010	Council passes ordinance blocking establishment of any residential units on Panoramic Hill	Ordinance requires adoption of a Specific Plan for safety improvements to infrastructure
2010	City of Berkeley adopts Ordinance 7,157-N.S.	Adopts 2010 fire code with local amendments Adds addresses to fire zone two (to "combined hillside district") Designates Zones 2 and 3 to be Very high fire hazard severity zone(s) and Wildland-Urban Interface Fire areas
2010	City develops *Guide to Conserving Water through Rainwater Harvesting and Graywater Reuse for Outdoor Use*	Provides information to help homeowners be ready for impacts of climate change on regional water resources
2010	BMC Amended to require automatic gas shutoff valves	Automatic gas shutoff valves required for any existing building undergoing additions, alterations or repairs exceeding $50,000
December 2010	California Emergency Management Agency releases first-ever tsunami inundation maps within San Francisco bay	Map helps to inform tsunami readiness activities

Date	Event	Notes
2011	Diesel spill on UC Campus	Diesel enters Strawberry Creek; response requires coordination of City, State and federal agencies
2011	Public Works Engineering Division develops hydraulic models for Codornices and Potter watersheds	Models predict areas of likely overflows
March 2011	Earthquake off coast of Japan causes tsunami in Berkeley	Tsunami surge entered Berkeley Marina and caused $158,000 damage to boats and docks
October 2012	City Council adopts Watershed Management Plan	Plan goals include reducing urban flooding
2012	Berkeley Unified School District moves administrative offices	Moved out of seismically-unstable Old City Hall building and into newly-renovated building on Bonar and University
2012	Ratcliff Building retrofit complete	Retrofits made possible by $2.89 million FEMA grant
April 2012	Gas valve permit fee reduced	Permit fee for valve installation reduced. Established $50 flat rate permit fee for voluntary installation of gas shutoff valves in 2+ residences on a block.
2012	Dona Spring Animal Shelter opens	New animal shelter designed to governing seismic standards
2012	North Branch Library and Claremont Branch Library retrofits complete	Libraries seismically retrofitted to governing standards, fire sprinkler system added
2013	South Branch Library replaced	New building meets seismic codes, photovoltaic panels offset energy grid draws
January 2014	Soft-Story Phase II Ordinance takes effect	Owners of soft, weak or open front buildings with five or more dwelling units required to retrofit their buildings within the next five years

[i] Per Dan Gallagher, Senior Forestry Supervisor, City of Berkeley: The Fire Fuel Chipper Program collected green waste vegetation in the following amounts in the following years:

- 2005: 264.35 tons
- 2006: 237.59 tons
- 2007: 189.06 tons
- 2008: 175.16 tons
- 2009: 167.17 tons
- 2010: 161.31 tons
- 2011: 187.24 tons

[ii] Information provided by Andrew Schneider, Recycling Program Manager, City of Berkeley, as of March 2012.

[iii] Information provided by Andrew Schneider, Recycling Program Manager, City of Berkeley, as of March 2012.

[iv] Information provided by Doug McDonald, Senior Landscape Supervisor, City of Berkeley as of March 2012.

5 Community Profile and Trends

The people and structures of Berkeley are continually changing. This section examines changes that have occurred in hazard-prone areas and increased or decreased the vulnerability of Berkeley since 2004. First, this section discusses changes to the group of people who make up the Berkeley community, and how their characteristics will influence the population's hazard vulnerability, necessary approaches to mitigation and response. Next, changes in development are discussed, including description of recent and potential development throughout Berkeley. Next, the effects of this development of population and structures on Berkeley's vulnerability to natural hazards are discussed. Last, key City policies and goals that affect development are outlined.

5.1 *Community*[i]

The number of people living in Berkeley has grown by almost 10,000 in the last decade, to 112,580. As Berkeley's population of Berkeley has grown, the number of jobs in the city has increased from about 50,000 in 1970 to approximately 70,000 today[ii]. Additionally, UC Berkeley's Long Range Development Plan projects that as a result of growth in both education and research, by 2020 the total campus headcount during the regular academic year may increase to 51,260 – a 12% increase over 2001-2002 levels. These population increases means that more Berkeley residents and visitors will be exposed to the area's hazards.

Berkeley has a mobile population, with just 56 percent of current residents having lived in their homes for more than six years. This figure reflects people moving to Berkeley from out of the area, meaning that community disaster awareness activities need to be ongoing to penetrate the population. This figure also reflects community members moving within Berkeley, meaning that community-building activities must be constant as residents join new neighborhoods.

Much of Berkeley's mobility is due to its large college student population, which ranges from about 25 to 30 percent of city residents.

Students represent a significant portion of Berkeley's rental market and support a variety of local merchants. Large losses in rental units after an earthquake could force students to move to other nearby cities, which would profoundly affect Berkeley's character and economics. The University of California, Berkeley faces significant earthquake risks, and a closure of this campus for any length of time would greatly impact the city overall.

Over one quarter of Berkeley residents use a language other than English at home. It is critical for the city to make sure that emergency responders are prepared to communicate with limited-English speakers. This includes communicating emergency and evacuation warnings as well as mitigation strategies.

5.2 *Recent and Potential Development*

Berkeley is a densely-populated city with well-established land use patterns. Many private homes have been expanded and renovated, but few new lots have been developed due to Berkeley's already built-up state.

Nonetheless, development activity is ongoing. Since 2004, Berkeley has seen a significant increase in housing units. Typically, this development represents densification of commercial

areas, rather than development of new sites. Before the global recession of 2009, the City issued discretionary permits for many high-occupancy mixed-use commercial/ residential structures in commercial corridors on Shattuck, San Pablo and University Avenues. In the years that followed, these projects were not pursued. Now in 2014, many projects are once again moving forward.

2012 zoning changes from the City's new Downtown Area Plan have also added to the number of vulnerable buildings being upgraded or replaced with modern structures in the downtown area. In 2013, the City issued discretionary permits for three new 60-foot-tall mixed-use residential/ commercial buildings in the area. These three buildings will add 400 additional residential units to the area. Currently, another three buildings with another 600 residential units are in process for receiving conditional use permits. These six buildings alone could add 25,000 additional residents to Berkeley's downtown area in the coming two to three years.

1. Since 2004, the University of California, Berkeley expanded its facilities both on and off the campus. UC Berkeley's 2020 Long Range Development Plan projects space demands for campus academic and support programs may grow by up to 18%, or 2,200,000 GSF, over 2005 levels. This includes classrooms, libraries, research facilities and student services centers. These estimates of future space needs are both future growth and compensation for existing shortages.

5.3 *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. However, Because of Berkeley's built-out nature, new development tends not to add new geographic areas of hazard exposure. All of Berkeley is exposed to earthquake shaking. While commercial corridors are becoming denser, density in the eastern hills, which are exposed to wildland-urban interface fire and landslides, is stable. The city's western edge will be exposed to sea-level rise from climate change. 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.

New development generally 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, and elevation above flood levels. Replacing or significantly renovating older structures significantly increases the Berkeley community's protection from natural hazards. For example, pursuant to the Seismic Hazards Mapping Act codified in the Public Resources Code as Division 2, Chapter 7.8 and Guidelines for Evaluations and Mitigating Seismic Hazards in California (Special Publication 117), much of the new construction in the City's west must have site-specific geological and geotechnical investigations , due to the area's mapped potential liquefaction hazard. These investigations result in recommendations for design professionals to design new or rehabilitated buildings for human occupancy to mitigate the potential effects of liquefaction caused by earthquakes to a level that does not cause the collapse of the buildings . This means that a new or rehabilitated building will be equipped to better withstand potential liquefaction impacts than an old building.

5.4 *City 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 services.

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. As of September 2013, the City is considering changing its Demolition Ordinance to require a one-for-one replacement of demolished rent controlled units with permanently affordable housing.

Down Zoning

In the 1970s, residential areas of the city surrounding the UC Berkeley campus became subject to "down zoning." Future developments in these areas are required to be less dense than existing development. This designation was given following the construction of dense, multifamily structures in neighborhoods without community support. Many of the multifamily structures from this era are particularly vulnerable to earthquakes. If they are destroyed in an earthquake, the down zoning requirement requires that they be replaced with single-family homes or less dense occupancies.

A 2006 Zoning Amendment allows residential buildings of four or fewer units to be replaced by right if the buildings are damaged in a natural disaster. However, buildings in the area with five or more residential units would still need to go through a public hearing process to receive conditional use permits. Maintenance of the area's density levels would be contingent on community support. Without this support, following a catastrophic earthquake, the City could lose much of its low-income housing. This threatens one of the General Plan's central goals.

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.

Preserving Historic Character

The City has a strong value for 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.

[i] 2010 Census data was used when possible. When the 2010 Census data was not available, the data used is from the American Community Survey (ACS) 5-year estimates from 2007-11. The ACS is a nationwide survey conducted by the US Census Bureau, and while the survey gathers a wider variety of information than the official census, only a portion of the population is surveyed at a time. Because of this sampling, the data may be less accurate in some cases, and varies from the 2010 census count.
[ii] Plan Bay Area

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Animal Shelter	Animal Shelter	1 Bolivar Drive	Animal Shelter		Newly Constructed	2 stories New facility – Built in 2012 to 2010 Building Code	11,000	$7.8 million
Corporation Yard	Equipment Maintenance Building	1326 Allston Way	Equipment Maintenance Building			1 story Retrofit in approx. 2003.	12,922	$ 5.90 million
Corporation Yard	Fuel Island/ underground tanks	1326 Allston Way				All Steel, 1 story	1,200	$300,000
Corporation Yard	Office and Storage	1326 Allston Way				Concerns about eq vulnerability.	2,939	$730,000
Corporation Yard	Ratcliff Building	1326 Allston Way		Public Works Department Operations Center	Retrofitted	Retrofitted to essential serves standards in 2012	16,480	$6.0 million
Fire Station	Fire Department Warehouse	1011 Folger Avenue	Storage of Fire Response Equipment		Newly Constructed	Built in 2011 – to essential services standards	8021	$8.2 million
Fire Station	Fire Station #1	2442 8th Street	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1999 - retrofitted to essential services standards.	5,260	$1.5 million
Fire Station	Fire Station #2	2029 Berkeley Way	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1998 - retrofitted to essential services standards.	12,522	$3.6 million
Fire Station	Alarm Headquarters	2029 Berkeley Way			Newly Constructed/ Retrofitted	1 Story Rebuilt in 1998	840	$242,000
Fire Station	Fire Station #3	2710 Russell	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1999 - retrofitted to essential services standards.	5,100	$1.5 million
Fire Station	Fire Station #4	1900 Marin	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1999 - retrofitted to essential services standards.	5,341	$1.6 million
Fire Station	Gas Pump House	1900 Marin	Refueling facility		Newly Constructed/ Retrofitted	1 Story Rebuilt 1999	101	$29,5,00
Fire Station	Fire Station #5	2680 Shattuck Ave.	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1998 - retrofitted to essential services standards.	9,302	$2.7 million
Fire Station	Fire Station #6	999 Cedar Street	Fire Station		Newly Constructed/ Retrofitted	1 story Rebuilt 1999 - retrofitted to essential services standards.	4,153	$1.2 million
Fire Station	Fire Station #7	3000 Shasta Road	Fire Station		Newly Constructed	New two story – incorporates state-of-the-art fire-resistant technology; Located in Fire Zone 2 Constructed in 2006 to essential services standards	24,200	$7 million

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Key Civic Building	Civic Center Building Annex	1947 Center Street	Public Works Engineering and Transportation Divisions		Seismic Evaluation Needed	6 stories, concrete frame structure. Determined by V. Bertero to meet "substantial life safety" and not be a collapse hazard building, but may have problems.	116,450	$45.7 million
Key Civic Building	Fire Dept. Training Building	997 Cedar Street	Alternate Emergency Operations Center		Newly Constructed	Built in 1998 – retrofitted to essential services standards	3,893	$1.42 million
Key Civic Building	Martin Luther King, Jr. Civic Center	2180 Milvia Street	City Hall		Newly Constructed/ Retrofitted	6 story Concrete frame Retrofit in 2001 Base isolated	89,075	$34 million
Key Civic Building	Public Safety Building	2100 MLK Jr. Way	Police Department Headquarters, Fire Department Headquarters, 9-1-1 Headquarters	Primary Emergency Operations Center	Newly Constructed	2 story Built in 2000 to essential services standards Base isolated	60,108	$15 million
Key Civic Building	PSB Accessory Building		Communication equipment, Emergency Generator Storage		Newly Constructed	1 story Built in 2000	2,738	$1.1 million
Leased by the City	Permit Center/Planning Department	2118-20 Milvia Street	Offices for Economic Development, Planning, and Building departments. Contains all building plans and records for City.	Building and Safety DOC	Seismic Evaluation Needed	Has had some seismic bracing. Vulnerability unknown.		n/a
Leased by the City	Police substation. BPD traffic control	841 Folger Ave	Offices		Seismic Evaluation Needed	Wood Frame		n/a
Library	Library – North Branch	1170 The Alameda	Library, public assembly	Public assembly	Retrofitted	Retrofitted in 2012 to 2010 Building Code. Vulnerable to damage but repairable.	9,390	$ 4.76 million
Library	Library – South Branch and Tool Library	1901 Russell Street	Library, public assembly	Public assembly	Retrofitted	Retrofitted in 2013 to 2010 Building Code. Vulnerable to damage but repairable.	8,656	$4.9 million
Library	Library – West Branch	1125 University Avenue	Library, public assembly	Public assembly	Retrofit in process 5/13	Retrofitted in 2013 to 2010 Building Code. Vulnerable to damage but repairable.	9,400	$5.55 million
Library	Library- Claremont Branch	2940 Benvenue Ave	Library, public assembly	Public assembly	Retrofitted	Retrofitted in 2012 to 2010 Building Code. Vulnerable to damage but repairable.	7,640	$3.3 million

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Library	Main Library	2090 Kittredge Street	Library, public assembly	Emergency Volunteer Center location	Retrofitted	Complete retrofit to seismic code with new underpinning and additional piles, and remodel completed in 2002. Vulnerable to damage, but repairable.	122,000	$45 million
Public Health	Mental Health Offices	2636-40 MLK Way	Mental Health Offices		Seismic Evaluation Needed	The City is having these two buildings' seismic resistance and vulnerabilities evaluated in Fiscal Year 2013. Actual improvements are in the initial evaluation and planning stage.	11,840	$3.0 million
Recreation and Parks	Frances Albrier Center	2800 Park Street	Recreation and public assembly	Shelter	Seismic Evaluation Needed		13,260	$3.68 million
Recreation and Parks	Grove Recreation Center	1730 Oregon Street	Recreation and public assembly - Young Adult Project (YAP)	Shelter	Seismic Evaluation Needed		10,600	$6.70 million
Recreation and Parks	James Kenney Community Center	1720 8th Street	Recreation and public assembly - MLK Jr Youth Service Center	Shelter			13,825	$9.2 million
Recreation and Parks	Live Oak Community Center	1301 Shattuck Ave.	Recreation and Assembly	Shelter	Retrofitted	URM structure retrofitted using a membrane designed by Pat Crosby. Remains vulnerable.	14,860	$9.9 million
Senior Center	North Berkeley Senior Citizens Center	1901 Hearst Street	Public assembly	Shelter	Seismic Evaluation Needed	Built in 1979. No seismic work done.	20,760	$14.57 million
Senior Center	South Berkeley Senior Citizens Center	2939 Ellis Street	Public assembly	Shelter	Seismic Evaluation Needed	Built in 1977	17,156	$12.04 million
Senior Center	West Berkeley Senior Citizens Center	1904 6th Street	Public assembly	Shelter	Seismic Evaluation Needed	Cl.D - 1982 - C/S fire alarm	10,245	$7.19 million
Solid Waste Transfer Buildings	Compressed Natural Gas Dispenser	1199 2nd Street	Compressed Natural Gas					$343,000
Solid Waste Transfer Buildings	Administration Building	1201 2nd Street	Offices			All Steel Constructed in 1984	3,750	$653,000
Solid Waste Transfer Buildings	Fuel Pumps and Tanks	1199 2nd Street	Fuel island/Wash Rack			All Steel Constructed in 1984	2,600	$465,000
Solid Waste Transfer Buildings	Hazmat Storage	1199 2nd Street	Storage					$1.5 million
Solid Waste Transfer Buildings	Tipping Building/Transfer Station	1199 2nd Street	Waste Transfer			Some maintenance problems. All Steel, 1984	21,000	$5.31 million

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Solid Waste Transfer Buildings	Underground Scales	1199 2nd Street				All Steel Constructed in 1984		$510,350
Solid Waste Transfer Buildings	Vehicle Maintenance Facility	1199 2nd Street	Maintenance Building			All Steel Constructed in 1984	6,280	$2.87 million
Solid Waste Transfer Buildings	Radio Transmitter	1199 2nd Street	Public Works Radio transmitter					
Wastewater Lift Stations	Marina Lift Station #1		Wastewater management					
Wastewater Lift Stations	Marina Lift Station #2		Wastewater management					
Wastewater Lift Stations	Marina Lift Station #3		Wastewater management					
Wastewater Lift Stations	Marina Lift Station #4	Corner of Marina	Wastewater management					
Wastewater Lift Stations	Marina Lift Station #5	Marina S.E. Entrance	Wastewater management					
Animal Shelter	Old Animal Shelter	3013 2nd Street	Office/ Kennel/ Cattery			Old Animal Shelter – To be sold	4,780	$857,087
Berkeley Housing Authority		1107-15 Francisco Street	Dwelling			Frame - 5 units	5,466	$1.4 million
Berkeley Housing Authority		1117-23 Francisco Street	Dwelling			Frame - 4 units	4,374	$1.1 million
Berkeley Housing Authority		1161-65 Francisco Street	Dwelling			Frame - 3 units	3,279	$820,000
Berkeley Housing Authority		1169-75 Francisco Street	Dwelling			Frame - 4 units	4,374	$1.1 million
Berkeley Housing Authority		1360-70 Dwight Way	Residential			Frame - 2 units	2,187	$550,000
Berkeley Housing Authority		1371 Dwight Way/ 2450 Valley	Dwelling			Frame - 2 units	2,187	$550,000
Berkeley Housing Authority		1402-08 MLK Way	Dwelling			Frame - 4 units	4,433	$1.1 million
Berkeley Housing Authority		1500-04 7th Street	Dwelling			Frame - 3 units	3,280	$820,000
Berkeley Housing Authority		1838-40 Rose Street	Dwelling			Frame - 2 units	2,067	$520,000
Berkeley Housing Authority		1903-09 Ward Street	Dwelling			Frame - 4 units	4,372	$1.1 million
Berkeley Housing Authority		1911-17 Ward Street	Dwelling			Frame - 4 units	4,374	$1.1 million
Berkeley Housing Authority		1921-27 Ward Street	Dwelling			Frame - 4 units	4,374	$1.1 million

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Berkeley Housing Authority		2024-30 Virginia Street	Residential			Frame - 4 units	4,659	$1.2 million
Berkeley Housing Authority		2032-36 Virginia Street	Residential			Frame - 3 units	3,389	$850,000
Berkeley Housing Authority		2374 West/1323 Channing Way	Residential			Frame - 2 units	2,200	$550,000
Berkeley Housing Authority		2725-27-29 Sojourner Ct.	Dwelling			Frame - 3 units	3,279	$820,000
Berkeley Housing Authority		2731-33 Sojourner Ct.	Dwelling			Frame - 2 units	2,187	$550,000
Berkeley Housing Authority		2735-37 Sojourner Ct.	Dwelling			Frame - 2 units	2,067	$520,000
Berkeley Housing Authority		2798 A/B Sacramento Street	Dwelling			Frame - 2 units	2,187	$550,000
Berkeley Housing Authority		2800 Sacramento Street	Dwelling			Frame - 1 unit	820	$200,000
Berkeley Housing Authority		870-80 Jones Street	Dwelling			Frame - 2 units	2,187	$550,000
Berkeley Police Department	BPD Pal Program	1255 Allston Way	Office			Unknown		$6,550
Corporation Yard	Assembly Building	1326 Allston Way	Assembly/Washroom			1 story Concerns about earthquake vulnerability.	2,405	$600,000
Corporation Yard	Equipment Shelter	1326 Allston Way	Equipment Shelter			1 story Metal shed	4000	$493,000
Corporation Yard	Guard Shack	1326 Allston Way				1 story	72	$18,000
Corporation Yard	Lumber/Pipe Storage	1326 Allston Way					774	$190,000
Corporation Yard	Nursery Assembly Room	1326 Allston Way					864	$220,000
Corporation Yard	Nursery Storage	1326 Allston Way					864	$67,450
Corporation Yard	NurseryStorage-1975	1326 Allston Way					240	$67,100
Corporation Yard	Quonset Warehouse	1326 Allston Way				All Steel, 1 story Concerns about earthquake vulnerability.	4,100	$380,500
Corporation Yard	Small Warehouse	1326 Allston Way				1 story	3,000	$750,000
Corporation Yard	Streets Storage & Office	1326 Allston Way					1300	$326,166
Corporation Yard	Traffic Maintenance	1326 Allston Way	TrafficSign/PaintShop			1 story Concerns about earthquake vulnerability.	4,320	$1.1 million
Echo Lake Camp and Toulumne Camp in the Sierras	(not included)	(not included)	(not included)			(not included)	(not included)	(not included)

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Fire Station	Drill Tower	999 Cedar Street	Training Facility		Newly Constructed	5 story Constructed in 1999	1,936	$558,500
Key Civic Building	Center Street Garage and Commercial space	2025 and 2033 Center Street	City and Public Parking and Offices		Seismic Retrofit or Replacement Required	5 story, concrete Frame Vulnerable to earthquake damage. Too expensive to retrofit. Will be replaced.	175,500	$29 million
Key Civic Building	Center Street Garage and Commercial space	2025 and 2033 Center Street	(LINKED)		Seismic Retrofit Required	5 story, concrete Frame Vulnerable to earthquake damage. Too expensive to retrofit. Will be replaced.	175,500	(LINKED)
Key Civic Building	Oxford Street Garage	2165 Kittredge Street	Garage/Offices		Newly Constructed	Basement Garage and Lot of 6 Story offices and housing project– Joint Project between City and UC Berkeley. Built in 2009 to seismic standards	46000 Garage only	$9 million
Key Civic Building	Telegraph/Channing (Sather Gate) Mall and Garage	2438 Durant Ave.	Public Parking and Retail		Retrofitted	Retrofitted about 1995. Still vulnerable to damage, but not collapse. Concrete Frame, 5 story	224,628	$56 million
Key Civic Building	Veterans Memorial Hall	1931 Center Street	Public assembly and Homeless Shelter		Seismic Retrofit Required	Collapse hazard building, study done, needs to be retrofitted	33,254	$27 million
Leased by the City	Berkeley Housing Authority	1901 Fairview Street	Offices					n/a
Leased by the City	Black infant health Building	1767 Alcatraz Avenue	health					n/a
Leased by the City	Martin Luther King, Jr. Center	1700 Hopkins Street	Pool, swim center			Field Act building on BUSD land. City pays for maintenance and may ultimately have full ownership.	3,329	n/a
Leased by the City	Rent Stabilization Board Office	2125 Milvia Street	Offices			Concrete frame. Should be evaluated. City leases only one floor.		n/a
Leased by the City	West Campus Center	2100 Browning Street	Pool, swim center			Field Act building on BUSD land. City pays for maintenance and may ultimately have full ownership.	2,567	n/a
Leased by the City	Willard Center	2771 Telegraph Avenue				Field Act building on BUSD land. City pays for maintenance and may ultimately have full ownership.	3,316	n/a
Leased to Others	Berkeley Adult Health Center	1890 Alcatraz Avenue	Berkeley Adult Health Center			Structural concerns. Leased for purchase.	4,000	$1.0 million
Leased to Others	Black Repertory Theater	3201 Adeline Street	Assembly		Seismic Evaluation Needed	2 story	24,150	$5.0 million
Leased to Others	Commonarts	2218 Acton Street	Residential/ Womens refuge				1,600	$400,000

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Leased to Others	Group Residence	2240 9th Street					2,052	$510,000
Leased to Others	Harrison House for men (B.O.S.S.)	711 Harrison Street	Residential shelter			One story		$1.4 million
Leased to Others	Japanese BBQ	235 University Avenue	Restaurant			2 story	12,755	$3.2 million
Leased to Others	McKinley House for women (B.O.S.S.)	2111 McKinley Avenue	Residential shelter			2 story, concrete block building	5,610	$1.4 million
Leased to Others	Old City Hall	2134 MLK, Jr. Way	Offices and Assembly		Seismic Retrofit Required	Collapse hazard building. Preliminary studies done. Needs funding for retrofit. BUSD has relocated offices to West Campus facility. Council Chambers will continue to be used by City Council through June 2013, while options are considered for temporary City Council chambers relocation.	38,400	$30 million
Leased to Others	Recycling	669 Gilman	Restroom				225	$45,100
Leased to Others	Recycling	669 Gilman Street	Recycling, some office space				18,000	$1.5 million
Leased to Others	Recycling		Office			Trailer	2,300	$580,000
Leased to Others	Recycling		Storage				1,350	$340,000
Marina	Berkeley Yacht Club	1 Seawall Drive	Berkeley Yacht Club		Seismic Evaluation Needed		6,100	$2.14 million
Marina	Boat Docks – Marina							$25 million (all docks)
Marina	Marina Administration Building	201 University Ave.	Offices		Seismic Evaluation Needed	2 story Some dry rot in piles, on liquefiable soils	2,529	$1,000,000
Marina	Marina Corporation Yard		Office/Storage/Meeting Rms			1 story	3,170	$2.23 million
Marina	North Hoist/boathouse					All Steel		$67,650
Marina	Restroom 1 - Marina	Marina, Fishing Pier					600	$227,000
Marina	Restroom 2 - Marina	Marina, Shorebird Park					600	$227,000
Marina	Restroom 3 - Marina	Marina, Marina Office					682	$258,000
Marina	Restroom 4 - Marina	Marina, Berth A-E					LINKED	LINKED
Marina	Restroom 4 - Marina	Marina, Berth A-E					600	$227,000
Marina	Restroom 5 - Marina	Marina, Berth N-O					400	$151,300
Marina	Restroom 6 - Marina	Marina, Berth L-M					400	$151,300
Marina	Restroom 7 - Marina	Marina, Berth F-I					400	$151,300
Marina	Restroom 8 - Marina	Marina, Berth A-E					600	$227,000

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Marina	Shorebird Nature Center	160 University Ave.				New building (1 story straw bale construction)	960	$1.0 million
Marina	South Hoist/boathouse					All Steel		$67,650
Public Health	Health Clinic	830 University Ave.	Health Clinic		Seismic Evaluation Needed	1 story building Interior upgraded and elevator added in 2011.	7,362	$6.79 million
Recreation and Parks	Aquatic Park – Bird Rescue Center	202 Bolivar Drive					1,400	$315,000
Recreation and Parks	Aquatic Park – Dreamland for Kids	80 Bolivar Drive						$211,500
Recreation and Parks	Aquatic Park – Sea Bird Sailing Center	80 Bolivar Drive					1,400	$315,000
Recreation and Parks	Aquatic Park – Storage House	80 Bolivar Drive					1,400	$315,000
Recreation and Parks	Aquatic Park – Storage House (Rod & Gun Club)	91 Bolivar Drive					1,400	$315,000
Recreation and Parks	Aquatic Park –Rowing Club	2851 W. Bolivar					1000	$162,100
Recreation and Parks	Art & Garden Center	1275 Walnut Street					1800	$1.14 million
Recreation and Parks	Cedar Rose Park Building	1300 Rose Street	Recreation and public assembly/ Child Care/ Center for disabled children		Seismic Evaluation Needed	Single story wood frame building	5,814	$3.06 million
Recreation and Parks	Codornices Park – Toilet Shelter	1201 Euclid Ave					2,600	$652,950
Recreation and Parks	Great Stone Face Park – Storage Shed	Thousand Oaks Blvd/Yosemite Rd					70	$3,680
Recreation and Parks	John Hinkle Park – Scout Building	Southampton Ave/ San Diego Road					480	
Recreation and Parks	John Hinkle Park Club House	Southampton Ave/ San Diego Road					2,100	$472,500
Recreation and Parks	Lawn Bowling Club House	2270 Acton Street					2,304	$580,000
Recreation and Parks	Live Oak Park – Toilet Shelter	1301 Shattuck Avenue					100	$18,350
Recreation and Parks	Parks Shelter	Queens Rd/Fairlawn					800	$80,350
Recreation and Parks	Restroom – Cragmont Park						600	$308,700

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Recreation and Parks	Restroom – La Loma Park	1339 La Loma Ave					600	$227,000
Recreation and Parks	Restroom – Peoples Park	2500 Haste Street					840	$317,800
Recreation and Parks	Restroom – Rose Garden						600	$227,000
Recreation and Parks	Restroom – San Pablo Park	2800 Park Street					1,092	$413,100
Recreation and Parks	Restroom - Strawberry Park	Allston Way/ West Street					600	$227,000
Recreation and Parks	Restroom – Willard Park	2702 Hillegass Ave					120	$45,400
Recreation and Parks	Skateboard Park Building	777 Harrison Street						$1.0 million
Recreation and Parks	Storage Shed	2270 Acton Street					100	$5,260
Redevelopment Agency		1646 5th Street	Dwelling			Frame, 2 unit, hard-wired smoke detectors	1,600	$400,000
Redevelopment Agency		1654 5th Street	Dwelling			Frame, 1 unit, hard-wired smoke detectors	1,425	$360,000
Redevelopment Agency		729-31 Virginia Street	Dwelling			Frame,1 unit, 2 Story Constructed in 1993	2,221	$560,000
Rental Housing Construction Program		1521 Alcatraz Street	Residential fourplex			Frame - 4 units - 1995	4,539	$1.1 million
Rental Housing Construction Program		1605 Stuart Street	Residential triplex			Frame - 3 units - 1995	3,280	$820,000
Rental Housing Construction Program		1812 Fairview Street	Residential triplex			Frame - 3 units - 1995	3,280	$820,000
Rental Housing Construction Program		2231 8th Street	Dwelling			Frame - 3 units - 1995	2,248	$560,000
Rental Housing Construction Program		3016 A and B Harper Street	Residential duplex			Frame - 2 units - 1995	2,398	$600,000
Solid Waste Transfer Buildings	Equipment Shelter	1199 2nd Street				Value incl. above	4,000	$400,000
Solid Waste Transfer Buildings	Old Storage Building	1231 2nd Street	Storage				1600	$314,700

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Solid Waste Transfer Buildings	Recycling Center	1201 2nd Street					18,326	$2,24 million
Solid Waste Transfer Buildings	Scale House	1199 2nd Street	Scale House			All Steel Constructed in 1984	360	$153,560
Solid Waste Transfer Buildings	Secondary Office	1231 2nd Street	Office				6,510	$1.6 million

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2014 Local Hazard Mitigation Plan

Appendices

Appendix A: 2004 Actions

Appendix B: List of City Owned and Leased Buildings

Appendix C: Plan Development Process

Appendix D: Documentation

Appendix E: Prioritization Structure

A. 2004 Actions

This Plan was originally adopted on June 22, 2004. Since that date, Berkeley has made steady progress on implementing 2004 plan actions and supporting activities. This appendix describes Berkeley's progress on the actions and activities identified in the 2004 plan. It also identifies where some 2004 actions and activities have been incorporated into this new plan.

In the following pages, Berkeley's progress on each 2004 mitigation activity is described using a detailed narrative. Progress on each activity is summarized in Table A.2 using the categories presented below.

Table A.1: Progress Categories

Category	**Description**	**2014 Inclusion**
Completed	Activity has been completed as written.	No
Completed with Modifications	Over the course of completing this action, the City modified the activity to better meet the associated objective.	No
In progress	Progress has been made since 2004, but the activity has not been fully completed.	Yes
Deferred	Progress has not been made since 2004, but the activity is still relevant.	Yes
Deleted	Progress has not been made since 2004, and the activity is no longer relevant.	No

In Progress or *Deferred* activities have been incorporated into the 2014 plan's mitigation strategy. Table A.2 shows where in the 2014 strategy the 2004 *In Progress* or *Deferred* activities have been incorporated.

Table A.2 2004 Action and Activity Status Summary

2004 Action	2004 Activity							
	a	b	c	d	e	f	g	h
A-1	Completed	Deferred - *Strengthen and Replace City Buildings*, c	Deferred - *Strengthen and Replace City Buildings*, c	In Progress - *Strengthen and Replace City Buildings*, b				
A-2	Completed	Completed	Completed	Deleted	Completed			
A-3	In Progress - *URM*, a	In Progress - *URM*, b	In Progress - *URM*, c	Deleted				
A-4	In Progress - *Hazard Information*, d and *Buildings*, b	Completed	Completed					
A-5	Completed	Completed	Completed	Completed	Completed	Completed		
A-6	Completed	Completed	Completed					
A-7	Completed	Completed	Completed	Completed	Completed	Completed		
A-8	In Progress - *Building Assessment*, a	Deferred - *Building Assessment*, b	In Progress - *Building Assessment*, c	Deferred - *Building Assessment*, d				
B-1	Deleted	Deleted	Deleted	Deleted	Completed	Completed		
B-2	Completed with Modifications							
B-3	In Progress - *Stormwater System*, a	Deferred - *Stormwater System*, b	Completed with Modifications					
B-4	Completed	Completed	Completed					
C-1	Completed with Modifications	Completed	Completed with Modifications					
D-1	Completed	Completed	Completed	Completed with Modifications	Completed	Completed	Completed with Modifications	Completed
D-2	Completed	In Progress - *EBMUD*, a	Deleted	In Progress - *EBMUD*, b				
D-3	Completed	Completed	Completed	Completed	Deferred - *HazMat Floods*, a and b			

A.1 *2004 Actions in Detail*

In the following pages, progress on each 2004 action is presented in detail. 2004 actions were numbered using a code associated with the 2004 LHMP objectives:

A. Reduce the potential for life loss, injury and economic damage to Berkeley residents from earthquakes, wildfires, landslides and floods.

B. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.

C. Protect Berkeley's unique character and values from being compromised by hazard events.

D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.

2004 Actions A-1 through A-8 support 2004 Objective A; Actions B-1 through B-4 support Objective B, etc. 2004 action priorities were assigned as Very High, High, and Important.

2004 actions are presented in the following pages in order of their associated objective.

Action A-1.	**Strengthen or replace important city owned and used buildings that are known to have structural weaknesses.**
Proposed Activities:	a) Seismically strengthen the Ratcliff Building b) Seismically strengthen Old City Hall c) Seismically strengthen the Veteran's Memorial Building d) Replace the Center Street Garage e) Seek external funding for these projects
Special Environmental Concerns:	All construction activities recommended in this action will preserve historic character of buildings, take measures to control air quality and limit noise during construction.
Lead Organization:	Public Works Department, City Manager's Office
Timeline:	5 – 7 years
Resources Required:	External funding required
Priority:	Very High
Progress on Action Between 2004-2013:	**a) Seismically strengthen the Ratcliff Building (Completed)** In 2012, seismic retrofit work was completed for the Ratcliff Building, also known as the Facility Maintenance Building. This work was made possible by a pre-disaster mitigation program grant for $2.89 million, provided in 2006 by the State Office of Emergency Services and the Federal Emergency Management Agency. This building houses the City's Public Works Department Operations Center, the location at which the department's field response activities will be coordinated during a disaster. This retrofit will enable the department to better respond during and after seismic events. **b) Seismically strengthen Old City Hall (Deferred)** The City is reviewing approaches to finance the seismic retrofit of this building. **c) Seismically strengthen the Veteran's Memorial Building (Deferred)** The City applied for and received a $750,000 Federal earmark for mitigation of this building. Limited funds could be applied to nonstructural mitigation activities, but it was determined that these activities would not be eligible. The City is reviewing alternate approaches to finance the seismic retrofit of the Veteran's Memorial Building. **d) Replace the Center Street Garage (In Progress)** The City is developing plans to demolish and replace this building. This activity will be funded through a

	partnership among a private developer, the City, and Berkeley City College. **e) Seek external funding for these projects** See project-specific descriptions.

Action A-2.	**Increase efforts to reduce fire risk in existing development by improving vegetation management and appropriate code enforcement[i].**
Proposed Activities:	a) Continue and expand existing vegetation management programs by several thousand properties annually. b) Reduce fire risk in existing developed areas by requiring all existing buildings over 75 feet tall to install a sprinkler system and promote fire extinguishing systems in all buildings. c) Create mechanism to enforce provisions of the building code that require the installation of smoke detectors as a condition of granting a permit for any work on existing residential and commercial buildings over $1000, and as a condition for the transfer of property. d) Consider reestablishing a Fire Hazard Abatement District to fund reduction in fire risk in existing properties. e) Create a mechanism to require the bracing of water heaters, flexible couplings in gas appliances and the anchoring of houses to foundations to reduce fire ignitions following earthquakes.
Special Environmental Concerns:	All activities occurring in biologically sensitive areas will take measures to protect sensitive habitats and species[ii].
Lead Organization:	Fire Department, Building and Safety Division
Timeline:	5 – 7 years
Resources Required:	More fire department prevention staff, more building and safety enforcement staff.
Priority:	High
Progress on Action Between 2004-2013:	**a) Continue and expand existing vegetation management programs by several thousand properties annually. (Completed)** Since 2004, the State of California has revised Statewide Fire Hazard Maps; the City of Berkley has adjusted the State of California's basic Fire Hazard Map to include 26 additional parcels in Fire Zone 2.

Hazardous Fire Area (HFA) Inspection Program is in place for a subset of properties within Fire Zones 2 and 3

- Fire personnel inspect 1,200+ parcels/year in the Berkeley Hills HFA
- Additional parcels are added to the HFA inspection roster on a violation-driven basis; repeat violators are added to the HFA roster

New residential structures in Fire Zones 2 and 3 are required by the State and Local building codes (Chapter 7A, 701A.5) to have Fire Protection Plans (Vegetation Management Plans)

Within all Fire Zones, Fire Department Personnel conduct compliant-driven inspections.

The City offers several programs to reduce fire risk, especially in the hills, that should reduce future conflagrations. These include:

- The Fire Fuel Chipper Program, a popular yard waste collection service. The Program serves properties in the hills from June through September each year. From 2005 - 2011, over 200 tons of vegetation was collected and recycled, on average, each year.
- The Fire Fuel Debris Bin Program is coordinated by the Department of Public Works' Solid Waste Division, which delivers and removes 30 yard roll-off boxes from requesting neighborhoods. This effort yields an average of 20 tons of plant debris per year.
- 14,000 tons of residential plant debris is collected each year through weekly curbside collection. In 2007, the City switched curbside plant debris collection from every other week to weekly. This program enhancement doubled residents' capacity to help reduce the buildup of vegetation year-round.
- A fire fuel abatement program on public land. From mid-June to mid-August each year, an average of 125 tons of debris are removed from 95 public sites, including parks, pathways and medians. This effort is a joint effort of the City and the East Bay Conservation Corps.

In 2004, City of Berkeley used a Fire Protection grant to perform fuel management modeling for the Berkeley Hills HFA. This project collected data on vegetation and building characteristics through a survey of all parcels in the HFA. Survey results established a baseline assessment for fire risk analysis in the area. This assessment can be used to focus and prioritize future inspection and/or legislative actions.

b) Reduce fire risk in existing developed areas by requiring all existing buildings over 75 feet tall to install a sprinkler system and promote fire extinguishing systems in all buildings. (Completed)
California Building Code 3414.27: ***Automatic Sprinkler System – Existing High-Rise Buildings*** requires that every existing high-rise building of type II-B, type III-B or type V-B construction shall be provided with an automatic sprinkler system.

c) Create mechanism to enforce provisions of the building code that require the installation of smoke detectors as a condition of granting a permit for any work on existing residential and commercial buildings over $1000, and as a condition for the transfer of property. (Completed)
When building permits are issued for alterations exceeding $1,000, existing buildings are required to be retrofitted with smoke alarms (and effective 1/1/11, Carbon Monoxide alarms.) The building inspector will verify installation during final inspection.

d) Consider reestablishing a Fire Hazard Abatement District to fund reduction in fire risk in existing properties. (Deleted)

This effort did not have adequate public support to be prioritized.

e) Create a mechanism to require the bracing of water heaters, flexible couplings in gas appliances and the anchoring of houses to foundations to reduce fire ignitions following earthquakes. (Completed)

Current California Codes that require bracing of water heaters and flexible couplings in gas appliances have been locally adopted. These codes have been locally

	adopted. Building and Residential Codes require the anchoring of houses to foundations in new construction. These codes have been locally adopted. In Berkeley, to incentivize that existing components which do not meet earthquake safety requirements of current codes be retrofitted, the City developed Transfer Tax incentives which allow for rebates of 1/3 of the transfer tax to the homeowner for the voluntary seismic retrofit work. This includes, but is not limited to: • Anchoring existing water heaters • Repairing or replacing foundations using prescriptive foundation requirements of CBC Chapter 18 (where applicable) or engineered plans with structural calculations • Similar earthquake risk reduction measures.

Action A-3.	**Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings[iii].**
Proposed Activities:	a) Work with owners of remaining potentially hazardous 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. b) Apply penalties to owners who show inadequate effort to upgrade their URM buildings. c) Maintain or improve program notification to building occupants and owners. d) Improve program implementation for single-family homes and small multi-unit buildings.
Special Environmental Concerns:	All building upgrade activities will include efforts to minimize impacts to existing residential and commercial tenants[iv].
Lead Organization:	Planning Department
Timeline:	5 – 7 years
Resources Required:	¼ to ½ FTE[v]
Priority:	Very High
Progress on Action Between 2004-2013:	**a) Work with owners of remaining potentially hazardous 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)

Since 2004, more than 90% of the URMs on the City's Hazardous Buildings list have been seismically retrofit, demolished, or demonstrated to have adequate reinforcement. Fewer than 25 have not yet had significant action taken to reduce their risk:

- 20 buildings out of compliance
  - 7 rigid non compliance ready for citation, previous citations issued but not followed up on
  - 2 are under construction
  - 2 in plan check
  - 6 need engineers letters or calculations
  - 3 are involved in larger projects and may be demolished in all or part.

b) Apply penalties to owners who show inadequate effort to upgrade their URM buildings. (In Progress)

The City has issued administrative citations to URM owners that have made no progress improving their buildings. The City has started a "last chance" program for owners who remain on the list, requiring an explanation of their failure to comply and a reasonable schedule for compliance. Those failing to do so have and will be cited.

An amendment to the URM Ordinance identifies two triggers to require immediate compliance with the URM ordinance:

- Transfer of Title: URM buildings that are out of compliance can't be sold until URM improvements are made.
- Building Permit: Building permits will not be issued for URM buildings that are out of compliance

c) Maintain or improve program notification to building occupants and owners. (In Progress)

BMC 19.38.070 *Obligation to tenants* requires URM building owners notify tenants that the building is included on the URM inventory and constitutes a severe threat to life safety in the event of an earthquake of moderate to high magnitude. This information must be shared via written notice, and it must also be posted and

	maintained inside the main entrance of the building. **d) Improve program implementation for single-family homes and small multi-unit buildings. (Deleted)** Not applicable: URM does not apply to single-story homes or small multi-unit buildings. See Action A-5: *Create a program to reduce risks for people and property for all potentially hazardous single-family, soft-story, and hillside residences* for further detail.

Action A-4.	**Better inform residents about emergency preparedness options.**
Proposed Activities:	a) Expand existing programs to enable, encourage, or require property owners, managers, and realtors to provide information to tenants and homebuyers about emergency preparedness, evacuation routes, and home safety. b) Develop a set of materials to provide relevant information. c) Encourage owners of private schools and other privately owned high-occupancy structures to assess the safety of their buildings.
Lead Organization:	Planning Department, Office of Emergency Services, Department of Housing and Rent Board
Timeline:	Ongoing
Resources Required:	To be determined
Priority:	Very High
Progress on Action Between 2004-2013:	**a) Expand existing programs to enable, encourage, or require property owners, managers, and realtors to provide information to tenants and homebuyers about emergency preparedness, evacuation routes, and home safety[vi]. (In Progress)** The City's Office of Emergency Services is coordinating with the Rent Stabilization Board to develop and distribute outreach materials for disaster readiness materials for property owners, managers and renters. **b) Develop a set of materials to provide relevant information. (Completed)** The City's Five Critical Steps brochures and training includes home mitigation information. Brochures are available on the City of Berkeley website. Five Critical

	Steps in-person trainings are administered by Fire Department staff, and in 2012 the Department extended its training delivery capability to all Department personnel. The Hills Emergency Forum has developed a brochure of Wildfire Evacuation Tips, which is available on its website. In 2010, the CERT program adopted the national curriculum, which addresses in-home mitigation. On May 6, 2006, the City organized volunteers to deliver approximately 30,000 door hangers with basic disaster preparedness information and ways for people to get involved in preparing their neighborhood. The City conducted more than 50 Community Emergency Response Training classes on a range of topics, attended by over 1,000 residents. The City has held more than 80 neighborhood talks on "The Five Critical Steps You Can Take to Prepare for an Earthquake," attended by around 1,000 residents. **c) Encourage owners of private schools and other privately owned high-occupancy structures to assess the safety of their buildings. (Completed)** The City has provided Five Critical Steps presentations to private school children as well as staff.

Action A-5.	**Create a program to reduce risks for people and property for all potentially hazardous single-family, soft-story, and hillside residences[vii].**
Proposed Activities:	a) Recommend adoption of a retrofit standard for single-family homes, small multi-unit apartment buildings and soft-story buildings that includes standard plan sets and construction details. b) Require engineered plans for single-family homes on hillsides and multi-unit residential structures to qualify for the transfer tax rebate. c) Investigate and adopt financial, procedural, and land use incentives to facilitate retrofit of soft-story buildings. d) Explore development of an ordinance to require owners of soft-story structures to strengthen them. e) Provide technical assistance in seismically strengthening these types of structures. f) 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.
Special Environmental Concerns:	All building upgrade activities will include efforts to minimize impacts to existing residential and commercial tenants[viii].
Lead Organization:	Planning Department
Timeline:	5 – 7 years
Resources Required:	Up to ½ FTE for program enforcement
Priority:	Very High
Progress on Action Between 2004-2013:	**a) Recommend adoption of a retrofit standard for single-family homes, small multi- unit apartment buildings and soft-story buildings that includes standard plan sets and construction details. (Completed)** The City has developed more options to seismically strengthen structures. In August of 2010, the City adopted Appendix A3 of the 2009 International Building Code – "Prescriptive Provisions for the Seismic Strengthening of Cripple Walls and Sill Plate Anchorage of Light, Wood-Frame Residential Buildings" as amendment into the 2007 and 2010 California Existing Building Code. In addition, the City has adopted Standard Plan Set A for wood frame homes of two stories or less that provides typical details and other guidance. This plan set simplifies the design of cripple wall retrofits for many homes in Berkeley. *Note: Soft-story retrofit standards are grouped into separate categories.* **b) Require engineered plans for single-family homes on hillsides and multi-unit residential structures to qualify for the transfer tax rebate. (Completed)** To qualify for the transfer tax rebate, seismic strengthening work must have plans and calculations prepared by a California registered civil or structural engineer. This work must also meet additional standards. *(Engineering work is necessary when Seismic Strengthening Work does not comply with ABAG Plan Set A or Appendix Chapter A3 of the 2009 International Existing Building Code.)*

c) Investigate and adopt financial, procedural, and land use incentives to facilitate retrofit of soft-story buildings. (Completed)

To qualify for the transfer tax rebate, soft-story buildings must have corrective work required by BMC Chapter 19.39.

In 2008, the City amended its land use regulations to exempt alterations for public safety from the front and side yard and parking requirements (BMC 23C.04.075)

d) Explore development of an ordinance to require owners of soft-story structures to strengthen them. (Completed)

On December 3, 2013 City Council adopted Ordinance No. 7,318-N.S. amending Berkeley Municipal Code Chapter 19.39 to require property owners of soft, weak or open front ("SWOF") buildings with five or more dwelling units to retrofit their buildings within the next five years. Owners have three years to apply for a building permit and two years to complete the work after submitting their permit application. The law applies to buildings constructed prior to 1978 and takes effect January 4, 2014. This is the second phase of the Soft Story Program.

In Phase I of the Soft-Story Program, the City passed an ordinance requiring owners of soft-story buildings with five or more units to:

- Submit an engineering report analyzing the building's seismic safety within two years of notice
- Post the building with a warning sign, and
- Notify tenants of the building's seismic weaknesses.

Alternately, owners could chose to retrofit without submitting the detailed engineering analysis.

Owners of all 321 identified soft-story wood frame buildings were sent Notices and Orders in 2006. 51 buildings were removed upon further investigation as not being within the scope of the ordinance.

Of the remaining 270 buildings, 94 percent are in compliance with Phase I of the ordinance:

- 112 have been retrofitted or are in the process of

being retrofitted

- 140 have submitted engineering evaluation reports that have been approved by the City, verifying their status as soft-story buildings

18 buildings are not in compliance with Phase I of the ordinance.

e) Provide technical assistance in seismically strengthening these types of structures. (Completed)

The City has developed more options and technical standards to seismically strengthen single-family homes and multi-unit apartment buildings.

- On August 16, 2010, the California Building Standards Commission adopted Appendix A3 of the 2009 International Building Code – "Prescriptive Provisions for the Seismic Strengthening of Cripple Walls and Sill Plate Anchorage of Light, Wood-Frame Residential Buildings," which became effective immediately statewide as an emergency supplement to the 2010 California Building Code and was codified as Chapter A3 into the California Existing Building Code.
- In addition, the City uses Standard Plan Set A as a prescriptive guide to facilitate design of cripple wall retrofits for wood frame homes of two stories or less. This plan set simplifies the design of cripple wall retrofits for many homes in Berkeley.

The City has published guidelines for Transfer Tax Reductions to establish the types of voluntary seismic strengthening work that qualify for a Transfer Tax Rebate.

f) 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. (Completed)

The City has adopted the 2010 California Building Code and 2010 California Residential Code, including the Wildland Urban Interface Fire Standards and the

	International Existing Building Codes Standards for analysis and retrofit. The City further expanded the application of the Wildland Urban Interface Fire Standards. Berkeley's Fire Safety Zones are larger than defined by the State and the requirements were expanded to include additions, alterations, repairs and re-roofs. Berkeley Building Code adopts the State's approach for protecting structures from wildland fires and includes additional local provisions: • Roofs (and roof replacements) are required to be Class A minimum - that means that they are effective against severe fire exposure. Wooden shakes or shingles are prohibited regardless of the assembly rating of the roof system; • Spark arrestors are required when certain kinds of heating appliances are modified or whenever a structure is re-roofed; • There are higher standards for replacement of existing exterior wall coverings; • Underground utility connections are required for new construction; • Areas in the local Fire Zone 3 (very high fire hazard severity zone) have additional requirements for a fire warning systems, automatic sprinkler systems, utility enclosures, water service, access roads and fire trails, and brush and vegetation control. *(Repeated from above): In August of 2010, the City adopted Appendix A3 of the 2009 International Building Code – "Prescriptive Provisions for the Seismic Strengthening of Cripple Walls and Sill Plate Anchorage of Light, Wood-Frame Residential Buildings" as amendment into the 2007 and 2010 California Existing Building Code.*

Action A-6.	**Encourage the retrofit of commercial concrete tilt-up, non-ductile frame, and wood frame buildings to improve their ability to resist earthquakes and fires[ix].**
Proposed Activities:	a) Recommend adoption of a retrofit standard for these types of buildings. b) Investigate and adopt financial, procedural and land use incentive programs for owners of these types of buildings

	to facilitate retrofit. c) Provide technical assistance in strengthening these structures.
Special Environmental Concerns:	All building upgrade activities will include efforts to minimize impacts to existing residential and commercial tenants[x].
Lead Organization:	Planning Department, Building and Safety Division
Timeline:	5 – 7 years
Resources Required:	Up to ½ FTE
Priority:	High
Progress on Action Between 2004-2013:	**a) Recommend adoption of a retrofit standard for these types of buildings. (Completed)** • Concrete tilt-up • Non-ductile frame • Wood frame As part of the local 2007 and 2010 code adoption, the city adopted the following standards of the International Existing Building Code: • Earthquake Hazard Reduction in Existing Reinforced Concrete and Reinforced Masonry Wall Buildings with Flexible Diaphragms, • Earthquake Hazard Reduction in Existing Wood-frame Residential Buildings with Soft, Weak or Open-front walls, • Earthquake Hazard Reduction in Existing Concrete Buildings and Concrete with Masonry Infill Buildings. Furthermore, as part of the local code adoption, the City amended California Building Code Chapter 34 Existing Structures by adding a new Section "Repairs to Existing Buildings and Structures by the Occurrence of a Natural Disaster," which establishes seismic evaluation and design procedures for damaged buildings based on ASCE 31 Seismic Evaluation of Existing Buildings and ASCE 41 Seismic Rehabilitation of Existing Building. **b) Investigate and adopt financial, procedural and land use incentive programs for owners of these types of buildings to facilitate retrofit. (Completed)** Transfer Tax Rebate program applies to commercial buildings. Retrofit would require an engineered design.

	c) Provide technical assistance in strengthening these structures. (Completed) Adopted standards provide technical guidance. When additional technical assistance is needed, plan check engineers provide staff consultations.

Action A-7.	**Reduce the vulnerability of residential areas located in the Hazardous Hill Fire Area to fires through implementation of the Subdivision Ordinance's merger provisions and through changes to the existing residential zoning laws and building code requirements[13].**
Proposed Activities:	a) Consider fire safety, evacuation, and emergency vehicle access when reviewing secondary unit or other proposals to add residential units in these areas. b) Encourage the installation of early warning fire alarm systems. c) Maintain City standards for minimum width and vertical clearance, and ensure that new driveways and roadways meet minimum standards of the Uniform Fire Code or subsequent standards adopted by the City. d) Provide adequate water for fire suppression for new development in accordance with City standards for minimum volume and duration of flow. e) Establish criteria for the installation of gas shutoff valves in new and existing construction, to reduce the risk of post-earthquake fires. f) Assist the Panoramic Area Association to obtain funding to study the feasibility of building a fire trail on the south side of the Hill including evaluation of alternate routes.
Special Environmental Concerns:	All activities occurring in biologically sensitive areas will take measures to protect sensitive habitats and species[xi].
Lead Organization:	Planning Department
Timeline:	5 years
Resources Required:	¼ FTE
Priority:	High
Progress on Action Between 2004-2013:	**a) Consider fire safety, evacuation, and emergency vehicle access when reviewing secondary unit or other proposals to add residential units in these areas.**

(Completed)

The Accessory Dwelling Unit Ordinance (Berkeley Municipal Code Title 23) prohibits Accessory Dwelling Units in the Environmental Safety-Residential Zone to protect against undue exposure of people and property to seismic hazards.

b) Encourage the installation of early warning fire alarm systems. (Completed)

The City further expanded the application of the Wildland Urban Interface Fire Standards. Berkeley Building Code adopts the State's approach for protecting structures from wildland fires and has additional requirements for fire warning systems. The NFPA 72 Fire Alarm Standard applies to Fire Zone 3.

c) Maintain City standards for minimum width and vertical clearance, and ensure that new driveways and roadways meet minimum standards of the Uniform Fire Code or subsequent standards adopted by the City. (Completed)

The City maintains citywide road standards that meet or exceed those of the Uniform Fire Code. According to Berkeley Municipal Code, Section 21.40.040, minimum width of right-of-way is 40 feet, minimum curb-to-curb width is 28 feet, and minimum unobstructed clearance is 13.6 feet.

d) Provide adequate water for fire suppression for new development in accordance with City standards for minimum volume and duration of flow. (Completed)

EBMUD has been involved with a few development projects in the Berkeley Hills, such as the Fire Station #7, completed in 2006. All new development projects are required to meet the local fire agency's fire flow requirements where feasible at the project sponsor's expense.

e) Establish criteria for the installation of gas shutoff valves in new and existing construction, to reduce the risk of post-earthquake fires. (Completed)

In October 2010, the Berkeley Municipal Code was amended to require automatic gas shutoff valves for any existing building undergoing additions, alterations or repairs with the valuation of the work exceeding $50,000.

	In April 2012, the City reduced the unit cost permitting fee for valve installation. The City also established a $50 flat rate permit for voluntary installation of automatic gas shutoff valves in two or more residences on a block, when no other plumbing work takes place and inspections are performed on a coordinated basis. **f) Assist the Panoramic Area Association to obtain funding to study the feasibility of building a fire trail on the south to study the feasibility of building a fire trail on the south side of the Hill including evaluation of alternate routes. (Completed)** The City awarded the Panoramic Hill Association $25,000, and in 2009 entered into a contract for the PHA to perform feasibility studies, preliminary design and preparation of initial cost estimates for a controlled access road for emergency vehicles onto Panoramic Hill, and improved means for emergency pedestrian evacuation from Panoramic Hill. UC Berkeley's Chancellor's Community Partnership Program Fund provided a $25,000 matching grant to the Panoramic Hill Association for the Feasibility Study for Secondary, Emergency Access to Panoramic Hill. Neither award was spent.

Action A-8.	**Perform appropriate seismic and fire safety analysis based on current and future use for all City-owned and leased facilities and structures[xii].**
Proposed Activities:	a) Analyze structures with important emergency response and recovery functions, first, and make recommendations for structural improvements. b) Analyze remaining structures based on occupancy and structure type, and make recommendations for structural improvements. c) Establish a prioritized program for seismic retrofit of the remaining seismically unsafe public structures. d) Reduce the occupancy of and develop emergency guidelines for buildings with structural deficiencies prior to being upgraded.
Lead Organization:	City Manager's Office, Public Works, Capital Improvement Division
Timeline:	1 year
Resources Required:	½ FTE plus consultant time
Priority:	High

Progress on Action Between 2004-2013:	**a) Analyze structures with important emergency response and recovery functions, first, and make recommendations for structural improvements. (In Progress)** The Department of Public Works hired a consultant to conduct facility condition assessments. These assessments will incorporate seismic evaluations for both structural and nonstructural elements. The project will run from June – December, 2013. Priority facilities are: • Senior Centers • Recreation Centers • Corporation Yard facilities (not including newly-retrofitted Ratcliff Building) • Transfer Station facilities **b) Analyze remaining structures based on occupancy and structure type, and make recommendations for structural improvements. (Deferred)** Facility condition assessments will inform necessary mitigation activities. **c) Establish a prioritized program for seismic retrofit of the remaining seismically unsafe public structures. (In Progress)** Mitigation activities will be incorporated into a short- and long-term work plan. Among already-assessed buildings, the two highest-priority projects have partially- or fully-identified funding sources: • Structural mitigation at James Kenny Recreation Center will be conducted using a federal mitigation funding. • Replacement of Center Street Garage has potential funding. **d) Reduce the occupancy of and develop emergency guidelines for buildings with structural deficiencies prior to being upgraded. (Deferred)** Old City Hall, the Veteran's Memorial Building and Center Street Garage have been assessed and deemed potential collapse hazards. These facilities continue to operate because no viable alternatives have been identified for activities occurring in these structures.

Action B-1.	**Establish pre-event planning for post-disaster recovery as an integral element of the emergency response planning of the City Council and each of the City departments[xiii].**
Proposed Activities:	a) Establish a framework and process for recovery planning that specifies roles, priorities, and responsibilities of various departments within the city, and that outlines a structure and process for policy-making involving elected officials and appointed advisory committee(s). b) Prepare a basic Recovery Plan that outlines the major issues and tasks that are likely to be the key elements of community recovery. c) Integrate recovery planning as an element of the Community-Based Disaster Response Plan. d) Evaluate the feasibility of resuming most city government functions within 30 days of a major disaster. e) Explore use of new technologies, such as early warning systems. f) Review and improve City's short-term and intermediate-term sheltering plans.
Lead Organization:	City Manager's Office
Timeline:	1 year
Resources Required:	No additional resources required
Priority:	Very High

Progress on Action Between 2004-2013:	**a) Establish a framework and process for recovery planning that specifies roles, priorities, and responsibilities of various departments within the city, and that outlines a structure and process for policy-making involving elected officials and appointed advisory committee(s). (Deleted)** Staff is monitoring the American Planning Association's development of the referenced Model Pre-Event Recovery Ordinance. The Model Ordinance is currently under public review and is not yet finalized. Tailoring and adoption of the model recovery ordinance would be a precursor to a complete disaster recovery plan for Berkeley. This Action is being deleted because recovery planning is outside the scope of this Mitigation Plan. **b) Prepare a basic Recovery Plan that outlines the major issues and tasks that are likely to be the key elements of community recovery. (Deleted)** See above **c) Integrate recovery planning as an element of the Community-Based Disaster Response Plan. (Deleted)** See above **d) Evaluate the feasibility of resuming most city government functions within 30 days of a major disaster. (Deleted)** A multi-department City team is evaluating procedures for inspecting and reopening City buildings following earthquakes. The Department of Public Works is developing a building conditions survey for all City buildings, so that the City has pre-disaster documentation of the condition of City buildings. This Action is being deleted because continuity of operations planning is outside the scope of this Mitigation Plan. **e) Explore use of new technologies, such as early warning systems. (Completed)** In 2004, the City established the Berkeley Emergency Notification System (BENS) to provide mass emergency notification capabilities. BENS can contact Berkeley land lines for geo-targeted "reverse 9-1-1" phone calls, as well as voice calls, SMS text messages and email to

community members who subscribe their mobile phones, VoIP phones and email addresses with the system.

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, and it will carry smaller flows to higher elevations. This capacity was based on calculations of water volumes required to fight the fire front presented in the 1991 blaze, assuming that some capacity will be available from EBMUD sources, in light of system upgrades.

The City joined the East Bay Regional Communications System, which provides radio interoperability among the City's first responders, as well as with other P25 systems throughout the Bay Area and elsewhere.

The California Emergency Management Agency, Caltech, California Geological Survey, University of California Berkeley, United States Geological Survey, and others have been conducting early warning research and development in California and together they operate the California Integrated Seismic Network. By building upon the network and processing data from an array of sensors throughout the state, a fully developed earthquake early warning system would effectively detect the strength and progression of earthquakes and alert the public within seconds, up to 60 seconds, before potentially damaging ground shaking is felt.
In April 2013, City Council unanimously adopted a resolution in support of Senate Bill 135, which would require the development of a comprehensive statewide earthquake early warning system in California. Development would be led by the California Office of Emergency Services, in collaboration with the California Institute of Technology (Caltech), the California Geological Survey, the University of California Berkeley, and the United States Geological Survey.

The City is exploring the use of emergency management software to facilitate disaster response and recovery activities through its Emergency Operations Center.

f) Review and improve City's short-term and intermediate-term sheltering plans. (Completed)

Mass Care and Shelter planning is ongoing among the City and its partners at the American Red Cross Bay Area Chapter (ARCBA), UC Berkeley and the Berkeley Unified School District.

The City has worked with ARCBA to assess City-run sites for sheltering, and to integrate the information into the National Shelter System.

The City has partnered with the Red Cross to train staff in mass care and sheltering operations. Fifty-five City staff members from six departments have been trained in the Red Cross Shelter Operations course, which included an animal sheltering unit by the City's Animal Services Division. Twenty-one staff members have received additional Red Cross shelter manager training.

In 2009, the City purchased three care and shelter trailers with equipment and supplies for shelter operations (cots, blankets, and comfort kits), as well as one trailer stocked with equipment and supplies necessary for animal sheltering. These trailers are strategically placed throughout the City. Use of animal care and care and shelter trailers has been incorporated into shelter operations training.

In 2013, 18 City staff and a care and shelter trailer were activated to support the temporary relocation of a homeless shelter following a power outage at the normal shelter site.

Action B-2.	**Review and revise the Disaster Preparedness and Safety Element of the City's General Plan biannually.**
Proposed Activities:	a) Make the DMA 2000 Plan an appendix to the Disaster Preparedness and Safety Element and incorporate its review into the annual General Plan update.
Lead Organization:	Planning Department
Timeline:	First review in 2006
Resources Required:	No extra resources required
Priority:	High

Progress on Action Between 2004-2013:	**a) Make the DMA 2000 Plan an appendix to the Disaster Preparedness and Safety Element and incorporate its review into the annual General Plan update. (Completed with modifications)** DMA 2000 Plan (2004 Hazard Mitigation Plan) was adopted as an appendix to the Disaster Preparedness and Safety Element of the General Plan. General plan updates did not occur annually. High-priority, funded projects outlined in the 2004 Hazard Mitigation Plan were incorporated into the regular work plans of responsible departments. Project progress was reviewed at regular departmental meetings with the City manager on a semi-annual basis. Unfunded projects were reviewed as part of the budget process.

Action B-3.	**Rehabilitate the City's clean water system to reduce local flooding caused by inadequate storm drainage[xiv].**
Proposed Activities:	a) Conduct a hydraulic analysis of runoff and drainage systems in the city to predict areas of insufficient capacity in the storm drain system. b) Incorporate improving the system capacity and disaster resistance in regular maintenance activities. c) Ensure that new development pays its fair share of improvements to the storm sewerage system necessary to accommodate increased flows from the development.
Special Environmental Concerns:	Any non-emergency construction work on the storm drain system will take steps to minimize impacts to riparian habitat[xv].
Lead Organization:	Public Works Department
Timeline:	2 years
Resources Required:	1-½ FTE plus consultant time
Priority:	High
Progress on Action Between 2004-2013:	**a) Conduct a hydraulic analysis of runoff and drainage systems in the city to predict areas of insufficient capacity in the storm drain system. (In Progress)** In 2011, the Engineering Division of the City's Public Works Department developed hydraulic models for two of the City's ten watersheds. The Potter and Codornices Watersheds were selected because they represent the full range of the urban drainage spectrum in Berkeley.[xvi] The modeling identified locations of predicted overflows. The City plans to develop hydraulic models of the

	remaining eight watersheds within Berkeley as funding becomes available. **b) Incorporate improving the system capacity and disaster resistance in regular maintenance activities. (Deferred)** Existing funding levels limit the City's ability to conduct proactive maintenance and condition assessments, undertake needed infrastructure repairs. **c) Ensure that new development pays its fair share of improvements to the storm sewerage system necessary to accommodate increased flows from the development. (Deleted)** City has not done a study to determine what fees that would be assigned to new development for improvements, and funding is not available for such a study. Instead, the City's Municipal Regional Permit (the City's storm water permit) for new development has C3 requirements that reduce or eliminate flows for new development.

Action B-4.	**Explore the feasibility and need to incorporate cost-effective terrorism-resistant design features when city owned buildings undergo major renovations.**
d) Proposed Activities:	a) Identify reasonable building alterations that could reduce vulnerability of terror attacks, such as moving air intake vents. b) Study how the city could incorporate these alterations into ongoing building upgrades and maintenance. c) Encourage other governmental agencies and the private sector to consider similar measures.
Lead Organization:	Public Works Department, Capital Improvements Division, City Manager's Office
Timeline:	1 year
Resources Required:	½ FTE
Priority:	Important
Progress on Action Between 2004-2013:	a) **Identify reasonable building alterations that could reduce vulnerability of terror attacks, such as moving air intake vents. (Completed)** The Police Department has performed vulnerability assessments of key City buildings. The City will

	incorporate measures recommended in the assessments as funding becomes available. b) **Study how the city could incorporate these alterations into ongoing building upgrades and maintenance. (Completed)** See above c) **Encourage other governmental agencies and the private sector to consider similar measures. (Completed)** See above

Action C-1.	**Encourage and support the long-term protection of historic and architecturally significant structures to preserve neighborhood and community character[xvii].**
Proposed Activities:	a) Create incentives for owners of historic or architecturally significant structures to undertake mitigation to levels that will minimize the likelihood of damage during or demolition after a disaster. b) Establish preservation-sensitive measures, including requirements for temporary shoring or stabilization where needed; arrangements for consulting with preservationists; expedited permit procedures for suitable repair or rebuilding of historically or architecturally valuable structures; and, where appropriate, provisions for replanting. c) Require alterations to designated and potentially significant structures to conform to the federal Secretary of the Interior's Guidelines for Rehabilitation.
Lead Organization:	Planning Department
Timeline:	Ongoing
Resources Required:	To be determined
Priority:	High
Progress on Action Between 2004-2013:	**a) Create incentives for owners of historic or architecturally significant structures to undertake mitigation to levels that will minimize the likelihood of damage during or demolition after a disaster. (Completed with modifications)** The City has made its participation in the State's Mills Act Program more effective. The Mills Act Program provides tax incentives to owners of historic structures who perform repairs or upgrades to those structures,

including disaster mitigation work.
Currently, the City has 27 Mills Act Contracts. The Program works through a rolling 10-year contract between the building owner and the City. The contract outlines the improvements the owner intends to make in the upcoming 10 years. At the five year mark, the City has the option not to renew the contract if it is clear that the owner is not making progress on the improvements outlined in the contract. Until recently, the City did not have an established revenue stream to monitor these contracts at the five-year mark. In 2012, the City adopted a fee to process Mills Act contracts, as well as a fee to support the ongoing maintenance and inspections associated with these contracts. Through establishment of this funding stream, the City will be able to effectively perform necessary maintenance and inspections of these contracts.

The Transfer Tax Rebate Program provides a reduction in the real estate transfer tax for homeowners who perform qualifying seismic safety work on their homes.

b) Establish preservation-sensitive measures, including requirements for temporary shoring or stabilization where needed; arrangements for consulting with preservationists; expedited permit procedures for suitable repair or rebuilding of historically or architecturally valuable structures; and, where appropriate, provisions for replanting. (Completed)
Expedited permit procedures: For all homes (historic/architecturally significant or not), a Zoning Amendment (BMC Section 23.C.04.100) allows homeowners to rebuild by right if the buildings are damaged in a natural disaster. Before this Amendment was adopted, owners were required to use the permitting process to rebuild.

c) Require alterations to designated and potentially significant structures to conform to the federal Secretary of the Interior's Guidelines for Rehabilitation. (Completed with modifications)
Owners of historic structures who seek to alter their buildings must obtain a Structural Alteration Permit issued by the Landmarks Preservation Commission.

	Owners doing maintenance work on their historic structures must have the construction plans reviewed by a Historic Preservation Planner in the Land Use Division of the Planning Department. Land Use Division staff evaluates permit requests according to the Secretary of the Interior's Standards for Rehabilitation. If these Standards cannot be met, the owner can use CEQA Process to identify acceptable alternatives and perform an Environmental Impact Report.

Action D-1.	**Encourage mitigation efforts with key institutions serving Berkeley [xviii].**
Proposed Activities:	a) Promote information sharing and seek to coordinate and implement collaborative mitigation and response planning and information gathering efforts with neighboring cities, Alameda and Contra Costa Counties, and the East Bay Regional Park District. b) Coordinate mitigation efforts with UC Berkeley and Berkeley Lab for hazardous materials and natural hazards, especially flood, fire and landslide. c) Support and encourage efforts of key lifeline agencies (e.g. PG&E, EBMUD, Caltrans, etc.) to plan for and finance seismic retrofit and other disaster resistant measures. d) Conduct a Disaster Forum to bring these groups together with community members and stakeholders in Berkeley. e) Work with the business community in Berkeley to identify ways to improve business resiliency to disasters. f) Initiate joint planning effort for the Panoramic Hill area with the University of California and City of Oakland, who share responsibility for regulating development in this area. g) Coordinate with and encourage mitigation actions in public and private schools and hospitals. h) Coordinate with neighboring cities through existing forums such as the Hills Emergency Forum, the Disaster Resistant California (previously Project Impact Communities) activities, and the Alameda County City and Emergency Managers' Associations to continue collaboration and joint mitigation planning.
Lead Organization:	City Manager's Office, Planning Department, Office of Emergency Services, Public Works Department, Office of Transportation
Timeline:	Ongoing

Resources Required:	½ FTE engineer staff
Priority:	Very High
Progress on Action Between 2004-2013:	**a) Promote information sharing and seek to coordinate and implement collaborative mitigation and response planning and information gathering efforts with neighboring cities, Alameda and Contra Costa Counties, and the East Bay Regional Park District. (Completed)** City staff coordinates information-sharing and mitigation and response planning with other emergency managers through participation in the Alameda County Emergency Management Organization. Alameda County and its Cities, as well as special districts and healthcare facilities, participate in these meetings. City Fire Prevention staff participates in Hills Emergency Forum meetings to continue collaboration and joint WUI fire mitigation planning. The Hills Emergency Forum has representation from CALFIRE, EBMUD, EBRPD, UC Berkeley, Lawrence Berkeley Lab, and the Cities of Oakland, El Cerrito, Kensington, Moraga and Orinda. **b) Coordinate mitigation efforts with UC Berkeley and LBNL for hazardous materials and natural hazards, especially flood, fire and landslide. (Completed)** Along with City staff, UC Berkeley and Berkeley Lab participate in meetings of the Alameda County Emergency Management Organization and the Hills Emergency Forum. Additionally, City OES staff meets monthly with counterparts at UC Berkeley and Berkeley Lab, and coordinate on disaster exercises and training. The City's Toxics Management Division regulates UC Berkeley and Berkeley Lab.[xix] Both of these sites provide lists of the substances used in campus research to the Toxics Management Division, which then provides the information to the Berkeley Fire Department in accordance with California Health and Safety Code. **c) Support and encourage efforts of key lifeline agencies (e.g. PG&E, EBMUD, Caltrans, etc.) to plan for and finance seismic retrofit and other disaster resistant measures. (Completed)** PG&E has proposed $2.2 billion in pipeline upgrades through 2014 and outlined a Pipeline Safety Enhancement Plan to

modernize its gas transmissions operations over the next several years.

In 2002 BART completed a study of the earthquake vulnerability of the entire system, analyzing multiple earthquakes, predicting damage, and assessing cost-effectiveness of retrofits. Upgrades to the system are being funded by $980 million in General Obligation Bonds, authorized by voters in Alameda, Contra Costa, and San Francisco counties, supplemented with an additional $240 million from other sources.

EBMUD completed a seismic retrofit of the Claremont Tunnel in February 2007, which included constructing a bypass tunnel where the Claremont Tunnel intersects the Hayward fault.

There are two reservoirs with dams in or near the city that have been evaluated for their seismic safety as part of EBMUD's dam safety program. Both reservoirs are safe for continued operation and do not pose a life safety risk.

d) Conduct a Disaster Forum to bring these groups together with community members and stakeholders in Berkeley. (Completed with modifications)

Representatives from key agencies attend Disaster and Fire Safety Commission meetings to discuss mitigation topics.

e) Work with the business community in Berkeley to identify ways to improve business resiliency to disasters. (Completed)

The City provides a Disaster Preparedness Guide for Berkeley Businesses.

Businesses are integrated into Citywide disaster drills.

f) Initiate joint planning effort for the Panoramic Hill area with the University of California and City of Oakland, who share responsibility for regulating development in this area. (Completed)

In 2006, the Alameda County Local Agency Formation Commission (LAFCo) expanded Berkeley's Sphere of Influence to include the Oakland part of Panoramic Hill. LAFCo acted to do so despite opposition letters from the City Manager of the City of Berkeley and City Administrator from City of Oakland. LAFCo's action means that the City of Berkeley is now officially charged with planning for all of Panoramic Hill, including those areas currently in Oakland.

g) Coordinate with and encourage mitigation actions in

public and private schools and hospitals. (Completed with modifications)

As of 2013, all Berkeley Unified School District pre-K, K-12, adult, transportation, and administration buildings requiring retrofit under the Field Act and subsequently adopted State safety laws have been retrofitted. In November 2010, Berkeley voters approved Measure I, funding improvements to school safety and facilities. Seismic work funded by the measure includes demolition of the Old Gymnasium at Berkeley High School and replacement of the unreinforced masonry building at the BUSD corporation yard that functions as its maintenance facility (due to begin work in 2016). In 2012, the District moved its administrative offices out of the seismically-unsafe Old City Hall and into a newly-renovated building on Bonar and University. In addition, as the building code becomes more stringent, Berkeley continues to improve the seismic safety of its schools. By way of example, Berkeley plans to do a voluntary upgrade of the Jefferson Elementary School over the next two years.

Staffing requirements described in 2004 Plan did not accurately predict resources necessary to address mitigation efforts in private schools.

Under the Hospital Seismic Safety Act, Alta Bates is retrofitting or replacing acute care facilities by 2030 to meet standards to be repairable or functional following an earthquake.

In 1993, the UC Berkeley Tang Center was constructed to an essential facilities standard, due to both its health-related mission and its then-designation as a backup Emergency Operations Center for the campus.[xx] Since then, the Center has taken nonstructural mitigation steps to reduce the risk of injury to patients and staff during an earthquake, and to speed the Center's ability to return to function following an earthquake. To secure access to electronic health records, the Center moved its clinical management system to a hardened data server on campus, and is arranging a "hot" standby server out of the area.

h) Coordinate with neighboring cities through existing forums such as the Hills Emergency Forum, the Disaster Resistant California (previously Project Impact Communities) activities, and the Alameda County City and Emergency Managers' Associations to continue collaboration and joint mitigation planning. (Completed)

City Office of Emergency Services staff participates in

	monthly Alameda County Emergency Managers Association meetings to continue collaboration and joint all-hazards mitigation planning. City Fire Prevention staff participates in Hills Emergency Forum meetings to continue collaboration and joint WUI fire mitigation planning.

Action D-2.	**Work with EBMUD, PG&E, BART and other agencies to ensure an adequate supply of water, power and other critical services during emergency periods and during recovery[xxi].**
Proposed Activities:	a) Continue to work with the East Bay Municipal Utility District to complete the decommissioning of the Berryman Reservoir. b) Encourage improvements to EBMUD's north-south 48" water main and the sewer interceptors. c) Coordinate with PG&E and EBMUD for mitigation post-disaster power resumption so that vulnerable communities, such as the disabled and elderly, are given priority. d) Investigate upgrading water line capacity to neighborhoods at most risk of wildfire.
Lead Organization:	Public Works Department
Timeline:	Ongoing
Resources Required:	¼ FTE
Priority:	High
Progress on Action Between 2004-2013:	**a) Continue to work with the East Bay Municipal Utility District to complete the decommissioning of the Berryman Reservoir. (Completed)** The Berryman reservoir on Euclid Avenue was drained and removed from service by EBMUD in 2006 because it was determined to be seismically unsafe. EBMUD has placed free-standing water tanks inside the drained reservoir. **b) Encourage improvements to EBMUD's north-south 48" water main and the sewer interceptors. (In progress)** EBMUD plans to install 8,000 linear feet of new 48-inch pipeline parallel to the north-south 48 to 54 -inch water transmission main in Berkeley in 2015 and 2016. The new 48-inch pipeline will add water transmission capacity to the system and the existing 48 to 54-inch water

transmission main will remain in service. The project is nearing completion of the Environmental Impact Reporting phase.

EBMUD's 10-year Capital Improvement Program budget for FY14 - FY23 includes one future project related to wastewater interceptor improvements within Berkeley. The Pump Station Q Forcemain Dual-mode Operation Project will modify portions of the North Interceptor system to allow dual operation of the Pump Station Q forcemain for use as either a gravity relief sewer (north to south flow) or a forcemain (south to north flow).

c) Coordinate with PG&E and EBMUD for mitigation post-disaster power resumption so that vulnerable communities, such as the disabled and elderly, are given priority. (Deleted)

After further consultation with partners at PG&E and EBMUD, the City has determined that this action was not aligned with current emergency management regulations and practices.

Following a disaster, power will be restored to critical facilities and then to as many people as possible as quickly as possible. It cannot be prioritized on the basis suggested in the action.

EBMUD's initial response to a major disaster will be to locate and document damage to the extent practicable while there is still water in the system. In general, EBMUD will not make repairs immediately, but will instead try to understand the damage and isolate sections of pipe where the flow from the break could cause life safety issues, significant property damage, and/or major water loss.

The post-disaster recovery will probably start with the larger transmission systems and then work from there using the following priorities for restoring water service:

- Fire service;
- Hospitals and shelters;
- Domestic users;
- Commercial, industrial, and other users.

In general, EBMUD will be restoring service in areas of its system (i.e., groups of customers) based on these priorities. These restoration priorities were created under EBMUD's Seismic Improvement Program and are based on EBMUD priorities for incident response, for which life safety is the highest priority.

	d) Investigate upgrading water line capacity to neighborhoods at most risk of wildfire. (In Progress) Since 2004, EBMUD has completed various maintenance based pipe replacements in and around the city of Berkeley, including the Berkeley Hills, as well as adjacent cities and county areas subject to wildfire. These water system improvements are primarily replacing deteriorated pipelines due to leaks and main breaks. In accordance with EBMUD policy and practices, these individual pipe replacement segments were sized to meet current fire flow standards, where feasible.

Action D-3.	**Update and revise flood maps for the city and consider applying to the Community Rating System (CRS) under the National Flood Insurance Program[xxii].**
Proposed Activities:	a) Update and revise flood maps for the city using state of the art techniques. b) Assess the cost-effectiveness of qualifying for the Community Rating System (CRS) evaluation under the National Flood Insurance Program (NFIP). c) Incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards. d) Encourage private owners in the floodplain to undertake flood-proofing measures. e) Explore legislation to require hazardous materials stored in the flood zone to be elevated or otherwise protected from floodwaters.
Lead Organization:	Public Works Department
Timeline:	1 year
Resources Required:	¼ FTE
Priority:	Important
Progress on Action Between 2004-2013:	**a) Update and revise flood maps for the city using state of the art techniques. (Completed)** In 2011, the Engineering Division of the City's Public Works Department developed hydraulic models the Potter and Codornices Watersheds, which were selected because they represent the full range of the urban drainage spectrum in Berkeley.[xxiii] The modeling identified locations of predicted overflows.

	b) Assess the cost-effectiveness of qualifying for the Community Rating System (CRS) evaluation under the National Flood Insurance Program (NFIP). (Completed) Determined in 2009 that it was not cost-effective for the City to participate in the Community Rating System under the NFIP. **c) Incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards. (Completed)** In September 2009, the City updated Berkeley Municipal Code Chapter 17.12: Flood Zone Development Ordinance to ensure 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. It establishes the Director of the Public Works Department as the Floodplain Administrator for the City; addresses standards for construction, utilities, subdivisions, manufactured homes and recreational vehicles; and addresses development in floodways and coastal high hazard areas. **d) Encourage private owners in the floodplain to undertake flood-proofing measures. (Completed)** See Flood Zone Development Ordinance above. **e) Explore legislation to require hazardous materials stored in the flood zone to be elevated or otherwise protected from floodwaters. (Deferred)** Due to the lack of Level 1 facilities in Berkeley's relatively small flood hazard area, this activity was not specifically prioritized.

[i] Policy S-23 in the Safety Element of the General Plan, 2003 revision.

[ii] The Environmental Initial Study conducted by the city identified the following mitigation actions to eliminate environmental impacts from this action:

- Before initiating conversion of any natural area into historic coastal grasslands, City staff shall consult with natural resource regulatory agencies (e.g., United States Fish and Wildlife Service, California Department of Fish and Game) to ensure that such conversion would not result in any take of any special status species, and to ensure that critical wildlife breeding or foraging habitat would not be lost.

- The construction of new fire roads, trails, or pedestrian paths shall require environmental review to identify the presence of biologically sensitive species or erosion-prone soils and identify project-specific measures to mitigate any potentially significant impacts.

[iii] Portion of policy S-20 in the Safety Element of the General Plan, 2003 revision.

[iv] The Environmental Initial Study conducted by the city noted that while actions that promote the retrofit of potentially hazardous buildings could prevent the loss of housing and other structures following a major seismic event, such programs could also result in the displacement of existing housing if the cost of retrofit made it infeasible to repair and maintain existing units. The proposed Plan does not establish any new requirements for retrofit that would displace housing units or residents but proposes the investigation and adoption of incentives to ensure that such impacts would not result from any new retrofit programs.

[v] FTE refers to Full time equivalent of a staff member.

[vi] Policy S-3 in the Safety Element of the General Plan, 2003 revision.

[vii] Portion of policy S-20 in the Safety Element of the General Plan, 2003 revision.

[viii] The Environmental Initial Study conducted by the city noted that while actions that promote the retrofit of potentially hazardous buildings could prevent the loss of housing and other structures following a major seismic event, such programs could also result in the displacement of existing housing if the cost of retrofit made it infeasible to repair and maintain existing units. The proposed Plan does not establish any new requirements for retrofit that would displace housing units or residents but proposes the investigation and adoption of incentives to ensure that such impacts would not result from any new retrofit programs.

[ix] Portion of policy S-20 in the Safety Element of the General Plan, 2003 revision.

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- Before initiating conversion of any natural area into historic coastal grasslands, City staff shall consult with natural resource regulatory agencies (e.g., United States Fish and Wildlife Service, California Department of Fish and Game) to ensure that such conversion would not result in any take of any special status species, and to ensure that critical wildlife breeding or foraging habitat would not be lost.
- The construction of new fire roads, trails, or pedestrian paths shall require environmental review to identify the presence of biologically sensitive species or erosion-prone soils and identify project-specific measures to mitigate any potentially significant impacts.

[xii] Portion of policy S-10 in the Safety Element of the General Plan, 2003 revision.

[xiii] Policy S-9 in the Safety Element of the General Plan, 2003 revision.

[xiv] Portion of policy S-26 in the Safety Element of the General Plan, 2003 revision.

[xv] The Environmental Initial Study conducted by the city identified the following mitigation action to eliminate environmental impacts from this action:

- Non-emergency projects involving construction work or other physical alteration of previously undisturbed areas outside of the existing right-of-way, along creeks, or in other riparian zones shall require environmental review to identify the presence of biologically sensitive species or erosion-prone soils and identify project-specific measures to mitigate any potentially-significant impacts.

[xvi] 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.

[xvii] Policy S-11 in the Safety Element of the General Plan, 2003 revision.

[xviii] Policies S-5, S-7 and S-12 in the Safety Element of the General Plan, 2003 revision.

[xix] Per Nabil Al-Hadithy, Toxics Management Division, City of Berkeley: Per the State's Unified Hazardous Waste and Hazardous Materials Management Regulatory Program, the City's Toxics Management Division is the agency responsible for administering six of the State's hazardous materials and waste programs for Berkeley. The City of Berkeley regulates both UC Berkley and Berkeley Lab for the following six State programs:

1. Hazardous Materials Release Response Plans and Inventories (HMBP) Program, Health and Safety Code, Division 20, Chapter 6.95, Article 1, with supplemental regulations in California Code of Regulations Title 19, Sections 2620-2732.

2. California Accidental Release Prevention (CalARP) Program, Health and Safety Code, Division 20, Chapter 6.95, Article 2, with supplemental regulations in California Code of Regulations, Title 19, Sections 2735-2785.

3. Underground Storage Tank (UST) Program, Health and Safety Code, Division 20, Chapter 6.7, with accompanying regulations in the California Code of Regulations, Title 23.

4. Aboveground Petroleum Storage Act Requirement for Spill Prevention, Control and Countermeasure (SPCC) Plans, Health and Safety Code, Division 20, Chapter 6.67, Section 25270-25270.13.

5. Hazardous Waste Generator and Onsite Hazardous Waste Treatment (tiered permitting) Programs, Health and Safety Code, Division 20, Chapter 6.5, with accompanying regulations in the California Code of Regulations, Title 22.

6. California Fire Code: Hazardous Materials Management Plans (HMMP) and Hazardous Materials Inventory Statements, California Code of Regulations, Title 27, Division 2, Chapter 4.5.

The Toxics Management Division also enforces City codes regarding hazardous materials and waste. These codes are often more stringent than CUPA codes.

[xx] The Tang Center is no longer considered to be an alternate Emergency Operations Center site for the UC Berkeley campus.

[xxi] Portion of policy S-26 in the Safety Element of the General Plan, 2003 revision.

[xxii] Policies S-26 and S-28 in the Safety Element of the General Plan, 2003 revision.

[xxiii] 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.

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Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Animal Shelter	Animal Shelter	1 Bolivar Drive	Animal Shelter		Newly Constructed	2 stories New facility – Built in 2012 to 2010 Building Code	11,000	$7.8 million
Corporation Yard	Equipment Maintenance Building	1326 Allston Way	Equipment Maintenance Building			1 story Retrofit in approx. 2003.	12,922	$ 5.90 million
Corporation Yard	Fuel Island/ underground tanks	1326 Allston Way				All Steel, 1 story	1,200	$300,000
Corporation Yard	Office and Storage	1326 Allston Way				Concerns about eq vulnerability.	2,939	$730,000
Corporation Yard	Ratcliff Building	1326 Allston Way		Public Works Department Operations Center	Retrofitted	Retrofitted to essential serves standards in 2012	16,480	$6.0 million
Fire Station	Fire Department Warehouse	1011 Folger Avenue	Storage of Fire Response Equipment		Newly Constructed	Built in 2011 – to essential services standards	8021	$8.2 million
Fire Station	Fire Station #1	2442 8th Street	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1999 - retrofitted to essential services standards.	5,260	$1.5 million
Fire Station	Fire Station #2	2029 Berkeley Way	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1998 - retrofitted to essential services standards.	12,522	$3.6 million
Fire Station	Alarm Headquarters	2029 Berkeley Way			Newly Constructed/ Retrofitted	1 Story Rebuilt in 1998	840	$242,000
Fire Station	Fire Station #3	2710 Russell	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1999 - retrofitted to essential services standards.	5,100	$1.5 million
Fire Station	Fire Station #4	1900 Marin	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1999 - retrofitted to essential services standards.	5,341	$1.6 million
Fire Station	Gas Pump House	1900 Marin	Refueling facility		Newly Constructed/ Retrofitted	1 Story Rebuilt 1999	101	$29,5,00
Fire Station	Fire Station #5	2680 Shattuck Ave.	Fire Station		Newly Constructed/ Retrofitted	2 story Rebuilt 1998 - retrofitted to essential services standards.	9,302	$2.7 million
Fire Station	Fire Station #6	999 Cedar Street	Fire Station		Newly Constructed/ Retrofitted	1 story Rebuilt 1999 - retrofitted to essential services standards.	4,153	$1.2 million
Fire Station	Fire Station #7	3000 Shasta Road	Fire Station		Newly Constructed	New two story – incorporates state-of-the-art fire-resistant technology; Located in Fire Zone 2 Constructed in 2006 to essential services standards	24,200	$7 million

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Key Civic Building	Civic Center Building Annex	1947 Center Street	Public Works Engineering and Transportation Divisions		Seismic Evaluation Needed	6 stories, concrete frame structure. Determined by V. Bertero to meet "substantial life safety" and not be a collapse hazard building, but may have problems.	116,450	$45.7 million
Key Civic Building	Fire Dept. Training Building	997 Cedar Street	Alternate Emergency Operations Center		Newly Constructed	Built in 1998 – retrofitted to essential services standards	3,893	$1.42 million
Key Civic Building	Martin Luther King, Jr. Civic Center	2180 Milvia Street	City Hall		Newly Constructed/ Retrofitted	6 story Concrete frame Retrofit in 2001 Base isolated	89,075	$34 million
Key Civic Building	Public Safety Building	2100 MLK Jr. Way	Police Department Headquarters, Fire Department Headquarters, 9-1-1 Headquarters	Primary Emergency Operations Center	Newly Constructed	2 story Built in 2000 to essential services standards Base isolated	60,108	$15 million
Key Civic Building	PSB Accessory Building		Communication equipment, Emergency Generator Storage		Newly Constructed	1 story Built in 2000	2,738	$1.1 million
Leased by the City	Permit Center/Planning Department	2118-20 Milvia Street	Offices for Economic Development, Planning, and Building departments. Contains all building plans and records for City.	Building and Safety DOC	Seismic Evaluation Needed	Has had some seismic bracing. Vulnerability unknown.		n/a
Leased by the City	Police substation. BPD traffic control	841 Folger Ave	Offices		Seismic Evaluation Needed	Wood Frame		n/a
Library	Library – North Branch	1170 The Alameda	Library, public assembly	Public assembly	Retrofitted	Retrofitted in 2012 to 2010 Building Code. Vulnerable to damage but repairable.	9,390	$ 4.76 million
Library	Library – South Branch and Tool Library	1901 Russell Street	Library, public assembly	Public assembly	Retrofitted	Retrofitted in 2013 to 2010 Building Code. Vulnerable to damage but repairable.	8,656	$4.9 million
Library	Library – West Branch	1125 University Avenue	Library, public assembly	Public assembly	Retrofit in process 5/13	Retrofitted in 2013 to 2010 Building Code. Vulnerable to damage but repairable.	9,400	$5.55 million
Library	Library- Claremont Branch	2940 Benvenue Ave	Library, public assembly	Public assembly	Retrofitted	Retrofitted in 2012 to 2010 Building Code. Vulnerable to damage but repairable.	7,640	$3.3 million

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Library	Main Library	2090 Kittredge Street	Library, public assembly	Emergency Volunteer Center location	Retrofitted	Complete retrofit to seismic code with new underpinning and additional piles, and remodel completed in 2002. Vulnerable to damage, but repairable.	122,000	$45 million
Public Health	Mental Health Offices	2636-40 MLK Way	Mental Health Offices		Seismic Evaluation Needed	The City is having these two buildings' seismic resistance and vulnerabilities evaluated in Fiscal Year 2013. Actual improvements are in the initial evaluation and planning stage.	11,840	$3.0 million
Recreation and Parks	Frances Albrier Center	2800 Park Street	Recreation and public assembly	Shelter	Seismic Evaluation Needed		13,260	$3.68 million
Recreation and Parks	Grove Recreation Center	1730 Oregon Street	Recreation and public assembly - Young Adult Project (YAP)	Shelter	Seismic Evaluation Needed		10,600	$6.70 million
Recreation and Parks	James Kenney Community Center	1720 8th Street	Recreation and public assembly - MLK Jr Youth Service Center	Shelter			13,825	$9.2 million
Recreation and Parks	Live Oak Community Center	1301 Shattuck Ave.	Recreation and Assembly	Shelter	Retrofitted	URM structure retrofitted using a membrane designed by Pat Crosby. Remains vulnerable.	14,860	$9.9 million
Senior Center	North Berkeley Senior Citizens Center	1901 Hearst Street	Public assembly	Shelter	Seismic Evaluation Needed	Built in 1979. No seismic work done.	20,760	$14.57 million
Senior Center	South Berkeley Senior Citizens Center	2939 Ellis Street	Public assembly	Shelter	Seismic Evaluation Needed	Built in 1977	17,156	$12.04 million
Senior Center	West Berkeley Senior Citizens Center	1904 6th Street	Public assembly	Shelter	Seismic Evaluation Needed	Cl.D - 1982 - C/S fire alarm	10,245	$7.19 million
Solid Waste Transfer Buildings	Compressed Natural Gas Dispenser	1199 2nd Street	Compressed Natural Gas					$343,000
Solid Waste Transfer Buildings	Administration Building	1201 2nd Street	Offices			All Steel Constructed in 1984	3,750	$653,000
Solid Waste Transfer Buildings	Fuel Pumps and Tanks	1199 2nd Street	Fuel island/Wash Rack			All Steel Constructed in 1984	2,600	$465,000
Solid Waste Transfer Buildings	Hazmat Storage	1199 2nd Street	Storage					$1.5 million
Solid Waste Transfer Buildings	Tipping Building/Transfer Station	1199 2nd Street	Waste Transfer			Some maintenance problems. All Steel, 1984	21,000	$5.31 million

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Solid Waste Transfer Buildings	Underground Scales	1199 2nd Street				All Steel Constructed in 1984		$510,350
Solid Waste Transfer Buildings	Vehicle Maintenance Facility	1199 2nd Street	Maintenance Building			All Steel Constructed in 1984	6,280	$2.87 million
Solid Waste Transfer Buildings	Radio Transmitter	1199 2nd Street	Public Works Radio transmitter					
Wastewater Lift Stations	Marina Lift Station #1		Wastewater management					
Wastewater Lift Stations	Marina Lift Station #2		Wastewater management					
Wastewater Lift Stations	Marina Lift Station #3		Wastewater management					
Wastewater Lift Stations	Marina Lift Station #4	Corner of Marina	Wastewater management					
Wastewater Lift Stations	Marina Lift Station #5	Marina S.E. Entrance	Wastewater management					
Animal Shelter	Old Animal Shelter	3013 2nd Street	Office/ Kennel/ Cattery			Old Animal Shelter – To be sold	4,780	$857,087
Berkeley Housing Authority		1107-15 Francisco Street	Dwelling			Frame - 5 units	5,466	$1.4 million
Berkeley Housing Authority		1117-23 Francisco Street	Dwelling			Frame - 4 units	4,374	$1.1 million
Berkeley Housing Authority		1161-65 Francisco Street	Dwelling			Frame - 3 units	3,279	$820,000
Berkeley Housing Authority		1169-75 Francisco Street	Dwelling			Frame - 4 units	4,374	$1.1 million
Berkeley Housing Authority		1360-70 Dwight Way	Residential			Frame - 2 units	2,187	$550,000
Berkeley Housing Authority		1371 Dwight Way/ 2450 Valley	Dwelling			Frame - 2 units	2,187	$550,000
Berkeley Housing Authority		1402-08 MLK Way	Dwelling			Frame - 4 units	4,433	$1.1 million
Berkeley Housing Authority		1500-04 7th Street	Dwelling			Frame - 3 units	3,280	$820,000
Berkeley Housing Authority		1838-40 Rose Street	Dwelling			Frame - 2 units	2,067	$520,000
Berkeley Housing Authority		1903-09 Ward Street	Dwelling			Frame - 4 units	4,372	$1.1 million
Berkeley Housing Authority		1911-17 Ward Street	Dwelling			Frame - 4 units	4,374	$1.1 million
Berkeley Housing Authority		1921-27 Ward Street	Dwelling			Frame - 4 units	4,374	$1.1 million

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Berkeley Housing Authority		2024-30 Virginia Street	Residential			Frame - 4 units	4,659	$1.2 million
Berkeley Housing Authority		2032-36 Virginia Street	Residential			Frame - 3 units	3,389	$850,000
Berkeley Housing Authority		2374 West/1323 Channing Way	Residential			Frame - 2 units	2,200	$550,000
Berkeley Housing Authority		2725-27-29 Sojourner Ct.	Dwelling			Frame - 3 units	3,279	$820,000
Berkeley Housing Authority		2731-33 Sojourner Ct.	Dwelling			Frame - 2 units	2,187	$550,000
Berkeley Housing Authority		2735-37 Sojourner Ct.	Dwelling			Frame - 2 units	2,067	$520,000
Berkeley Housing Authority		2798 A/B Sacramento Street	Dwelling			Frame - 2 units	2,187	$550,000
Berkeley Housing Authority		2800 Sacramento Street	Dwelling			Frame - 1 unit	820	$200,000
Berkeley Housing Authority		870-80 Jones Street	Dwelling			Frame - 2 units	2,187	$550,000
Berkeley Police Department	BPD Pal Program	1255 Allston Way	Office			Unknown		$6,550
Corporation Yard	Assembly Building	1326 Allston Way	Assembly/Washroom			1 story Concerns about earthquake vulnerability.	2,405	$600,000
Corporation Yard	Equipment Shelter	1326 Allston Way	Equipment Shelter			1 story Metal shed	4000	$493,000
Corporation Yard	Guard Shack	1326 Allston Way				1 story	72	$18,000
Corporation Yard	Lumber/Pipe Storage	1326 Allston Way					774	$190,000
Corporation Yard	Nursery Assembly Room	1326 Allston Way					864	$220,000
Corporation Yard	Nursery Storage	1326 Allston Way					864	$67,450
Corporation Yard	NurseryStorage-1975	1326 Allston Way					240	$67,100
Corporation Yard	Quonset Warehouse	1326 Allston Way				All Steel, 1 story Concerns about earthquake vulnerability.	4,100	$380,500
Corporation Yard	Small Warehouse	1326 Allston Way				1 story	3,000	$750,000
Corporation Yard	Streets Storage & Office	1326 Allston Way					1300	$326,166
Corporation Yard	Traffic Maintenance	1326 Allston Way	TrafficSign/PaintShop			1 story Concerns about earthquake vulnerability.	4,320	$1.1 million
Echo Lake Camp and Toulumne Camp in the Sierras	(not included)	(not included)	(not included)			(not included)	(not included)	(not included)

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Fire Station	Drill Tower	999 Cedar Street	Training Facility		Newly Constructed	5 story Constructed in 1999	1,936	$558,500
Key Civic Building	Center Street Garage and Commercial space	2025 and 2033 Center Street	City and Public Parking and Offices		Seismic Retrofit or Replacement Required	5 story, concrete Frame Vulnerable to earthquake damage. Too expensive to retrofit. Will be replaced.	175,500	$29 million
Key Civic Building	Center Street Garage and Commercial space	2025 and 2033 Center Street	(LINKED)		Seismic Retrofit Required	5 story, concrete Frame Vulnerable to earthquake damage. Too expensive to retrofit. Will be replaced.	175,500	(LINKED)
Key Civic Building	Oxford Street Garage	2165 Kittredge Street	Garage/Offices		Newly Constructed	Basement Garage and Lot of 6 Story offices and housing project– Joint Project between City and UC Berkeley. Built in 2009 to seismic standards	46000 Garage only	$9 million
Key Civic Building	Telegraph/Channing (Sather Gate) Mall and Garage	2438 Durant Ave.	Public Parking and Retail		Retrofitted	Retrofitted about 1995. Still vulnerable to damage, but not collapse. Concrete Frame, 5 story	224,628	$56 million
Key Civic Building	Veterans Memorial Hall	1931 Center Street	Public assembly and Homeless Shelter		Seismic Retrofit Required	Collapse hazard building, study done, needs to be retrofitted	33,254	$27 million
Leased by the City	Berkeley Housing Authority	1901 Fairview Street	Offices					n/a
Leased by the City	Black infant health Building	1767 Alcatraz Avenue	health					n/a
Leased by the City	Martin Luther King, Jr. Center	1700 Hopkins Street	Pool, swim center			Field Act building on BUSD land. City pays for maintenance and may ultimately have full ownership.	3,329	n/a
Leased by the City	Rent Stabilization Board Office	2125 Milvia Street	Offices			Concrete frame. Should be evaluated. City leases only one floor.		n/a
Leased by the City	West Campus Center	2100 Browning Street	Pool, swim center			Field Act building on BUSD land. City pays for maintenance and may ultimately have full ownership.	2,567	n/a
Leased by the City	Willard Center	2771 Telegraph Avenue				Field Act building on BUSD land. City pays for maintenance and may ultimately have full ownership.	3,316	n/a
Leased to Others	Berkeley Adult Health Center	1890 Alcatraz Avenue	Berkeley Adult Health Center			Structural concerns. Leased for purchase.	4,000	$1.0 million
Leased to Others	Black Repertory Theater	3201 Adeline Street	Assembly		Seismic Evaluation Needed	2 story	24,150	$5.0 million
Leased to Others	Commonarts	2218 Acton Street	Residential/ Womens refuge				1,600	$400,000

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Leased to Others	Group Residence	2240 9th Street					2,052	$510,000
Leased to Others	Harrison House for men (B.O.S.S.)	711 Harrison Street	Residential shelter			One story		$1.4 million
Leased to Others	Japanese BBQ	235 University Avenue	Restaurant			2 story	12,755	$3.2 million
Leased to Others	McKinley House for women (B.O.S.S.)	2111 McKinley Avenue	Residential shelter			2 story, concrete block building	5,610	$1.4 million
Leased to Others	Old City Hall	2134 MLK, Jr. Way	Offices and Assembly		Seismic Retrofit Required	Collapse hazard building. Preliminary studies done. Needs funding for retrofit. BUSD has relocated offices to West Campus facility. Council Chambers will continue to be used by City Council through June 2013, while options are considered for temporary City Council chambers relocation.	38,400	$30 million
Leased to Others	Recycling	669 Gilman	Restroom				225	$45,100
Leased to Others	Recycling	669 Gilman Street	Recycling, some office space				18,000	$1.5 million
Leased to Others	Recycling		Office			Trailer	2,300	$580,000
Leased to Others	Recycling		Storage				1,350	$340,000
Marina	Berkeley Yacht Club	1 Seawall Drive	Berkeley Yacht Club		Seismic Evaluation Needed		6,100	$2.14 million
Marina	Boat Docks – Marina							$25 million (all docks)
Marina	Marina Administration Building	201 University Ave.	Offices		Seismic Evaluation Needed	2 story Some dry rot in piles, on liquefiable soils	2,529	$1,000,000
Marina	Marina Corporation Yard		Office/Storage/Meeting Rms			1 story	3,170	$2.23 million
Marina	North Hoist/boathouse					All Steel		$67,650
Marina	Restroom 1 - Marina	Marina, Fishing Pier					600	$227,000
Marina	Restroom 2 - Marina	Marina, Shorebird Park					600	$227,000
Marina	Restroom 3 - Marina	Marina, Marina Office					682	$258,000
Marina	Restroom 4 - Marina	Marina, Berth A-E					LINKED	LINKED
Marina	Restroom 4 - Marina	Marina, Berth A-E					600	$227,000
Marina	Restroom 5 - Marina	Marina, Berth N-O					400	$151,300
Marina	Restroom 6 - Marina	Marina, Berth L-M					400	$151,300
Marina	Restroom 7 - Marina	Marina, Berth F-I					400	$151,300
Marina	Restroom 8 - Marina	Marina, Berth A-E					600	$227,000

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Marina	Shorebird Nature Center	160 University Ave.				New building (1 story straw bale construction)	960	$1.0 million
Marina	South Hoist/boathouse					All Steel		$67,650
Public Health	Health Clinic	830 University Ave.	Health Clinic		Seismic Evaluation Needed	1 story building Interior upgraded and elevator added in 2011.	7,362	$6.79 million
Recreation and Parks	Aquatic Park – Bird Rescue Center	202 Bolivar Drive					1,400	$315,000
Recreation and Parks	Aquatic Park – Dreamland for Kids	80 Bolivar Drive						$211,500
Recreation and Parks	Aquatic Park – Sea Bird Sailing Center	80 Bolivar Drive					1,400	$315,000
Recreation and Parks	Aquatic Park – Storage House	80 Bolivar Drive					1,400	$315,000
Recreation and Parks	Aquatic Park – Storage House (Rod & Gun Club)	91 Bolivar Drive					1,400	$315,000
Recreation and Parks	Aquatic Park –Rowing Club	2851 W. Bolivar					1000	$162,100
Recreation and Parks	Art & Garden Center	1275 Walnut Street					1800	$1.14 million
Recreation and Parks	Cedar Rose Park Building	1300 Rose Street	Recreation and public assembly/ Child Care/ Center for disabled children		Seismic Evaluation Needed	Single story wood frame building	5,814	$3.06 million
Recreation and Parks	Codornices Park – Toilet Shelter	1201 Euclid Ave					2,600	$652,950
Recreation and Parks	Great Stone Face Park – Storage Shed	Thousand Oaks Blvd/Yosemite Rd					70	$3,680
Recreation and Parks	John Hinkle Park – Scout Building	Southampton Ave/ San Diego Road					480	
Recreation and Parks	John Hinkle Park Club House	Southampton Ave/ San Diego Road					2,100	$472,500
Recreation and Parks	Lawn Bowling Club House	2270 Acton Street					2,304	$580,000
Recreation and Parks	Live Oak Park – Toilet Shelter	1301 Shattuck Avenue					100	$18,350
Recreation and Parks	Parks Shelter	Queens Rd/Fairlawn					800	$80,350
Recreation and Parks	Restroom – Cragmont Park						600	$308,700

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Recreation and Parks	Restroom – La Loma Park	1339 La Loma Ave					600	$227,000
Recreation and Parks	Restroom – Peoples Park	2500 Haste Street					840	$317,800
Recreation and Parks	Restroom – Rose Garden						600	$227,000
Recreation and Parks	Restroom – San Pablo Park	2800 Park Street					1,092	$413,100
Recreation and Parks	Restroom - Strawberry Park	Allston Way/ West Street					600	$227,000
Recreation and Parks	Restroom – Willard Park	2702 Hillegass Ave					120	$45,400
Recreation and Parks	Skateboard Park Building	777 Harrison Street						$1.0 million
Recreation and Parks	Storage Shed	2270 Acton Street					100	$5,260
Redevelopment Agency		1646 5th Street	Dwelling			Frame, 2 unit, hard-wired smoke detectors	1,600	$400,000
Redevelopment Agency		1654 5th Street	Dwelling			Frame, 1 unit, hard-wired smoke detectors	1,425	$360,000
Redevelopment Agency		729-31 Virginia Street	Dwelling			Frame,1 unit, 2 Story Constructed in 1993	2,221	$560,000
Rental Housing Construction Program		1521 Alcatraz Street	Residential fourplex			Frame - 4 units - 1995	4,539	$1.1 million
Rental Housing Construction Program		1605 Stuart Street	Residential triplex			Frame - 3 units - 1995	3,280	$820,000
Rental Housing Construction Program		1812 Fairview Street	Residential triplex			Frame - 3 units - 1995	3,280	$820,000
Rental Housing Construction Program		2231 8th Street	Dwelling			Frame - 3 units - 1995	2,248	$560,000
Rental Housing Construction Program		3016 A and B Harper Street	Residential duplex			Frame - 2 units - 1995	2,398	$600,000
Solid Waste Transfer Buildings	Equipment Shelter	1199 2nd Street				Value incl. above	4,000	$400,000
Solid Waste Transfer Buildings	Old Storage Building	1231 2nd Street	Storage				1600	$314,700

Category	*Building Name*	*Address*	*Normal Use*	*Disaster Function (if different)*	*Seismic Retrofit Status*	*Comments on Condition & Construction*	*Square Feet*	*Building Replacement Value*
Solid Waste Transfer Buildings	Recycling Center	1201 2nd Street					18,326	$2,24 million
Solid Waste Transfer Buildings	Scale House	1199 2nd Street	Scale House			All Steel Constructed in 1984	360	$153,560
Solid Waste Transfer Buildings	Secondary Office	1231 2nd Street	Office				6,510	$1.6 million

C. Plan Development Process

Note: Appendix D contains detailed documentation on the planning process.

C.1 *Planning Process Overview*

The City of Berkeley's Disaster Mitigation Plan was originally adopted by the City Council on June 22, 2004, following a process that built on years of disaster mitigation activities. To update the Plan for 2014, Berkeley followed the same multi-phased, broadly-inclusive process used to develop the original Plan in 2004.

In 2011, the City convened an interdepartmental planning team, which reviewed and updated the 2004 goals and objectives. Over the next two years, the Project Manager and Chief Technical Advisor collaborated with numerous City staff, partner representatives and hazard experts to update the hazard analysis (Section 3), progress on 2004 actions (Appendix A), and to develop the 2014 mitigation strategy (Section 1). The Planning Team then provided the First Draft Plan to the Berkeley community for review and feedback. The Planning Team responded to public comments and incorporated appropriate feedback into the Final Draft Plan. Staff then brought the Final Draft Plan to public Commissions for their recommendations to City Council on adoption of the Final Draft Plan as an amendment to the City of Berkeley's General Plan.

Hazard Analysis Update

The Project Manager worked with City staff to update information in the 2004 hazard analysis, accounting for new scientific research on hazards that could affect Berkeley, their areas of exposure and their potential impacts. To update hazard analysis references to key infrastructure and programs not operated by the City, the Project Manager and Advisor also worked with partners outside of City government: both those identified in the 2004 Plan, as well as new partners identified for the 2014 Plan.

For each section in the hazard analysis, the Project Manager and Advisor solicited review of 2014 content by outside technical experts. Engaged individuals are listed in this Plan's Acknowledgements section.

Mitigation Strategy Update

City and partner representatives worked with the project manager to identify Berkeley's progress mitigation actions identified in 2004. Next, the project manager, City representatives and partner representatives combined information on the success of 2004 actions, updates to the hazard analysis, and guidance from the City's General Plan to identify 2014 "pre-draft" actions.

These pre-draft actions were initially vetted by the City's Core Planning Team in September 2013. These pre-draft actions were then further vetted by a diverse group of partner representatives at the October 2013 Institutional Community Partner Meeting. The Core Planning Team revised actions to reflect feedback received from institutional partners, then incorporated the actions into a complete 2014 First Draft Plan.

Public Review Process

From October through mid-December, 2013, the City posted the First Draft Plan on the City website and at City libraries for review and comment by the Berkeley community. All of the City's 30+ commissions were invited to provide feedback on the Plan, and during this time, the First Draft Plan was discussed at meetings of 19 commissions and boards, all of which were held in public. Following receipt of Commission and community feedback, the City incorporated appropriate community comments to develop the 2014 Final Draft Plan.

Commission Process

Staff presented the Final Draft Plan and a summary of plan changes to the Disaster and Fire Safety Commission at its February 26, 2014 meeting. The Commission unanimously approved the following motion recommending adoption of the Final Draft 2014 LHMP:

> Motion to Recommend Adoption of the Local Hazard Mitigation Plan Update to City Council: J. Gage
>
> Second: R. Grimes
>
> Vote: (7 Ayes: Grimes, Mitchell, Flasher, Gage, Zummo, Goldstein, Hamm; 0 Absent; 0 Noes; 0 Abstain)

Staff presented the Final Draft Plan and a summary of plan changes to the Planning Commission at its March 19, 2014 meeting. This meeting served as the First Public Hearing for the Final Draft Plan. The Commission unanimously approved the following motion recommending adoption of the Final Draft 2014 LHMP:

> Motion to adopt staff draft language for page S-3 of the General Plan; update General Plan pages S-4, S-5 and Figure 11 to include current information from the LHMP as necessary; adopt the draft LHMP as presented to the Commission: G Poschman.
>
> Second: S. Murphy
>
> Vote: (8 Ayes: Tracy Davis, Elizabeth Lam, Dan Lindheim, Stephen Murphy, Jim Novosel, Gene Poschman, Patrick Sheahan, Harry Pollack; 0 Noes; 0 Abstain)

C.2 *Organizations Involved in the 2014 Plan Update*

Many individuals and institutions participated in different roles in Berkeley's mitigation plan update. Key groups are listed below, with a description of their role in the update process:

Fire Department – Office of Emergency Services

The Project Manager, in the Fire Department - Office of Emergency Services, managed all aspects of preparing the mitigation plan update.

Consultant

The Chief Technical Advisor, in the Association of Bay Area Governments, provided assistance with document review, data compilation, technical analyses, preparation and other activities associated with developing the Plan.

Core Planning Team

Many City departments participated actively in the development of the mitigation plan. The City Manager's Office, Department of Planning and Development, Department of Public Works, Fire Department and Department of Information Technology participated in regular meetings to update the Plan. Other City departments participated in selected meetings and provided detailed reviews of the draft plans.

Technical Reviewers

Following initial updates to the hazard analysis section, the City engaged a range of technical reviewers to identify/correct any inaccuracies or outdated information in the description of the science of the hazards and their impacts, to identify additional/more recent/better research to support any of the impacts described in the document, to identify any additional impacts that should be highlighted in the section, and to suggest other improvements to the document as necessary. Technical reviewers are listed individually in the Acknowledgments section of this Plan.

Institutional Community Partners

Representatives from key regional lifelines, utilities, educational institutions and Berkeley institutions participated in the plan development process from the beginning. The Project Manager and Advisor 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. Key institutional partners include the East Bay Municipal Utility District, Pacific Gas & Electric Company, the Berkeley Unified School District, Sutter Health, Lifelong Medical, the Bay Area Rapid Transit District, Caltrans, the U.S. Forest Service, AT&T, Verizon Wireless and Comcast. Many partner agency representatives attended the City's Institutional Community Partner meeting on October 7, 2013.

Disaster and Fire Safety Commission

In 1989, Berkeley established a Disaster Council of experts and concerned citizens to monitor disaster mitigation and preparedness activities in the city. In 2006, the Disaster Council and the Fire Safety Commission were combined by the City Council to form the Disaster and Fire Safety Commission. It is an advisory body that provides the City Council with advice and information relating to disasters. For this reason, in February 2014, staff requested the Commission's recommendation to Council on the Final Draft Plan. Its members are appointed by the City Council, per the guidance of a local ordinance. This Commission meets in public monthly.

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 will be an appendix to the City of Berkeley's General Plan, in March 2014, staff requested the Commission's recommendation to Council on the Final Draft Plan.

Other 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 October 21 –

December 20, 2013. In addition to the Planning Commission and the Disaster and Fire Safety Commission, 19 commissions reviewed the Plan's executive summary and mitigation strategy in detail and discussed it at a public meeting during this period, as outlined in the table on the following page.

Table C.1. *LHMP Commission Meetings During the First Draft Plan Public Comment Period*

Date/Time	**Commission**
October 23, 7:00 p.m.	Disaster and Fire Safety Commission
November 7, 7:00 p.m.	Housing Advisory Commission
November 7, 7:00 p.m.	Public Works Commission
November 7, 7:00 p.m.	Landmarks Preservation Commission
November 11	Solano BID Advisory Board
November 13, 7:00 p.m.	Parks and Waterfront Commission
November 13, 6:30 p.m.	Commission on Disability
November 13, 7:00 p.m.	Homeless Commission
November 13, 7:00 p.m.	Police Review Commission
November 14, 7:00 p.m.	Zoning Adjustments Board
November 20, 1:30 p.m.	Commission on Aging
November 20, 7:00 p.m.	Planning Commission
November 20, 7:00 p.m.	Human Welfare & Community Action Commission
November 20, 7:00 p.m.	Commission on Labor
November 21, 7:00 p.m.	Transportation Commission
December 2, 7:00 p.m.	Personnel Board
December 4, 7:00 p.m.	Disaster and Fire Safety Commission
December 5, 7:00 p.m.	Housing Advisory Commission
December 5, 7:00 p.m.	Community Environmental Advisory Commission
December 12, 7:00 p.m.	Mental Health Commission
December 18, 6:30 p.m.	Energy Commission

C.3 *Partner Input to the 2014 Plan Update*

As the Project Team updated Section 3: *Hazard Analysis*, members engaged institutional key partners to include detailed information about partners' hazard and risk assessments and mitigation initiatives in the hazard analysis section of the Plan. The Project Team worked with partner representatives to identify opportunities for collaboration on Actions in the 2014 mitigation strategy.

Institutional Community Partner Meeting

Many partner agency representatives attended the City's Institutional Community Partner meeting on October 7, 2013. This event was the culmination of two years of collaboration in order to update the 2004 mitigation plan. Meeting participants were provided the 2014 mitigation strategy's pre-draft objectives and actions. Attendees helped the City to ensure that the 2014 mitigation strategy was in alignment with their agencies' strategic program goals. Partner representatives and City staff discussed mitigation approaches proposed in the pre-draft mitigation actions, identifying actions that were most supportive of their agencies' missions, as well as opportunities for partnership to implement mitigation initiatives.

More than forty invited leaders representing the following groups attended the event. Attendees' agencies and position titles are indicated below:

Alameda County Fire Department

Emergency Preparedness Manager

Alameda County Sheriff's Office

Emergency Planner

Association of Bay Area Governments

Policy Advisor, Earthquake and Hazard Specialist

Bay Area Joint Policy Committee

Climate Consultant

Bay Conservation Development Commission

Coastal Planner

Berkeley Lab

Emergency Management Specialist

Berkeley Path Wanderers Association

President, Senior Path Builder

California Energy Commission

CaLEAP Program Manager

City of Albany

Fire Chief

Photo Credit: Aaron Lee

City of Emeryville

Management Analyst

City of Oakland

Senior Emergency Planning Coordinator

East Bay Municipal Utility District

Senior Civil Engineer

East Bay Regional Park District

Fire Chief

Ecology Center

Program Director

Kinder Morgan Corporation

Area Manager

Lifelong Medical

Compliance Manager

Pacific Gas & Electric

Sustainable Communities Supervisor

Community Energy Manager

Sutter Health

Regional Director, Environmental Health & Safety

University of California, Berkeley

Emergency Management Coordinator

Continuity Planner

Deputy Fire Marshal

City of Berkeley

Building & Safety Division: Program and Administration Manager

City Manager's Office: Deputy City Manager, Assistant to the City Manager

Department of Public Works: Deputy Director, Zero Waste Manager, Supervising Civil Engineer, Disability Services Specialist

Photo Credit: Aaron Lee

Photo Credit: Aaron Lee

Fire Department: Fire Chief, Assistant Chief of Special Operations, Special Operations Lieutenant, Acting Fire Marshal, Emergency Services Coordinator, Associate Management Analyst

Office of Energy and Sustainable Development: Manager, Climate Action Coordinator, Sustainability Outreach Specialist

Parks, Recreation and Waterfront Department: Parks Superintendent

Public Health Division: Program Manager

Toxics Management Division: Division Manager

C.4 *Public Review Process*

Public input is a way of life in Berkeley's City governance. Berkeley has a long tradition of an involved and active public. Disaster mitigation planning in the city is no exception: all of Berkeley's mitigation programs have involved extensive community involvement; often, they were initiated by the community itself rather than City government. Public input to this Plan occurred in numerous ways:

From 2011 – 2012, City staff provided updates and presentations to three Commissions regarding the update process and the status of the Plan's development:

- September 28, 2011 – Disaster and Fire Safety Commission
- January 15, 2012 – Planning Commission
- January 25, 2012 – Disaster and Fire Safety Commission
- March 14, 2012 – Commission on Disability
- March 28, 2012 – Disaster and Fire Safety Commission

On September 30, 2013, the City Manager sent memos to City Council and secretaries of all City Commissions notifying them of the upcoming public review process for the 2014 Plan. The memos outlined the purpose of the Plan, the release date and the update process for the Plan. The memos invited recipients to communicate with their stakeholders about the effort.

On October 21, 2013, the City made the 2014 First Draft Plan a public document for review and comment by the Berkley community. The City Manager sent a memo to City Council members, outlining the process for Commissions to provide feedback and including the First Draft Plan's Executive Summary and Actions. City staff provided memos from the City Manager to secretaries of all City Commissions. The memos included the First Draft Plan's Executive Summary and Actions, and invited all Commissions to provide feedback.

From October 21 through December 20, 2013:

- The City posted the Plan on the City website and at City libraries, and community members were invited to provide feedback on the plan.
- At the October 23 Disaster and Fire Safety Commission meeting, staff presented the updated hazard analysis to Commissioners and community members. At the December 4 Disaster and Fire Safety Commission meeting, staff presented the 2014 mitigation strategy for review and feedback by Commissioners and community members.

- At the November 20 Planning Commission meeting, staff presented the planning process, the updated hazard analysis, and the 2014 mitigation strategy for review and feedback by Commissioners and community members.

Following the December 20 comment deadline, City staff reviewed feedback from Commissions and community members, and incorporated appropriate changes into the Final Draft Plan.

C.5 *Adoption Process*

Staff presented the Final Draft Plan and a summary of plan changes to the Disaster and Fire Safety Commission at its February 26, 2013 meeting. At this meeting, staff requested the Disaster and Fire Safety Commission's recommendation to Council on the 2014 Final Draft Plan. The Commission unanimously recommended adoption of the Final Draft Plan.

Staff presented the Final Draft Plan and a summary of plan changes to the Planning Commission at its March 19, 2014 meeting. This meeting also served as the first Public Hearing for the 2014 Plan. At this meeting, staff requested the Planning Commission's recommendation to Council on the 2014 Final Draft Plan. The Commission unanimously recommended adoption of the Final Draft Plan.

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D. Documentation

All documentation in this section is first described in the narrative below. Documentation is organized following this narrative.

PDF bookmarks are available to guide digital review of this document.

Page numbers are indicated to guide review of a printed version of this document.

1. Core Planning Team (pp. 6-27)

During the Plan development process, multiple meetings were held to discuss different elements of the Local Hazard Mitigation Plan Participants did not sign in at these meetings.

- Meeting 1: September 21, 2011
- Meeting 2: October 3, 2011
- Meeting 3: October 31, 2011
- Meeting 4: December 5, 2011
- Meeting 5: February 6, 2012
- Meeting 6: March 5, 2012 (Meeting 7 Cancelled)
- Meeting 8: April 30, 2012
- Meeting 9: June 4, 2012
- Meeting 10: July 9, 2012
- Meeting 11: September 9, 2013

2. Project Manager – Stakeholder Meetings (pp. 28-32)

During the Plan development process, the Project Manager had multiple meetings with internal and external stakeholders where the Local Hazard Mitigation Plan was discussed. This list only includes Outlook-calendared meetings and is not an exhaustive list of every informal or unscheduled phone call or conversation relating to the mitigation plan.

3. Institutional Community Partner Meeting

Institutional Community Partner representatives were invited to the Institutional Community Partner Meeting on October 7, 2013. The following documentation is provided:

- Meeting Invitation List **(pp. 33 – 39)**
- Meeting Invite Example **(p. 40)**
- Invitation /Confirmation **(pp. 41-42)**
- Pre-Draft Mitigation Actions **(pp. 43 – 54)**

- Sign-In Sheet **(pp. 55-58)**
- Presentation **(pp. 59-88)**
- Action Feedback Activity: Partner Feedback **(pp. 89-97)**

4. Public Involvement

The City of Berkeley has over 30 Commissions. Commissioners are community members and meetings are open to the public. All Commission meeting agendas are publicly posted on the City's website and on community bulletin boards. Community members are invited to attend Commission meetings to provide comment on any agendized topic.

Public Outreach, Phase I: Initial Drafting

During development of the First Draft Local Hazard Mitigation Plan, the Project Manager made presentations on the Plan development process at five different commission meetings. Publicly-posted agendas and corresponding presentations are provided for these meetings:

- Disaster and Fire Safety Commission – September 28, 2011 **(pp. 98-108)**
- Disaster and Fire Safety Commission – January 25, 2012 **(pp. 109 - 114)**
- Planning Commission – February 15, 2012 **(pp. 115-126)**
- Commission on Disability – March 14, 2012 **(pp. 127-136)**
- Disaster and Fire Safety Commission – March 28, 2012 **(pp. 137-153)**

Community members did not choose to provide input during public comment periods at these meetings.

Public Outreach, Phase II: Secondary Drafting

The First Draft Local Hazard Mitigation Plan was released for public review in October 2013. Community members were invited to provide input on the First Draft Plan at 19 commission meetings during October – December 2013.

Date/Time	**Commission**
October 23, 7:00 p.m.	Disaster and Fire Safety Commission
November 7, 7:00 p.m.	Housing Advisory Commission
November 7, 7:00 p.m.	Public Works Commission
November 7, 7:00 p.m.	Landmarks Preservation Commission

November 11	Solano BID Advisory Board
November 13, 7:00 p.m.	Parks and Waterfront Commission
November 13, 6:30 p.m.	Commission on Disability
November 13, 7:00 p.m.	Homeless Commission
November 13, 7:00 p.m.	Police Review Commission
November 14, 7:00 p.m.	Zoning Adjustments Board
November 20, 1:30 p.m.	Commission on Aging
November 20, 7:00 p.m.	Planning Commission
November 20, 7:00 p.m.	Human Welfare & Community Action Commission
November 20, 7:00 p.m.	Commission on Labor
November 21, 7:00 p.m.	Transportation Commission
December 2, 7:00 p.m.	Personnel Board
December 4, 7:00 p.m.	Disaster and Fire Safety Commission
December 5, 7:00 p.m.	Housing Advisory Commission
December 5, 7:00 p.m.	Community Environmental Advisory Commission
December 12, 7:00 p.m.	Mental Health Commission
December 18, 6:30 p.m.	Energy Commission

Publicly-posted agendas and presentations are provided for meetings at which staff did presentations:

- Disaster and Fire Safety Commission – October 23, 2013 **(pp. 154-165)**
- Planning Commission – November 20, 2013 **(pp. 166-171)**
- Disaster and Fire Safety Commission – December 4, 2013 **(pp. 172-179)**

Community Input, Phase II

Community members provided substantial input on the First Draft Plan during Public Outreach Phase II. All community feedback is provided in the documents below. The

process to review, address and incorporate that feedback into the Final Draft Plan is also described in detail in the below documents.

- Public Comments and Staff Responses for the First Draft 2014 Local Hazard Mitigation Plan **(pp. 180-269)**
- Summary of Changes to the First Draft 2014 Local Hazard Mitigation Plan **(pp. 270-291)**

Public Outreach, Phase III: Final Draft Plan Presentation

Following the receipt and incorporation of public feedback into the Plan, staff brought the Final Draft Plan for public review at two public Commission meetings. Publicly-posted agendas and presentations are provided for these meetings:

- Disaster and Fire Safety Commission – February 25, 2104 **(pp. 292-303)**
- Planning Commission – March 19, 2014 **(pp. 304-317)**

Ongoing Outreach: City Manager Memos **(pp. 318-341)**

Throughout the drafting of this plan, the City Manager communicated to City Council and City Commissions about the process and opportunities for public participation. In these memos, Council members and Commissioners were requested to ensure that their constituents were aware of the process and invited to participate.

- September 30, 2013: Memo to City Council regarding upcoming public review process for the 2014 plan
- September 30, 2013: Memo to Secretaries of all City Commissions regarding upcoming public review process for the 2014 plan
- First Draft Plan Release Memos: October 21, 2013
  - Memo to City Council members, outlining the process for Commissions to provide feedback and including the First Draft Plan's Executive Summary and Actions.
  - Memo to Disaster and Fire Safety Commission Secretary regarding the First Draft Plan and feedback process
  - Memo to Planning Commission Secretary regarding the First Draft Plan and feedback process
  - Memo to all other Commission Secretaries regarding the First Draft Plan and feedback process
- November 15, 2013: Memo to City Council regarding the extension of the community feedback deadline for the First Draft Plan
- February 18, 2014: Memo to City Council regarding the posting of the Final Draft Plan

Ongoing Outreach: Website Postings **(pp. 342-362)**

The City of Berkeley's Website was updated throughout the drafting of this plan. Updates to the Mitigation-specific page included planning documents, presentations and a schedule of in-person opportunities for community members to provide input.

Updates to the City's Homepage pointed to the Mitigation Page so that all community members who visited the website were aware of the project and opportunities to contribute.

- CityofBerkeley.info/Mitigation
    - 10-29-13 – Initial Mitigation Page Launch
    - 11-20-13 – First Draft Plan Posted
    - 12-05-13 – Revised Community Response Deadline updated
    - 02-14-14 – Full screenshot of page
    - 02-18-14 – Final Draft Plan posted
- CityofBerkeley.info
    - 12-16-13 – Community Response Deadline posted
    - 02-24-14 – Final Draft Plan posted

Lana, Sarah

Subject: Disaster Mitigation Plan - Kickoff Meeting
Location: Fire Conference Room (2100 MLK Room 2143)

Start: Wed 9/21/2011 9:00 AM
End: Wed 9/21/2011 11:00 AM

Recurrence: (none)

Meeting Status: Meeting organizer

Organizer: Tyler, Sarah
Required Attendees: Room: Fire Only: Fire Conference Room; Imrie, Sabina; Pryor, Debra; Chin, Khin; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Daniel, Christine; Amoroso, Alexander
Optional Attendees: Cosin, Wendy

Categories: Mitigation

Hello all,

The City is revising its Disaster Mitigation Plan. You've been selected by the City Manager's Office to participate as a member of Core Project Team that will lead the update process.

The attached memo was distributed to relevant Department Directors. The memo further describes the process and your role on the team:

LHMP Core
ject Team Memo A

For more background -- the Disaster Mitigation Plan:

1. Identifies the natural/manmade hazards facing Berkeley,
2. Describes our vulnerabilities to those hazards, and
3. Outlines and prioritizes mitigation actions to reduce Berkeley's hazard vulnerabilities.

The City's Disaster Mitigation Plan, which was originally adopted in 2004, is available at:
http://www.ci.berkeley.ca.us/uploadedFiles/Fire/Disaster%20Mitigation%20Plan%202004.pdf

Core Project Team members will work together and with the subject matter experts within their respective departments to lead the Plan update for the City. The attached Memorandum provides additional background on the project, along with projected meeting dates over the course of the revision process.

I'm looking forward to working with you and your staff members on this project!

Please contact me with any questions, comments or concerns.

Best,
Sarah

Sarah Tyler, Emergency Services Coordinator
Berkeley Fire Department

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Association of Bay Area Governments

City of Berkeley Local Hazard Mitigation Plan Update

September 21, 2011 9:00 a.m. – 11:00 a.m.
Fire Conference Room (2100 MLK Room 2143)

Kick-off Meeting Agenda

1. Welcome and introductions
2. Hazard mitigation planning background
3. Coordination with other hazard mitigation plans
4. Berkeley mitigation plan status and update process
5. Review and provide input to preliminary plan update
    a. Plan goals and objectives
    b. Hazards of concern
    c. Status of prior mitigation actions
    d. Community profile and trends
    e. Evaluate current mitigation programs and City resources
6. Next meeting: October 3rd, 1-2pm, Redwood Conference Room 2180 Milvia St, 6th Floor

Lana, Sarah

Subject: LHMP Core Project Team Meeting #2
Location: Redwood Conference Room, 2180 Milvia St, 6th Floor

Start: Mon 10/3/2011 1:00 PM
End: Mon 10/3/2011 2:00 PM

Recurrence: (none)

Meeting Status: Meeting organizer

Organizer: Tyler, Sarah
Required Attendees: Room: Redwood, 2180 6N; Imrie, Sabina; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Daniel, Christine; Rogers, William

City of Berkeley Local Hazard Mitigation Plan Update
Core Planning Team Check-in Meeting
Monday, October 3, 2011
1:00 pm – 2:00 pm

Sign-in

	Name	Department
1.		
2.		
3.		
4.		
5.		
6.		
7.		
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10.		
11.		
12.		
13.		
14.		
15.		

Agenda

1. Cal EMA meeting

2. Review project schedule

3. Section 1 Submission Deadline: Friday, October 14
    a. Assigned Mitigation Actions
    b. Timeline of Berkeley Mitigation Activities and Key Events
    c. Plans
    d. Community Profile and Trends (CMO only)
    e. Assigned Points of Contact with key stakeholder/partner organizations

4. December 7 Disaster and Fire Safety Commission Meeting Location

Next Meeting

October 31, 2011 1:00 p.m. – 3:00 p.m.
Fire Department Conference Room, 2100 Martin Luther King Jr Way, 2nd Floor

Lana, Sarah

Subject:	LHMP Core Project Team Meeting #3
Location:	Fire Department Conference Room, 2100 Martin Luther King Jr Way, 2nd Floor
Start:	Mon 10/31/2011 1:00 PM
End:	Mon 10/31/2011 3:00 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Tyler, Sarah
Required Attendees:	Room: Fire Only: Fire Conference Room; Imrie, Sabina; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Daniel, Christine; Rogers, William
Categories:	Awaiting Response, Mitigation

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City of Berkeley Local Hazard Mitigation Plan Update
October 31, 2011

Fire Department Conference Room
2100 Martin Luther King Jr Way, 2nd Floor

Meeting Agenda

1. Welcome and introductions
2. Round Robin: Review progress on updating status of assigned mitigation actions
3. Review of Hazards of Concern
    a. Consider new hazards
    b. Determine mapping needs/information-gathering assignments
4. Public Participation Process Discussion

Next meeting: December 5, 1-2pm, Redwood Conference Room, 2180 Milvia St, 6th Floor

Lana, Sarah

Subject: LHMP Core Project Team Meeting #4 - Revised
Location: Redwood Conference Room, 2180 Milvia St, 6th Floor

Start: Mon 12/5/2011 1:00 PM
End: Mon 12/5/2011 2:00 PM

Recurrence: (none)

Meeting Status: Meeting organizer

Organizer: Tyler, Sarah
Required Attendees: Room: Redwood, 2180 6N; Chin, Khin; Pryor, Debra; Sanderson, Debra; Rogers, William; Dong, Gil

Categories: Awaiting Response, Mitigation

LHMP Core Planning Team – Monday's LHMP meeting will be a very small workgroup (CMO-Fire-Land Use Planning) to look at the mechanics of plan adoption, along with requirements/approaches for public outreach and engaging with Commissions.

I will follow up with departments individually on the status of your Actions.

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City of Berkeley Local Hazard Mitigation Plan Update

LHMP Core Project Team Subgroup Meeting
Public Outreach and Plan Adoption Process

December 5, 2011

Redwood Conference Room
2180 Milvia, 6th Floor

Meeting Agenda

1. Review process used in 2004
    a. Public Outreach
    b. Plan Adoption documents
2. Review FEMA expectations/recommendations for:
    a. Public Outreach
    b. Plan Adoption
3. Review initial proposal for public outreach and plan adoption process
4. Clarify and hone public outreach and plan adoption process document

Next meeting: February 6, 1-2pm, Redwood Conference Room, 2180 Milvia St, 6th Floor

Lana, Sarah

Subject: LHMP Core Project Team Meeting #5
Location: Redwood Conference Room, 2180 Milvia St, 6th Floor

Start: Mon 2/6/2012 1:00 PM
End: Mon 2/6/2012 2:00 PM

Recurrence: (none)

Meeting Status: Meeting organizer

Organizer: Tyler, Sarah
Required Attendees: Room: Redwood, 2180 6N; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Rogers, William; Dong, Gil

Categories: Awaiting Response, Mitigation

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City of Berkeley Local Hazard Mitigation Plan Update

LHMP Core Project Team Meeting

February 6, 2011

Redwood Conference Room
2180 Milvia, 6th Floor

Meeting Agenda

1. Review revised project schedule
    a. Plan development
    b. Commission engagement
    c. Public outreach
2. Updated Hazard Analysis Section review
    a. Determine remaining assignments/completion path forward
3. Questionnaire review

Next meeting: March 5, 1-3 pm, Fire Conference Room, 2100 Martin Luther King Jr Way, 2nd Floor

Lana, Sarah

Subject: LHMP Core Project Team Meeting #6
Location: Fire Conference Room (2100 MLK Room 2143)

Start: Mon 3/5/2012 1:00 PM
End: Mon 3/5/2012 3:00 PM

Recurrence: (none)

Meeting Status: Meeting organizer

Organizer: Tyler, Sarah
Required Attendees: Room: Redwood, 2180 6N; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Rogers, William; Room: Fire Only: Fire Conference Room; Dong, Gil

Categories: Awaiting Response, Mitigation

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City of Berkeley Local Hazard Mitigation Plan Update
LHMP Core Project Team Meeting
March 5, 2012

Fire Conference Room
2100 Martin Luther King Jr. Way, 2nd Floor

Meeting Agenda

1. Review revised project schedule
    a. Hazard Analysis Section: Public Release
        i. Target date: **March 14 (posted through April 11)**
    b. Mitigation Actions: Updates and New Actions
        i. (Sarah will have meetings with you between now – April 9)
        ii. April 9 meeting
            1. Bring mitigation updates and proposed new actions
        iii. April 30 meeting
            1. Finalize mitigation updates/new actions
            2. Team prioritizes actions
        iv. **Mid-May**: Post updated plan
    c. Commission engagement: work to date and future plans
        i. Presented project introduction to Disaster and Fire Safety Commission and Planning Commission
        ii. Presenting project introduction to Commission on Disability 3/14
        iii. Hazard Analysis
            1. DFSC: March 28, Planning Commission March 21
        iv. Actions and Priorities
            1. June 7: Public Works Commission
            2. June 7: Housing Advisory Commission
            3. June 7: Landmarks Preservation Commission
            4. June 7: Community Environmental Advisory Commission

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5. June 13: Commission on Disability
6. June 13: Waterfront Commission
7. June 20: Planning Commission
8. June 27: Disaster and Fire Safety Commission
9. June 27: Energy Commission
10. June 27: Police Review Commission

v. Final Plan Update/Recommend Council Approval

1. September 26: Disaster and Fire Safety Commission
2. September 5 or 19: Planning Commission

2. Review Updated Hazard Analysis Section
   a. Determine remaining assignments/completion path forward
3. Questionnaire review

Next meeting: April 9, 1-3 pm, Redwood Conference Room, 2180 Milvia, 6th Floor

Lana, Sarah

Subject:	LHMP Core Project Team Meeting #8
Location:	Redwood Conference Room, 2180 Milvia St, 6th Floor
Start:	Mon 4/30/2012 1:00 PM
End:	Mon 4/30/2012 3:00 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Tyler, Sarah
Required Attendees:	Tyler, Sarah; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Rogers, William; Dong, Gil; Roshal, Alexander; Room: Fire Only: Fire Conference Room
Optional Attendees:	Jensen, Lorin
Categories:	Awaiting Response, Mitigation

City of Berkeley Local Hazard Mitigation Plan Update
LHMP Core Project Team Meeting
April 30, 2012

Redwood Conference Room
Redwood Conference Room, 2180 Milvia St, 6th Floor

Meeting Agenda

1. Review Section 3 Status and Edits
2. Path Forward: Public Engagement
    a. Questionnaire Discussion
        i. Questionnaire purpose and linkage to other City activities
        ii. Questionnaire 1 content review
    b. Commissions
        i. Planning (May 16, June 6 or June 20?)
        ii. Disaster and Fire Safety (May 23 or June 27?)
        iii. Other Commission Meeting Assignments
3. Actions
    a. Overall Status
    b. Discuss Particular Actions – Progress Since 2004 and Path Forward

Next meeting: June 4, 1-3 pm, Redwood Conference Room, 2180 Milvia, 6th Floor

Tentative Commission Meeting Assignments: Core Project Team members attend Commission meetings to present relevant Mitigation Action updates for identified Commissions:

~Planning: Debra Sanderson (Alex Amoroso)

~Public Works: Andrew Clough (Jeffrey Egeberg)

~Housing Advisory: Jane Micallef (Kathryn Hoover)

~Landmarks Preservation: Debra Sanderson (Sally Zarnowitz)

~Community Environmental Advisory: Sarah Tyler (Nabil Al-Hadithy)

~Commission on Disability: Khin Chin (Paul Church)

~Waterfront: Sarah Tyler (John Mann)

~Disaster and Fire Safety: Sarah Tyler (Debra Pryor, Khin Chin)

~Energy: Debra Sanderson (Neal De Snoo)

i. A-2: Increase efforts to reduce fire risk in existing development by improving vegetation management and appropriate code enforcement.
ii. A-3: Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.
iii. A-5: Create a program to reduce risks for people and property for all potentially hazardous single-family, soft-story, and hillside residences.
iv. A-6: Encourage the retrofit of commercial concrete tilt-up, non-ductile frame, and wood frame buildings to improve their ability to resist earthquakes and fires.
v. C-1: Encourage and support the long-term protection of historic and architecturally significant structures to preserve neighborhood and community character.

Lana, Sarah

Subject: LHMP Core Project Team Meeting #9
Location: Redwood Conference Room, 2180 Milvia St, 6th Floor

Start: Mon 6/4/2012 1:00 PM
End: Mon 6/4/2012 2:00 PM

Recurrence: (none)

Meeting Status: Meeting organizer

Organizer: Tyler, Sarah
Required Attendees: Room: Redwood, 2180 6N; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Rogers, William; Dong, Gil; Jensen, Lorin

Categories: Awaiting Response, Mitigation

City of Berkeley Local Hazard Mitigation Plan Update
LHMP Core Project Team Meeting
June 4, 2012

Redwood Conference Room
Redwood Conference Room, 2180 Milvia St, 6th Floor

Meeting Agenda

1. Plan Objectives
2. 2004 Plan Actions
3. Updating Actions
    a. Action A-2
    b. Action C-1

Next meeting: July 9, 1-3 pm, Redwood Conference Room, 2180 Milvia, 6th Floor

Lana, Sarah

Subject:	LHMP Core Project Team Meeting #10
Location:	Fire Conference Room (2100 MLK Room 2143)
Start:	Mon 7/9/2012 1:00 PM
End:	Mon 7/9/2012 3:00 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Tyler, Sarah
Required Attendees:	Room: Fire Only: Fire Conference Room; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Dong, Gil; Jensen, Lorin; Rogers, William
Optional Attendees:	Genolaga, Sheila
Categories:	Awaiting Response, Mitigation

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City of Berkeley Local Hazard Mitigation Plan Update

July 9, 2012 1:00 p.m. – 3:00 p.m.
Fire Conference Room (2100 MLK Room 2143)

Core Team Meeting Agenda

1. Project Update: Progress, Timelines and Responsibilities
2. Presentation: Hazard Mitigation Grant Funding Opportunities
3. Work Session: Mitigation Activities and Funding Sources

Next meetings:

a. August 6, 1-3 pm, Redwood Conference Room 2180 Milvia St, 6th Floor

Lana, Sarah

Subject: LHMP Core Project Team Meeting #11
Location: Room: Redwood, 2180 6N

Start: Mon 9/9/2013 2:00 PM
End: Mon 9/9/2013 4:00 PM

Recurrence: (none)

Meeting Status: Accepted

Organizer: Rogers, William
Required Attendees: Lana, Sarah; Lee, Aaron; Brannigan, David; Chin, Khin; Dong, Gil; Delgado, Cristi; Micallef, Jane; Berreman, Janet; Clough, Andrew; Jensen, Lorin; Roshal, Alexander; McNulty, Jenny; Sanderson, Debra; Angstadt, Eric; DeSnoo, Neal; Burroughs, Timothy; Schwartz, Marna; Al-Hadithy, Nabil; Busche, Karl; Ferris, Scott; Mann, John; Harrington, Phillip; Ferrera, Susan
Optional Attendees: Chakko, Matthai; LaSala, Donna

When: Monday, September 09, 2013 2:00 PM-4:00 PM (GMT-08:00) Pacific Time (US & Canada).
Where: Room: Redwood, 2180 6N

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*~*

Please see the attached agenda for Monday's meeting.

Core Team
eting Agenda 09-(

Nicole Kelly
Assistant to Deputy City Manager
City Manager's Office
(510) 981-7005 direct
(510) 981-7099 fax

Local Hazard Mitigation Plan Update: Core Team Meeting #11

September 9, 2013 2:00 p.m. – 4:00 p.m.

Redwood Conference Room (2180 Milvia, 6th Floor)

Meeting Folder/Documents

Meeting Objectives:

1. Understand the purpose and scope of the Local Hazard Mitigation Plan.
2. Identify any issues with Plan Actions before they are presented to a public audience.
3. Understand roles/responsibilities in the plan's public engagement and adoption process.

Agenda

1. Introductions
2. Objective 1: Plan Purpose and Scope
    a. Review Plan Vision, Goals and Objectives
3. Objective 2: Plan Content
    a. Key Hazards from the Hazard Analysis and associated 2013 Action proposals
    b. Action Prioritization Structure
4. Objective 3: Public Engagement
    a. October 7 Institutional Community Partner Meeting
        i. Goals and Agenda
        ii. Invitee review/suggestions
    b. First Draft Plan Release
        i. General Public Comment
        ii. Commission Engagement
            1. Disaster and Fire Safety/Planning Commissions
            2. Other key Commissions
            3. All other Commissions
    c. Final Draft Plan/Adoption Process

Upcoming Key Dates

- October 7: LHMP Institutional Community Partners Meeting: 9:00 – 11:00 a.m., Redwood/Sequoia Conference Room
- October 21: Release of First Draft Plan: City Website and City Libraries
- October 23: Disaster and Fire Safety Commission – Hazard Analysis Presentation
- November 20: Planning Commission Presentation
- December 4: Disaster and Fire Safety Commission Presentation
- December 9: Deadline for Commission and community feedback on First Draft Plan

Subject	Start	End	Required Attendees
2014 EOC Section Chiefs Meeting	Wed 1/22/2014 10:00 AM	Wed 1/22/2014 11:00 AM	Lana, Sarah; LaSala, Donna; Oyekanmi, Henry; Hicks, Robert; Meehan, Michael; Dong, Gil; Rogers, William; Angstadt, Eric; Chew, Jenny; Micallef, Jane; Clough, Andrew; Daniel, Christine; Thygesen, Sharon; Lee, Aaron; Chin, Khin; Brannigan, David; Lazo, Jenn
Berkeley Local Hazard Mitigation Plan Meeting	Tue 2/5/2013 1:00 PM	Tue 2/5/2013 2:30 PM	Lana, Sarah; 'arriettachakos@gmail.com'
Check in re: Berkeley LHMP	Thu 3/15/2012 11:15 AM	Thu 3/15/2012 11:45 AM	Danielle Hutchings (danielleh@abag.ca.gov)
Checkin re: Emergency Management, Safety Officer, etc.	Wed 10/5/2011 11:30 AM	Wed 10/5/2011 12:30 PM	Tyler, Sarah; Mason, James E.; Room: Fire Only: Fire Library
Check-In re: LHMP and Commissions	Tue 10/15/2013 9:30 AM	Tue 10/15/2013 10:00 AM	Lana, Sarah; Lee, Aaron; Amoroso, Alexander; Numainville, Mark L.
Check-in with Danielle for LHMP	Fri 9/16/2011 1:30 PM	Fri 9/16/2011 2:30 PM	Tyler, Sarah; Imrie, Sabina; 'Danielle Hutchings'
City of Berkeley Mitigation Meeting	Mon 10/7/2013 9:00 AM	Mon 10/7/2013 11:00 AM	'nick.zubel@acgov.org'; 'anna.lee@acgov.org'; 'HPStokes@acgov.org'; 'phess@acgov.org'; 'smithe@sutterhealth.org'; 'arriettachakos@gmail.com'; 'bruce@bayareajpc.net'; 'sarap@bcdc.ca.gov'; 'keithskinner.public@gmail.com'; 'jboito@albanyca.org'; 'jrios@ebmud
City of Berkeley's PG&E Pipeline Questions Conf. Call	Tue 7/2/2013 2:00 PM	Tue 7/2/2013 3:00 PM	Rezendez, Aaron R; Lana, Sarah; Hamdani, Eban (GSO); Huang, Kevin (GSO)
Climate Change - Local Hazard Mitigation Plan - Meeting 4	Tue 2/19/2013 1:30 PM	Tue 2/19/2013 3:00 PM	Lana, Sarah; Schwartz, Marna; Burroughs, Timothy; Ridel, Suzanne; 'Danielle Hutchings Mieler'; 'arriettachakos@gmail.com'
Commission on Disability - LHMP	Wed 12/18/2013 3:00 PM	Wed 12/18/2013 4:00 PM	Lana, Sarah; Church, Paul
Conference Call re: ABAG Core Team Meeting Schedule with Danielle Hutchings	Fri 7/29/2011 3:00 PM	Fri 7/29/2011 3:30 PM	Imrie, Sabina; Chin, Khin
DFSC LHMP Meeting with Neil Goldstein	Thu 2/20/2014 3:00 PM	Thu 2/20/2014 4:00 PM	Lana, Sarah; Lee, Aaron
Disability/AFN Check-In	Mon 11/28/2011 11:00 AM	Mon 11/28/2011 12:00 PM	Tyler, Sarah; Church, Paul
Disaster and Fire Safety Commission - LHMP	Wed 2/26/2014 7:00 PM	Wed 2/26/2014 9:00 PM	Chin, Khin; Lee, Aaron; Brannigan, David; Lana, Sarah; Lazo, Jennifer
Disaster Mitigation Plan - Kickoff Meeting	Wed 9/21/2011 9:00 AM	Wed 9/21/2011 11:00 AM	Tyler, Sarah; Room: Fire Only: Fire Conference Room; Imrie, Sabina; Pryor, Debra; Chin, Khin; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Daniel, Christine; Amoroso, Alexande
discuss LHMP release	Wed 10/9/2013 3:00 PM	Wed 10/9/2013 3:30 PM	Chakko, Matthai; Lana, Sarah
Discuss Local Hazard Mitigation Plan Questions	Tue 1/28/2014 11:30 AM	Tue 1/28/2014 12:00 PM	Lana, Sarah; Riggs, Steven
Discussion - Climate Change in the Local Hazard Mitigation Plan	Tue 11/20/2012 10:00 AM	Tue 11/20/2012 11:00 AM	Tyler, Sarah; Burroughs, Timothy
DROP Meeting with Chief Pryor (9 am)	Fri 7/15/2011 8:45 AM	Fri 7/15/2011 9:45 AM	
EAP Check-In	Thu 6/13/2013 2:00 PM	Thu 6/13/2013 2:30 PM	Lana, Sarah; Schwartz, Marna; Burroughs, Timothy
Emergency Messaging and LHMP Outreach	Wed 10/30/2013 3:30 PM	Wed 10/30/2013 4:30 PM	Chakko, Matthai
Emergency Services and Environmental Service Connections	Tue 9/4/2012 2:00 PM	Tue 9/4/2012 3:00 PM	Schwartz, Marna; Tyler, Sarah; Chin, Khin; Burroughs, Timothy; 'pincus@risingsunenergy.org'; 'martin@ebenergy.org'; 'joanna@ebenergy.org'
Energy Assurance Plan - Project Brainstorm with Enernex	Tue 7/9/2013 1:00 PM	Tue 7/9/2013 2:00 PM	Lana, Sarah; Loyola, Mike; Ivie, Bill; DeSnoo, Neal; 'bruss@enernex.com'; Fletcher, Perry; Lee, Aaron; Stover, Samella
Energy Assurance Plan Check-In	Thu 4/10/2014 1:30 PM	Thu 4/10/2014 2:30 PM	Lana, Sarah; Burroughs, Timothy; Schwartz, Marna; DeSnoo, Neal
Energy Assurance, LHMP, Etc.	Tue 3/26/2013 10:30 AM	Tue 3/26/2013 12:00 PM	Lana, Sarah; Arrietta Chakos (arriettachakos@gmail.com)
EOC Section Chiefs Meeting	Wed 7/24/2013 10:00 AM	Wed 7/24/2013 11:00 AM	Lana, Sarah; LaSala, Donna; Oyekanmi, Henry; Hicks, Robert; Meehan, Michael; Dong, Gil; Rogers, William; Angstadt, Eric; Chew, Jenny; Micallef, Jane; Clough, Andrew; Daniel, Christine; Thygesen, Sharon; Lee, Aaron; Chin, Khin; Brannigan, David
EOC Section Chiefs Meeting Agenda	Mon 10/21/2013 1:30 PM	Mon 10/21/2013 2:00 PM	Lana, Sarah; Lee, Aaron; Brannigan, David
Finalize PW LHMP Content	Fri 1/24/2014 1:00 PM	Fri 1/24/2014 2:00 PM	Lana, Sarah; Harrington, Phillip
Hazard Mitigation Grant Check-in Meeting/Conference call with Ricardo Castillo	Fri 1/27/2012 1:15 PM	Fri 1/27/2012 2:30 PM	Tyler, Sarah; Lawson, Sandi; Battle, Reeve
Hazard Mitigation Plan	Wed 10/12/2011 9:00 AM	Wed 10/12/2011 10:00 AM	Room: Fire Only: Fire Library; Fitch, John; Riggs, Steven; Fernandez, Stanley; Thompson, Jim; Law, Sam; Tyler, Sarah

Hazard Mitigation Plan Review with CalEMA (mtg 10:00 - 12:00)	Fri 10/7/2011 10:30 AM	Fri 10/7/2011 2:00 PM	'Danielle Hutchings'; Imrie, Sabina; Tyler, Sarah; 'Danielle Hutchings'
Invitation: Tom Klatt - Sarah Lana @ Thu Feb 14, 2013 2pm - 4pm (slana@ci.berkeley.ca.us)	Thu 2/14/2013 2:00 PM	Thu 2/14/2013 4:00 PM	tklatt@berkeley.edu; Lana, Sarah
LHMP	Tue 2/14/2012 3:00 PM	Tue 2/14/2012 4:30 PM	Sanderson, Debra; Tyler, Sarah
LHMP - Check-In	Wed 8/21/2013 11:00 AM	Wed 8/21/2013 11:30 AM	Lana, Sarah; Roshal, Alexander; McNulty, Jenny
LHMP - Community Comments	Wed 1/8/2014 1:00 PM	Wed 1/8/2014 2:00 PM	Lana, Sarah; Harrington, Phillip
LHMP - Community Questions	Wed 1/22/2014 1:30 PM	Wed 1/22/2014 2:30 PM	Lana, Sarah; Roshal, Alexander
LHMP - Complete Review	Tue 10/15/2013 11:15 AM	Tue 10/15/2013 11:30 AM	Lana, Sarah; Rogers, William
LHMP - Finalizing Building and Safety Components	Thu 7/26/2012 3:30 PM	Thu 7/26/2012 4:30 PM	Tyler, Sarah; Roshal, Alexander
LHMP - Fire Actions	Thu 3/29/2012 3:00 PM	Thu 3/29/2012 4:00 PM	Tyler, Sarah; Dong, Gil; Pryor, Debra; Fitch, John
LHMP - Fire Check-In	Tue 2/7/2012 1:30 PM	Tue 2/7/2012 2:30 PM	Tyler, Sarah; Pryor, Debra; Dong, Gil; Fitch, John; Room: Fire Only: Fire Conference Room
LHMP - GIS Map Follow-up	Thu 2/16/2012 9:00 AM	Thu 2/16/2012 10:00 AM	Tyler, Sarah; Delgado, Cristi; Pryor, Debra; Dong, Gil; Room: Fire Only: Fire Conference Room
LHMP - Planning Commission + Adoption	Wed 10/30/2013 11:00 AM	Wed 10/30/2013 12:00 PM	Lana, Sarah; Angstadt, Eric; Amoroso, Alexander
LHMP - Planning Department Action Review	Wed 9/4/2013 11:00 AM	Wed 9/4/2013 12:00 PM	Lana, Sarah; Sanderson, Debra; Angstadt, Eric; Roshal, Alexander; Al-Hadithy, Nabil; Burroughs, Timothy; Cosin, Wendy; DeSnoo, Neal
LHMP - Pre-Reviewer Questions	Wed 5/29/2013 3:30 PM	Wed 5/29/2013 4:30 PM	Lana, Sarah; Jensen, Lorin
LHMP - Review Draft Climate Adaptation Actions	Thu 8/15/2013 1:30 PM	Thu 8/15/2013 2:30 PM	Lana, Sarah; Burroughs, Timothy; Schwartz, Marna
LHMP - Review OES Actions	Wed 8/28/2013 3:30 PM	Wed 8/28/2013 5:00 PM	Lana, Sarah; Lee, Aaron; Brannigan, David; Chin, Khin
LHMP - Soft-Story/Fire Alarm Coordination	Wed 9/4/2013 1:00 PM	Wed 9/4/2013 2:00 PM	Lana, Sarah; Dong, Gil; Roshal, Alexander; McNulty, Jenny; Riggs, Steven; Lee, Aaron
LHMP - Update of OES Actions	Wed 4/3/2013 3:00 PM	Wed 4/3/2013 4:30 PM	Lana, Sarah; Chin, Khin; Lee, Aaron; Brannigan, David
LHMP - Work on Actions	Thu 8/2/2012 1:00 PM	Thu 8/2/2012 2:30 PM	Tyler, Sarah; Sanderson, Debra
LHMP - Working on Actions	Fri 7/13/2012 10:00 AM	Fri 7/13/2012 12:00 PM	Tyler, Sarah; Roshal, Alexander
LHMP (Answer Questions)	Tue 2/26/2013 11:00 AM	Tue 2/26/2013 11:30 AM	Jensen, Lorin; Lana, Sarah
LHMP Action/Vulnerability Review	Tue 7/16/2013 1:30 PM	Tue 7/16/2013 2:30 PM	Lana, Sarah; Jensen, Lorin
LHMP Actions	Fri 6/7/2013 2:30 PM	Fri 6/7/2013 3:30 PM	Lana, Sarah; Jensen, Lorin
LHMP Actions Review	Mon 8/19/2013 3:00 PM	Mon 8/19/2013 4:00 PM	Lana, Sarah; Ferrera, Susan
LHMP Actions Update	Mon 6/3/2013 3:30 PM	Mon 6/3/2013 5:00 PM	Lana, Sarah; Jensen, Lorin
LHMP CEQA Review	Wed 11/13/2013 2:00 PM	Wed 11/13/2013 3:00 PM	Lana, Sarah; Amoroso, Alexander
LHMP Check-In	Fri 6/1/2012 1:00 PM	Fri 6/1/2012 2:00 PM	Tyler, Sarah; Sanderson, Debra
LHMP Check-In	Fri 6/7/2013 10:00 AM	Fri 6/7/2013 11:00 AM	Danielle Hutchings Mieler (daniellem@abag.ca.gov)
LHMP Check-In	Fri 7/26/2013 10:00 AM	Fri 7/26/2013 11:00 AM	Lana, Sarah; Roshal, Alexander
LHMP Check-In	Mon 2/24/2014 3:30 PM	Mon 2/24/2014 4:30 PM	Lana, Sarah; Greene, Elizabeth
LHMP Check-In	Mon 4/9/2012 1:30 PM	Mon 4/9/2012 2:00 PM	Tyler, Sarah; Pryor, Debra; Dong, Gil
LHMP Check-In	Mon 4/9/2012 2:00 PM	Mon 4/9/2012 3:00 PM	Tyler, Sarah; Jensen, Lorin
LHMP Check-In	Thu 7/21/2011 3:00 PM	Thu 7/21/2011 3:30 PM	Tyler, Sarah; Chin, Khin; Imrie, Sabina
LHMP Check-In	Tue 6/18/2013 4:00 PM	Tue 6/18/2013 5:00 PM	Danielle Hutchings Mieler (daniellem@abag.ca.gov)
LHMP Check-In	Wed 12/18/2013 2:00 PM	Wed 12/18/2013 2:30 PM	Lana, Sarah; Sanderson, Debra
LHMP Check-In	Thu 2/9/2012 10:30 AM	Thu 2/9/2012 12:00 PM	Tyler, Sarah; Sanderson, Debra
LHMP Check-In call	Tue 3/19/2013 4:00 PM	Tue 3/19/2013 4:30 PM	Danielle Hutchings Mieler (daniellem@abag.ca.gov)
LHMP Climate Change	Wed 1/9/2013 3:00 PM	Wed 1/9/2013 4:00 PM	Tyler-Lana, Sarah; Burroughs, Timothy; Schwartz, Marna; Ridel, Suzanne
LHMP Climate Change Adaptation Actions	Thu 7/25/2013 2:00 PM	Thu 7/25/2013 3:30 PM	Lana, Sarah; Burroughs, Timothy; Schwartz, Marna; Sanderson, Debra; Amoroso, Alexander; Harrington, Phillip; Ferrera, Susan
LHMP Climate Change Check-In	Mon 2/4/2013 2:00 PM	Mon 2/4/2013 3:30 PM	Lana, Sarah; Schwartz, Marna; Burroughs, Timothy; Ridel, Suzanne; 'Danielle Hutchings Mieler'
LHMP Climate Change Check-In	Mon 4/1/2013 3:00 PM	Mon 4/1/2013 4:00 PM	Lana, Sarah; Burroughs, Timothy
LHMP Contract with ABAG	Mon 4/8/2013 1:00 PM	Mon 4/8/2013 1:30 PM	Lana, Sarah; Jones, Melanie
LHMP Core Project Team Meeting #10	Mon 7/9/2012 1:00 PM	Mon 7/9/2012 3:00 PM	Tyler, Sarah; Room: Fire Only: Fire Conference Room; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Dong, Gil; Jensen, Lorin; Rogers, William

LHMP Core Project Team Meeting #11	Mon 9/9/2013 2:00 PM	Mon 9/9/2013 4:00 PM	Rogers, William; Lana, Sarah; Lee, Aaron; Brannigan, David; Chin, Khin; Dong, Gil; Delgado, Cristi; Micallef, Jane; Berreman, Janet; Clough, Andrew; Jensen, Lorin; Roshal, Alexander; McNulty, Jenny; Sanderson, Debra; Angstadt, Eric; DeSnoo, Neal; Burrough
LHMP Core Project Team Meeting #2	Mon 10/3/2011 1:00 PM	Mon 10/3/2011 2:00 PM	Tyler, Sarah; Room: Redwood, 2180 6N; Imrie, Sabina; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Daniel, Christine; Rogers, William
LHMP Core Project Team Meeting #3	Mon 10/31/2011 1:00 PM	Mon 10/31/2011 3:00 PM	Tyler, Sarah; Room: Fire Only: Fire Conference Room; Imrie, Sabina; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Daniel, Christine; Rogers, William
LHMP Core Project Team Meeting #4 - Revised	Mon 12/5/2011 1:00 PM	Mon 12/5/2011 2:00 PM	Tyler, Sarah; Room: Redwood, 2180 6N; Chin, Khin; Pryor, Debra; Sanderson, Debra; Rogers, William; Dong, Gil
LHMP Core Project Team Meeting #5	Mon 2/6/2012 1:00 PM	Mon 2/6/2012 2:00 PM	Tyler, Sarah; Room: Redwood, 2180 6N; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Rogers, William; Dong, Gil
LHMP Core Project Team Meeting #6	Mon 3/5/2012 1:00 PM	Mon 3/5/2012 3:00 PM	Tyler, Sarah; Room: Redwood, 2180 6N; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Rogers, William; Room: Fire Only: Fire Conference Room; Dong, Gil
LHMP Core Project Team Meeting #8	Mon 4/30/2012 1:00 PM	Mon 4/30/2012 3:00 PM	Tyler, Sarah; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Rogers, William; Dong, Gil; Roshal, Alexander; Room: Fire Only: Fire Conference Room
LHMP Core Project Team Meeting #9	Mon 6/4/2012 1:00 PM	Mon 6/4/2012 2:00 PM	Tyler, Sarah; Room: Redwood, 2180 6N; Chin, Khin; Pryor, Debra; 'Danielle Hutchings'; Micallef, Jane; Delgado, Cristi; Berreman, Janet; Sanderson, Debra; Clough, Andrew; Roshal, Alexander; Rogers, William; Dong, Gil; Jensen, Lorin
LHMP DFSC path forward	Fri 2/7/2014 1:15 PM	Fri 2/7/2014 1:45 PM	Lana, Sarah; Lee, Aaron; Chin, Khin; Brannigan, David; Lazo, Jennifer
LHMP discussion	Tue 1/21/2014 11:00 AM	Tue 1/21/2014 12:00 PM	Greene, Elizabeth; Lana, Sarah; Amoroso, Alexander
LHMP Discussion + Lunch	Fri 7/19/2013 11:00 AM	Fri 7/19/2013 1:00 PM	Lana, Sarah; Sanderson, Debra
LHMP Document Review	Wed 8/21/2013 3:30 PM	Wed 8/21/2013 4:30 PM	Lana, Sarah; Al-Hadithy, Nabil; Busche, Karl
LHMP Fire Actions	Tue 7/24/2012 1:30 PM	Tue 7/24/2012 3:00 PM	Tyler, Sarah; Dong, Gil; Pryor, Debra
LHMP Follow-Up	Fri 9/20/2013 1:00 PM	Fri 9/20/2013 2:00 PM	Lana, Sarah; Harrington, Phillip
LHMP Institutional Community Partner Meeting	Mon 10/7/2013 9:00 AM	Mon 10/7/2013 11:00 AM	Lana, Sarah; Chin, Khin; Riggs, Steven; Lee, Aaron; Brannigan, David; Roshal, Alexander; Burroughs, Timothy; Busche, Karl; Sanderson, Debra; McNulty, Jenny; Schwartz, Marna; Ferrera, Susan; Mann, John; Rose, Sean; Fletcher, Perry; Jensen, Lorin; Etheringt
LHMP Letters	Mon 9/23/2013 10:00 AM	Mon 9/23/2013 10:30 AM	Lana, Sarah; Rogers, William
LHMP Mapping Follow-Up Meeting	Fri 2/17/2012 9:00 AM	Fri 2/17/2012 10:00 AM	Tyler, Sarah; Delgado, Cristi; Room: Fire Only: Fire Conference Room
LHMP Part II - Energy Assurance Planning	Wed 1/9/2013 4:00 PM	Wed 1/9/2013 5:00 PM	Tyler-Lana, Sarah; Burroughs, Timothy; Schwartz, Marna; 'arriettachakos@gmail.com'; Ridel, Suzanne
LHMP Payment Schedule Review	Fri 7/22/2011 1:00 PM	Fri 7/22/2011 1:30 PM	Tyler, Sarah; Imrie, Sabina; Chin, Khin
LHMP peer review call	Fri 1/25/2013 2:00 PM	Fri 1/25/2013 2:30 PM	Burroughs, Timothy; Lana, Sarah; 'bruce@bayareajpc.net'
LHMP Public Participation Plan Development	Tue 10/11/2011 3:00 PM	Tue 10/11/2011 4:30 PM	Tyler, Sarah; Sanderson, Debra; Room: Fire Only: Fireworks Conference Room
LHMP Public Participation Plan Development	Wed 10/5/2011 3:00 PM	Wed 10/5/2011 4:00 PM	Tyler, Sarah; Sanderson, Debra; Room: Fire Only: Fireworks Conference Room
LHMP Strategic Planning	Thu 2/7/2013 3:00 PM	Thu 2/7/2013 5:00 PM	'Danielle Hutchings Mieler'
LHMP Vegetation Management Concerns	Fri 1/3/2014 10:30 AM	Fri 1/3/2014 12:00 PM	Brannigan, David; Lana, Sarah; Lee, Aaron; Riggs, Steven
LHMP: Building and Safety Check-In	Wed 2/8/2012 10:30 AM	Wed 2/8/2012 11:30 AM	Tyler, Sarah; Roshal, Alexander

LHMP: Finalize Fire Components of Hazard Analysis Section	Mon 3/26/2012 11:00 AM	Mon 3/26/2012 11:30 AM	Tyler, Sarah; Dong, Gil; Pryor, Debra; Room: Fire Only: Fire Conference Room
LHMP: Public Works Check-In	Thu 2/9/2012 9:00 AM	Thu 2/9/2012 10:00 AM	Jensen, Lorin
Local Hazard Mitigation Path Forward	Mon 11/7/2011 3:00 PM	Mon 11/7/2011 4:30 PM	Tyler, Sarah; Sanderson, Debra
Local Hazard Mitigation Plan	Tue 9/3/2013 11:00 AM	Tue 9/3/2013 12:00 PM	Rogers, William; Lana, Sarah
Local Hazard Mitigation Plan	Wed 2/1/2012 3:00 PM	Wed 2/1/2012 4:00 PM	Sanderson, Debra; Tyler, Sarah; Amoroso, Alexander; Greene, Elizabeth; Harrison, Jordan; Buckley, Steven
Local Hazard Mitigation Plan - Action Review	Tue 8/20/2013 11:00 AM	Tue 8/20/2013 12:00 PM	Lana, Sarah; Harrington, Phillip
Local Hazard Mitigation Plan - Commission Engagement Path Forward/Document Review	Mon 12/12/2011 9:30 AM	Mon 12/12/2011 10:00 AM	Tyler, Sarah; Dong, Gil; Pryor, Debra
Local Hazard Mitigation Plan - Finalize your Actions	Tue 9/3/2013 1:00 PM	Tue 9/3/2013 2:00 PM	Lana, Sarah; Sanderson, Debra
Local Hazard Mitigation Plan - Fire Actions	Fri 3/16/2012 10:00 AM	Fri 3/16/2012 11:00 AM	Tyler, Sarah; Dong, Gil; Pryor, Debra; Room: Fire Only: Fire Conference Room
Local Hazard Mitigation Plan - Fire Dept Meeting	Wed 10/5/2011 9:30 AM	Wed 10/5/2011 10:30 AM	Tyler, Sarah; Pryor, Debra; Chin, Khin; Tyler, Sarah; Imrie, Sabina; Fitch, John; Dong, Gil; Room: Fire Only: Fireworks Conference Room
Local Hazard Mitigation Plan - Fire Elements Review	Wed 10/12/2011 12:00 PM	Wed 10/12/2011 1:00 PM	Tyler, Sarah; Dong, Gil; Pryor, Debra; Chin, Khin; Imrie, Sabina; Fitch, John; Room: Fire Only: Fireworks Conference Room
Local Hazard Mitigation Plan - Flooding Check-In	Mon 3/25/2013 2:00 PM	Mon 3/25/2013 2:30 PM	Lana, Sarah; Jensen, Lorin
Local Hazard Mitigation Plan - Mapping and Actions for Next 5 years	Mon 3/12/2012 10:30 AM	Mon 3/12/2012 12:00 PM	Tyler, Sarah; Roshal, Alexander
Local Hazard Mitigation Plan - Update	Fri 3/15/2013 3:00 PM	Fri 3/15/2013 4:00 PM	Lana, Sarah; Lee, Aaron
Local Hazard Mitigation Plan Briefing	Mon 8/19/2013 10:00 AM	Mon 8/19/2013 10:30 AM	Lana, Sarah; Angstadt, Eric
Local Hazard Mitigation Plan Briefing	Tue 9/17/2013 3:30 PM	Tue 9/17/2013 4:00 PM	Lana, Sarah; Rogers, William
Local Hazard Mitigation Plan Briefing	Wed 9/4/2013 10:00 AM	Wed 9/4/2013 11:00 AM	Lana, Sarah; Berreman, Janet; Ridel, Suzanne
Local hazard mitigation plan check-in	Fri 6/1/2012 2:30 PM	Fri 6/1/2012 3:00 PM	Tyler, Sarah; Pryor, Debra
Local Hazard Mitigation Plan Check-In	Tue 8/13/2013 3:30 PM	Tue 8/13/2013 4:30 PM	Lana, Sarah; Al-Hadithy, Nabil; Busche, Karl
Local Hazard Mitigation Plan Check-In	Wed 3/7/2012 4:00 PM	Wed 3/7/2012 4:30 PM	Tyler, Sarah; Jensen, Lorin
Local Hazard Mitigation Plan Check-In	Wed 5/9/2012 3:30 PM	Wed 5/9/2012 5:00 PM	Tyler, Sarah; Jensen, Lorin
Local Hazard Mitigation Plan Follow-Up Meeting	Tue 9/3/2013 3:30 PM	Tue 9/3/2013 5:00 PM	Lana, Sarah; Al-Hadithy, Nabil; Busche, Karl
Local Hazard Mitigation Plan Meeting Prep	Mon 6/4/2012 10:30 AM	Mon 6/4/2012 11:00 AM	Tyler, Sarah; Dong, Gil
Local Hazard Mitigation Plan Outreach Approach	Fri 1/20/2012 10:00 AM	Fri 1/20/2012 11:00 AM	Tyler, Sarah; Dong, Gil; Rogers, William; Pryor, Debra; Room: Pepperwood, 2180 5S
Local Hazard Mitigation Plan Partner Meeting	Mon 10/7/2013 9:00 AM	Mon 10/7/2013 9:15 AM	Lana, Sarah; Rogers, William
Local Hazard Mitigation Plan Updates -- Check-In	Thu 2/9/2012 3:30 PM	Thu 2/9/2012 4:00 PM	Tyler, Sarah; Dong, Gil; Pryor, Debra; Fitch, John; Room: Fire Only: Fire Conference Room
Lunch and LHMP with Sarah Tyler! :)	Mon 5/7/2012 12:00 PM	Mon 5/7/2012 1:30 PM	Tyler, Sarah; Sanderson, Debra; Rudnick, Tessa
Mass Evacuation Plan	Thu 1/9/2014 3:30 PM	Thu 1/9/2014 4:30 PM	Chin, Khin; King, Drew; Upson, Erik M.; Brannigan, David; Lana, Sarah; Lazo, Jennifer; Lee, Aaron
Meet re: Local Hazard Mitigation Plan	Wed 11/2/2011 9:00 AM	Wed 11/2/2011 10:00 AM	Tyler, Sarah; Jensen, Lorin
Meet to strategize re: Local Hazard Mitigation Plan	Thu 10/27/2011 2:00 PM	Thu 10/27/2011 3:00 PM	Tyler, Sarah; Roshal, Alexander
Meet with Sarah Tyler re: LHMP	Fri 11/9/2012 4:00 PM	Fri 11/9/2012 4:30 PM	Tyler, Sarah
Meeting for LHMP with Lorin Jensen	Fri 3/9/2012 9:00 AM	Fri 3/9/2012 1:00 PM	Jensen, Lorin
Meeting to work on LHMP	Fri 3/9/2012 1:00 PM	Fri 3/9/2012 5:00 PM	Tyler, Sarah; Jensen, Lorin
Meeting with Bernadette Cormier	Tue 10/4/2011 9:30 AM	Tue 10/4/2011 11:00 AM	Tyler, Sarah; Chin, Khin
Meeting with Sarah Tyler re: LHMP	Wed 11/21/2012 9:30 AM	Wed 11/21/2012 9:45 AM	Tyler, Sarah; Rogers, William
MIT Architecture Design Studio Tour	Thu 3/28/2013 3:15 PM	Thu 3/28/2013 5:15 PM	Lana, Sarah; Brannigan, David; Chin, Khin; Lee, Aaron
Mitigation Grant Check-in with Ricardo Castillo	Wed 2/15/2012 9:00 AM	Wed 2/15/2012 9:30 AM	Tyler, Sarah; Battle, Reeve
Mitigation Partner Meeting Setup/Registration	Mon 10/7/2013 8:00 AM	Mon 10/7/2013 10:00 AM	Lana, Sarah; Stover, Samella
Mitigation Planning/Project questions	Fri 7/20/2012 1:00 PM	Fri 7/20/2012 2:00 PM	Jami Childress-Byers; Tyler, Sarah
Planning Commission - LHMP	Wed 3/19/2014 7:00 PM	Wed 3/19/2014 9:00 PM	Lana, Sarah; Lee, Aaron
Planning Training: Debrief/Recommended Path Forward	Fri 1/24/2014 9:00 AM	Fri 1/24/2014 10:00 AM	Lana, Sarah; Brannigan, David
Review LHMP Fire Actions	Wed 1/29/2014 1:30 PM	Wed 1/29/2014 2:00 PM	Lana, Sarah; Lee, Aaron; Dong, Gil; Riggs, Steven
Review of LHMP Actions	Mon 7/16/2012 2:00 PM	Mon 7/16/2012 3:00 PM	Tyler, Sarah; Roshal, Alexander
Sarah Lana: Local Hazard Mitigation Plan	Tue 7/30/2013 11:30 AM	Tue 7/30/2013 12:00 PM	Rogers, William; Lana, Sarah

Sarah Lana: Local Hazard Mitigation Plan	Wed 8/7/2013 10:00 AM	Wed 8/7/2013 11:00 AM	Rogers, William; Lana, Sarah; Lee, Aaron
Sustainability Workgroup and LHMP	Wed 4/10/2013 3:00 PM	Wed 4/10/2013 4:00 PM	Lana, Sarah; Burroughs, Timothy
UC Berkeley - Berkeley Lab - City Coordination Meeting	Tue 10/23/2012 2:00 PM	Tue 10/23/2012 3:00 PM	Chin, Khin; Lee, Aaron; 'john.ruiz@berkeley.edu'; amina.assefa@berkeley.edu; mikesabel@berkeley.edu; Sara Wynne; Heidi Nelkie
Updated: Local Hazard Mitigation Plan - Commission Secretary Outreach Review	Wed 12/21/2011 2:30 PM	Wed 12/21/2011 3:30 PM	Tyler, Sarah; Dong, Gil; Room: Fire Only: Fireworks Conference Room; Pryor, Debra
Updated: Local Hazard Mitigation Plan Catch-Up	Wed 10/26/2011 2:45 PM	Wed 10/26/2011 3:45 PM	Tyler, Sarah; Debra Sanderson
Updated: Local Hazard Mitigation Plan Review	Fri 11/4/2011 9:30 AM	Fri 11/4/2011 10:30 AM	Tyler, Sarah; Alexander Roshal

Agency	Name	Position	Email	Invite Sent?	RSVP rec'd/Notes	Sent Actions?
UC Berkeley - Environment, Health and Safety	Tony Yuen	Campus Fire Marshal	awyuen@berkeley.edu	13-Sep	(N)	
Anna Lee	Alameda County Public Health	Local Policy Coordinator	anna.lee@acgov.org	20-Sep	N	24-Sep
Bay Area Rapid Transit	Marla Blagg	Emergency Manager	mblagg@bart.gov	23-Sep	N	24-Sep
California Office of Emergency Services	Victoria LaMar-Haas	Senior Emergency Services Coordinator	victoria.lamar-haas@calema.ca.gov	13-Sep	N	24-Sep
East Bay Municipal Utility District	Julia Halsne	Manager of Business Continuity	jhalsne@ebmud.com	13-Sep	N	
Bayer	Jeffrey Bowman	Emergency Response Manag	Jeffrey.bowman@bayer.com	20-Sep	N -- forwarded to Jeff Heaton	
Kinder Morgan Corporation	Nicole Stewart	Area Manager	nicole_stewart@kindermorgan.com	13-Sep	N - invite Clay Westlake	26-Sep
California Highway Patrol	Dave Dearborn	Environmental Crimes Investigator, Golden Gate Division	DDearborn@chp.ca.gov	20-Sep	N - passing on to supervisor (didn't say who)	
Alameda County Sheriff's Office - Office of Homeland Security and Emergency Services	Pace Stokes	Lieutenant	HPStokes@acgov.org	13-Sep	N - Sending Joe Gomez	24-Sep
Alameda County Sheriff's Office - Office of Homeland Security and Emergency Services	Paul Hess	Emergency Services Supervisor	phess@acgov.org	13-Sep	N - Sending Joe Gomez	24-Sep

Union Pacific Railroad	Jennifer Johnson	Hazardous Materials Manager for Northern California	jbjohns1@up.com	17-Sep	N - will send the Actions for review anyway	24-Sep
UC Berkeley - Office of Emergency Management	Amina Assefa	Manager	amina.assefa@berkeley.edu	13-Sep	N (in-person) - John/Mike will come	24-Sep
UC Berkeley - Environment, Health and Safety	Mark Freiberg	Director	freiberg@berkeley.edu	13-Sep	N (thru grapevine) - John/Mike will come	24-Sep
U.S. Forest Service	Amanda Cundiff	Regional Partnership Program	acundiff@fs.fed.us	13-Sep	N- Invite Susan/Sarah	24-Sep
Alameda County Public Health	Mona Mena	Program Specialist	mona.mena@acgov.org	17-Sep	N- Referred to Anna	
City of Albany	Jim Boito	Fire Captain	jboito@albanyca.org	17-Sep	N- referred to Fire Chief	
Union Pacific Railroad	Benjamin Salo	Hazardous Materials Manager	BRSALO@UP.COM	17-Sep	N-referred to Jennifer	
UC Berkeley - Vice Provost for Teaching , Learning Academic Planning & Facilities and Space & Capital Resources	Tom Klatt	Environmental Projects Manager	tklatt@berkeley.edu	13-Sep	out until sept 30	4-Oct
Amy Kiser	Ecology Center	Program Director	amy@ecologycenter.org	17-Sep	Y	4-Oct
Arrietta Chakos	Association of Bay Area Governments	Policy Advisor	arriettachakos@gmail.com	24-Sep	Y	24-Sep
Bruce Riordan	Bay Area Joint Policy Committee	Climate Consultant	bruce@bayareajpc.net	17-Sep	Y	24-Sep

Carl Scheuerman	Sutter Health	Director of Regulatory Affairs, Sutter Health Facility Planning &	ScheueC@sutterhealth.org	20-Sep	Y	27-Sep
Charlie Bowen	Berkeley Path Wanderers Association	Senior Path Builder	charlie_paths@comcast.net		Y	9/24/2013 (via Keith)
Clay Westlake	Kinder Morgan Corporation	Area Manager	WestlakeC@kindermorgan.com		Y	26-Sep
Daryl Shy	UC Berkeley	Deputy Fire Marshal	dshy@berkeley.edu	n/a	Y	3-Oct
David Michel	California Energy Commission	CaLEAP Program	David.Michel@energy.ca.gov	13-Sep	Y	4-Oct
Elizabeth Smith	Sutter Health	Regional Director, Environmental Health & Safety	smithe@sutterhealth.org	20-Sep	Y	24-Sep
Genevieve Pastor-Cohen	City of Oakland	Senior Emergency Planning Coordinator	gpastor-cohen@oaklandnet.com	16-Sep	Y	27-Sep
Gina Blus	Pacific Gas & Electric	Sustainable Communities Supervisor	R9By@pge.com	13-Sep	Y	24-Sep

Jacquelin Poon	Lifelong Medical	Compliance Manager	jpoon@lifelongmedical.org	13-Sep	Y	24-Sep
Jose Rios	East Bay Municipal Utility District	Senior Civil Engineer	jrios@ebmud.com	13-Sep	Y	24-Sep
Katie Grote	Pacific Gas & Electric	Community Energy Manager	K1GJ@pge.com	13-Sep	Y	24-Sep
Keith Skinner	Berkeley Path Wanderers Association	President	keithskinner.public@gmail.com	13-Sep	Y	24-Sep
Ken Blonski	East Bay Regional Park District	Fire Chief	kblonski@ebparks.org	23-Sep	Y	27-Sep
Lance Calkins	City of Albany	Fire Chief	jboito@albanyca.org	9/17/2013 (fwd)	Y	24-Sep
Lori Elefant	City of Emeryville	Management Analyst	lelefant@ci.emeryville.ca.us	13-Sep	Y	1-Oct
Michelle Heckle	Children's Hospital & Research Center Oakland	Emergency Management Coordinator	mheckle@mail.cho.org	n/a	Y	2-Oct
Nick Zubel	Alameda County Fire Department	Emergency Preparedness Manager	nick.zubel@acgov.org	20-Sep	Y	24-Sep
Sara Polgar	Bay Conservation Development Commission	Coastal Planner	sarap@bcdc.ca.gov	17-Sep	Y	24-Sep
Sara Wynne	Lawrence Berkeley Lab	Emergency Management Program Specialist	srwynne@lbl.gov	13-Sep	Y	24-Sep

Sarah Miggins	U.S. Forest Service	Regional Partnership Program	smiggins@mountainsfoundation.org	17-Sep	Y	27-Sep
Joe Gomez	Alameda County Sheriff's Office	Emergency Planner			Y - from Pace	
John Ruiz	UC Berkeley	Emergency Management Coordinator	john.ruiz@berkeley.edu	13-Sep	Y (in person)	24-Sep
Mike Sabel	UC Berkeley	Continuity Planner	mikesabel@berkeley.edu	13-Sep	Y (in person)	24-Sep
Dana Brechwald	Association of Bay Area Governments	Earthquake and Hazard Specialist	danab@abag.ca.gov	13-Sep	Y (via Arrietta)	(Arrietta shared)
Bay Conservation Development Commission	Joe LaClair	Sea-level rise expert	joel@bcdc.ca.gov	17-Sep		4-Oct
Berkeley City College	Shirley Slaughter	Business Officer and Safety Committee Chair	sslaughter@peralta.edu	13-Sep		4-Oct
Berkeley Unified School District - Maintenance Department	Lew Jones	Director	lewjones@berkeley.net	13-Sep		4-Oct
Berkeley Unified School District - Transportation Department	Bernadette Cormier	Manager	bernadette@berkeley.net	13-Sep		4-Oct
California Public Utilities Commission	Molly Sterkel	Infrastructure Planning and Permitting Branch	mts@cpuc.ca.gov	13-Sep		4-Oct
Caltrans	Bob Braga	Chief Maintenance Services/Emergency Management: Planning &	bob.braga@dot.ca.gov	13-Sep		4-Oct

City of El Cerrito	Karen Pinkos	Assistant City Manager	kpinkos@ci.el-cerrito.ca.us	17-Sep		4-Oct
East Bay Municipal Utility District	George Wright	Emergency Preparedness	gwright@ebmud.com	13-Sep		4-Oct
Federal Emergency Management Agency	Juliette Hayes	Planning Division Chief	Juliette.Hayes@fema.dhs.gov	17-Sep		4-Oct
Federal Emergency Management Agency	Phillip Ang	Plan Reviewer	Phillip.ang@fema.dhs.gov	17-Sep		4-Oct
Lawrence Berkeley Lab - Emergency Management Program	Aaron Ward	Emergency Management Program	award@lbl.gov	13-Sep		4-Oct
Pacific Gas & Electric	Michael Velasquez	Sr. Public Safety Specialist - Gas Emergency Preparedness	M1VD@pge.com	13-Sep		4-Oct
Pacific Gas & Electric	Roxanne Cruz	Government Affairs Representative	rect@pge.com	20-Sep		4-Oct
Red Cross Bay Area Chapter - Alameda County Office	Charles Telehala	Disaster Services Manager	TelehalaC@usa.redcross.org	13-Sep		4-Oct
U.S. Forest Service	Susan Skalski	Supervisor of the Stanislaus National Forest	sskalski@fs.fed.us	17-Sep		4-Oct
UC Berkeley - Facilities Services	Christine Shaff	Director of Communications	cshaff@berkeley.edu	13-Sep		4-Oct
UC Berkeley - Local Government and Community Relations	Julie Sinai	Director	jsinai@berkeley.edu	13-Sep		4-Oct

UC Berkeley - University Health Services	Pam Cameron	Associate Director	pcameron@uhs.berkeley.edu	13-Sep		4-Oct

Lana, Sarah

From: Lana, Sarah
Sent: Friday, September 13, 2013 8:52 AM
To: 'HPStokes@acgov.org'; 'Hess, Paul M., Sheriff'
Subject: Invitation: City of Berkeley Mitigation Partner Meeting

Dear Paul and Lt. Stokes,

The City of Berkeley is updating its Local Hazard Mitigation Plan. This document identifies natural hazards in Berkeley, and outlines a five-year plan to further protect Berkeley's people, buildings, infrastructure and environment from these hazards.

As OA emergency management staff, you are invited to participate in our Institutional Community Partner Meeting on October 7, from 9:00 – 11:00 a.m. in downtown Berkeley. When you RSVP, you will be issued a pre-draft version of the Plan's Mitigation Actions for your review prior to the meeting.

This meeting will be your agency's opportunity to preview the Pre-Draft Plan and provide feedback before the First Draft Plan is made public on October 21. City staff will be on hand to answer questions about the Plan's new hazard analysis and Mitigation Actions being proposed. Staff will also be seeking your suggestions on how the City can partner with your agency to further reduce our community's disaster vulnerabilities.

Please RSVP to Mitigation@CityofBerkeley.info by September 27 for this invitation-only meeting.

Please contact me with questions, comments or concerns.

Sincerely,
Sarah Lana

Sarah (Tyler) Lana, Emergency Services Coordinator
Berkeley Fire Department
Office of Emergency Services
2100 Martin Luther King Jr. Way, Second Floor
Berkeley, CA 94704
510.981.5576 voice
510.981.5579 fax
slana@CityofBerkeley.info

INVITATION

Subject:

Invitation: City of Berkeley Mitigation Partner Meeting

Dear XX,

The City of Berkeley is updating its Local Hazard Mitigation Plan. This document identifies natural hazards in Berkeley, and outlines a five-year plan to further protect Berkeley's people, buildings, infrastructure and environment from these hazards.

As XXX, you are invited to participate in our Institutional Community Partner Meeting on October 7, from 9:00 – 11:00 a.m. in downtown Berkeley. When you RSVP, you will be issued a pre-draft version of the Plan's Mitigation Actions for your review prior to the meeting.

This meeting will be your agency's opportunity to preview the Pre-Draft Plan and provide feedback before the First Draft Plan is made public on October 21. City staff will be on hand to answer questions about the Plan's new hazard analysis and Mitigation Actions being proposed. Staff will also be seeking your suggestions on how the City can partner with your agency to further reduce our community's disaster vulnerabilities.

Please RSVP to Mitigation@CityofBerkeley.info by September 27 for this invitation-only meeting.

Please contact me with questions, comments or concerns.

Sincerely,

Sarah Lana

CONFIRMATION

Dear X,

Thank you for your RSVP for the City of Berkeley's October 7 Mitigation Partners Meeting.

Mitigation Actions

Attached to this email is the current "pre-draft" version of the Mitigation Actions that will be discussed at this meeting. Please note that this document is not for distribution or attribution at this time.

Meeting Information

Monday, October 7 from 9:00 – 11:00 a.m.

City of Berkeley Public Safety Building – Emergency Operations Center

2100 Martin Luther King Jr Way in Berkeley (Cross Street: Center)

Transportation: The Public Safety Building is 2 blocks away from the Downtown Berkeley BART station. If you are driving, please note that street parking in this area is metered or limited to under 2 hours. Please plan to park in the Center Street Garage, located 1.5 blocks away at 2025 Center Street between Milvia and Shattuck. Parking will be $6.

We will also follow up with a calendar invitation.

Please contact me with any questions, comments or concerns. We look forward to seeing you on the 7th!

Best,
Sarah

September 24, 2013

Dear City Mitigation Partner,

City of Berkeley staff looks forward to your participation at our October 7 Local Hazard Mitigation Plan Institutional Community Partner Meeting. In preparation for that meeting, please find attached for your review the pre-draft Mitigation Actions under consideration for the 2013 Plan Update. This pre-draft content is not for distribution or attribution at this time.

Twenty-three pre-draft Actions are presented in the following pages. They are designed to mitigate Berkeley's natural hazards:

Hazards of Greatest Concern

- Earthquake
- Wildland-Urban Interface Fire

Hazards of Concern

- Rainfall-Induced Landslide
- Floods
- Tsunami
- Climate Change

Each Action has been assigned a letter (A – W) for identification purposes. Each Action has been assigned a draft priority level (High-Medium-Low). We have outlined the City departments that will lead implementation of the Action, as well as Key Institutional Partners that we expect to work with to implement the Action.

On October 7, staff will present these Actions in the context of Berkeley's updated Hazard Analysis, which describes Berkeley's vulnerabilities to the natural hazards of concern. At that meeting, you will be invited to provide feedback on behalf of your agency in four areas:

1) Actions that will have the most positive impact on your organization's disaster readiness activities
2) Actions that will conflict with your agencies' programmatic activities
3) Actions with opportunity to partner with your agency for implementation
4) Opportunities for the City to support your agency in implementing its own mitigation activities

If you have any major questions or comments prior to this meeting, please don't hesitate to contact me at (510) 981-5576 or slana@cityofberkeley.info

Sincerely,
Sarah Lana

Emergency Services Coordinator/Local Hazard Mitigation Plan Project Manager

Short Name	Details	Lead City Division(s)	Key Institutional Partners
A. Building Assessment ***High***	***Perform appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.*** - First, complete analysis of structures supporting critical emergency response and recovery functions, and make recommendations for structural and nonstructural improvements. - Prioritize analysis of remaining structures based on occupancy and structure type, and make recommendations for structural and nonstructural improvements. - Integrate unsafe structures into a prioritized program for retrofit or replacement. Develop emergency guidelines for buildings with structural deficiencies.	Public Works Department: Facilities Division	
B. Strengthen and Replace City Buildings ***Medium***	***Strengthen or replace City buildings in the identified prioritized order as funding is available.*** - Seismically strengthen James Kenney Recreation Center - Replace the Center Street Garage - Seek funding to seismically strengthen or replace additional City buildings in a prioritized order	Public Works Department – Engineering Division	Federal Emergency Management Agency California Office of Emergency Services

C. Soft-Story ***High***	***Implement Phase Two of the Soft-Story Retrofit Program, mandating retrofit of soft-story residences.*** <u>- Phase II, Part 1: Complete Public Review and Adopt a Mandatory Retrofit Ordinance</u> - Pass ordinance to amend the Berkeley Municipal Code 19.39 to require owners of soft-story buildings to retrofit their buildings - Identify and address related zoning issues (e.g., parking elimination requirements, demolitions, etc.) - Outreach to impacted property owners and tenants <u>- Phase II, Part 2 – Implementation of Mandatory Soft-story Retrofit Ordinance</u> - Develop and publish Framework Guidelines calibrating, delineating and detailing technical requirements to be used for building retrofits. - Inform impacted property owners of the requirement to retrofit their building - Designated project manager will: • Prepare handouts and correspondence • Respond to inquiries from owners, tenants, engineers, contractors and realtors about the mandatory program, compliance procedures and requirements - Investigate and adopt financial, procedural, and land use incentives to facilitate retrofit. • The Rent Board will review requests for pass-through of capital improvement expenses for seismic retrofits. They will determine on a case-by-case basis if rent increases to tenants can be approved. • Explore establishment of a loan program to assist landlords who cannot access financing to retrofit their buildings. - Review plan submittals for soft-story seismic retrofits - Issue permits and perform field inspections - Remove retrofitted buildings from the Soft Story Inventory - Review appeals to accommodate unique circumstances preventing owners from meeting program requirements; consider time extensions, etc.	Planning Department – Building and Safety Division	

D. URM ***High***	***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.- Apply available legal remedies, including but not limited to citations, to owners who fail to comply with the URM ordinance.- Maintain program notification to building occupants and owners.	Planning Department - Building and Safety Division	
E. Buildings ***High***	***Reduce hazard vulnerabilities in Berkeley buildings.*** - 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. - Explain requirements and provide guidance to owners of potentially hazardous structures to facilitate retrofit.	Planning Department – Building and Safety Division	
F. Energy Assurance ***Medium***	***Develop an Energy Assurance Plan for City operations.*** - Develop a plan to assist the City of Berkeley to prepare for, respond to, and recover from disasters that include energy emergencies. - Assess the energy supply and demand of key City facilities supporting emergency operations. - Assess those facilities' vulnerabilities to power loss. - Identify actions to mitigate those vulnerabilities (e.g., photovoltaic-supplemented emergency generation, energy efficiency activities, mobile charging stations). - Integrate energy assurance actions into Citywide planning processes.	Fire Department – Office of Emergency Services Planning Department – Office of Energy and Sustainable Development Department of Public Works – Facilities Division	California Energy Commission – CaLEAP Program

G. Gas safety ***Medium***	***Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.*** - Work with the Public Utilities Commission, utilities, and oil companies to strengthen, relocate, or otherwise safeguard natural gas and other pipelines where they extend through areas of high liquefaction potential, cross potentially active faults, or traverse potential landslide areas, or areas that may settle differentially during an earthquake. - Establish a program to provide free automatic gas shutoff valves, including subsidized permit fee waivers for low-income homeowners, to participants attending disaster readiness training.	Fire Department – Office of Emergency Services	California Public Utilities Commission Pacific Gas & Electric
H. EBMUD ***High***	***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 pipeline parallel to the existing north-south water main in 2015-2016. - Explore project approaches with EBMUD to expedite replacement of problem pipelines in Berkeley neighborhoods exposed to wildland-urban interface fire and seismic ground failure. - Coordinate with EBMUD to ensure that pipeline replacement projects and upgrades are coordinated with the City's five-year street paving program.	Department of Public Works – Engineering Division	East Bay Municipal Utility District
I. Stormwater System ***Medium***	***Rehabilitate the City's stormwater system to reduce local flooding caused by inadequate storm drainage.*** - Complete the hydraulic analysis of watersheds in the city to predict areas of insufficient capacity. - Seek funding to perform system capacity and disaster resistance improvements.	Public Works Department – Engineering Division	East Bay Municipal Utility District

J. Partnerships ***High***	***Ensure that the City provides leadership and coordination of the private sector, public institutions, and other public bodies in disaster mitigation.*** - Support and encourage efforts undertaken by key lifeline providers to plan for and finance seismic retrofit and other disaster-resistance measures, including: • Utility providers • Transportation agencies • Communication providers • Healthcare facilities - Coordinate with and encourage mitigation actions of: • Institutions serving the Berkeley community • Berkeley organizations and nonprofits • Other partners whose actions affect the Berkeley community	City Manager's Office Fire Department – Office of Emergency Services	ALL PARTNERS
K. Fire Code ***High***	***Reduce fire risk in existing development through fire code updates and enforcement.*** - Periodically update and adopt the Berkeley Fire Code with local amendments to incorporate the latest knowledge and design standards to protect people and property against known risks in both structural and non-structural building and site components. - Maintain Fire Department efforts to reduce fire risk through inspections: • Annual inspections in all Fire Zones • Hazardous Fire Area inspections • Multi-unit-residential building inspections in all Fire Zones - Create a standard for written vegetation management plans for major construction projects in Fire Zones 2 and 3.	Fire Department – Division of Fire Prevention	

L. Vegetation Management ***Medium***	***Reduce fire risk in existing development through vegetation management.*** - Maintain Fire Fuel Chipper Program - Maintain Fire Fuel Abatement Program on Public Land - Maintain Fire Fuel Debris Bin Program - Maintain Weekly Curbside Plant Debris Collection	Department of Parks Recreation and Waterfront – Parks Division Department of Public Works – Zero Waste Division	
M. Hills Evacuation ***High***	***Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.*** - Ensure that all public pathways are maintained to provide safe and accessible pedestrian evacuation routes from the hill areas. - Update City maps of all emergency access and evacuation routes to include pedestrian pathways. - Coordinate with UC Berkeley and Lawrence Berkeley Labs to ensure that evacuation route options account for paths on UC and LBL property. - Publicize up-to-date maps of all emergency access and evacuation routes.	Department of Public Works – Engineering Division Information Technology GIS Division Fire Department Office of Emergency Services	Berkeley Path Wanderers Association UC Berkeley Lawrence Berkeley Lab
N. NFIP ***Medium***	***Maintain City participation in the National Flood Insurance Program.*** - Continue to update and revise flood maps for the City. - Continue to incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards.	Public Works – Engineering Division	Federal Emergency Management Agency

O. HazMat Floods ***Low***	***Explore legislation to require hazardous materials stored in the flood zones to be elevated or otherwise protected from floodwaters.*** - Conduct cost/benefit evaluation to determine if hazardous materials should be elevated/protected in existing development in flood hazard zones: • Assess potential impacts from hazardous materials release due to flooding • Consult with federal, State and regional partners to identify legislative best practices and lessons learned • Work with Berkeley Building Official to identify engineering solutions and potential permitting requirements for hazardous materials • Identify potential costs to hazardous materials owners - If cost/benefit evaluation is positive, work with City Manager's Office and City Council to determine and implement path forward. - If cost/benefit is not positive, consider alternative methods of compliance such relocation or modification of business activities.	Planning Department – Toxics Management Division	San Francisco Bay Conservation and Development Commission
P. Hazard Information ***High***	***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. - Partner with the Association of Bay Area Governments to explore incorporating Berkeley vulnerabilities onto regionally-managed hazard maps. - Publicize financial and technical assistance resources for risk reduction.	Fire Department – Office of Emergency Services Office of Energy and Sustainable Development	Association of Bay Area Governments

Q. Climate Change Integration ***High***	***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 - Develop and implement a process to integrate adaptation planning into City operations. Activities include: • Integrate climate change adaptation actions into the Citywide Work Plan • Integrate climate change adaptation considerations into templates for staff reports to City Council and City Commissions • Develop funding mechanisms to address climate change impacts and integrate climate change adaptation into the City's budget process • Train City staff on the basic science and impacts of climate change and on climate adaptation strategies • Develop a staff recognition and award program to encourage staff to integrate climate change considerations into City projects and programs	City Manager's Office Planning Department – Office of Energy and Sustainable Development	
R. Extreme Heat ***Medium***	***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 into City operations and services. - Create and maintain shading by sustaining municipal tree planting efforts and continuing to maintain the health of existing trees. - 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.	Planning Department – Office of Energy and Sustainable Development Department of Parks, Recreation and Waterfront – Parks Division	

S. Severe Storms ***Medium***	***Reduce Berkeley's vulnerability to severe storms and associated hazards.*** - Support and monitor research on climate change impacts on local rainfall patterns and incidences of severe storms. - Integrate considerations of severe storms into City operations and services: • Use development review to ensure that new development does not contribute to an increase in flood potential. • Complete the hydraulic analysis of watersheds in the city to predict areas of insufficient capacity. • Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio-filtration systems such as greenscapes. • Continue to encourage use of permeable surfaces and other techniques as appropriate in both greenscape and hardscape areas for retention and infiltration of stormwater. • Continue to encourage the development of green roofs by providing local outreach and guidelines consistent with the Building Code.	Planning Department – Office of Energy and Sustainable Development Planning Department – Land Use Planning Division Department of Public Works – Engineering Division	
T. Sea-Level Rise ***Low***	***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. - Develop guidelines, regulations, and development review procedures to protect new and existing public and private developments and infrastructure from floods due to expected sea-level rise.	Planning Department – Office of Energy and Sustainable Development Planning Department – Land Use Planning Division	San Francisco Bay Conservation and Development Commission

U. Water Security ***Medium***	***Collaborate with local, State, regional and federal partners to increase the security of Berkeley's water supply from climate change impacts.*** - Support efforts by the U.S. Forest Service and its partners to improve water security through restoration of the Headwaters Forest and Mokelumne River. - Encourage water recycling and gray water use through the distribution of outreach materials and local guidelines that are consistent with the Building Code. - Encourage the use of water conservation technologies and techniques in the design of new buildings and landscapes, such as waterless urinals and cisterns, through the development of local guidelines that are consistent with the Building Code. - Partner with East Bay Municipal Utility District (EBMUD) to provide and market incentives for residents, businesses and institutions to conserve water. - Partner with agencies such as EBMUD and StopWaste.org 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.	City Manager's Office Planning Department – Office of Energy and Sustainable Development	U.S. Forest Service East Bay Municipal Utility District StopWaste.org
V. Streamline Rebuild ***Medium***	***Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.*** - Adopt a Zoning Amendment to BMC 23C.04.100 that streamlines the Zoning permitting process to allow industrial and commercial buildings, and multiple-family dwellings to rebuild by right following disasters. - Develop a process and information required for residential and commercial property owners to document their buildings' current conditions, to enable them to rebuild by right following disasters.	Planning Department – Land Use Planning Division	

W. Tsunami ***Medium***	***Define and mitigate Berkeley's tsunami hazard.*** - Collaborate with the California Office of Emergency Services to define Berkeley's different areas of inundation for different tsunami scenarios. - Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to document and implement potential tsunami hazard mitigation measures for Berkeley's maritime communities.	Fire Department – Office of Emergency Services (Scenarios) Parks, Recreation and Waterfront Department – Marina Division (Mitigation Measures)	California Office of Emergency Services California Geological Survey Federal Emergency Management Agency

COPY 1

Sign-In Sheet: October 7 Mitigation Partner Meeting

44 attendees

Name	Agency/City Dept	Position	Email	Sign-In
Aaron Lee	Fire Department	Assistant Chief of Sepcial Operations		
~~Alex Roshal~~	~~Building & Safety Division~~	Building Official		
Amy Kiser	Ecology Center	Program Director		
Arrietta Chakos	Association of Bay Area Governments	Policy Advisor		
Bruce Riordan	Bay Area Joint Policy Committee	Climate Consultant		
~~Carl Scheuerman~~	~~Sutter Health~~	Director of Regulatory Affairs, ~~Sutter Health Facility Planning~~		
Charlie Bowen	Berkeley Path Wanderers Association	Senior Path Builder		
Clay Westlake	Kinder Morgan Corporation	Area Manager		
Dana Brechwald	Association of Bay Area Governments	Earthquake and Hazard Specialist		
Daryl Shy	UC Berkeley	Deputy Fire Marshal		
Dave Brannigan	Fire Department	Special Operations Lieutenant		
David Michel	California Energy Commission	CaLEAP Program		
~~Debbie Sanderson~~	~~Land Use Planning Division~~	~~Director~~		
Elizabeth Smith	Sutter Health	Regional Director, Environmental Health & Safety		
Genevieve Pastor-Cohen	City of Oakland	Senior Emergency Planning Coordinator		
Gil Dong	Fire Department	Fire Chief		

Sign-In Sheet: October 7 Mitigation Partner Meeting

Name	Agency/City Dept	Position	Email	Sign-In
Gina Blus	Pacific Gas & Electric	Sustainable Communities Supervisor		
Jacquelin Poon	Lifelong Medical	Compliance Manager		
Jenny McNulty	Building & Safety Division	Program and Administration Manager		
Joe Gomez	Alameda County Sheriff's Office	Emergency Planner		
~~John Mann~~	~~Parks, Recreation and Waterfront Department~~	~~Waterfront Manager~~		
John Ruiz	UC Berkeley	Emergency Management Coordinator		
Jose Rios	East Bay Municipal Utility District	Senior Civil Engineer		
~~Karl Busche~~ Nabil Al-Hadithy	Toxics Management Division	~~Hazardous Materials Specialist~~ manager		
Katie Grote	Pacific Gas & Electric	Community Energy Manager		
Keith Skinner	Berkeley Path Wanderers Association	President		
Ken Blonski	East Bay Regional Park District	Fire Chief		
Ken Etherington	Department of Public Works	Zero Waste Manager		
Khin Chin	Office of Emergency Services	Associate Management Analyst		
Lance Calkins	City of Albany	Fire Chief		
Lori Elefant	City of Emeryville	Management Analyst		
Lorin Jensen	Department of Public Works	Supervising Civil Engineer		

Sign-In Sheet: October 7 Mitigation Partner Meeting

Name	Agency/City Dept	Position	Email	Sign-In
Marna Schwartz	Office of Energy and Sustainable Development	Sustainability Outreach Specialist		
Matthai Chakko	City Manager's Office	Assistant to the City Manager		
~~Michelle Heckle~~	Children's Hospital & Research Center Oakland	Emergency Management Coordinator		
Mike Sabel	UC Berkeley	Continuity Planner		
Neal DeSnoo	Office of Energy and Sustainable Development	Manager		
Nick Zubel	Alameda County Fire Department	Emergency Preparedness Manager		
Paul Church	Department of Public Works	Disability Services Specialist		
Perry Fletcher	Department of Public Works	Facility Maintenance Superintendent		
Phil Harrington	Department of Public Works	Deputy Director		
Sara Polgar	Bay Conservation Development Commission	Coastal Planner		
Sara Wynne	Lawrence Berkeley Lab	Emergency Management ~~Program~~ Specialist		
Sarah Lana	Office of Emergency Services	Emergency Services Coordinator		
~~Sarah Miggins~~	~~U.S. Forest Service~~	~~Regional Partnership Program~~		
~~Sean Rose~~	~~Department of Public Works~~	~~City Engineer~~		
Steve Riggs	Fire Department	Acting Fire Marshal		
Sue Ferrera	Parks, Recreation and Waterfront Department	Parks Superintendent		

Sign-In Sheet: October 7 Mitigation Partner Meeting

Name	Agency/City Dept	Position	Email	Sign-In
Suzanne Ridel	Public Health Division	Program Manager		
Timothy Burroughs	Office of Energy and Sustainable Development	Climate Action Coordinator		
William Rogers	City Manager's Office	Deputy City Manager		

KEN EATHERINGTON ZERO WASTE

(OK other page

City of Berkeley

Local Hazard Mitigation Plan Update

Institutional Community Partner Meeting

October 7, 2013

Primary Meeting Goal: Your Feedback

- Positive impact
- Conflict
- Partnership opportunity

Plan Objectives

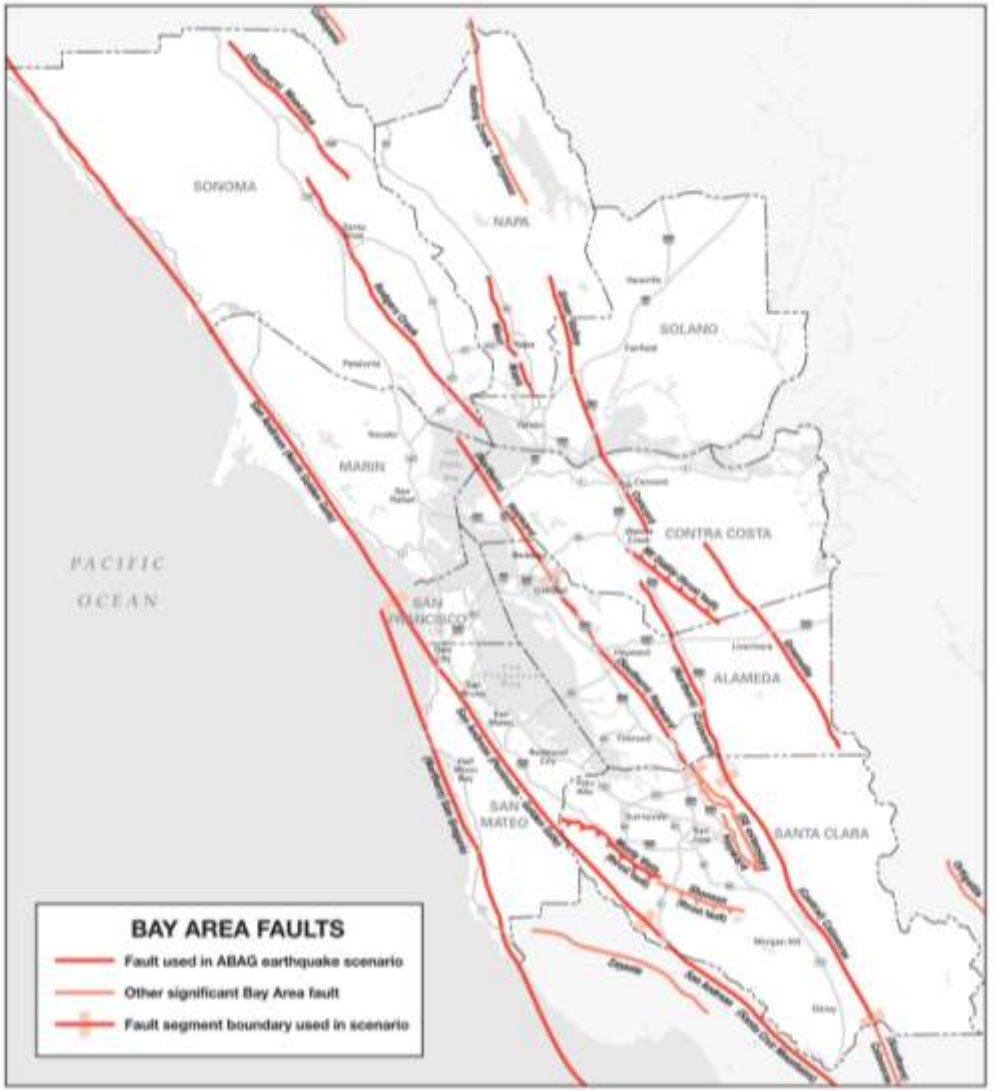
A. Reduce the potential for life loss, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
B. Increase City government's ability to serve the community during disaster response and recovery by mitigating risks to key buildings and infrastructure.
C. Protect Berkeley's unique character and values from being compromised by hazard events.
D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.

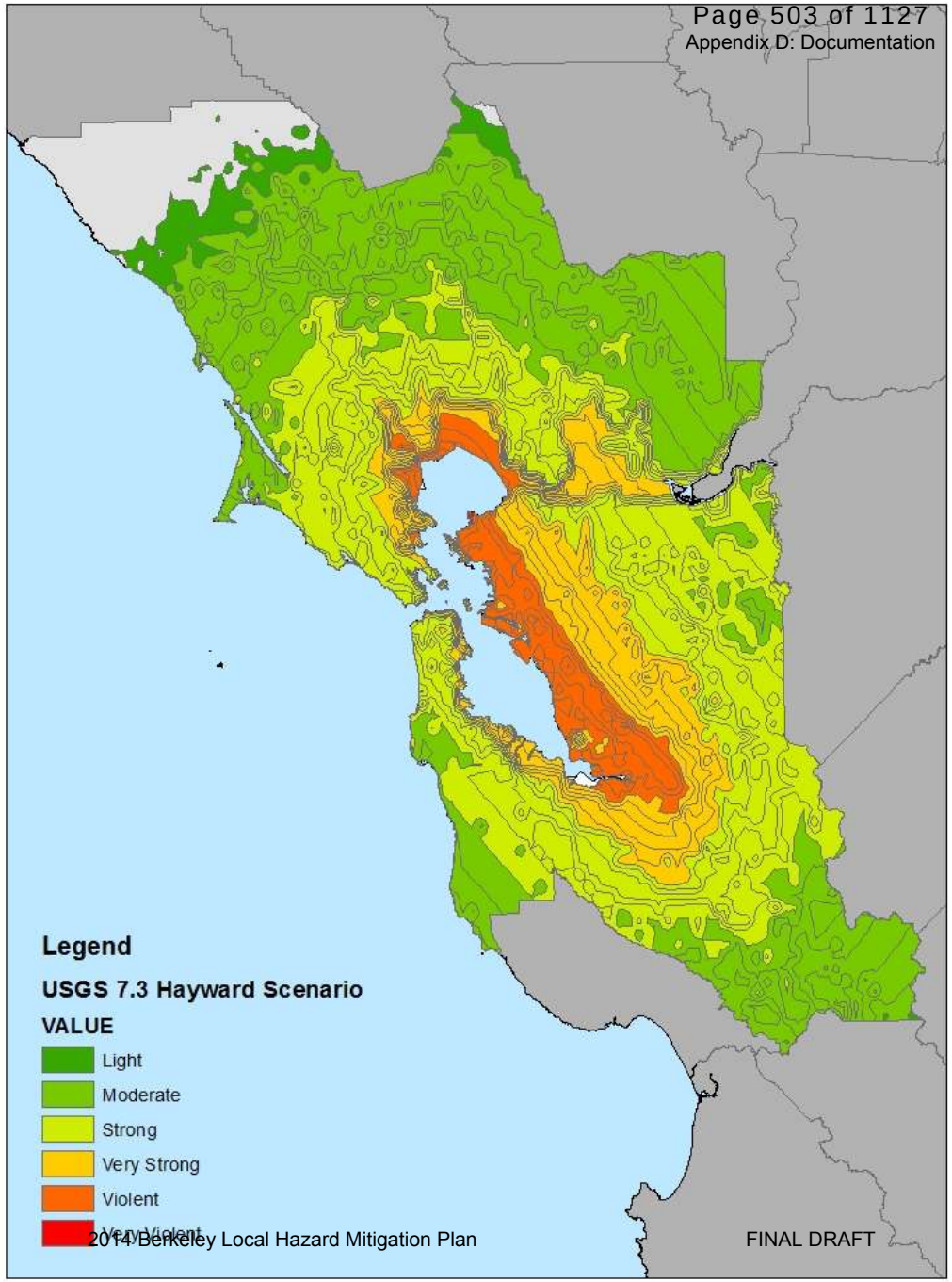
Hazard Analysis Summary

Hazard	Likelihood	Severity
Earthquake	**Likely**	**Catastrophic**
Wildland-Urban Interface Fire	**Likely**	**Catastrophic**
Rainfall-Triggered Landslide	Likely	Moderate
Flood	Likely	Minor
Tsunami	Possible	Unknown
Climate Change	Likely	Unknown

Hazards of Greatest Concern

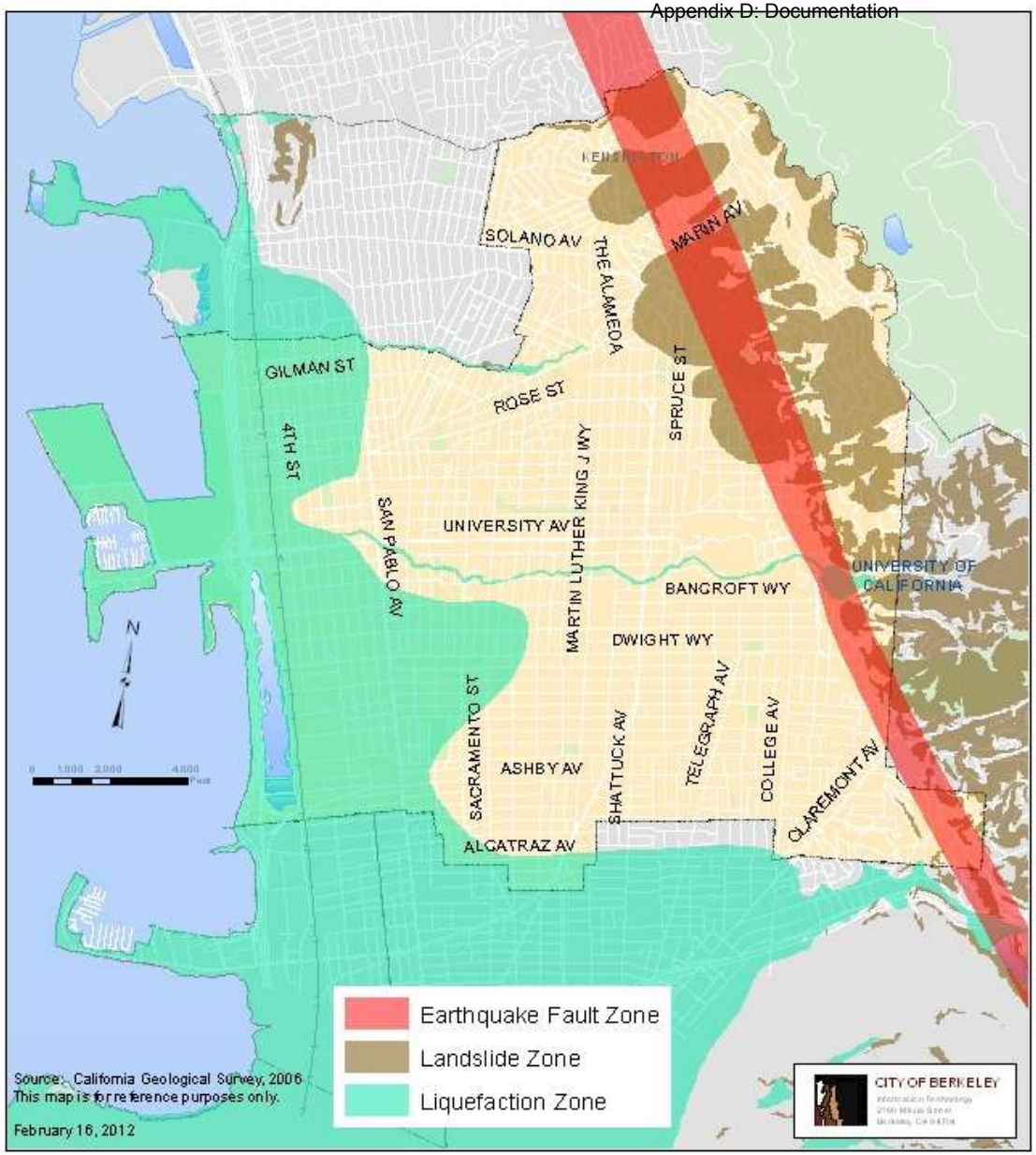
EARTHQUAKE





Shakemap

7.3 Hayward Fault Earthquake Scenario


SOLANO AV
THE ALAMEDA
MARIN AV
GILMAN ST
ROSE ST
SPRUCE ST
4TH ST
MARTIN LUTHER KING J WY
SAN PABLO AV
UNIVERSITY AV
UNIVERSITY OF CALIFORNIA
BANCROFT WY
DWIGHT WY
SACRAMENTO ST
ASHBY AV
SHATTUCK AV
TELEGRAPH AV
COLLEGE AV
CLAREMONT AV
ALGATRAZ AV
N
Earthquake Fault Zone
Landslide Zone
Liquefaction Zone
Source: California Geological Survey, 2006
This map is for reference purposes only.
February 16, 2012
CITY OF BERKELEY

1989 Loma Prieta Earthquake

- Video

City-Owned Buildings

A. Building Assessment

B. Strengthen and Replace City Buildings

Privately-Owned Structures

- Soft-Story
- Unreinforced Masonry

C. Soft-Story

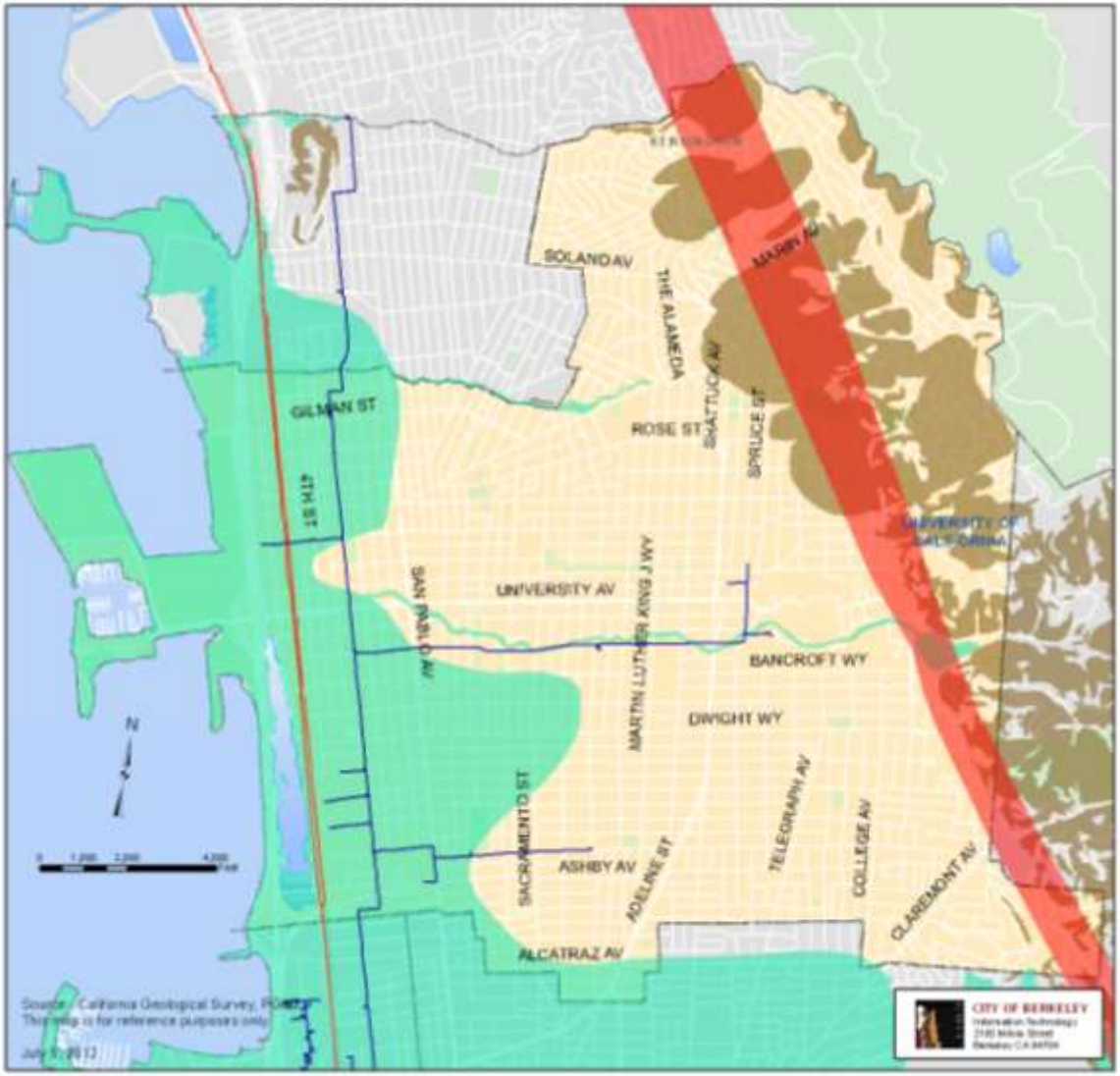
D. URM

E. Buildings

V. Streamline Rebuild

http://www.sfgate.com/news/article/S-F-soft-story-buildings-at-risk-in-quake-3180896.php

E.V. Leyendecker, U.S. Geological Survey



Gases

G: Natural Gas Safety

Partners:
PG&E,
Kinder Morgan,
California Public Utilities Commission

Electricity

- More than 60% of Berkeley households will be without electricity for days to a week

http://www.wisegeek.com/what-are-solar-roof-panels.htm

F: Energy Assurance

Partners: PG&E, California Energy Commission

http://www.best-tractor.com/china/diesel-generator.html

Water System

- In a catastrophic earthquake, water service is likely to stop functioning in 70% of Berkeley homes

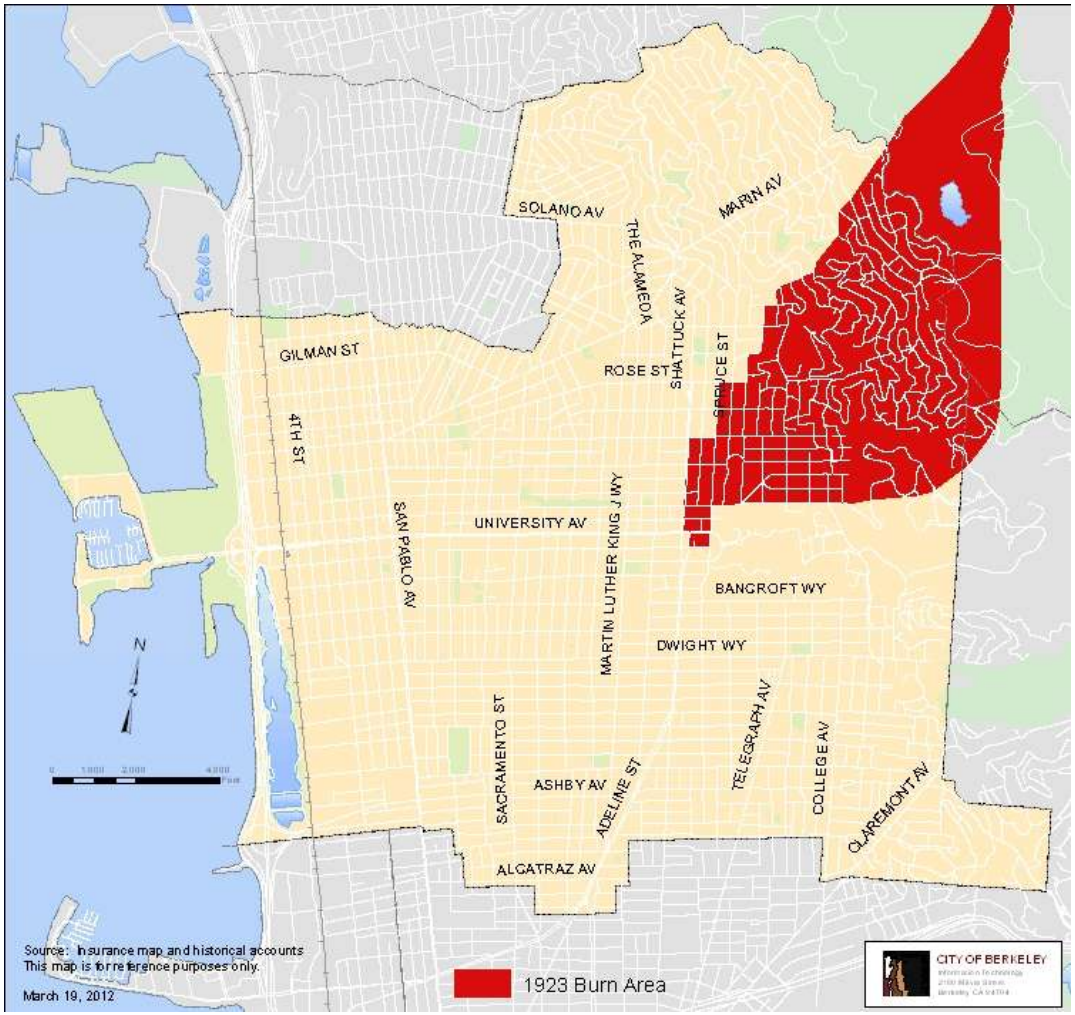
H: East Bay Municipal Utility District

Photo via dart2.arc.nasa.gov

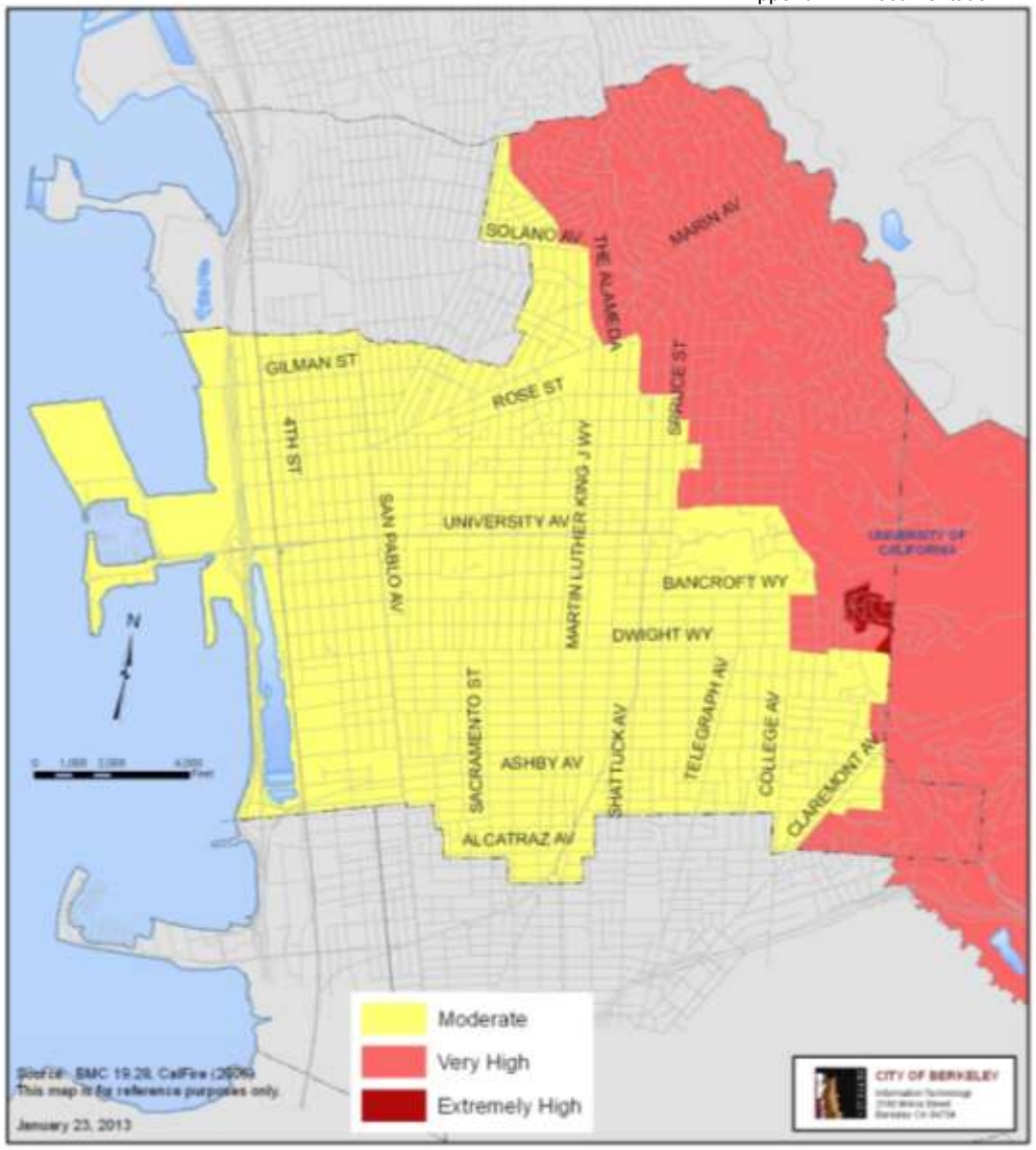
Hazards of Greatest Concern

WILDLAND-URBAN INTERFACE FIRE (WUI FIRE)

1991 TUNNEL FIRE



1923 Berkeley Fire Map



Planning Map

(not a scenario)

WUI Fire Hazard

K. Fire Code

L. Vegetation Management

Foot Paths for Evacuation

Path Name	Path	Streets
Acacia Walk	0.1 miles	0.4 miles
Glendale Path	0.2 miles	0.6 miles
Upper Covert Path	< 0.1 miles	0.5 miles
Wilson Walk	< 0.03 miles	0.4 miles

Colleen Neff, http://www.berkeleypaths.org/JAlbumPathPhotos/index.html

M. Hills Evacuation

Hazards of Concern

FLOODS

Creek Flooding Map

100- and 500-year Flood scenarios

N. National Flood Insurance Program

O. HazMat Floods

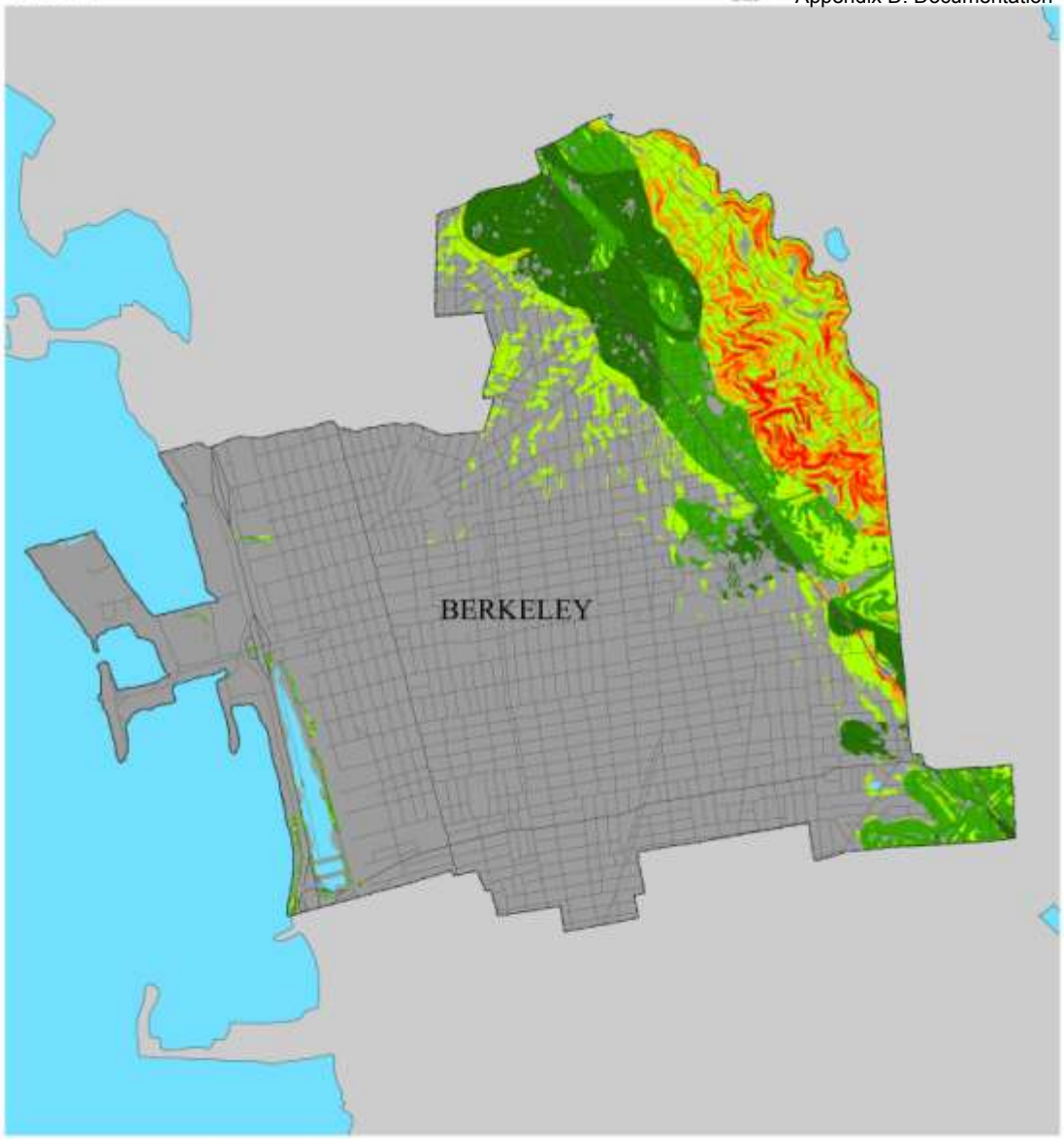
Flooding Vulnerabilities

- Storm Drain Overflow

I. Stormwater System

Hazards of Concern

LANDSLIDE



Landslide Map

7.1 Hayward Fault Earthquake Scenario

E. Buildings

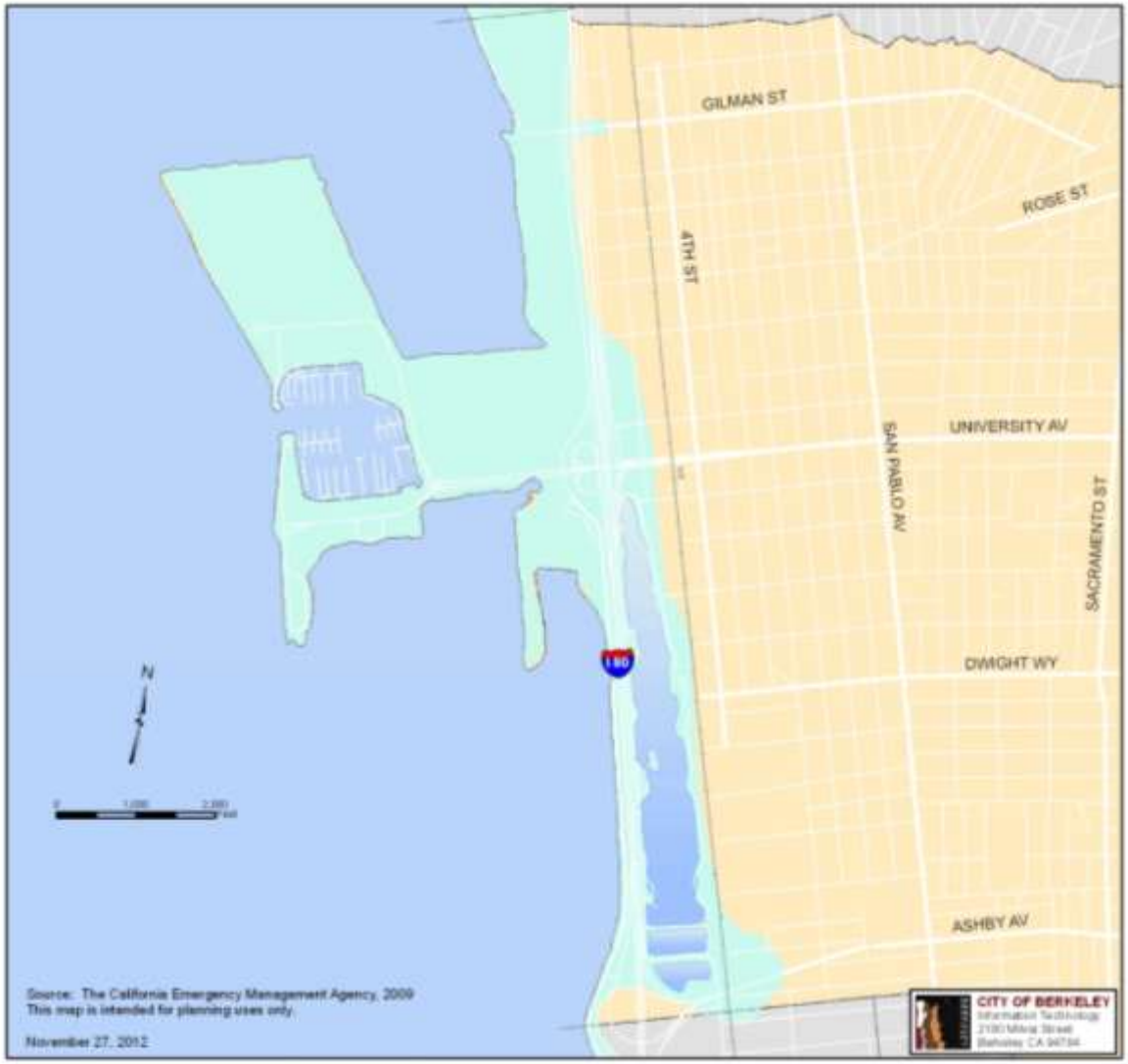
G. Gas Safety

I. Stormwater System

Steven Winter, http://www.berkeleyside.com/2011/03/11/tsunami-makes-it-to-bay-area-photographed-in-emeryville/

Hazards of Concern

TSUNAMI



Planning Map

(not a scenario)

Tsunami Inundation Hazard

W: Tsunami

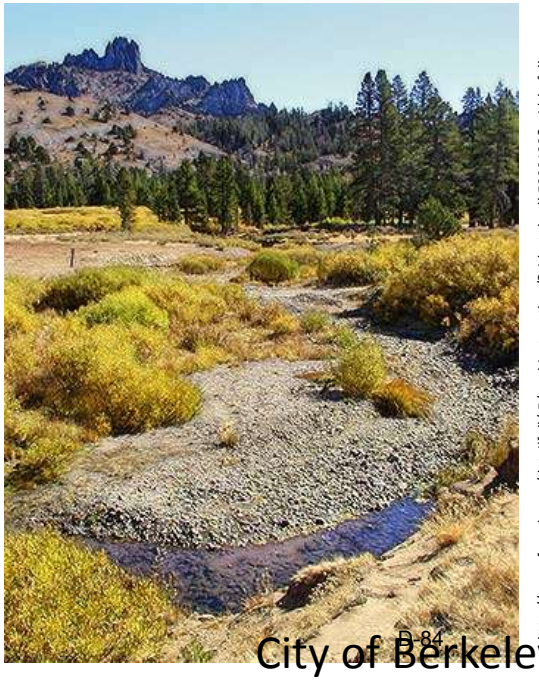
Hazards of Concern

CLIMATE CHANGE

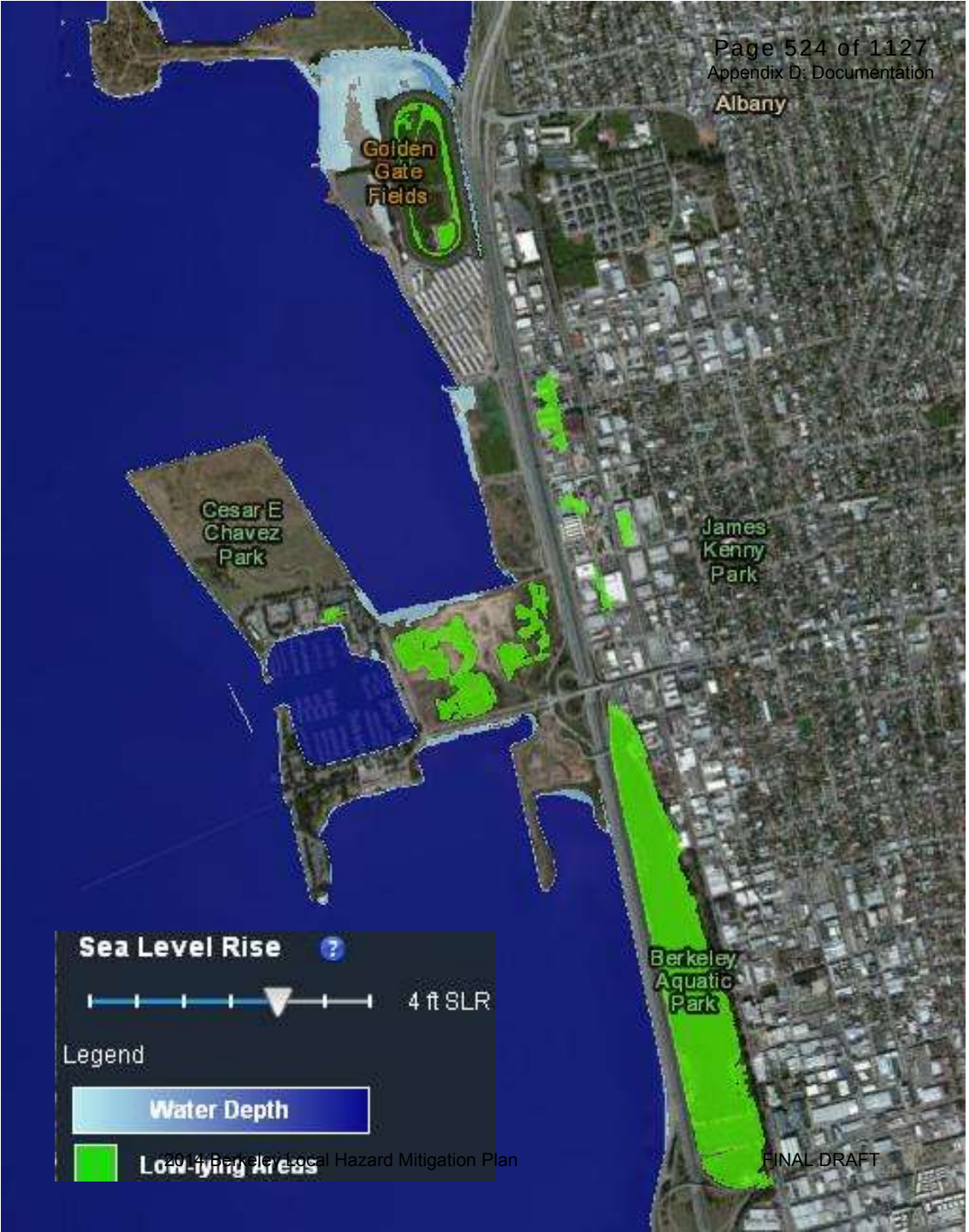
Cheng (Lily) Lee , http://www.sciencedaily.com/releases/2012/06/120606132308.htm

Climate Change Vulnerabilities

- Q: Climate Change Integration
  - Temperature Increases/ Heat Waves
    R: Extreme Heat
  - Drought/Reduced Water Security
    U: Water Security



http://www.fs.usda.gov/detailfull/r5/workingtogether/?cid=stelprdb5390138&width=full



Sea-Level Rise Planning Map

48” Sea-Level Rise

T: Sea-Level Rise

S: Severe Storms

Feedback Activity: Action Impact and Coordination

- Positive impact
- Conflict
- Partnership opportunity
  - City Actions
  - Your agency's Actions (Partnership Wall)

Next Steps/Key Dates

- Now: Incorporate key intuitional partner feedback
- **Public Review: October 21 – December 9**
  - Disaster and Fire Safety Commission (Oct 23 and Dec 4)
  - Planning Commission (Nov 20)
- Consultation with Cal OES and FEMA
- Adoption by City Council: Spring 2014 (est)

Thank you!

Questions, comments, concerns:

Sarah Lana

Mitigation Plan Manager

Slana@CityofBerkeley.info

(510) 981-5576

Action	Action supports agency/ Partnership Opportunity	Agency	Name	Commenter Notes
A. Building Assessment	Supportive	Association of Bay Area Governments	Arrietta Chakos	Hope to align the City of Berkeley's approach with regional efforts -- building a "best practice" method to share with other cities
B. Strengthen and Replace City Buildings	Supportive	UC Berkeley	Mike Sabel	Off-Campus buildings in proximity to City-owned buildings need to be aware of vulnerable buildings
C. Soft-Story	Supportive	Association of Bay Area Governments	Dana Brechwald	Model/guidance for other Bay Area jurisdictions
D. URM	Supportive	Alameda County Sheriff's Office	Joe Gomez	Your program to mitigate building collapses impacts our Op Area search and rescue efforts county-wide
E. Buildings	n/a	n/a	n/a	n/a
F. Energy Assurance	Supportive	Association of Bay Area Governments	Arrietta Chakos	
F. Energy Assurance	Supportive	Lifelong Medical	Jacquelin Poon	
F. Energy Assurance	Supportive	Pacific Gas & Electric	Gina Blus	
F. Energy Assurance	Supportive	Sutter Health	Elizabeth Smith	
G. Gas safety	Supportive	Alameda County Sheriff's Office	Joe Gomez	Your pre-planning and identification of gas lines; collaboration with PG&E should eliminate delays in responding utilities and preventing fires
G. Gas safety	Supportive	California Energy Commission	David Michel	

Action	Action supports agency/ Partnership Opportunity	Agency	Name	Commenter Notes
G. Gas safety	Supportive	City of Albany	Lance Calkins	Information-sharing; Gas lines run through Albany
G. Gas safety	Supportive	City of Emeryville	Lori Elefant	
G. Gas safety	Supportive	Kinder Morgan Corporation	Clay Westlake	
G. Gas safety	Supportive	Lifelong Medical	Jacquelin Poon	2 of our clinics are located in area where gas lines are (6th Street Area)
G. Gas safety	Supportive	Pacific Gas & Electric	Gina Blus	Hopefully you've been engaged/participated in PG&E's First Responder workshops?
G. Gas safety	Supportive	Pacific Gas & Electric	Katie Grote	
G. Gas safety	Supportive	UC Berkeley	Daryl Shy	Shutoffs for the campus if campus workers are over-tasked
G. Gas safety	Supportive	UC Berkeley	Mike Sabel	
H. EBMUD	Supportive	Alameda County Sheriff's Office	Joe Gomez	Your ability to mitigate and quickly respond to/restore utilities via pre-planning is a positive impact on the Op Area recovery process
H. EBMUD	Partnership	East Bay Municipal Utility District	Jose Rios	Add other cities to work with EBMUD on projects concurrently; add fire department as an internal partner -- consider doing research to document the areas that need water the most for firefighting
H. EBMUD	Supportive	Kinder Morgan Corporation	Clay Westlake	

Action	Action supports agency/ Partnership Opportunity	Agency	Name	Commenter Notes
I. Stormwater System	Supportive	East Bay Municipal Utility District	Jose Rios	Positive impact but not something EBMUD can do. A City issue that does impact EBMUD.
I. Stormwater System	Partnership	Ecology Center	Amy Kiser	The Ecology Center is interested in doing outreach, training, demonstrations on how residents in areas with storm drain limitations can aid in enhancing infiltration vial landscape choices and possibly curb cuts.
I. Stormwater System	Supportive	UC Berkeley	Mike Sabel	
J. Partnerships	Supportive	Alameda County Fire Department	Nick Zubel	Volunteers; public awareness
J. Partnerships	Partnership	Alameda County Sheriff's Office	Joe Gomez	Utilities, water and food, fires, search and rescue, mass causalities, and care/shelter are problems that the Alameda County Office of Emergency Services would be able to assist your City once you have exhausted your resources.
J. Partnerships	Partnership	Association of Bay Area Governments	Arrietta Chakos	Integrate with ABAG's resilience initiative
J. Partnerships	Partnership	Association of Bay Area Governments	Dana Brechwald	Work with ABAG to develop effective HMP process to use region-wide

Action	Action supports agency/ Partnership Opportunity	Agency	Name	Commenter Notes
J. Partnerships	Supportive	Bay Area Joint Policy Committee	Bruce Riordan	Links to 9 counties 101 Cities plus State agencies
J. Partnerships	Supportive	Bay Conservation Development Commission	Sara Polgar	
J. Partnerships	Supportive	Berkeley Path Wanderers Association	Keith Skinner	BPWA can help community groups plan escape routes and lead walks to learn those routes. Also need to partner with LBL, EBRPD, UC, City of Oakland, Contra Costa Co., Richmond, El Cerrito, etc.
J. Partnerships	Supportive	City of Albany	Lance Calkins	Information-sharing; mutual aid response training
J. Partnerships	Supportive	East Bay Regional Park District	Ken Blonski	Participate in the Hills Emergency Forum
J. Partnerships	Partnership	Ecology Center	Amy Kiser	Ecology Center has significant outreach capacity for promoting preferred practices to residents. We also specialize in demonstrating and educating residents via free and low-cost workshops. Areas of interest = climate hazards, water conservation, food and farming, waste.
J. Partnerships	Supportive	Lawrence Berkeley Lab	Sara Wynne	

Action	Action supports agency/ Partnership Opportunity	Agency	Name	Commenter Notes
J. Partnerships	Partnership	Lawrence Berkeley Lab	Sara Wynne	Berkeley, UCB and LBNL working together on evacuation planning
J. Partnerships	Supportive	Lifelong Medical	Jacquelin Poon	
J. Partnerships	Partnership	Lifelong Medical	Jacquelin Poon	Lifelong Medical Care More information and guidance/aide in 1) Energy assurance for our 4 healthcare facilities in Berkeley 2) Gas safety -- our 2 main clinics close to the gas line 3) Sharing hazards information to coordinate with our own disaster priorities
J. Partnerships	Partnership	Sutter Health	Elizabeth Smith	Alta Bates hospitals -- Herrick 1) Drill with partners 2) Learn more about reliable utilities 3) Community outreach
K. Fire Code	Supportive	East Bay Regional Park District	Ken Blonski	Participate in the Hills Emergency Forum

Action	Action supports agency/ Partnership Opportunity	Agency	Name	Commenter Notes
K. Fire Code	Supportive	Ecology Center	Amy Kiser	Ecology Center fielded many calls from the public re: recent FEMA fire mitigation plan in Berkeley hills. We functioned as a switchboard or hub, connecting residents with resources, referrals, and links to experts on native plants, bird habitat, herbicides, etc. while stressing importance of fire mitigation.
K. Fire Code	Supportive	UC Berkeley	Daryl Shy	
K. Fire Code	Supportive	UC Berkeley	John Ruiz	
L. Vegetation Management	Supportive	City of Oakland	Genevieve Pastor-Cohen	
L. Vegetation Management	Supportive	East Bay Regional Park District	Ken Blonski	Participate in the Hills Emergency Forum
L. Vegetation Management	Supportive	Lawrence Berkeley Lab	Sara Wynne	
L. Vegetation Management	Partnership	Pacific Gas & Electric	Gina Blus	PG&E may be able to help/share info about veg management -- we actively trim trees to reduce risk of fires, etc. from power lines.
L. Vegetation Management	Supportive	Pacific Gas & Electric	Katie Grote	
L. Vegetation Management	Supportive	UC Berkeley	Daryl Shy	Continue to work with surrounding areas
L. Vegetation Management	Supportive	UC Berkeley	John Ruiz	
M. Hills Evacuation	Supportive	Berkeley Path Wanderers Association	Charlie Bowen	Path building

Action	Action supports agency/ Partnership Opportunity	Agency	Name	Commenter Notes
M. Hills Evacuation	Supportive	Berkeley Path Wanderers Association	Keith Skinner	We can help with raising path awareness. Retain funding for path maintenance. Retain path support.
M. Hills Evacuation	Supportive	City of Oakland	Genevieve Pastor-Cohen	
M. Hills Evacuation	Supportive	Kinder Morgan Corporation	Clay Westlake	
M. Hills Evacuation	Supportive	Lawrence Berkeley Lab	Sara Wynne	
M. Hills Evacuation	Supportive	UC Berkeley	John Ruiz	
N. NFIP	Supportive	Bay Area Joint Policy Committee	Bruce Riordan	Critical piece of the puzzle-- insurance generally
O. HazMat Floods	n/a	n/a	n/a	n/a
P. Hazard Information	Supportive	Alameda County Fire Department	Nick Zubel	
P. Hazard Information	Supportive	Association of Bay Area Governments	Dana Brechwald	
P. Hazard Information	Supportive	California Energy Commission	David Michel	
P. Hazard Information	Supportive	City of Albany	Lance Calkins	
P. Hazard Information	Supportive	City of Emeryville	Lori Elefant	
P. Hazard Information	Supportive	City of Oakland	Genevieve Pastor-Cohen	
P. Hazard Information	Supportive	Pacific Gas & Electric	Gina Blus	

Action	Action supports agency/ Partnership Opportunity	Agency	Name	Commenter Notes
Q. Climate Change Integration	Supportive	Association of Bay Area Governments	Arrietta Chakos	Perfect link!
Q. Climate Change Integration	Supportive	Bay Area Joint Policy Committee	Bruce Riordan	
Q. Climate Change Integration	Supportive	Bay Conservation Development Commission	Sara Polgar	
Q. Climate Change Integration	Supportive	California Energy Commission	David Michel	Include extreme wind too!
Q. Climate Change Integration	Supportive	Ecology Center	Amy Kiser	Work with partners to reduce barriers to climate adaptation practices (e.g., urban agriculture or community garden processes, codes)
R. Extreme Heat	Partnership	Ecology Center	Amy Kiser	Ecology center could do community outreach to encourage residents to participate in street trees. Or could enhance program with other nonprofit partners.
R. Extreme Heat	Partnership	Pacific Gas & Electric	Katie Grote	
S. Severe Storms	n/a	n/a	n/a	n/a

Action	Action supports agency/ Partnership Opportunity	Agency	Name	Commenter Notes
T. Sea-Level Rise	Supportive	Bay Conservation Development Commission	Sara Polgar	BCDC's role: Providing support to City planning efforts. Consider linkages between SLR and storms. Not just for SLR… Consider differential needs of vulnerable populations (e.g., medically-dependent renters, very young/old, pet owners in mitigation and response)
U. Water Security	Supportive	East Bay Municipal Utility District	Jose Rios	
U. Water Security	Supportive	Ecology Center	Amy Kiser	Ecology Center continues to conduct graywater, rainwater catchment, and "berm and swale" landscaping workshops.
U. Water Security	Partnership	Ecology Center	Amy Kiser	Ecology Center is very interested in demonstrating waterless urinals and cistern at our demonstration site, and doing community outreach and education around these options/technologies.
U. Water Security	Supportive	Sutter Health	Elizabeth Smith	
V. Streamline Rebuild	Supportive	Association of Bay Area Governments	Dana Brechwald	Develop model appreciable for other Bay Area jurisdictions
W. Tsunami	n/a	n/a	n/a	n/a

Department of Fire and Emergency Services

Agenda
For the Regular Meeting of the
Disaster and Fire Safety Commission

DATE: Wednesday, September 28, 2011
TIME: 7:00 PM
PLACE: Fire Department Training Facility - 997 Cedar Street

I. Call to Order.

II. Public Comment on Items Not on Agenda.

III. Approval of Draft Minutes of Meeting of August 3, 2011.

IV. Fire Department and Office of Emergency Services Staff Report including discussion of Measure GG with the City Manager.

V. Overview of Local Hazard Mitigation Planning Concepts and the Current Process to Update the City of Berkeley's Disaster Mitigation Plan

VI. Report of Measure GG Subcommittee on Measure GG Expenditures and Budget. (Commissioners Mitchell & Goldstein)

VII. Proposal for a Discount on Permit Fees for Residential Automatic Gas-Shutoff Valve Installations.

VIII. Discussion of and Ideas for Future Agenda Topics.

IX. Adjourn.

(*Material attached for Commissioners for this month's meeting)

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.

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 981-6346(v) or 981-7075(TDD) at least three business days before the meeting date.
Please refrain from wearing scented products to this meeting.

Local Hazard Mitigation Plan Update

Disaster and Fire Safety Commission

September 28, 2011

Agenda

- Define hazard mitigation
- Describe hazard mitigation planning
- Explain the City of Berkeley's process to update its local hazard mitigation plan
  - Disaster and Fire Safety Commission role

Hazard Mitigation

Hazards in Berkeley

- Earthquake
- Wildfire
- Flood
- Landslide
- Tsunami
- Climate change
- … and many more

Two Ways to Deal With Hazards

- Increase emergency *response* capability
- Increase actions taken to *reduce or eliminate the impacts* of future incidents

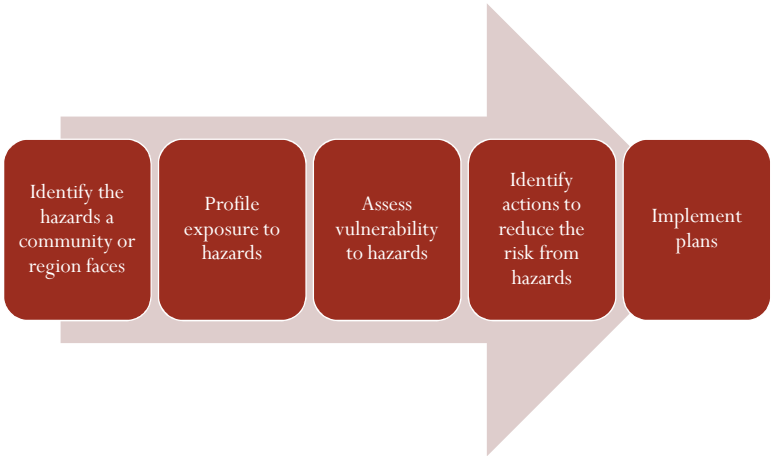
What Is Mitigation?

- Any 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

What is a Hazard Mitigation Plan?

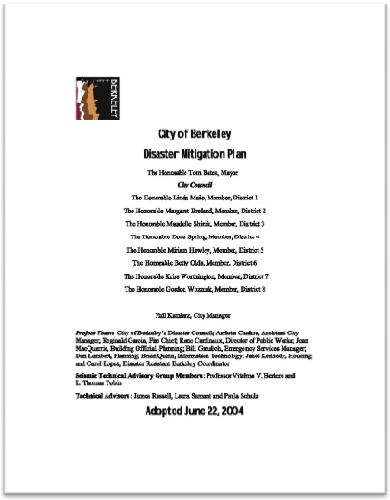


Financial Incentives for Plan Development

- FEMA grant funding is available to local governments with approved mitigation plans
  - Both pre- and post-disaster grant funding is available
- Eliminates the 6.25% local match requirement for the City of Berkeley to receive post-disaster public assistance from FEMA

Mitigation Plan Update Process

City of Berkeley Mitigation Plan


City of Berkeley
Disaster Mitigation Plan
The Honorable Tom Bates, Mayor
City Council
Adopted June 22, 2004

- Approved and adopted 2004
- Preliminary updates in 2008
- Update must demonstrate progress since last plan
  - Comprehensive review and update of each section

2011 Plan Update Review Process

- Core Project Team: ABAG Consultant, Project Leaders and Department Leaders

1. Review and update Plan
   - Seek input from key partners/stakeholders and the public
   - Seek input from DFSC on Final Draft Plan (est. July 2012)
2. Submit plan to Cal EMA/FEMA for review, comment and preliminary approval
3. Adoption by City Council
4. Final FEMA approval

Key Partners

- Neighboring jurisdictions
- Alameda County
- Regional transit/utility agencies
- Berkeley educational institutions
- Other private/nonprofit entities

Public Participation Plan

- Two public comment periods
- Notification via news articles, newsletters, website and library posting
- Engage public in-person and online
  - Post draft content on City website
  - Solicit feedback via public survey
  - Get in-person input from the public at Disaster and Fire Safety Commission meetings

Public Participation Plan

- Public Comment Period 1: Hazard and Vulnerability Analysis
  - Mid-November – mid-December, 2011
  - Notification, draft content online, public survey
  - Presentation to Disaster and Fire Safety Commission Meeting (December 7)
    - Request finalized DFSC feedback by January Commission meeting

Public Participation Plan

- Public Comment Period 2: Mitigation Actions and Priorities
  - Mid-April – mid-May, 2012
  - Notification, draft content online, public survey
  - Community interactive workshop at Disaster and Fire Safety Commission Meeting (April 25, 2012)
    - Request finalized DFSC feedback by May Commission meeting

Thank you!

2007 State Legislation

- AB 2140 (Hancock, 2007)
- Post-disaster Public Assistance
  - FEMA pays 75%, State pays up to 25%
- Allows for increased State share of post-disaster public assistance
  - May increase state share from 18.75% to 25%
  - Reduce local share from 6.25% to zero
- Requires adoption of LHMP into safety element of general plan
  - By reference or incorporation

Department of Fire and Emergency Services

Agenda
For the Regular Meeting of the Disaster and Fire Safety Commission

DATE: Wednesday, January 25, 2012
TIME: 7:00 PM
PLACE: Fire Department Training Facility - 997 Cedar Street

I. Call to Order.

II. Public Comment on Items Not on Agenda.

III. Approval of Draft Minutes of Meeting of December 7, 2011.*

IV. Fire Department and Office of Emergency Services Staff Report (Including Measure GG Budget Update)

V. Local Hazard Mitigation Plan Update Process: Update on process for public outreach, plan adoption and the role of the Disaster and Fire Safety Commission

VI. Report from the Measure GG Subcommittee (Commissioner Mitchell)

VII. Discussion of Commission Representative to Speak at the City Council Meeting Regarding Measure GG Expenditures (Commissioner Mitchell)

VIII. Discussion of Propriety of EOC Enhancements as a Measure GG Expenditure (Commissioner Zummo)

IX. Proposal for Waiting Lists or Similar Procedures for Community Emergency Response Team (CERT) Classes. (Commissioner Goldstein)

X. Revisiting the Proposal for Establishing a Subcommittee on OES Community Activities/Training Programs Oversight. (Commissioner Goldstein)

Local Hazard Mitigation Plan Update

Disaster and Fire Safety Commission

January 25, 2012

Agenda

- What is Mitigation?
- City of Berkeley Mitigation Plan
- Plan update process
  - Public engagement
  - Commission engagement
    - All Commissions
    - Planning Commission
    - Disaster and Fire Safety Commission

What is Mitigation?

- Two Ways to Deal With Hazards
  a. Increase emergency *response* capability
  b. Increase actions taken to *reduce or eliminate the impacts* of future incidents

What Is Mitigation?

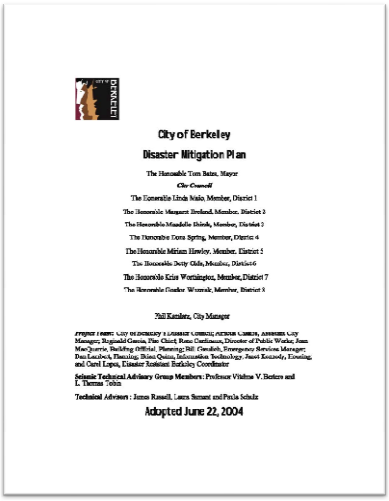
- Any sustained actions
  - To **reduce or eliminate long-term risks** to people and property from hazards and their effects
  - That provide **passive protection** at the time of disaster impact

Source: FEMA's Hazard Mitigation Grant Program Desk Reference (1999, p. 1-1)

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

City of Berkeley Mitigation Plan



City of Berkeley

Disaster Mitigation Plan

The Honorable Tom Bates, Mayor

City Council

The Honorable Linda Maio, Member, District 1

The Honorable Margaret Breland, Member, District 2

The Honorable Mandelle Shirek, Member, District 3

The Honorable Dona Spring, Member, District 4

The Honorable Miriam Hawley, Member, District 5

The Honorable Betty Olds, Member, District 6

The Honorable Kriss Worthington, Member, District 7

The Honorable Gordon Wozniak, Member, District 8

Phil Kamlarz, City Manager

Adopted June 22, 2004

- Financial incentives for Mitigation Plan development (pre-and post-event)
- Appendix to City's General Plan
- Approved and adopted 2004
- Update in process since fall 2011

Public Engagement

Phase	**Document Posted** Public Engagement Goals

Phase 1: March	**Hazard and Vulnerability Analysis Update**
	• Educate the community about Berkeley's exposure and vulnerabilities to hazards (including any updates since 2004)
	• Solicit public feedback on:
	  • Reaction to Hazard Analysis
	  • General hazard awareness
	  • Mitigation steps taken

Phase 2: Mid-May	**Complete Draft Plan Update** • Share updates to 2004 mitigation actions and priorities • Solicit public feedback on reaction to mitigation actions and prioritization

Commission Engagement Goals

- All Commissions
  - Publicize public engagement opportunities to community members *(ongoing)*
  - As requested, review of specific Commission-relevant content in Draft Plan Update *(est. May-June)*

Commission Engagement Goals

- Planning Commission
  - Must recommend approval of the final Plan Update because LHMP will be an Appendix to the City's General Plan
  - Estimated Commission presentation dates/topics
    - February: Project, Process, Role of Planning Commission
    - March: Hazard Analysis Updates
    - June: Plan Update Process and Results
    - July: Recommend Approval of Final Plan Update

Commission Engagement Goals

- Disaster and Fire Safety Commission
  - Closely monitors the City's preparedness and mitigation efforts
  - Recommend Approval of Final Plan Update to City Council
  - Estimated Commission presentation dates/topics
    - January: Update on public outreach, adoption process and role of the Disaster and Fire Safety Commission
    - March: Updates to Hazard Analysis
    - May: Updates to Mitigation Actions and Priorities
    - June: Final Plan Update/Recommend Approval of Final Plan Update

AGENDA

REGULAR MEETING OF THE PLANNING COMMISSION

This meeting is held in a wheelchair accessible location.

(PDF of the entire packet)

February 15, 2012
7:00 PM
City Council Chambers,
2134 Martin Luther King Jr. Way
Old City Hall

See "MEETING PROCEDURES" below.

All written materials identified on this agenda are available on the Planning Commission webpage: *http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=13072*

PRELIMINARY MATTERS:

1. Roll Call.
2. *Order of Agenda*: The Commission may rearrange the agenda or place additional agendized items on the Consent Calendar.
***3. Public Comment*:** Comments on subjects not included on the agenda. Speakers may comment on agenda items when the Commission hears those items. *See "Public Testimony Guidelines" below.*
***4. Planning Staff Report and Future Agenda Items*:** In addition to the items below, additional matters may be reported at the meeting.
***5. Chairperson's Report*:** Report by Planning Commission Chair.
***6. Committee Reports*:** Reports by Commission committees or liaisons. In addition to the items below, additional matters may be reported at the meeting.
7. *Approval of Minutes: January 18, 2012* (attached).
8. Other Planning-Related Events (none)***.***

CONSENT Calendar items: *See "Consent Calendar Guidelines" below.*
None.

Agenda Items: *All agenda items are for discussion and possible action. Public Hearing items require hearing prior to Commission action.*

9.	**Presentation:**	**Local Hazard Mitigation Plan Update**
	Recommendation:	Consider information provided in presentation and provide feedback.
	Written Materials:	None.
	Web Information:	None.

Continued From: None.

10. Discussion/Action: Downtown Berkeley Design Guidelines

Recommendation: Consider the Downtown Berkeley Design Guidelines (2012). Either recommend changes, or adopt the guidelines as presented.

Written Materials: Attached

Web Information: None.

Continued From: None.

11. Action: **Election of officers for 2012**

Recommendation: Conduct election of Chair and Vice-Chair for a one-year term beginning in March 2012.

Written Materials: None.

Web Information: None.

Continued From: None.

ADDITIONAL AGENDA ITEMS: In compliance with Brown Act regulations, no action may be taken on these items. However, discussion may occur at this meeting upon Commissioner request.

INFORMATION REPORTS:

12. Revised Green Pathway Chapter.

COMMUNICATIONS IN PACKET:

- Liz Menkes, Director, Northern California Operations Center for Municipal Solutions: Flyer Invitation to Complimentary Workshop: Cell Towers-- Preventing Litigation by Understanding the Issues
- Avram Gur Arye: Downtown Design Guidelines

- AC Transit: East Bay Bus Rapid Transit (BRT) Final Environmental Impact Report/Statement available for review and comment: http://www.actransit.org/planning-focus/east-bay-bus-rapid-transit/

LATE COMMUNICATIONS (RECEIVED AFTER DEADLINE BUT BEFORE MEETING):

- John English: Downtown Berkeley Design Guidelines – Comments
- Commissioner Poschman: Green Pathway RFD
- Commissioner Poschman: Green Pathway Lines 93-96 – Different from Motion

LATE COMMUNICATIONS (RECEIVED AT MEETING):

- Commissioner Novosel: Downtown Berkeley Design Guidelines - Additional wording for bay windows and other projections.
- Steve Finacom: Downtown Berkeley Design Guidelines - Suggested addition to page 6-6 regarding signs on taller buildings.
- Staff Sarah Tyler (BFD): Local Hazard Mitigation Plan Update - PowerPoint presentation.

ADJOURNMENT

Meeting Procedures

Public Testimony Guidelines:

Speakers are customarily allotted up to three minutes each. The Commission Chair may limit the number of speakers and the length of time allowed to each speaker to ensure adequate time for all items on the Agenda. **To speak during Public Comment or during a Public Hearing, please line up behind the microphone.** Customarily speakers are asked to address agenda items when the items are before the Commission rather than during the general public comment period. Speakers are encouraged to submit comments in writing. See “Procedures for correspondence to the Commissioners” below.

Consent Calendar Guidelines:

The Consent Calendar allows the Commission to take action with no discussion on projects to which no one objects. The Commission may place items on the Consent Calendar if no one present wishes to testify on an item. Anyone present who wishes to speak on an item should submit a speaker card prior to the start of the meeting, or raise his or her hand and advise the Chairperson and the item will be pulled from the consent calendar for public comment and discussion prior to action.

Procedures for correspondence to the Commissioners:

- To distribute correspondence to Commissioners prior to the meeting date, submit comments by 12:00 noon, eight (8) days before the meeting day (Tuesday). Email is preferred.
- If correspondence is more than twenty (20) pages, requires printing of color pages, or includes pages larger than 8.5x11 inches, please provide 15 copies.
- Any correspondence received after this deadline will be given to Commissioners on the meeting date just prior to the meeting.
- Staff will not deliver to Commissioners any additional written (or email) materials received after 12:00 noon on the day of the meeting.
- Members of the public may submit written comments themselves early in the meeting. To distribute correspondence at the meeting, please provide 15 copies and submit to the Planning Commission Secretary just before or at the beginning of the meeting.

- Written comments should be directed to the Planning Commission Secretary at the Land Use Planning Division (Attn: Planning Commission Secretary).

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Written material may be viewed in advance of the meeting at the Planning and Development Department, 2118 Milvia Street, First Floor, during working hours, or at the Main Branch Library, Shattuck/Kittredge Streets, during regular library hours at the Reference Desk.

Accommodations Provided Upon Request. To request a disability-related accommodation(s) to participate in the meeting, including auxiliary aids or services, please contact the Disability Services Specialist at 981-6342(V), or 981-7075 (TDD), and/or Commission Secretary at least three business days before the meeting date. Five (5) business days are needed to request a sign language or oral interpreter.

Note: If you object to a project or to any City action or procedure relating to the project application, any lawsuit which you may later file may be limited to those issues raised by you or someone else in the public hearing on the project, or in written communication delivered at or prior to the public hearing. The time limit within which to commence any lawsuit or legal challenge related to these applications is governed by Section 1094.6 of the Code of Civil Procedure, unless a shorter limitations period is specified by any other provision. Under Section 1094.6, any lawsuit or legal challenge to any quasi−adjudicative decision made by the City must be filed no later than the 90th day following the date on which such decision becomes final. Any lawsuit or legal challenge, which is not filed within that 90−day period, will be barred.

Please refrain from wearing scented products to public m

Local Hazard Mitigation Plan Update

Planning Commission

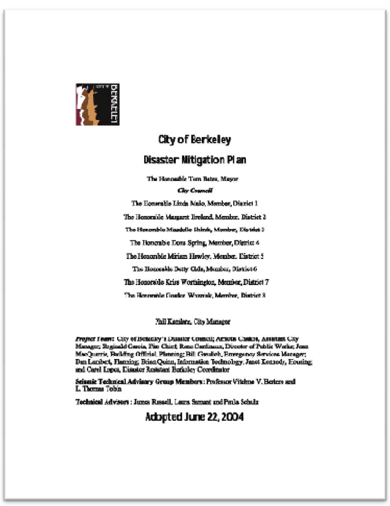
February 15, 2012

Agenda

- Overview
- Hazard Mitigation
- Hazard Mitigation Plan Update
  - Initial Plan Development Process
  - 2102 Plan Update Process
  - Planning Commission Engagement
  - Plan Update Approval Process

Overview

City of Berkeley Disaster Mitigation Plan



City of Berkeley
Disaster Mitigation Plan
The Honorable Tom Bates, Mayor
City Council
The Honorable Linda Maio, Member, District 1
The Honorable Dona Spring, Member, District 4
The Honorable Miriam Hawley, Member, District 5
The Honorable Betty Olds, Member, District 6
The Honorable Kriss Worthington, Member, District 7
Phil Kamlarz, City Manager
Adopted June 22, 2004

- Appendix to City's General Plan
- Approved and adopted 2004
- Update process throughout 2012
- Financial incentives (pre- and post-disaster)

Planning Commission Update Role

- *Timeframe: March through September, 2012*
- Host public meetings (along with Disaster and Fire Safety Commission)
- Review updated content
  - Specific review of land use planning actions
  - Review all updates for consistency with the General Plan
- Recommend adoption of Plan update by Council

Hazard Mitigation

Hazards in Berkeley

- Earthquake
- Wildfire
- Flood
- Landslide
- Tsunami
- Climate change
- … and many more

Readiness = Mitigation + Preparedness

1. **Mitigation: Reduce or eliminate disaster impacts**
2. Preparedness: Increase emergency response capability

Readiness = Mitigation + Preparedness

Mitigation is:

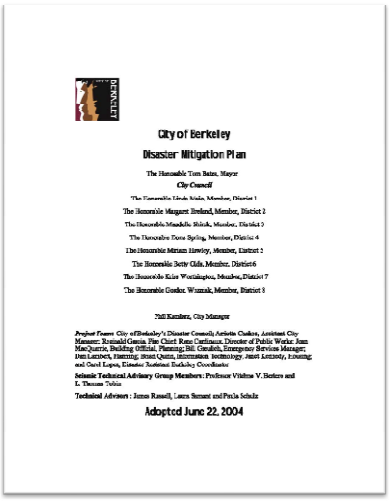
- Strengthening structures
- Making land use decisions that will minimize damage
- Reducing vegetation in high-fire areas
- Strapping down water heaters

Preparedness is:

- Purchasing equipment to use in emergency response
- Conducting disaster response drills
- Storage of disaster supplies for post-disaster relief

Hazard Mitigation Plan Update

City of Berkeley Disaster Mitigation Plan



City of Berkeley

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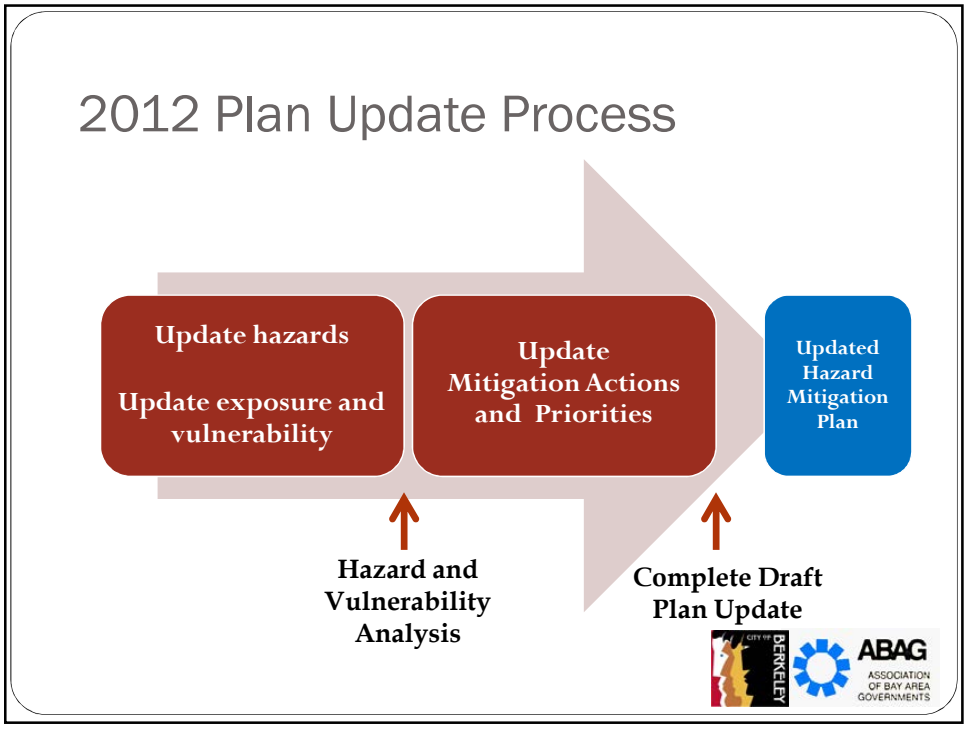
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Update hazards
Update exposure and vulnerability
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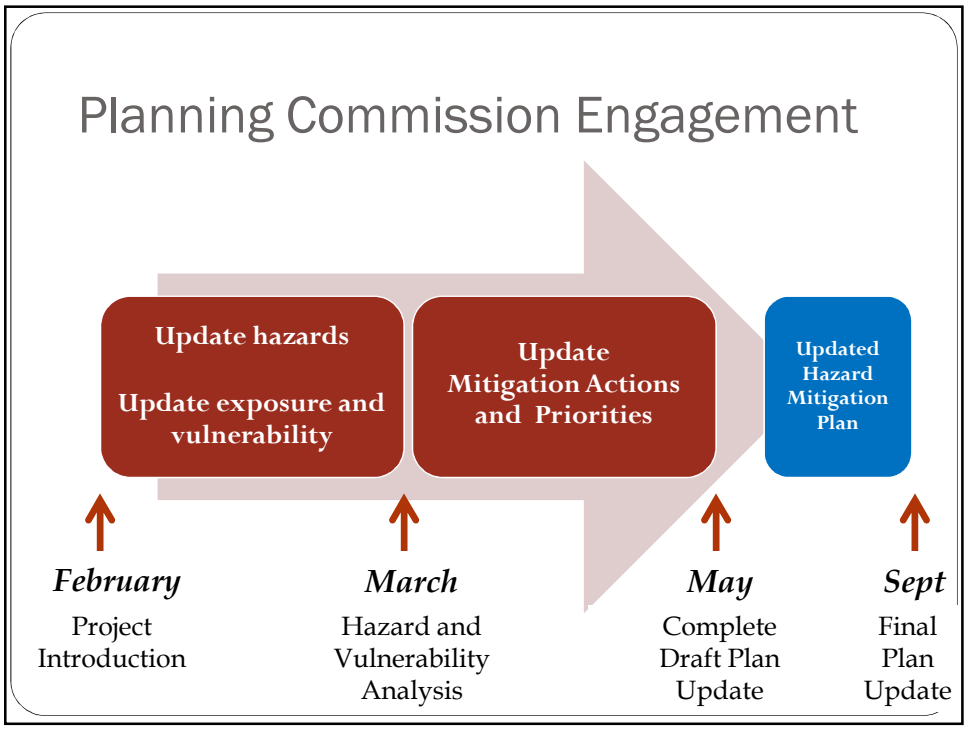
Updated Hazard Mitigation Plan
Hazard and Vulnerability Analysis
Complete Draft Plan Update
ABAG
ASSOCIATION OF BAY AREA GOVERNMENTS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Hazard and Vulnerability Analysis
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Complete Draft Plan Update
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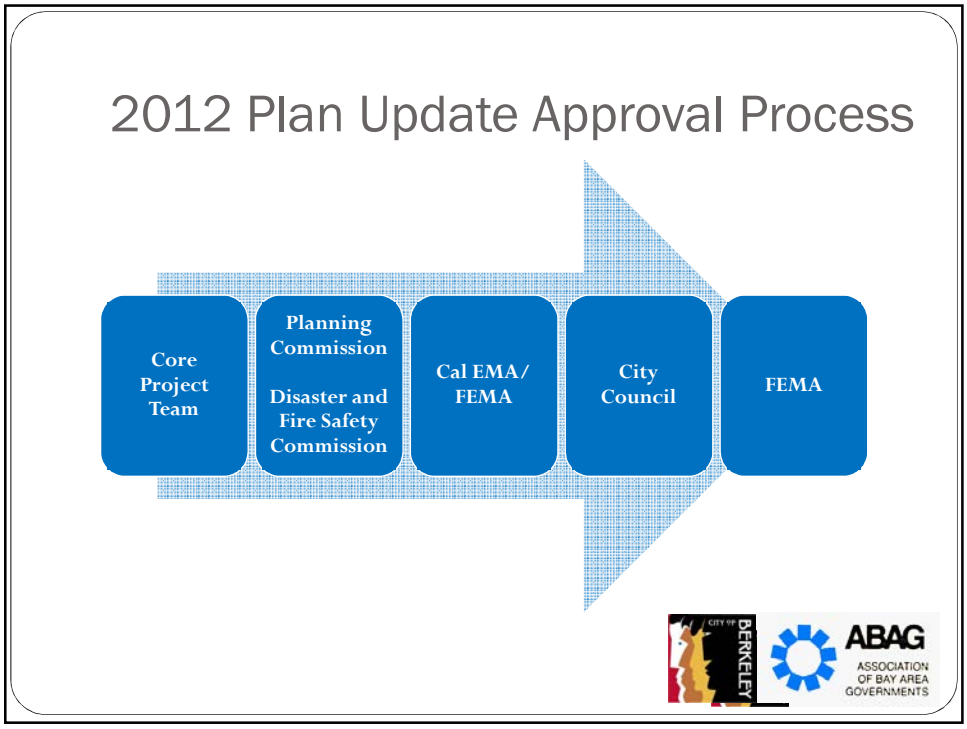
Final Plan Update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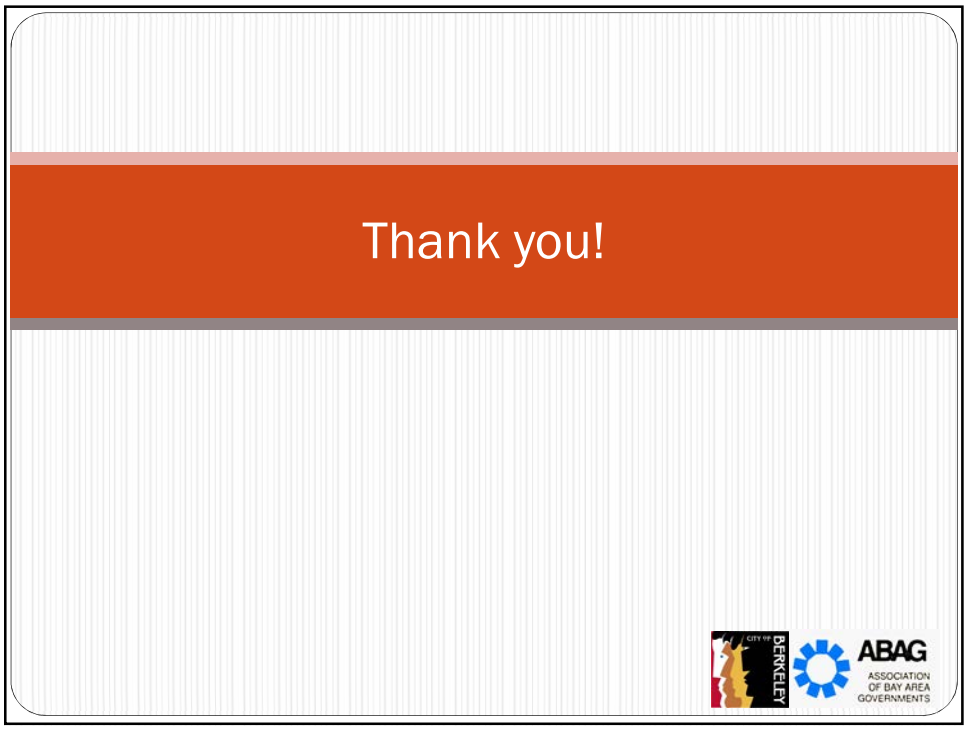
Thank you!
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Commission on Disability

COMMISSION ON DISABILITY
MEETING NOTICE/AGENDA
Wednesday, March 14, 2012
6:30 p.m. - 9:30 P.M.
North Berkeley Senior Center, Workshop B
1901 Hearst Avenue

Please Note: The Commission takes a 15-minute break around 8:00 p.m.
The Commission may take action related to any agenda items.

1. Roll call.

2. Agenda Review

3. Public comment

4. Announcements from Commissioners and or Staff.

5. Approval of Minutes, February 8, 2011.

6. Local Hazard Mitigation Plan Update, Sarah Tyler Emergency Services Coordinator, Office of Emergency Services

7. Project Olmstead, Annalee Cobbett, Community Organizer, Project Olmstead, Center for Independent Living

8. General Discussion of In Home Support Services and the Impact of the State Budget, Denise Trahan, Chair, Commission on Disability

9. Service Animal Update, Paul Church, Secretary, Commission on Disability.

10. Discussion and Update on the Warm Pool, Madelyn Stelmach, Commissioner

11. Discussion on Changes to the Paratransit Program Presented at the January/February 2012 Meeting, Paul Church, Secretary, Commission on Disability.

ACCOMMODATIONS PROVIDED UPON REQUEST
To request meeting materials in large print, Braille, or on cassette, or to request a sign language interpreter, assistive-listening device, real-time captioning or other accommodation for the meeting, call 981-6342 (voice) or 981-6345 (TDD). Providing at least five working days' notice will help to ensure availability at the meeting.

1947 Center Street, Berkeley, CA 94704-1155 Tel: 510-981-6342 TDD: 510-981-6345 Fax: 510-981-6340
Email: pchurch@ci.berkeley.ca.us

PLEASE NOTE: Materials distributed at meetings must be in alternative formats. The Commission will not consider materials presented at meetings unless materials are in Braille and in print. Presentations involving graphs and visuals must be accompanied by clear, equivalent audio description. For further information, please call (510) 981-6342 or email pchurch@ci.berkeley.ca.us.

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Local Hazard Mitigation Plan Update

Commission on Disability

March 14, 2012

Agenda

- Overview
- Hazard Mitigation
- Hazard Mitigation Plan Update
  - Initial Plan Development Process
  - 2102 Plan Update Process
  - Commission and Public Engagement
  - Plan Update Approval Process

Overview

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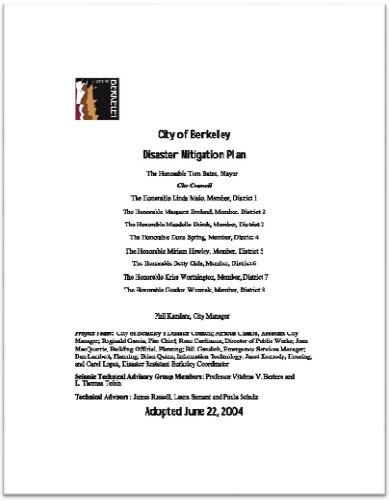

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Commission on Disability Role

- *Timeframe: March through September, 2012*
- Plan Content
  - Review actions related to people with disabilities (est. May-June)
- Outreach
  - Inform constituents about questionnaires and posted plan content (March and May-June)

Hazard Mitigation

Hazards in Berkeley

- Earthquake
- Wildfire
- Flood
- Landslide
- Tsunami
- Climate change
- … and many more

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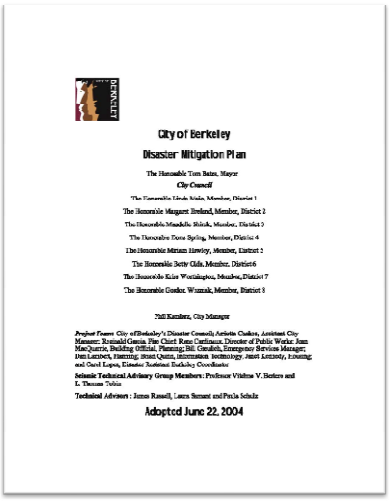
Hazard Mitigation Plan Update

City of Berkeley Disaster Mitigation Plan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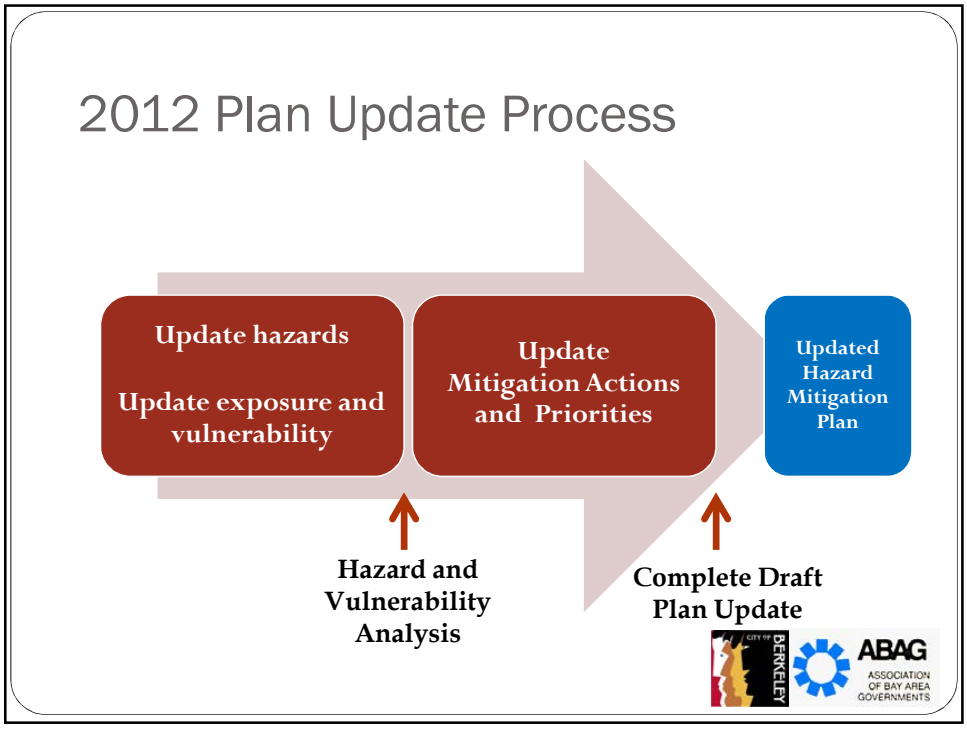
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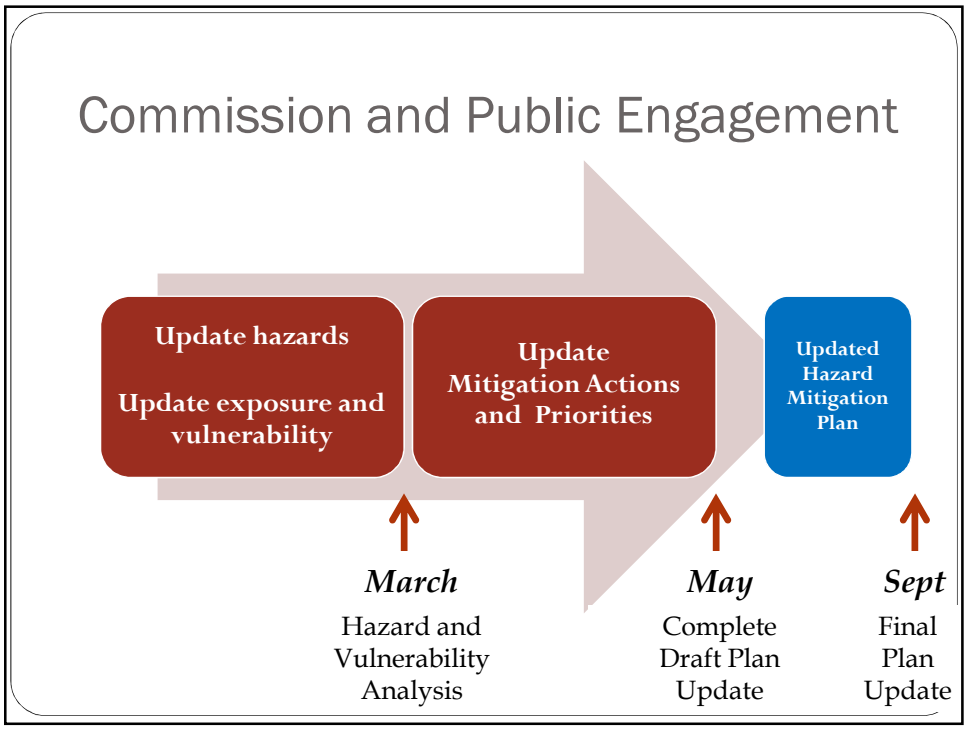
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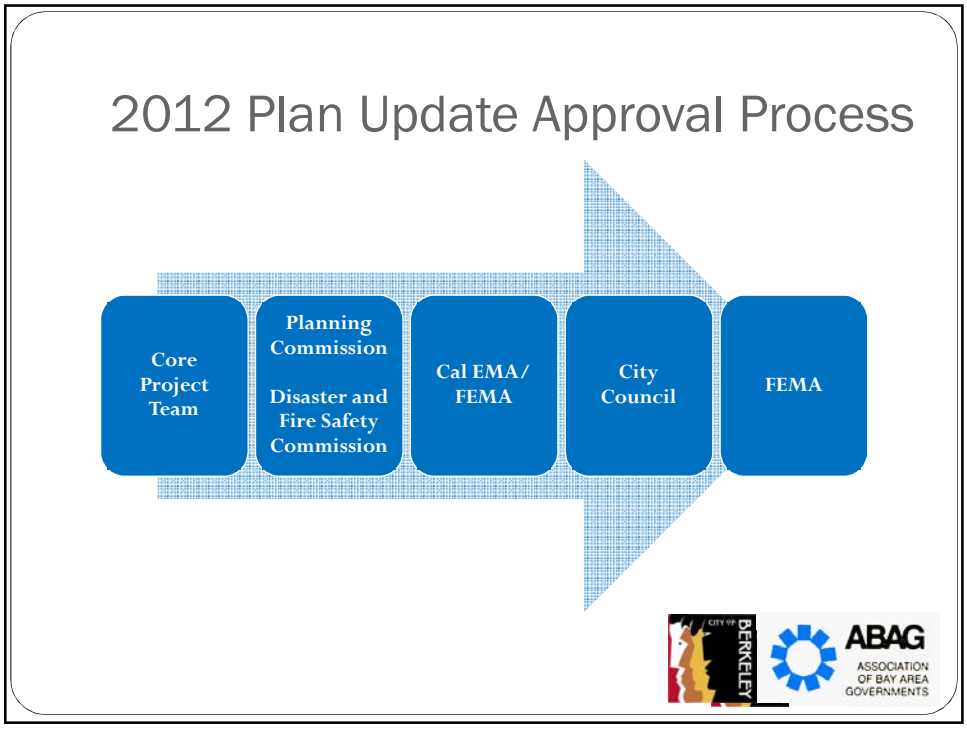
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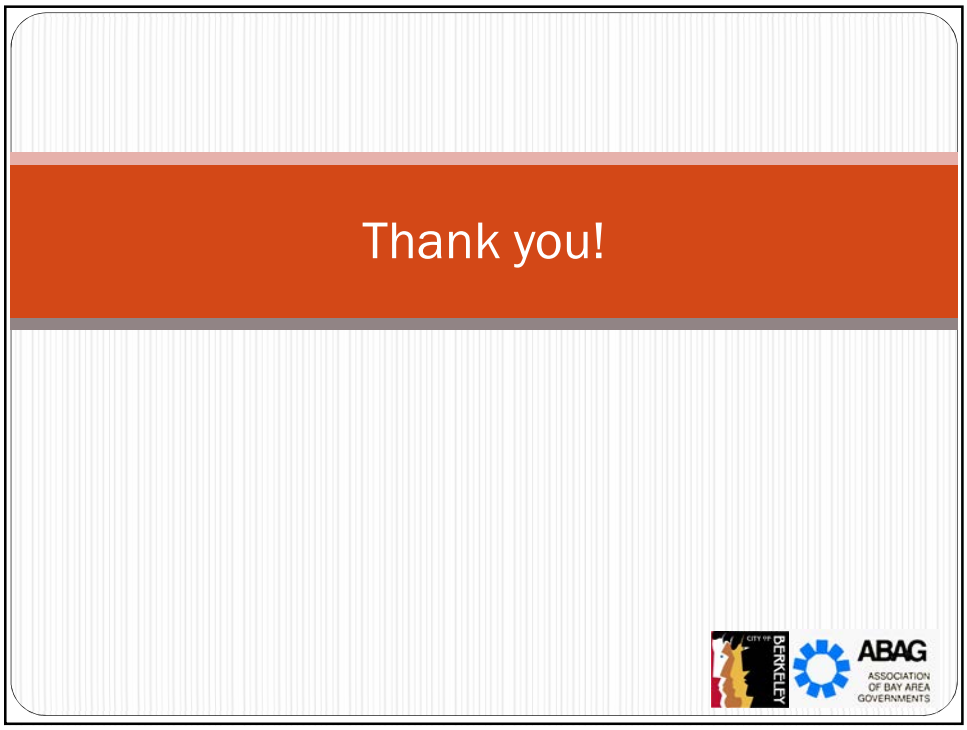
Thank you!
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Department of Fire and Emergency Services
Agenda
For the Regular Meeting of the
Disaster and Fire Safety Commission

DATE: **Wednesday, March 28, 2012**
TIME: **7:00 PM**
PLACE: **Fire Department Training Facility - 997 Cedar Street**

I. Call to Order.

II. Public Comment on Items Not on Agenda.

III. Approval of Draft Minutes of Meeting of February 22, 2012.*

IV. Fire Department and Office of Emergency Services Staff Report

V. Presentation on Berkeley's Local Hazard Mitigation Plan

VI. Proposal for Waiting Lists or Similar Procedures for Community Emergency Response Team (CERT) Classes. (Commissioner Goldstein)

VII. Discussion of Fire Inspection Program for the Berkeley Hills (Commissioner Sharpe)

VIII. Request for a Report from the Public Works Department on the Projected Ongoing Expenses of the New Interoperable Radio System, Including an Explanation of Any Expenses Not Known When the Contract was entered into. (Commissioner Mitchell)

IX. Discussion of the Philosophy of Contents Selection for Emergency Equipment Caches Awarded By the City and Possible Recommendations for Adjustments in Cache Contents Policy. (Commissioner Mitchell)

X. Report of March 20 City Council Meeting Regarding Councilmember Capitelli's Consent Item (Commissioner Zummo)

XI. Adjourn.

(*Material attached for Commissioners for this month's meeting)

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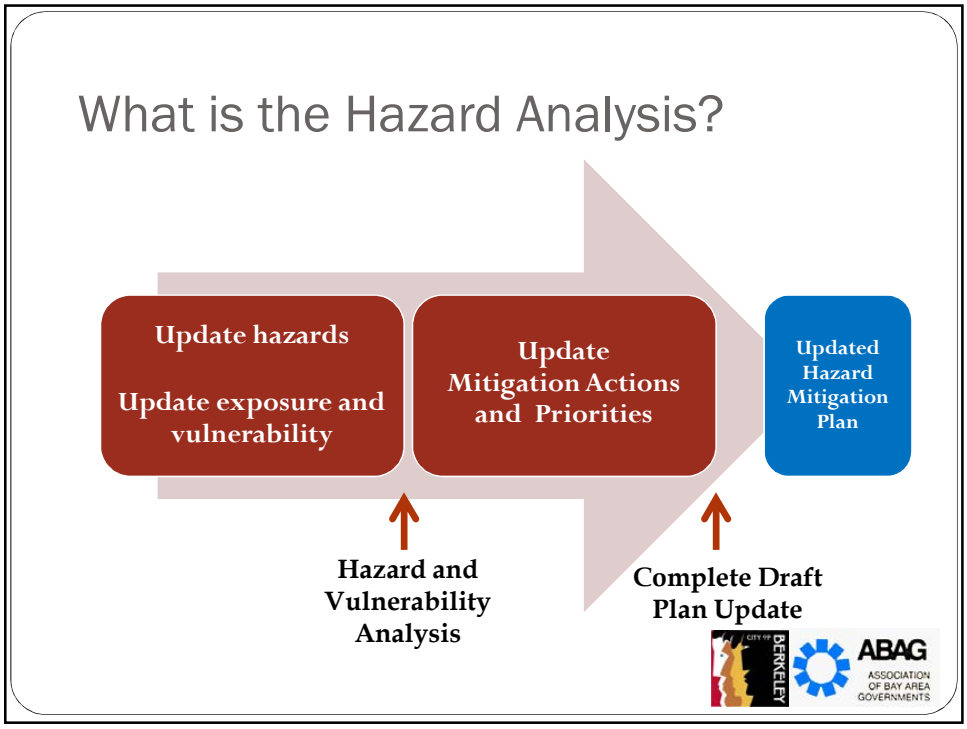
Local Hazard Mitigation Plan Update

Preview: 2012 Hazard Analysis Update

Disaster and Fire Safety Commission
March 28, 2012

Goals and Agenda

- Presentation Goals
  - Share content from Hazard and Vulnerability Analysis of the Local Hazard Mitigation Plan
  - Give a preview of 2012 updates to the Hazard and Vulnerability Analysis
- What is the Hazard Analysis?
- Hazard Analysis 2012 Updates
- Hazards
- Earthquake
- Wildfire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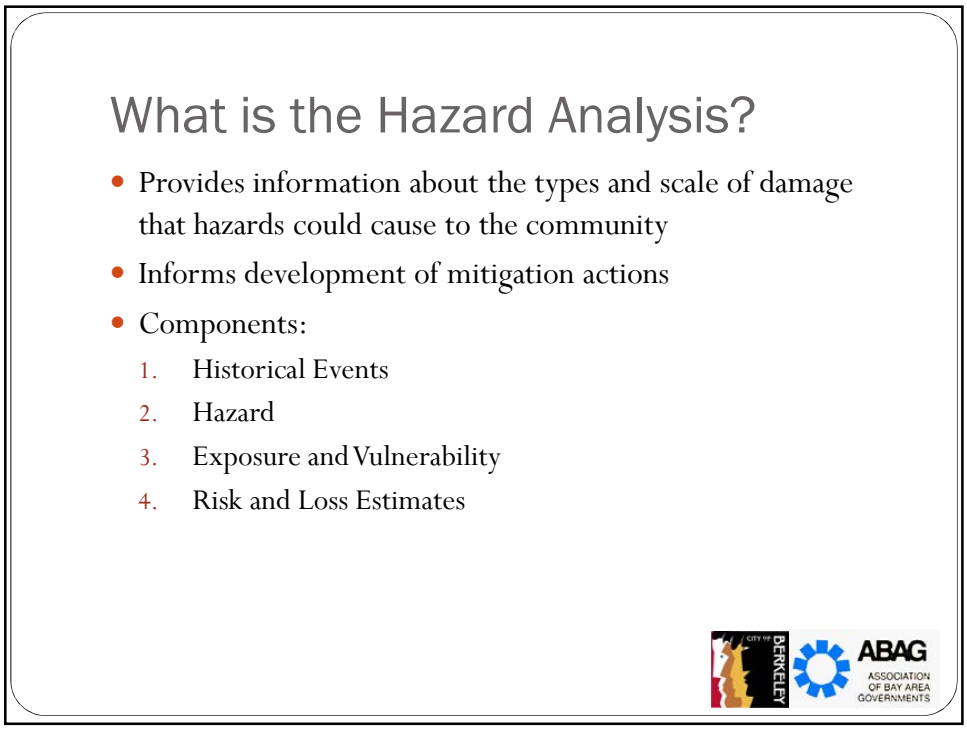
What is the Hazard Analysis?
Provides information about the types and scale of damage that hazards could cause to the community
Informs development of mitigation actions
Components:
1. Historical Events
2. Hazard
3. Exposure and Vulnerability
4. Risk and Loss Estimates
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Hazard Analysis 2012 Updates

- Added two hazards of concern
- Updated information on Berkeley mitigation programs and results
- Added new hazard scenario maps
- Updated information about key partners' mitigation activities
- Added more detail to hazard descriptions
- Reconfigured maps to show hazards and exposure/ vulnerability
- Reorganized content for improved organization/ease of reading

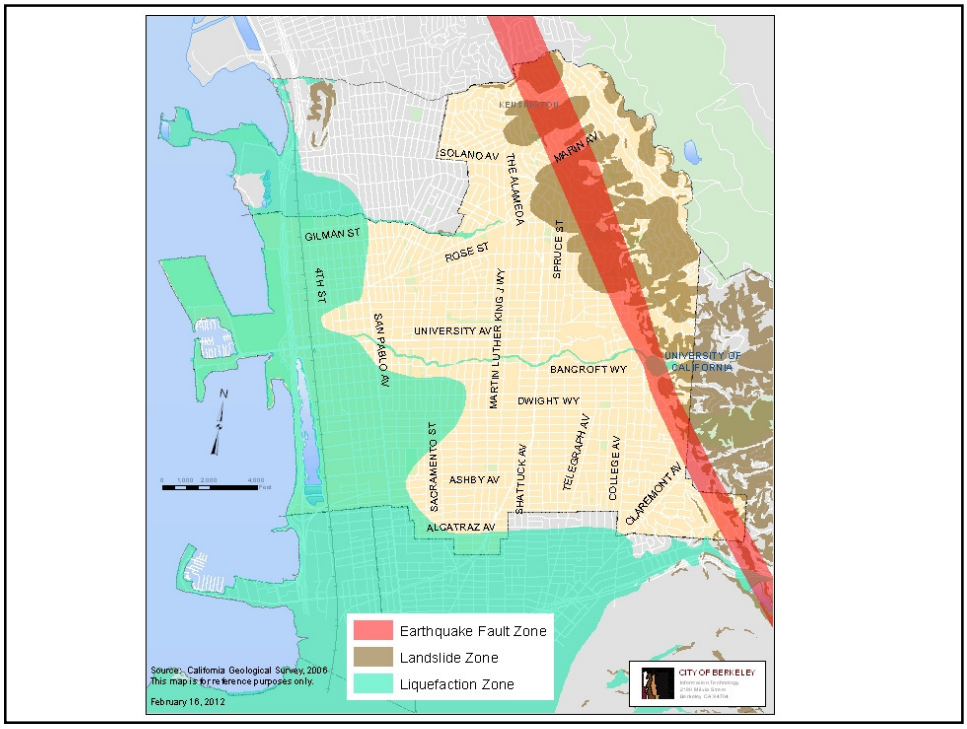
Hazards

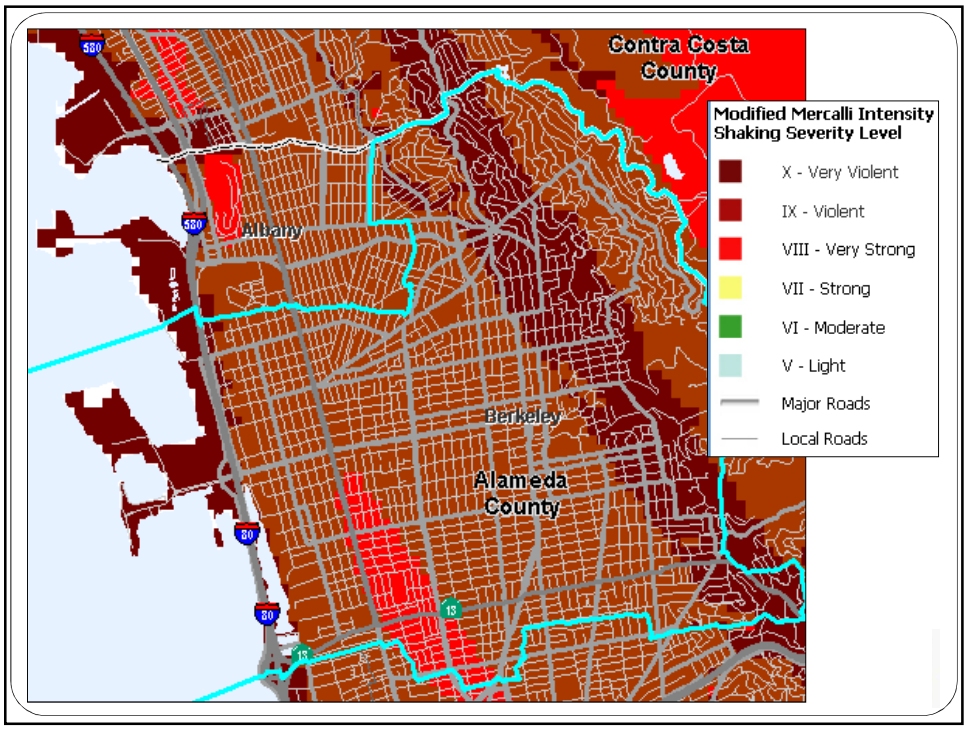
- Hazards of Greatest Concern
  - Earthquake
  - Wildfire
- Hazards of Concern
  - Landslides
  - Floods
  - **Tsunami***
  - **Climate Change***
- Additional Hazards
  - Hazardous Materials Accidents
  - Terror Attack

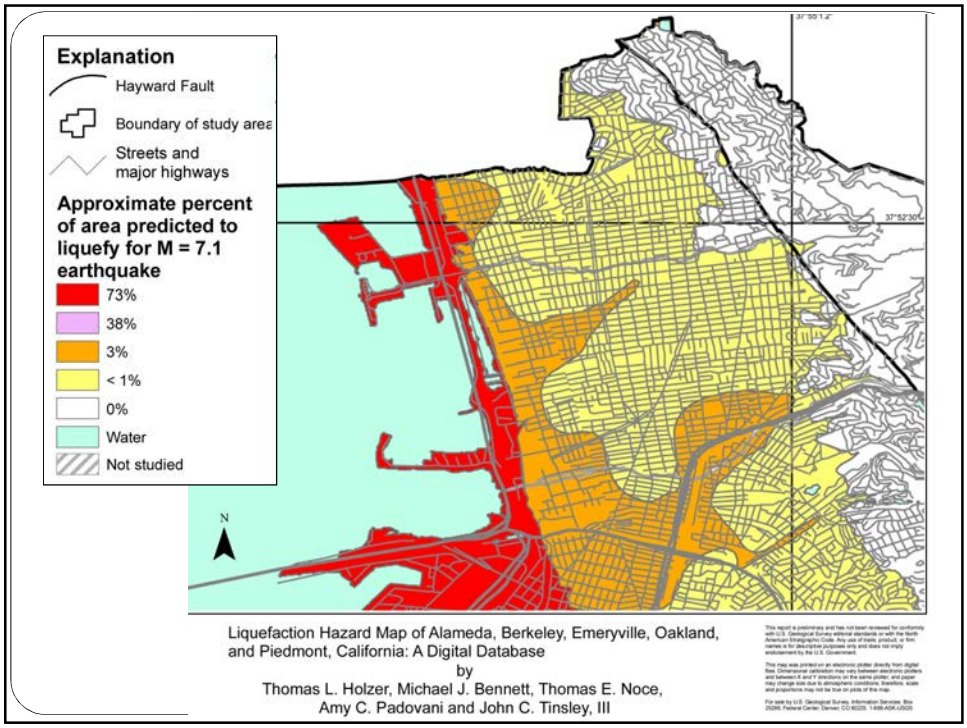
Earthquake

Earthquake Hazard

- Primary hazards
  - Ground shaking
  - Ground failure
    - Surface fault rupture
    - Seismically-triggered Landslides
    - Liquefaction
- Secondary hazards
  - Fire following earthquake


SOLANO AV
THE ALAMEDA
MARIN AV
GILMAN ST
ROSE ST
SPRUCE ST
6TH ST
SAN PABLO AV
UNIVERSITY AV
MARTIN LUTHER KING JR WY
BANCROFT WY
UNIVERSITY OF CALIFORNIA
DWIGHT WY
SACRAMENTO ST
ASHBY AV
SHATTUCK AV
TELEGRAPH AV
COLLEGE AV
CLAREMONT AV
ALCATRAZ AV
Earthquake Fault Zone
Landslide Zone
Liquefaction Zone
Source: California Geological Survey, 2006
This map is for reference purposes only.
February 16, 2012
CITY OF BERKELEY


Contra Costa County
Albany
Berkeley
Alameda County
Modified Mercalli Intensity Shaking Severity Level
X - Very Violent
IX - Violent
VIII - Very Strong
VII - Strong
VI - Moderate
V - Light
Major Roads
Local Roads



Earthquake Exposure and Vulnerability

- **Buildings**
  - **Soft-story buildings**
  - **Unreinforced masonry structures**
  - Tilt-up structures
- Infrastructure
  - Utilities
  - Transportation
  - Hazardous materials
- Critical response facilities
  - Fire stations
  - Hospitals
  - Schools, recreation centers and senior centers

Soft-story buildings

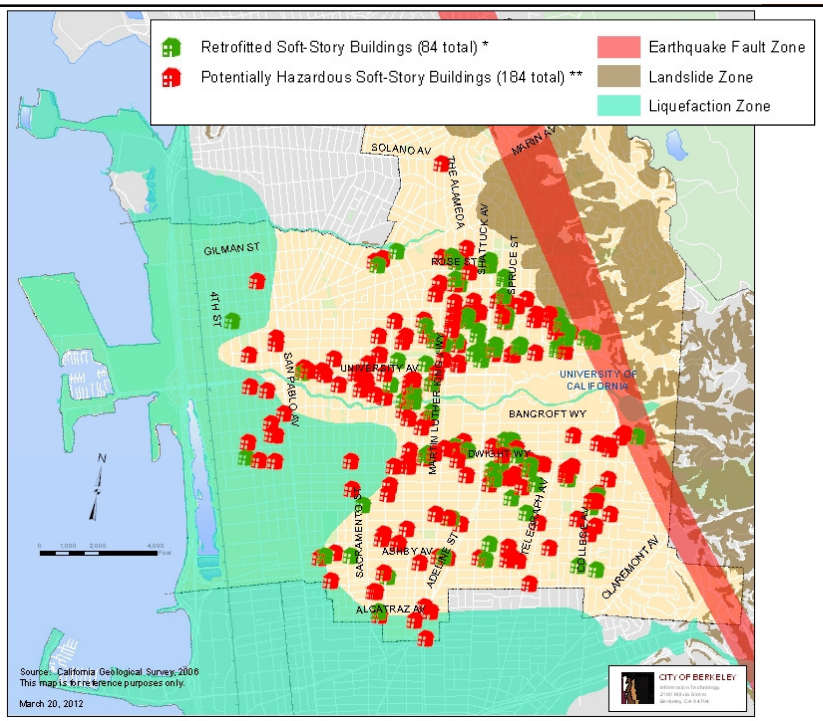
- Multi-story building
- Ground-floor space (with windows, wide doors, large unobstructed commercial space) where a wall might otherwise be

Soft-story buildings

- After a large earthquake:
  - 60% of multifamily residences would be uninhabitable after a large earthquake on the Hayward fault
  - <2% of single-family homes would be similarly damaged
- 2005 City ordinance requires owners of soft-story buildings with 5+ units to hire professional engineers to evaluate their building's seismic vulnerability

Soft-story Units– Progress since 2004

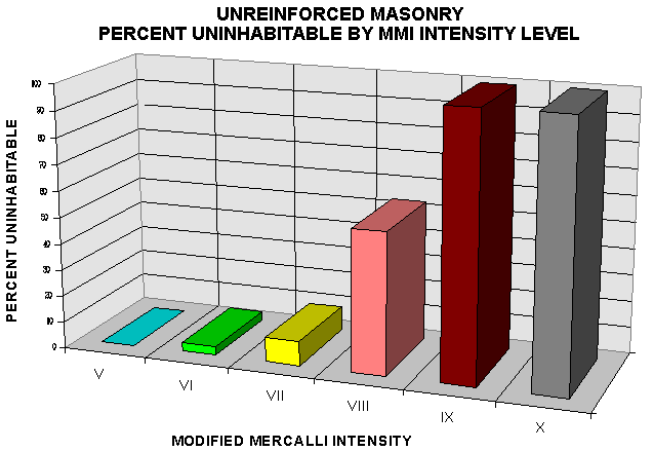
	2004	2012
1. Soft-Story Units	4,950 10% of all Berkeley units	3,465 8% of all Berkeley units
1a. Unretrofitted Soft-Story Units	Data not available	1,976 4.5 % of all Berkeley units 57% of all soft story units

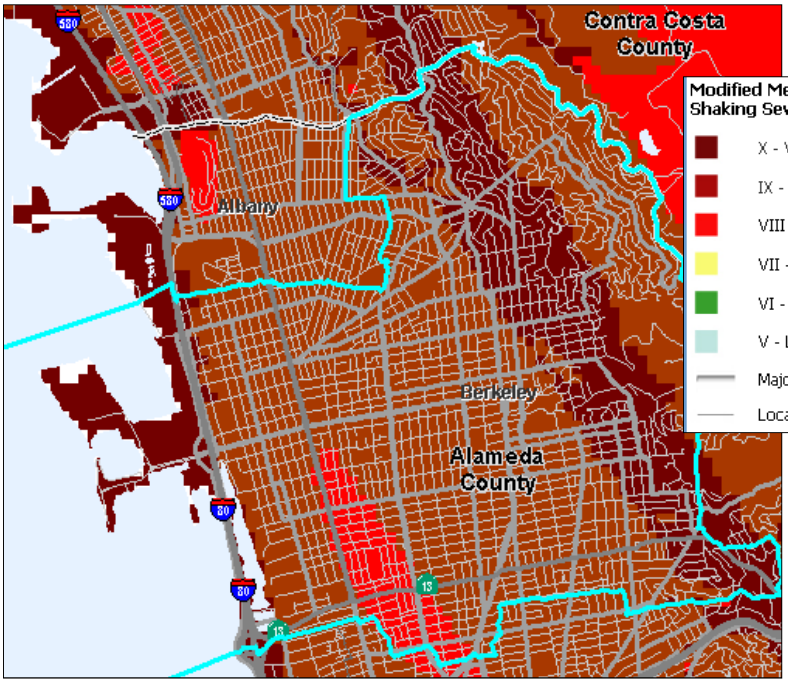


Unreinforced Masonry Buildings

- Unreinforced masonry (URM) buildings are structures in which there is no steel reinforcing within a masonry wall.

Unreinforced Masonry Buildings

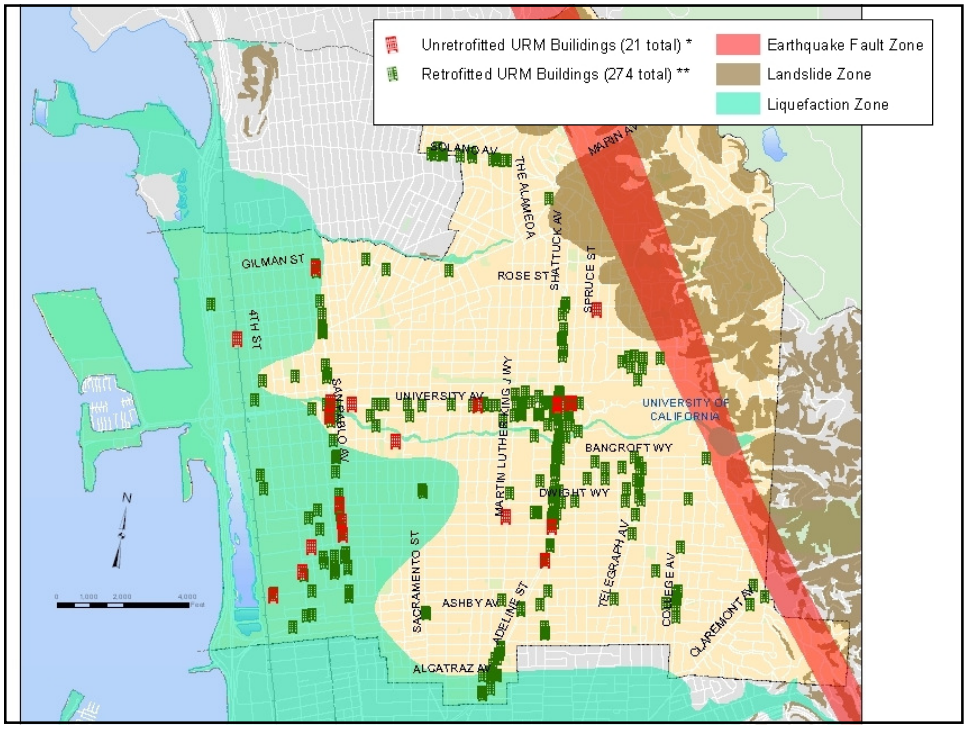




Unreinforced Masonry Buildings

Year	1990	2004	2012
URM Structures	700	89	21

- More than 90% of the URMs on the City's Hazardous Buildings List have been seismically retrofitted, demolished, or demonstrated to have adequate reinforcement



Fire Following Earthquake

- Earthquake shaking and ground failure can:
  - Tip over appliances with pilot lights
  - Damage electrical equipment, leading to sparks
  - Knock down open flames from stoves, candles, fireplaces and grills
  - Rupture gas lines (both underground and at the private gas meter)

Fire Following Earthquake

- Buildings will likely both cause and feed fires:
  - Seismically hazardous buildings (e.g., soft story buildings and URM structures)
  - Older multi-unit apartment buildings without fire sprinkler systems, (e.g., 2441 Haste and 2227 Dwight)
  - Densely populated neighborhoods with wooden homes, such as most of the residential areas in Berkeley

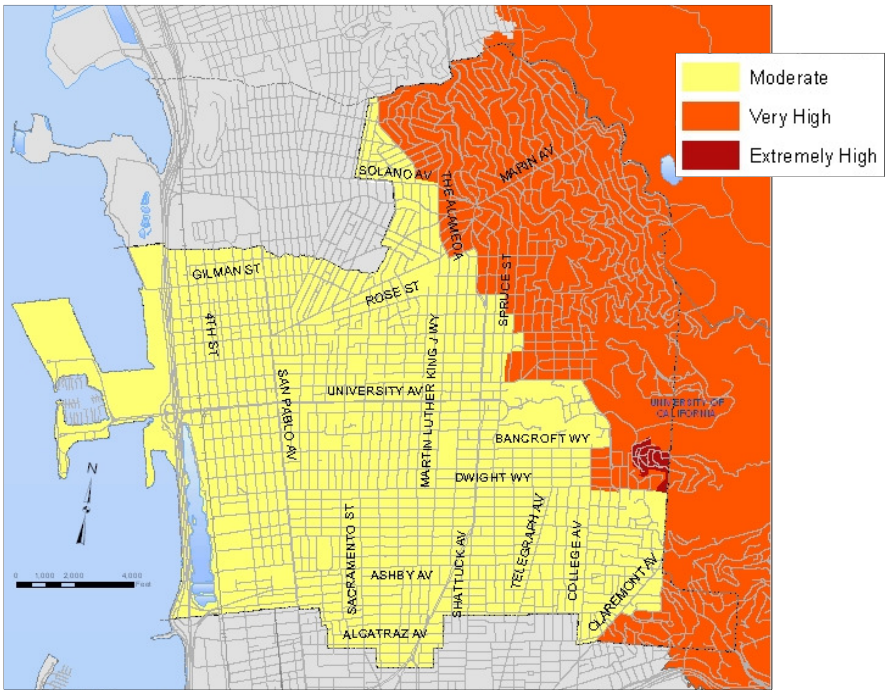
Wildfire

Wildfire Hazard

History of Major Fires in the Oakland/Berkeley Area		
September 17, 1923	Berkeley Fire	640 Structures
September 22, 1970	Fish Canyon Fire (Oakland)	39 Structures
December 14, 1980	Wildcat Canyon Fire (Berkeley)	5 Structures
October 20, 1991	East Bay Hills Fire (Oakland/Berkeley)	3,354 Structures; 25 lives lost

Wildfire Hazard

- Threat from wildland fire along Berkeley hillsides in wildland-urban interface
- Manmade and natural causes
- Exacerbating factors present in Berkeley hills
  - Topography
  - Wind (esp. "Diablo" winds, prevalent in August – October)
  - Dry, dense vegetation (and wooden homes) = fuel
  - Limited access/egress routes for responders and evacuees

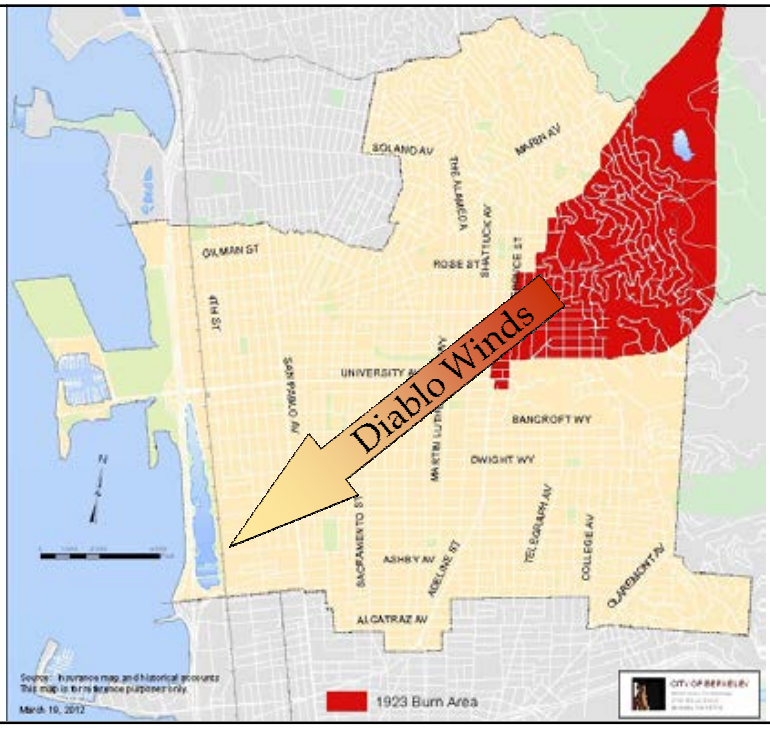


Fire Zones 2 and 3

- Hazardous Fire Area Inspection Program is in place for a subset of properties within Fire Zones 2 and 3
  - Fire personnel inspect 1100+ parcels/year in the Berkeley Hills HFA
- New residential structures in Fire Zones 2 and 3 are required by State and Local building codes to have Fire Protection Plans (aka Vegetation Management Plans)

Vegetation Management Programs

Program	Average Results
Fire Fuel Chipper Program	• Yard waste collection service • 6,300+ properties in the hills served • 200 tons of vegetation collected/recycled yearly
Fire Fuel Debris Bin Program	• Delivers and removes yard roll-off boxes • 20 tons of plant debris collected per year
Fire Fuel Abatement Program (Public Land)	• 125 tons of debris are removed from 95 public sites yearly
Weekly Curbside Collection	• 14,000 tons of residential plant debris is collected yearly • 2007 – switched to weekly plant debris collection



Department of Fire and Emergency Services

Agenda
For the Regular Meeting of the
Disaster and Fire Safety Commission

DATE: Wednesday, October 23, 2013
TIME: 7:00 PM
PLACE: Fire Department Training Facility - 997 Cedar Street

Preliminary Matters

Call to Order.

Approval of the Agenda

Public Comment on Non-Agenda Matters.

1. Fire Department and Office of Emergency Services Staff Report

Consent Items

2. Approval of Draft Minutes of Meeting of August 7 2013.*

Action Items

3. Improvements in Procedures for Advance Review by Commission of Overall Budget for Measure GG Funds and of Expenses not Originally Included in Work Programs Previously Presented to Commission.
4. Presentation on the Local Hazard Mitigation Plan Update.
5. Philosophy of Contents Selection for Emergency Equipment Caches Awarded By the City and Action on Possible Recommendations for Adjustments in Cache Contents Policy.

6. Undergrounding of All Utility Lines Along Grizzly Peak from Spruce to Centennial, to Allow For Emergency Exit During a Disaster.

7. Proposal for Reconsideration of Focus of Community Disaster Preparedness Efforts and Review of Available Literature to Support Such an Initiative.*

Discussion Items

8. Report on Status of Rent Board Actions on Proposals for Disaster Preparedness for Multi-Unit Buildings

9. Discussion of Coronal Mass Injection

10. Future Agenda Items

Adjournment
(*Material attached for Commissioners for this month's meeting)

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Please refrain from wearing scented products to this meeting.

City of Berkeley

2014 Local Hazard Mitigation Plan

Hazard Analysis Update

Disaster and Fire Safety Commission

October 23, 2013

10/23/13 City of Berkeley

LHMP Hazard Analysis Update

Hazard Experts

- United States Geological Survey
- California Geological Survey
- Earthquake Engineering Research Institute
- California Office of Emergency Services
- California Energy Commission
- Alameda County Public Health
- Alan Kropp & Associates
- Association of Bay Area Governments
- Bay Area Joint Policy Committee
- CALFIRE
- Bay Conservation Development Commission

(etc)

Institutional Key Partners

- UC Berkeley
- Berkley Lab
- Pacific Gas & Electric
- Berkley Unified School District
- Sutter Health
- Kinder Morgan Corporation
- Caltrans
- LifeLong Medical
- Bayer
- Bay Area Rapid Transit
- Ecology Center
- AT&T
- Berkeley City College

(etc)

2014 Hazard Analysis Summary

Hazard	Likelihood	Severity
Earthquake	**Likely**	**Catastrophic**
Wildland-Urban Interface Fire	**Likely**	**Catastrophic**
Rainfall-Triggered Landslide	Likely	Moderate
Flood	Likely	Minor
Tsunami	Possible	Unknown
Climate Change	Likely	Unknown

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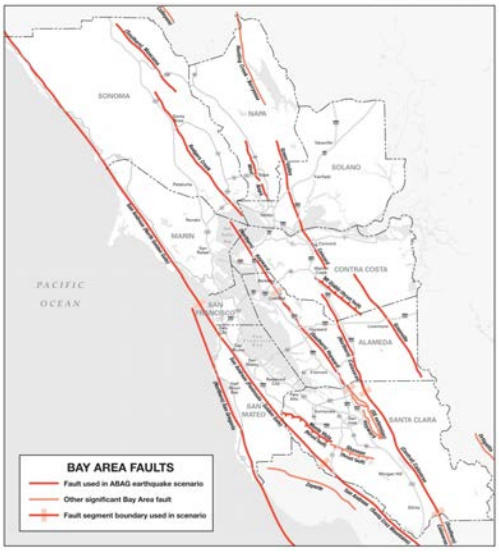
Hazards of Greatest Concern

EARTHQUAKE



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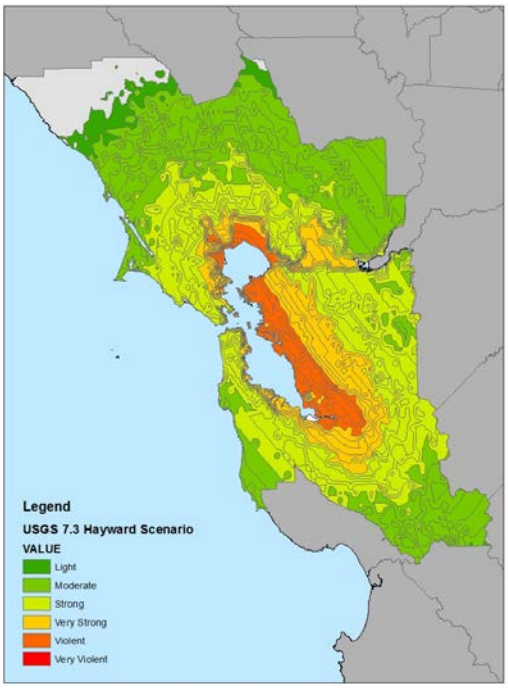

Shakemap

7.3 Hayward Fault Earthquake Scenario

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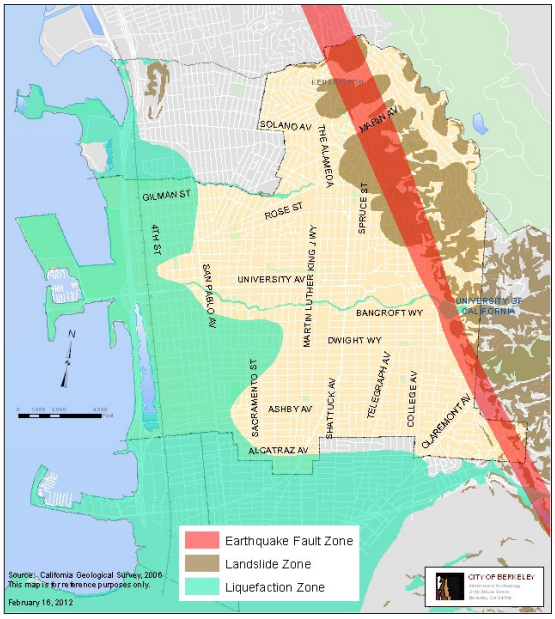

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Buildings

Soft-Story

- 158 unretrofitted buildings

http://www.sfgate.com/news/article/S-F-soft-story-buildings-at-risk-in-quake-3180896.php

Unreinforced Masonry (URM)

- 20 unretrofitted buildings

E.V. Leyendecker, U.S. Geological Survey

10/23/13

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Utilities

- In a catastrophic earthquake:
  - No water to 70% of Berkeley homes
  - Power outage for more than 60% of Berkeley households for days to a week
  - Breaks to natural gas mains, valves and service connections

http://www.wisegeek.com/what-are-solar-roof-panels.htm

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Photo via dart2.arc.nasa.gov

Hazards of Greatest Concern

WILDLAND-URBAN INTERFACE FIRE (WUI FIRE)

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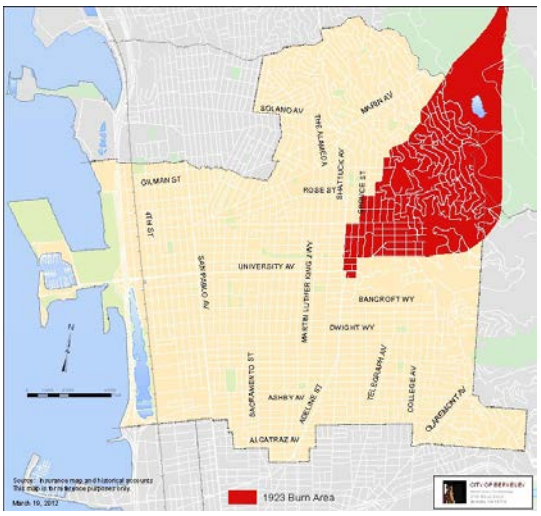

1923 Berkeley Fire Map

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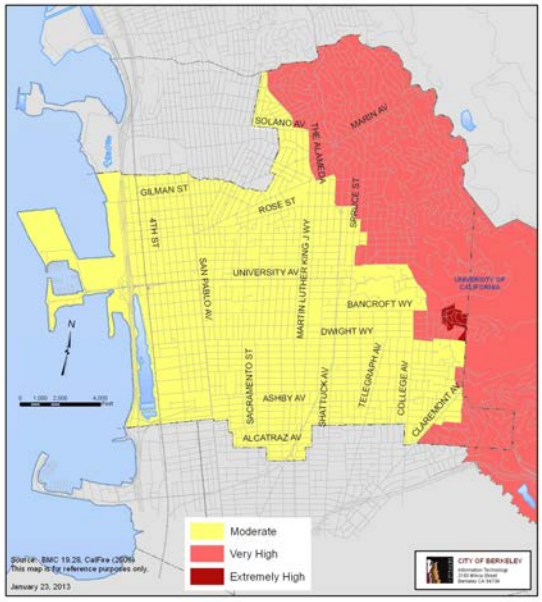

Planning Map

(not a scenario)

WUI Fire Hazard

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Hazards of Concern

FLOODS

10/23/13

City of Berkeley

Creek Flooding Map

100- and 500-year Flood scenarios

10/23/13

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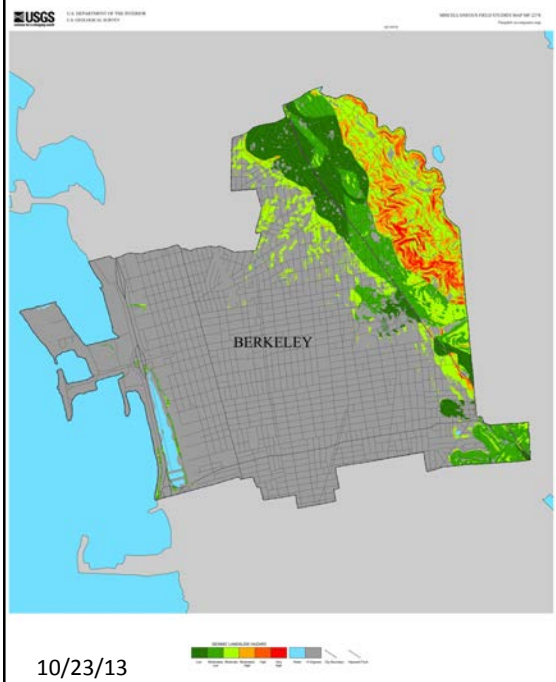

Landslide Map

7.1 Hayward Fault Earthquake Scenario

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http://www.australiangeographic.com.au/journal/facts-and-figures-how-tsunamis-form.htm

Steven Winter, http://www.berkeleyside.com/2011/03/11/tsunami-makes-it-to-bay-area-photographed-in-emeryville/

Hazards of Concern

TSUNAMI

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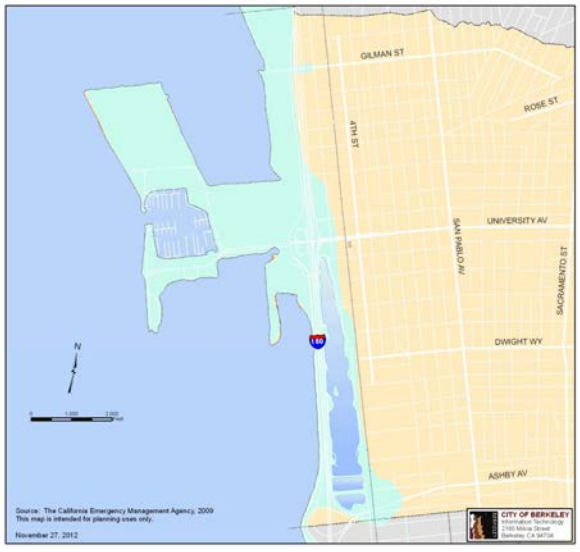

Tsunami Inundation Hazard

Planning Map
(not a scenario)

10/23/13

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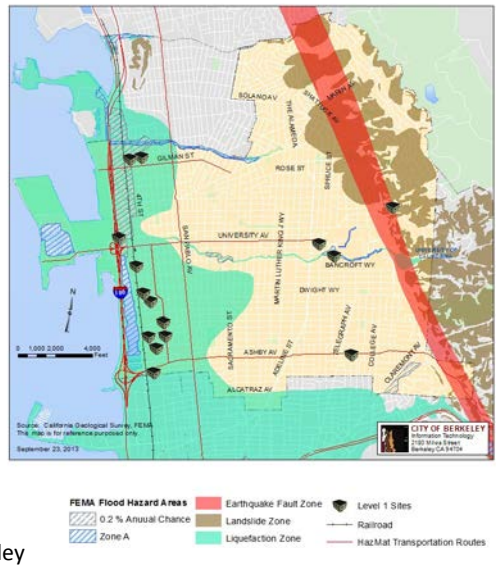
Hazardous Materials Release

- Secondary, manmade hazard
- 2014 Plan updates:
  - Level 1 facilities
  - Transportation routes



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Climate Change

- Exacerbates natural hazards of concern
  - Temperature increases and heat waves
  - More severe storms and flooding
  - Drought
  - Sea-level rise

Cheng (Lily) Lee , http://www.sciencedaily.com/releases/2012/06/120606132308.htm

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Public Review Process

- **First Draft: October 21 – December 9**
  - Planning Commission (Nov 20)
  - Disaster and Fire Safety Commission (Dec 4)
- Final Draft (2014)
  - Planning Commission (January 15)
  - Disaster and Fire Safety Commission (January 22)

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Full plan available City libraries and
www.CityofBerkeley.info/Mitigation

Send Comments and feedback to
Mitigation@CityofBerkeley.info

AGENDA

REGULAR MEETING OF THE PLANNING COMMISSION

This meeting is held in a wheelchair accessible location.

November 20, 2013 **North Berkeley Senior Center**
7:00 PM **1901 Hearst Ave / MLK Jr. Way**

See "MEETING PROCEDURES" below.

All written materials identified on this agenda are available on the Planning Commission webpage: http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=13072

PRELIMINARY MATTERS

1. ***Roll Call.***
2. ***Order of Agenda:*** The Commission may rearrange the agenda or place additional agendized items on the Consent Calendar.
3. ***Public Comment:*** Comments on subjects not included on the agenda. Speakers may comment on agenda items when the Commission hears those items. *See "Public Testimony Guidelines" below.*
4. ***Planning Staff Report:*** In addition to the items below, additional matters may be reported at the meeting.
5. ***Chairperson's Report:*** Report by Planning Commission Chair.
6. ***Committee Reports:*** Reports by Commission committees or liaisons. In addition to the items below, additional matters may be reported at the meeting.
7. ***Approval of Minutes:*** Approval of draft minutes of November 6, 2013.
8. ***Future Agenda Items and Other Planning-Related Events:*** None.
9. ***CONSENT CALENDAR ITEMS*** *See "Consent Calendar Guidelines" below:* None.

AGENDA ITEMS: *All agenda items are for discussion and possible action. Public Hearing items require hearing prior to Commission action.*

10. ***Public Hearing:*** **Condominium Conversion Subdivision Map: 1820-22 Hearst**

Recommendation/Action:	APPROVE Tentative Map #8066 pursuant to BMC Section 21.16.047
Written Materials:	Attached.
Web Information:	None.
Continued From:	None.

11. ***Discussion/Action:*** **Local Hazard Mitigation Plan (LHMP) – Review**
Recommendation/Action: None.
Written Materials: Attached.
Web Information: ***www.CityofBerkeley.info/Mitigation***
Continued From: None.

ADDITIONAL AGENDA ITEMS: In compliance with Brown Act regulations, no action may be taken on these items. However, discussion may occur at this meeting upon Commissioner request.

Information Reports: None.

Communications in Packet: None.

Late Communications (received at the meeting on 11-6-13):

- Handout, Re: Standards for Rehabilitation.
- Sally Nelson, Letter to Planning Commission, Re: Zoning Overlay Proposed for Berkeley's Existing Historic District.
- Andrew D. Masri, Letter to City, Re: Hazard from the Retaining Wall in Front of the House at 15 Canyon Rd.

ADJOURNMENT

Meeting Procedures

Public Testimony Guidelines:
Speakers are customarily allotted up to three minutes each. The Commission Chair may limit the number of speakers and the length of time allowed to each speaker to ensure adequate time for all items on the Agenda. ***To speak during Public Comment or during a Public Hearing, please line up behind the microphone.*** Customarily speakers are asked to address agenda items when the items are before the Commission rather than during the general public comment period. Speakers are encouraged to submit comments in writing. See "Procedures for correspondence to the Commissioners" below.

Consent Calendar Guidelines:
The Consent Calendar allows the Commission to take action with no discussion on projects to which no one objects. The Commission may place items on the Consent Calendar if no one present wishes to testify on an item. Anyone present who wishes to speak on an item should submit a speaker card prior to the start of the meeting, or raise his or her hand and advise the Chairperson, and the item will be pulled from the consent calendar for public comment and discussion prior to action.

Procedures for correspondence to the Commissioners:
To distribute correspondence to Commissioners prior to the meeting date, submit comments by 12:00 noon, eight (8) days before the meeting day (Tuesday) (email preferred).

- If correspondence is more than twenty (20) pages, requires printing of color pages, or includes pages larger than 8.5x11 inches, please provide 15 copies.
- Any correspondence received after this deadline will be given to Commissioners on the meeting date just prior to the meeting.

- Staff will not deliver to Commissioners any additional written (or email) materials received after 12:00 noon on the day of the meeting.
- Members of the public may submit written comments themselves early in the meeting. To distribute correspondence at the meeting, please provide 15 copies and submit to the Planning Commission Secretary just before or at the beginning of the meeting.
- Written comments should be directed to the Planning Commission Secretary at the Land Use Planning Division (Attn: Planning Commission Secretary).

Communications are Public Records: Communications to Berkeley boards, commissions, or committees are public records 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.

Written material may be viewed in advance of the meeting at the Planning and Development Department, 2118 Milvia Street, First Floor, during working hours, or at the Main Branch Library, Shattuck/Kittredge Streets, during regular library hours, at the Reference Desk.

Accommodations Provided Upon Request: To request a disability-related accommodation(s) to participate in the meeting, including auxiliary aids or services, please contact the Disability Services Specialist at 981-6342(V), or 981-7075 (TDD), and/or the Commission Secretary at least three (3) business days before the meeting date. Five (5) business days are needed to request a sign language or oral interpreter.

Note: If you object to a project or to any City action or procedure relating to the project application, any lawsuit which you may later file may be limited to those issues raised by you or someone else in the public hearing on the project, or in written communication delivered at or prior to the public hearing. The time limit within which to commence any lawsuit or legal challenge related to these applications is governed by Section 1094.6, of the Code of Civil Procedure, unless a shorter limitations period is specified by any other provision. Under Section 1094.6, any lawsuit or legal challenge to any quasi-adjudicative decision made by the City must be filed no later than the 90th day following the date on which such decision becomes final. Any lawsuit or legal challenge, which is not filed within that 90-day period, will be barred.

Please refrain from wearing scented products to public meetings.

City of Berkeley

Local Hazard Mitigation Plan

2014 First Draft Plan Update

Planning Commission

November 20, 2013

2014 Hazard Analysis Summary

Hazard	Likelihood	Severity
Earthquake	**Likely**	**Catastrophic**
Wildland-Urban Interface Fire	**Likely**	**Catastrophic**
Rainfall-Triggered Landslide	Likely	Moderate
Flood	Likely	Minor
Tsunami	Possible	Unknown
Climate Change	Likely	Unknown

2014 Mitigation Strategy

- Plan approaches and objectives expanded to include tsunami and climate change
  - Reduce disaster impacts on the Berkeley community
  - Protect City infrastructure
  - Encourage mitigation activities

11/20/13 City of Berkeley

Plan Development Process

- First Draft Public Comment Period
  - October 21 – December 20 (extended)
  - Commission and community review and feedback
- Final Draft Review and Adoption
  - Disaster and Fire Safety Commission (January 22*)
  - Planning Commission: First Public Hearing (February 5*)
  - State and FEMA review
  - Council (spring)

*Planned dates, subject to change

11/20/13 City of Berkeley

First Draft Plan available City libraries and

www.CityofBerkeley.info/Mitigation

Send Comments and feedback to

Mitigation@CityofBerkeley.info

11/20/13

City of Berkeley

Department of Fire and Emergency Services

Agenda
For the Regular Meeting of the
Disaster and Fire Safety Commission

DATE: Wednesday, December 4, 2013
TIME: 7:00 PM
PLACE: Fire Department Training Facility - 997 Cedar Street

Preliminary Matters

Call to Order.

Approval of the Agenda

Public Comment on Non-Agenda Matters.

1. Fire Department and Office of Emergency Services Staff Report

Consent Items

2. Approval of Draft Minutes of Meeting of October 23, 2013.*

Action Items

3. Approval of the 2014 Commission Meeting Schedule.
4. Presentation on the Local Hazard Mitigation Plan Update.
5. Disaster and Fire Safety Commission Participation in City Council Work Session on Drones
6. Proposal for Reconsideration of Focus of Community Disaster Preparedness Efforts and Review of Available Literature to Support Such an Initiative.*
7. Report on Status of Rent Board Actions on Proposals for Disaster Preparedness for Multi-Unit Buildings

Discussion Items

8. Discussion of the City's Emergency Evacuation Plan

9. Discussion of the City's Disaster Service Worker Volunteer Enrollment Procedures

10. Future Agenda Items

Adjournment
(*Material attached for Commissioners for this month's meeting)

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City of Berkeley

Local Hazard Mitigation Plan Update

Disaster and Fire Safety Commission

December 4, 2013

Hazard Analysis Summary

Hazard	Likelihood	Severity
Earthquake	**Likely**	**Catastrophic**
Wildland-Urban Interface Fire	**Likely**	**Catastrophic**
Rainfall-Triggered Landslide	Likely	Moderate
Flood	Likely	Minor
Tsunami	Possible	Unknown
Climate Change	Likely	Unknown

2014 Mitigation Strategy

- Plan objectives
  - Reduce disaster impacts on the Berkeley community
  - Protect City infrastructure
  - Encourage mitigation activities
- 23 Actions

12/04/13 City of Berkeley

Buildings and Structures

Privately-Owned Structures

- Buildings
- Soft-Story
- Unreinforced Masonry (URM)
- Streamline Rebuild

City-Owned Buildings

- Building Assessment
- Strengthen and Replace City Buildings

12/04/13 City of Berkeley

Utilities

- Energy Assurance
- East Bay Municipal Utility District
- Gas Safety

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Wildland-Urban Interface Fire

- Fire Code
- Vegetation Management
- Hills Evacuation

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Other Natural Hazards

- Floods
  - National Flood Insurance Program
  - HazMat Floods
  - Stormwater System
- Tsunami
  - Tsunami
- Landslide
  - Buildings
  - Gas Safety
  - Stormwater System

12/04/13 City of Berkeley

Climate Change

- Climate Change Integration
- Extreme Heat
- Water Security
- Sea-Level Rise
- Severe Storms

12/04/13 City of Berkeley

Action Prioritization

- Prioritization Factors:
  - Support of goals and objectives
  - Cost/benefit relationship
  - **Funding availability**
  - Hazards addressed
  - **Public and political support**
  - Adverse environmental impact
  - Environmental benefit
  - Timeline for completion

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Next Steps/Key Dates

- First Draft Public Comment Period
  - October 21 – December 20 (extended)
  - Commission and community review and feedback
- Final Draft Review and Adoption
  - Disaster and Fire Safety Commission (January 22*)
  - Planning Commission: First Public Hearing (February 5*)
  - State and FEMA review
  - Council (spring)

*Planned dates, subject to change

12/04/13 City of Berkeley

First Draft Plan available City libraries and

www.CityofBerkeley.info/Mitigation

Send Comments and feedback to

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12/04/13

City of Berkeley

Public Comments and Staff Responses for the First Draft 2014 Local Hazard Mitigation Plan

This document provides all feedback received as part of the community review process for the 2014 Local Hazard Mitigation Plan, along with staff responses to this feedback. When feedback resulted in modifications to the Plan, those modifications are described as part of the staff response.

A complete list of modifications between the First and Final Draft 2014 LHMP versions is provided in the *Summary of Changes to the First Draft 2014 Local Hazard Mitigation Plan*.

Overview of Public Review Process

FEMA's March 2013 Local Mitigation Planning Handbook is the official guide for local governments to develop, update and implement local mitigation plans to meet the requirements of the Stafford Act and Title 44 Code of Federal Regulations CFR 201.6. The guide states: "The planning process shall include an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval." (44 CFR §201.6(b)(1))

In accordance with this requirement, the First Draft LHMP was circulated for public review for 61 days (October 21 through December 20, 2013). During this period, 19 City Commissions discussed the First Draft LHMP at public meetings. Staff made presentations at three of these meetings to provide interested persons with an in-person opportunity to ask questions and provide feedback on the First Draft LHMP. Staff made presentations at the Disaster and Fire Safety Commission Meetings on October 23 and December 4, 2013, and at the Planning Commission Meeting on November 20, 2013. A full description of the plan development process is described in the Final Draft 2014 Local Hazard Mitigation Plan's Appendix C: *Plan Development Process*.

Comments Received

This document contains the feedback received during the public review period for the First Draft 2014 Local Hazard Mitigation Plan. City Commissions, partner agencies and community members provided written and oral comments.

Table 1 below lists the comment letters received (A-T) during the public review period for the First Draft 2014 LHMP. Each letter is marked to identify distinct comments on the First Draft Plan. Staff responses to these comments are provided following each letter. Responses are numbered to correspond to the comment numbers that appear in the margins of the comment letters.

In addition, staff summarized oral comments received from Commissioners and Board Members during public meetings of the Disaster and Fire Safety Commission, Planning Commission, Zoning Adjustments Board, and Landmarks Preservation Commission.

These comments are presented after the written comment letters, along with staff responses.

Comment letters received and staff summaries taken on the First Draft LHMP are presented in the order listed in Table 1 below. The right-hand margins of each letter have been marked to identify specific comments (i.e., **A-1**, **C-2**, etc.) Following each letter, the staff responses to identified comments in that letter are presented sequentially (for example, the first comment on the First Draft LHMP identified in **LETTER A** is identified as A-1 in the right-hand margin of the letter, and the corresponding response immediately following **LETTER A** is coded as **RESPONSE A-1**).

Table 1: Comment Letters Received

Code	Commenting Persons, Organizations, and/or Agency	Comment Date
Partner Agencies		
A	Aaron Rezendez, Pacific Gas & Electric	10-22-13
Individuals/Community Groups		
B	Igor Tregub	12-23-13*
C	Jennifer Mary Pearson	12-20-13
D	Karen Weinstein	12-20-13
E	Lessly Wikle Field	11-06-13
F	Mark Gilligan	12-05-13
G	Matthew Mitchell	10-26-13
H	Moni Law	11-20-13
I	Neighbors for Fire Safety	12-19-13
J	Pam Grossman	11-30-13
K	Susan Schwartz	12-16-13
L	Terrie Light/Berkeley Food and Housing Project	12-09-13
Commissions		
M	Community Environmental Advisory Commission	12-05-13

N	Energy Commission	12-18-13
O	Housing Advisory Commission	12-09-13
P	Commission on Disability	12-09-13
Q	Mental Health Commission	12-13-13
R	Public Works Commission	12-09-13
S	Solano Business Improvement District Advisory Board	12-13-13
T	Community Health Commission	01-09-14*
Commissions: Oral Comments		
U	Disaster and Fire Safety Commission	12-04-13
V	Zoning Adjustments Board	12-14-13
W	Planning Commission	11-20-13
X	Landmarks Preservation Commission	11-07-13

*Comments were received following the final deadline.

Edits to the First Draft LHMP

Revisions to the First Draft LHMP were developed in response to feedback received during the public review period. When revisions were made in response to specific written comments received in a comment letter or summary, edits to text are provided in the responses. The Final Draft LHMP is a reprinted version of the First Draft LHMP that includes these revisions. A summary of all edits to the First Draft Plan is compiled in the *Summary of Changes to the First Draft 2014 Local Hazard Mitigation Plan.*

General Responses

Issues/questions below were presented in multiple letters in the feedback process. These issues are addressed here:

- Scope and Detail of the Mitigation Plan
- Action Prioritization
- Pedestrian Evacuation Routes in the Hills
- Overhead Utility Lines

Scope and Detail of the Mitigation Plan

The Local Hazard Mitigation Plan has two main functions:

1) It provides a Hazard Analysis (Section 3) that analyzes Berkeley's exposure and vulnerabilities to natural hazards present in the area.
2) It outlines a five-year Mitigation Strategy (Section 1) to reduce the vulnerabilities described in the Hazard Analysis.

Community comments included a number of questions and suggestions regarding hazards, topics and programs to consider for inclusion in this Plan. Many of those suggestions related to emergency management, but were not within the scope of this Plan. Mitigation is one of four recognized phases of the disaster life cycle, which includes mitigation, preparedness, response and recovery. This mitigation plan does not address recovery, which describes the planning and activities necessary to bring the community back to a "new normal" after a disaster. It does not address how the City responds to a disaster.

Mitigation and preparedness together describe the activities that make a community ready for a disaster. They are closely linked, but are distinct from one another. Preparedness describes the pre-disaster activities that enable disaster response, such as storing supplies, training people in disaster response procedures, writing plans to use in disaster response, and preparing alert and warning systems for activation in an emergency.

Mitigation describes pre-disaster activities that reduce the impact of a disaster by providing passive protection at the time of disaster impact. These activities are the focus of this Plan. Mitigation activities include retrofitting buildings to prevent their collapse in an earthquake, reducing vegetation to prevent the spread of fire, and developing zoning regulations to reduce development in hazard-exposed areas.

The key distinction between mitigation and preparedness activities lies in mitigation's *passive* protection at the time of a disaster. If an activity or system can be "activated" after a disaster to reduce vulnerability, then it is likely a preparedness activity. If the activity creates a steady state of protection that exists both before and after a disaster occurs, they it is likely a mitigation activity.

Where relevant to the mitigation topics being discussed, the Plan also includes information about the City's disaster preparedness activities. The Plan also includes information about the mitigation and preparedness activities of Berkeley's key institutional partners outside of City government. These partners are not required to provide information for this plan, and their participation in this effort demonstrates their collaborative working relationship with the City. The City will continue to work with its partners to improve Berkeley's disaster resilience in the future.

Action Prioritization

In the 2014 LHMP, Section 1: *Mitigation Strategy* highlights key Actions that the City wants to pursue to reduce hazard vulnerabilities identified in Section 3: *Hazard Analysis*. Title 44 Code of Federal Regulations CFR 201.6 (44 CFR §201.6(c)(3)(iii))

requires that Plan Actions be prioritized, but does not stipulate a particular prioritization structure. In the First Draft Plan, the Planning Team prioritized Actions by emphasizing the likelihood of Action implementation over the five years that will be covered by this Plan's Mitigation Strategy. This meant that the availability of funding largely dictated the Actions' assigned priorities.

Community responses indicated that resource availability should not play such a large role in defining an Action's priority. To address this opinion, the Planning Team revised the prioritization structure used for the Final Draft Plan. Appendix E: *Prioritization Structure* outlines the factors considered in assigning priority to an Action. The Planning Team changed Factor 4, *Funding Availability*, to allow Actions that do not have secured funding at this time, but that are eligible for identified grant programs, to be categorized as high priority.

This prioritization structure change has resulted in the reprioritization of two actions from medium to high priority:

Action	**First Draft**	**Final Draft**
Vegetation Management	Medium	High
Strengthen and Replace City Buildings	Medium	High

Pedestrian Evacuation Routes in the Hills

The 2014 LHMP highlights paths in the hills areas as important elements of Berkeley's evacuation network. The Wildland-Urban Interface Fire information in Section 3: *Hazard Analysis* described how these pathways significantly reduced evacuation distances when compared to City streets alone. The Hills Evacuation Action presented in Section 1: *Mitigation Strategy* outlines how the City hopes to continue working with partners to maintain and promote these public pathways for pedestrian evacuation.

Some community responses identified concerns about the rustic state of these pathways, specifically their lack of lighting and the rise-to-run ratio of some of the stairs. These concerns are noted. Pathways are not intended to be the only option available for evacuation out of the hills. Instead, the City is focusing on path maintenance as an important supplement to the existing network of streets in the hills. The value of the paths is in the fact that as they are maintained, and as the community is made aware of their existence and utility for evacuation, they can contribute to the limited evacuation routes currently available to community members in the hills.

Some community members expressed concern about the utility of the paths following an earthquake. Concerns included following utility pose and lines obstructing the paths and rupture of sewer lines that could possibly exist under the paths. These concerns are noted. Paths will be exposed to ground failure impacts during an earthquake. City streets will also be exposed to these impacts, and as stated above, paths are intended to supplement, but not replace, existing City streets as evacuation routes.

While paths are vulnerable to earthquake impacts, evacuation from the hills could be necessary due to disasters other than earthquake, such as Wildland-Urban Interface fire. These paths are not a perfect or comprehensive evacuation solution. They are intended to expand evacuation options for community members in the hills areas.

Overhead Utility Lines

Each year, Pacific Gas & Electric credits the City of Berkeley with 525,000 credits for use in undergrounding utilities. Under Rule 20A, the City utilizes these credits on utility undergrounding projects that PG&E performs. The City may also borrow up to five years (2.6 million) of future credits at a time to help fund existing approved projects.

Currently, two projects are in the queue for undergrounding: Grizzly Peak Boulevard ($4.1 million) and Vistamont Avenue ($5.0 million). These projects will take 2-5 years to implement, and will utilize future credits. Because of these costs and use of future credits, Berkeley currently has no other planned underground utility Districts that would fall within the scope of this plan.

At this time, funding alternatives have not been identified.

The General Plan prioritizes undergrounding utilities along designated evacuation routes. See:

- Disaster Preparedness and Safety Element
    - Policy S-1 Response Planning, Actions B and C
    - Policy S-22 Fire Fighting Infrastructure, Action A
- Transportation Element
    - Policy T-28, Action E

In Spring 2014, the City will readdress the prioritization of underground utility districts with the Public Works Commission.

Letters, Comments and Responses

Letters and comments are presented in the following pages in the order outlined in Table 1: *Comment Letters Received*.

LETTER A

Lana, Sarah

From: Rezendez, Aaron R [ARR8@pge.com]
Sent: Tuesday, October 22, 2013 12:55 PM
To: Mitigation
Subject: RE: First Draft Posted: City of Berkeley 2014 Local Hazard Mitigation Plan

Sarah,

I scanned the document and noticed this update:

Transmission pipelines, which carry natural gas across long distances, usually to and from compressors or to a distribution center or storage facility. Transmission lines are large steel pipes (10" to 42" in diameter) that are federally-regulated. They carry **unodorized** gas at a pressure of approximately 60-900 psi.

A-1

PG&E's transmission pipelines contain **odorized** gas.

Aaron Rezendez
Damage Prevention | Pacific Gas and Electric Company
O: (925) 328-5846 | Fax: (925) 328-5594 | ARR8@pge.com
www.pge.com/b4udig

IMPORTANT NOTICE – NEW ADDRESS AND OFFICE PHONE NUMBER
Address: 6111 Bollinger Canyon Road, 4th Floor, Rm 4730J, San Ramon, CA 94583
Office Phone: (925) 328-5846

From: Mitigation [mailto:Mitigation@ci.berkeley.ca.us]
Sent: Monday, October 21, 2013 5:14 PM
To: Lana, Sarah
Subject: First Draft Posted: City of Berkeley 2014 Local Hazard Mitigation Plan

Dear Mitigation Partner,

Thank you for the assistance you provided to the City of Berkeley to develop our 2014 Local Hazard Mitigation Plan update.

The First Draft Local Hazard Mitigation Plan has been posted for public review at www.CityofBerkeley.info/Mitigation. It will be available there, and at City libraries, until December 9. After that point, City staff will incorporate appropriate feedback into the Final Draft Plan. We estimate that the Final Draft Plan will be presented to Berkeley City Council for adoption in late Spring next year.

If you are receiving this email, you will be listed in the Acknowledgements section of the Final Draft Plan. Please accept my sincere appreciation for your assistance in this project, and feel free to contact me with any questions, comments or concerns.

Best wishes,
Sarah

Sarah (Tyler) Lana, Emergency Services Coordinator

LETTER A Aaron Rezendez 10-22-13

RESPONSE A-1: Comment noted. "Unodorized" has been edited to "odorized."

Lana, Sarah

From: Igor Tregub [itregub@gmail.com]
Sent: Monday, December 23, 2013 12:13 PM
To: Mitigation
Cc: Schwartz, Marna; Burroughs, Timothy; Sanderson, Debra
Subject: Additional comments on the Local Hazard Mitigation Plan - ZAB Section

Dear Staff,

Happy holidays! Sorry to have missed last Friday's deadline, but I hope that these comments - which I make as an individual - could be incorporated into the record. They concern the sections that were provided to the ZAB at its November 2013 meeting. I have left out those comments which were already proposed by the Housing Advisory Commission. Please let me know if you have any questions.

P. 14: Soft-Story Ordinance - "Explore establishment of a loan program to assist landlords who cannot access financing to retrofit their buildings." **B-1**

Also explore the possibility of alternative financing mechanisms or a JPA with other interested cities (i.e. Oakland, San Francisco). For example, San Francisco appears to be using part of the existing PACE program, called GreenFinanceSF to fund retrofits. Could the Measure GG fund be used?

P. 18: 2014 Fire Code

(1) A resident of a multi-family building informed me that a few years ago, when she found a partially filled canister with fire accelerant that was suspiciously left in the garage, the Fire Department said that they would not test it, even though it appeared to be butane. If a policy of not testing suspicious equipment that may contribute to the cause of fire is still in effect, or the Fire Department does not respond to tenants' and homeowners' inquiries about the same, the City of Berkeley should work with the Fire Department to revisit it. **B-2**

(2) The RHSP self-certification model is only marginally conducive to effective enforcement. For example, in the case of 2227 Dwight, code violations may have occurred in installing the water tank that is suspected to have been a cause of the recent fire. If true, this slipped through the inspection process. It is recommended that staff propose to the City Council inspection and enforcement models that are more successful at achieving compliance with life safety codes. It is further recommended that the City of Berkeley cost out such alternatives so that those that fully meet the needs of life safety for Berkeley's residents are fully funded. **B-3**

P. 32: Energy Assurance Plan for City Operations (Also P. 41: Extreme Heat) **B-4**

This or a more appropriate section might be a good place to add goals of helping Berkeley's most vulnerable population (e.g. senior citizens, people with disabilities, the homeless) cope with climate change or evacuation. For example, makeshift heating stations during cold snaps and identifiable locations in municipal buildings with a robust HVAC system during periods of elevated external temperatures should be explored.

P. 36: Stormwater System (Also P. 42: Severe Storms)

Since the voters of Berkeley passed Measure M which promised improvements to the watershed as well as streets, grant opportunities from the Coastal Conservancy and other agencies should be aggressively explored to help provide an external source of funding that would supplement any existing and future bond obligations. **B-5**

P. 49: Sea-Level Rise

LETTER B, CONTINUED

B-6

The priority of this should be "High" or at least "Medium," not "Low." Some predictions suggest that the Eastshore Freeway might be completely flooded in the next 50 years. Planning for resiliency measures need to begin now and, as appropriate, should be leveraged with efforts to prevent stormwater runoff and flooding into low-lying areas such as Aquatic Park.

Best,
Igor

LETTER B Igor Tregub 12-23-13*

RESPONSE B-1: Suggestion to explore alternative financing mechanisms for a loan program is noted. The Special Tax To Fund Fire Protection And Emergency Response And Preparedness (“Measure GG”) is not eligible for this kind of project. This Tax funds elimination of rotating fire station closures, emergency medical services, community emergency response training and preparedness efforts, and equipment supporting City and community emergency response. Structural mitigation does not fall into these categories. See BMC 7.81.010.

RESPONSE B-2: Concerns or issues about hazardous materials response procedures are not within the scope of the Local Hazard Mitigation Plan. Commenter's anecdote does not provide adequate detail to allow for specific feedback by the City.

RESPONSE B-3: Commenter speculates that code violations occurred during installation of a water heater at 2227 Dwight, and further speculates that those speculative code violations led to the fire on March 8, 2013. This comment further alleges that this speculative code violation was not addressed because of a failure of the Residential Housing Safety Program self-certification model. No evidence is provided to support any of the claims or the commenter’s overall conclusion.

RESPONSE B-4: Ideas regarding care and shelter planning for extreme heat, severe weather and evacuation are noted. These are disaster response considerations, and are not within the scope of this Plan. Please see general response re: Scope and Detail of the Mitigation Plan.

LETTER C

Lana, Sarah

From: Jennifer Pearson [jennifer.maryphd@gmail.com]
Sent: Friday, December 20, 2013 4:58 PM
To: Mitigation
Cc: Arreguin, Jesse L.
Subject: Draft comments for Disaster Mitigation Planning

Mitigation@ci.berkeley.ca.us

Dear Sirs and Madams,

Very few people know of this draft planning process. Why hasn't the City Manager sent each household the request to provide comments as we expect for CITIZEN NOTIFICATION to ask for knowledgeable CITIZEN PARTICIPATION that we believe is critical, thus we wrote such into the General Plan? **C-1**

I only learned of this yesterday. I write here about my experience for the Flooding section. However, that is lacking on history, maps, charts, etc. It provides 1 skimpy map: #3.17. Berkeley Area Watersheds. Notwithstanding, there are many maps in the public domain. **C-2**

FLOODING in North Shattuck 2005

A neighbor asked I write the following given the lack of addressing the history of all watersheds with respect to flooding vulnerabilities. That section of the narrative is lacking, thus not enough information provided to comment on.

A few of our questions:

C-3

1)Where is the historical data on storm surges?

2) Where is the data on flooding in each of the 5 watersheds not addressed?

3)What are the sources relied upon to write the narrative?

4)How can we comment on a draft lacking a bibliography? **C-4**

Our experience: The Dec 18, 2005 storm surge of 2.84 inches flooded my home at 172 feet above sea level on Milvia Street in the basin of the Schoolhouse Creek watershed. Two years later, Asst. City Attorney awarded me a claim for 25% of requested.damages. As time passed I discovered more damage from the water that wicked up from the cement floor and patio..I then took out National Flood Insurance with my Homeowner Insurance Agent. I had to build a dike, relocate my gate entrance and still continue to place sand bags. I was one of many homeowners who suffered damage. I spoke at a Council Agenda Meeting and later in Jan 2006, I attended a Community Meeting led by Council member Darryl Moore on the that flooding.

LETTER C, CONTINUED

I reviewed the literature. That rainfall was not a rare event. The US Weather Station at McCone Hall records as well as Doris Sloan and Scott's Stine's publication work titled BERKELEY WATER (1983) show other years off intense rainfall in short time periods. Just under 3 inches of rain in an hour or so. The hills were already saturated, unable to absorb water in pervious land. Water flowed downhill in the streets--some came from the Codornices Creek Watershed down Oxford and Walnut Streets to Rose then down Shattuck, then Vine flowing into the Schoolhouse Creek Watershed. Floways of oily water ran down the streets. The ponding was 3 or 4 properties wide--approx 200 feet north to south. It overflowed the sidewalks into gardens and driveways. The water went underneath our house perimeter foundation seeping out downhill in the rear yard. Patio tiles were raised. The 95 year old (original) street sidewalk became cracked and had to be replaced

I saw on VIne Street mid block between Henry and Milvia water branched south to the next lowest land and rushed out into the sag on mid block Milvia between Cedar and Vine.The rushing flood waters on Shattuck from Rose to the Bank of America Parking lot was over 1 foot deep! It rushed down that parking lot ponding on Henry then through an apartment building to Milvia, ponding and on and on to the sags in each north/south street all the way to the Virginia Outfall. The configuration of that beach completely changed .

The storm drains were clogged--water geysered up from the catch basins--about an hour after the rainfall stopped, the street ponds suddenly went down as we heard gurgling in the storm drains. The sidewalk by my house was littered with catch basin polluted debris--including plastic pieces, -requiring degreasing and sanitizing given there were a few condoms and needles and who knows what else.

Every north south street with a sag (where the historic creek was undergrounded) flooded in the street over-flowing into lowest elevation properties--patios, basements and 1st floor apartments. IN my case at 1546 Milvia filthy water moved beneath the recently permitted perimeter foundation, rushed down the side path and the 1540 next door drive way dumping into my path and garden--creating a pond of oily water that killed the lawn for 5 years.

Sincerely, Jennifer Mary Pearson 1546 Milvia, Berkeley 94709

LETTER C Jennifer Mary Pearson 12-20-13

RESPONSE C-1: Please see Appendix C: *Plan Development Process* and Appendix D: *Documentation* regarding the community outreach efforts utilized for this Plan.

RESPONSE C-2: For creek flooding exposure, Map 3.16: Digital Flood Insurance Rate Map provides FEMA's 100- and 500-year flood areas.

For storm drain overflow exposure, the narrative in Section 3.6.3 lists intersections expected to see localized flooding in the Potter and Codornices Watersheds.

Map 3.18 indicates areas exposed to flooding from tsunami.

Map 3.19 indicates areas exposed to flooding from sea-level rise.

RESPONSE C-3: The City maintains records of high tides and uses that information to design storm drains in low-lying areas of the City that could experience high tides.

The narrative in Section 3.6.3 lists intersections expected to see localized flooding in the Potter and Codornices Watersheds. The hydraulic analysis mentioned in the Stormwater System Action is needed to identify these areas for other watersheds.

The narrative was written by City staff, using additional cited sources that are outlined in detail in the Endnotes of Section 3: *Hazard Analysis.*

RESPONSE C-4: See the Endnotes of Section 3: *Hazard Analysis*.

LETTER D

Lana, Sarah

From: Karen Weinstein [karenweinstein.berkeley@gmail.com]
Sent: Friday, December 20, 2013 4:57 PM
To: Mitigation
Subject: Feedback

Hello,

Just a few thoughts about the mitigation plan.

1. If we are going to use pathways for evacuation purposes from the Hills, and that is what is stated, could we please add on the maps, which pathways are usable for this. I know some are and some aren't, and some are being worked on. Thanks to the City for helping with this. But only add those pathways that are really viable for evacuation, or at least identify the status of these pathways. **D-1**

2. Please give annual reports as to the progress that is being made on management of vegetation for fire reduction. **D-2**

3. Consider an early warning system for fire, or any of the disasters. **D-3**

4. Please consider a more robust outreach to neighborhoods in the Hills area about fire evacuation routes. **D-4**

5. Better communication with Tilden for those families who are close to the Park, **D-5**

6. Consider discussion with the Commission on the status of women for further mitigation plans. **D-6**

Thank you,
Karen Weinstein
District 6
Commissioner, Status of Women

LETTER D Karen Weinstein 12-20-13

RESPONSE D-1: The Hills Evacuation Action includes the statement: "Update City maps of all emergency access and evacuation routes to include pedestrian pathways."

RESPONSE D-2: Annual reporting of progress on vegetation management will be included as part of the status reports on LHMP actions, as outlined in Section 2.1: *Implementing Actions and Reporting on Progress*.

RESPONSE D-3: See *Appendix A, Action B-1, Part E) Explore use of new technologies, such as early warning systems*, which addresses development of a comprehensive statewide earthquake early warning system in California.

RESPONSE D-4: The Hills Evacuation Action includes the statement: "Publicize up-to-date maps of all emergency access and evacuation routes."

RESPONSE D-5: Tilden Park is part of the East Bay Regional Park District and Moraga-Orinda Fire Protection District has jurisdictional authority for fire responses. The City actively coordinates emergency response with both the East Bay Regional Parks District Fire Department and the Moraga-Orinda Fire Department.

RESPONSE D-6: Please see Section 2: *Implementing, Monitoring and Updating the Plan* regarding the reporting process for Plan implementation.

LETTER E

Lana, Sarah

From: Lessly Fleld [henryfield@sbcglobal.net]
Sent: Wednesday, November 06, 2013 7:42 PM
To: Mitigation
Cc: Capitelli, Laurie; Nancy Bickel
Subject: Community Feedback Submittal - 2014 First Draft Mitigation Plan

Categories: Red Category

To Whom It May Concern -

Thank you for preparing such a thorough and well thought through hazard mitigation plan and for soliciting community feedback. After reviewing the report, I'd like to share the following suggestions:

Hazards

Please consider adding a train bleve involving both hazardous materials on rail cars, but also resulting from the derailed cars coming into contact with either the liquid petroleum pipeline or natural gas pipeline. Are there any places in Berkeley with larger working populations or vulnerable populations where this scenario might result in many casualties? **E-1**

Please review your data on infectious diseases like Avian Flu and tuberculosis to see if it rises to the level of importance to include in this report. Living adjacent to a large university with lots of close proximity student housing makes our population especially vulnerable to any large-scale infectious disease outbreak. **E-2**

Damage and Losses

I was surprised to see that the City only expects 6 - 12 ignitions following earthquake, especially given the number of soft story buildings that use natural gas still present in the City. I was unable to find the citation for this statistic, although I only looked closely for it in section 3.3.2.3. My understanding is that there could be dozens of fires in Berkeley following an earthquake. If it is not already clearly cited, could you consider adding the citation for that statistic? **E-3**

Earthquake and UWI Fire Mitigations

E-4

Consider adding a section that parallels your proactive relationship with EBMUD, but with PG&E. In either a UWI fire or following an earthquake, it is likely that PG&E will shut off electricity and gas on key circuits and mains. It would be great if the City could know in advance how they would coordinate with PG&E and how they will manage traffic, etc. following the shut-offs.

Consider adding, if it does not already exist, application of transfer tax to new home owner purchase of an automatic shut-off valve. While the draft report refers to reducing fires from the natural gas delivery system, service-related fires are also mentioned later in the report. Service-related fires are likely from appliance hose leaks coming into contact with pilot lights, especially in homes with older appliances. These fires are particularly problematic because thousands of services have to be "shut-in" in order to stop the fire at one house and unless every valve is automated or remotely operated it could take precious minutes to reach the right valve. If all Berkeley residents installed automatic shut-off valves on their service, we would completely eliminate service-related fires following earthquakes. **E-5**

Consider reviewing the earthquake warning systems in use in the Coachella Valley, CA. These early indicator systems give approximately 5 to 25 seconds of warning that an earthquake is coming. This amount of warning allows teachers to get children to duck, cover and hold and can allow fire departments to raise garage doors before the shaking begins. These precious seconds can make the difference between safety and injury and can shave critical minutes off of emergency response times. E-6

Consider regularly scheduled drills involving the operationalization of the new bay water fire suppression system. Our first responders can only benefit from the chance to roll it out, manage the traffic, coordinate the response between agencies, etc. It's a great system, but it needs to be practiced to work during the real deal, either UWI fire or fire following earthquake. This type of drill would also help to raise general citizen awareness about what to expect and how not to impede. E-7

Climate Change

Is it possible to add more strategic urban forest planning to the mitigation section? We're going to need a lot of the right kind of trees in the next 100 years and planting them now is going to make a difference in two decades. E-8

Thanks again for the opportunity to participate by providing feedback. If you would like to further explore these comments, I am happy to discuss.

Sincerely,

Lessly Wikle Field
1344 Carlotta Ave.
Berkeley, CA 94703
(510) 526-3676

LETTER E Lessly Wikle Field 11-06-13

RESPONSE E-1: The City has analyzed a limited number of scenarios for rupture and release of bulk chemicals from Kinder Morgan fuel pipelines, PG&E natural gas pipelines, and volatile and toxic chemicals from rail cars. Analysis of the interaction of these scenarios is too onerous since railcars carry an infinite variety of chemicals. A review of safety and accident statistics provided by the U.S. Department of Transportation shows that pipelines and rail transportation result in significantly fewer spillage incidents and injuries than road transportation. (See the Manhattan Institute's Issue Brief Pipelines Are Safest For Transportation of Oil and Gas, available at http://www.manhattan-institute.org/html/ib_23.htm.)

Exposure to potential hazardous materials release is greater for communities along the vehicular hazardous materials transportation routes that extend throughout the City. (See Map 3.20: Level 1 Hazardous Materials Facilities, Transportation Systems and Primary Natural Hazards). Red lines signify the major transportation routes for heavy transportation of bulk chemicals.

Chemical trucks use the two north-south roads – San Pablo Avenue, and the Sixth & Seventh Street corridor – and three east-west roads – Ashby Avenue, University Avenue, and Gilman from I-80 east to San Pablo Avenue. Heavy trucks are required to travel on these roads to the extent possible on trips within the City of Berkeley. This limitation will prevent large chemical trucks from going into many residential districts. Transporters must receive prior approval from the City before using alternate routes.

RESPONSE E-2: See Section 3.1.4: *Hazards Not Considered in the Plan* regarding why public health emergencies are not included in this plan.

RESPONSE E-3: The citation was provided in 3.3.4: *Earthquake Loss Estimates*. The citation has been added to the "6-12 ignitions" statement in the Executive Summary.

RESPONSE E-4: Related to mitigation activities, the City is and plans to continue partnering with PG&E, as inferred in the Partnerships Action.

Post-disaster coordination and traffic management are response activities, and are not addressed in particular because they do not fall under the scope of this mitigation plan. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE E-5: Automated gas shutoff valves are eligible under the transfer tax rebate program.

RESPONSE E-6: See *Appendix A, Action B-1, Part E) Explore use of new technologies, such as early warning systems*, which addresses development of a comprehensive statewide earthquake early warning system in California.

RESPONSE E-7: Drills do not fall under the scope of this mitigation plan. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE E-8: The Extreme Heat Action proposes the following activity: "Create and maintain shading by sustaining municipal tree planting efforts and continuing to maintain the health of existing trees."

Comments on Berkeley Local Hazard Mitigation Plan
by Mark Gilligan

General

F-1

In multiple locations in this document different earthquake magnitudes are used when discussing the magnitude of the risk. The values seem to vary between 6.7 and 7.3. As a minimum, when the lower values are used, the discussion should point out that the risks would be considerably higher if the larger number is used. In the case of the HAZUS model it is suggested that the model be rerun for the larger numbers.

A number of issues are discussed in multiple locations in the document and as a result there are problems in coordinating what is said in these different sections. This can also lead to situations where a properly nuanced statement is made in one location and more absolute statements exist in other portions. There is a concern that many of the users of the plan may not appreciate that the nuanced statements exist.

The document presents a positive spin on current conditions sometimes omitting problems. The question is can we be more forthcoming about our past failures and plans to correct the problems or do we try to downplay problems. This is a matter of moral leadership.

F-2

It is appreciated that the mitigation plan will not be addressing in detail the development of response and recovery plans still there is a need for an overview section that discusses how the mitigation, response, and recovery plans complement each other and the need to coordinate those efforts. This section should also put forward the City's plan for updating and creating these plans. Dates should be provided. It would also be helpful to provide a realistic evaluation of the status of the current response and recovery plans. My sense is that the response plan is out of date and is not consistent with our obligation to comply with various state and federal requirements.

The overview should also provide a realistic assessment of the ability of City departments to implement the existing response plan. My sense is that in many City departments key personnel are not aware of the existing plan and are not in a position to effectively implement it.

There were repeated references to protecting Berkeley's unique character and values. The reality is that Berkeley will be transformed by a major disaster such as an earthquake. Do we want to experience the stagnation experienced by Santa Cruz after the Loma Prieta Earthquake. The question is will the City Council and staff provide the moral leadership to help the citizens realize that hard decisions will have to be made?

F-3

Much of the discussions regarding "Partners" (other agencies or private entities) is obviously drawn from standard public relations documents prepared by these entities. Too some extent this is unavoidable but we can be more aggressive in providing transparency. It is not uncommon for one partner to discuss issues which are ignored by another partner. For example ATT mentions that they have batteries that allow operation for 4 hours off the grid while other partners are

silent on this issue. When such inconsistencies are noted it is suggested that the other partners be asked pointed questions and if they fail to be more forthcoming their lack of response should be noted in the plan.

Given that the City of Berkeley and UC are so intertwined and that UC is dependent on some City resources it appears that there will be a need for a unified command under the ICS system. It is not clear that the City and UC have ever had an exercise where they needed to work together in a unified command. **F-4**

When action items from the 2004 plan are listed as deferred or in progress they should be reflected in the new plan. It does not appear that this has consistently been done. **F-5**

I am concerned that the City Building Department does not have a more prominent role in the mitigation and I hope response and recovery activities related to City Buildings. First is the concern that the Public Works Department personnel, because they have not specialized in building design and construction, will inevitably not have the expertise and insight that the Building Department can provide. Secondly is the moral hazard that Public Works Department personnel will put the needs to get the building operational ahead of the need to identify and fix problems. I have seen this with the UC system and expect this to be a real possibility with the Public Works Department because their project managers may not be focused on certain concerns. **F-6**

Executive Summary

It should be noted that earthquake initiated fires could be indistinguishable from wildland- urban interface fire. The only difference is the cause. By labeling this risk as a Wildeland Urban Interface fire it encourages individuals to think of WUI fires and fires following earthquake as separate events. If we were recognize that we could have what we call a WUI fire and an earthquake as part of the same event then it is likely that the estimate of 1.8 Billion in building loss would be on the low side. (pg 3) **F-7**

There does not appear to be any consideration of the damage to city infrastructure. (pg 3) **F-8**

The summary of city buildings in the first bullet point is silent about other buildings where there are concerns or where buildings have not been evaluated and the implications of damage to these buildings. (pg 5) **F-9**

The statement that Berkeley is a leader in disaster management is inconsistent with the inability of the City to update the BLMP in a timely manner. The City may have at one time been a leader but to maintain this status it needs to be more aggressive. (pg 5)

A key element of disaster resilience has to do with the ability to respond and to facilitate recovery. Suggest that multiple key city departments do not have current plans for post earthquake action nor are the staff familiar with the out of date plans. (pg 5) **F-10**

Under medium priority actions it states that strengthening of replacement of city buildings will occur as funding is available. Without some commitment for action tied to specific dates little or no progress will be made. (pg 7)

A proposed medium priority action is to streamline zoning permitting process to rebuild residential and commercial structures following disasters. This effort needs to be expanded to include processes for evaluating buildings for damage as well as for permitting and inspecting construction after the disaster. (pg 7) **F-11**

Problems with the landslides in the Berkeley hills will require a plan involving multiple property owners working together. If this is not done as part of a mitigation program pre earthquake it will inhibit if not prevent much of the rebuilding after an earthquake. (pg 7) **F-12**

It is stated that the City has effective processes to implement disaster mitigation activities (top of pg 8). From my perspective the City has not been keeping the Disaster and Fire Safety Commission informed about the implication of mitigation efforts. **F-13**

Section 1

1.2.2 Prioritization of Actions

Prioritizing based on what we think we can do allows us to avoid coming to grips with major problems. Suggest you prioritize based on the magnitude of the risks and then contrast this with the expected resources that we will likely have. The public and the Council deserve to know the unvarnished truth. **F-14**

I would be surprised if the proposed strategy for prioritizing was what FEMA had in mind.

1.2.4.1 Building Assessment (pg 8)

Mention is made of analysis of critical structures being performed by December 2013. Provide clarity as to what are the critical structures, what sort of review will be undertaken and what is the criteria used. Since this mitigation plan will be published post Dec 2013 the action item needs to be updated reflecting current status of these efforts. **F-15**

What criteria is to be used for City leased buildings? These buildings sometimes house critical post disaster city services. **F-16**

1.2.4.1 Buildings (pg 13)

Rather than put the focus on new and better codes the focus should be on enforcement. The current codes if consistently enforced would have a bigger impact than adopting new codes. This may require readjustment of permitting fees to support the additional effort. **F-17**

It should be noted that the periodic adoption of the California Building Code is mandated by the state and the city has limited ability to modify this code. In addition attempts to develop local modifications would require more time and cost by staff to develop the new code provisions. In many cases this would result in the retention of outside specialists. Thus it is unrealistic to expect any building department to be on top of all of the code sections.

When the local code does not deviate from the California Building Code architects, engineers, and contractors will be more familiar with what is required thus resulting in a greater chance of code compliance.

1.2.4.2 Strengthen and replace City Buildings. (pg 27) **F-18**

Unless this priority is driven by some commitments it is not clear how progress will be achieved.

1.2.4.2 Develop and Energy Assurance Plan for City Operations. (pg 29)

In order to make use of photovoltaic generation after a disaster it will be necessary to modify the systems to make it possible to access the power when the electric grid is down. Suggest that the City take a leadership role in this. **F-19**

1.2.4.2 Tsunami. (pg 37)

Suggest that the cost of mitigation of Tsunamis is high for corresponding benefit. Since this hazard impacts an isolated element of the city it is suggested much of the work should be primarily self funded. **F-20**

Suggest that the Disaster and Fire Safety Commission will have problems with the use of Measure GG funding to mitigate Tsunami. **F-21**

1.2.4.2 Extreme Heat. (pg 38)

The proposal is ill defined and thus not likely to be effective. **F-22**

I realize that climate change is a major concern but wonder whether local communities can have considerable influence beyond conserving energy and resources. Suggest that the biggest policy influences will be actions taken at a regional or national level. On a local level we will probably be more effective in working to consistently implement these national and regional initiatives.

1.2.4.2 Streamline Rebuild. (pg 45)

If the work on the building can be characterized as repairs to residential buildings state statutes already provide for a right to make the repairs consistent with the original construction. **F-23**

Note that FEMA funding to assist with the reconstruction of damaged buildings may be negatively impacted if the jurisdiction imposes criteria that did not apply to buildings proior to the earthquake.

Section 2

2.1 Implementing Actions and Reporting on Progress.

F-24

The Disaster and Fire Safety Commission needs to appreciate the expanded scope of their involvement. This suggests that the commission provides oversight to more than the fire department. It is not clear that City staff has been providing the Commission with information about City activities consistent with this oversight.

Section 3

F-25

http://quake.abag.ca.gov/mitigation/ Suggests that the regional mitigation plan was developed in 2010 as opposed to 2011 as noted on page 5 of Section 3.

3.3.2.1 Magnitude and Intensity.

F-26

The Richter scale is not universally used. Refer to the discussion on the Moment Magnitude scale. http://en.wikipedia.org/wiki/Moment_magnitude_scale

3.3.2.2 Ground failure

F-27

Footnote 9 supposedly supports statements as to when these maps are used but actually provides no substance. The footnote should point to a specific regulation or other source that requires the use of this map.

While the state may have required that these maps be used for planning it would appear that the City based on detailed local studies could take the position that the liquefaction potential is overstated. It is important that the City draw from local resources and expertise to better access the actual risk.

3.3.2.2.3 Liquefaction

F-28

A point that gets lost in the discussion of liquefaction is that even when a layer of the soil has liquefied there may be no significant damage to certain structures. Some of the factors that might impact this are the thickness of the liquefiable layer and the potential settlement as well as the depth of the liquefiable layer. For example if a relatively thin liquefiable layer was overlaid with a thick layer of non-liquefiable soil a light residential building, with a shallow foundation, may see no noticeable distress. This is because the non-liquefiable soil protects the building from significant differentiable settlements.

It is my understanding that the liquefiable layer for much of Berkeley is overlain by a significant thickness of non-liquefiable soil. This would suggest that we will not see significant liquefaction induced damage to most of the buildings that inhabit this area.

The City needs to undertake a study in cooperation with geotechnical engineers who practice in Berkeley to access the impact of typical residential buildings. Feedback from local geotechnical engineers suggests that such a study would in many instances show that the concern is over rated.

At the bottom of page 21 it is stated that sea level rise could raise the water table in Berkeley thus increasing the potential for liquefaction. Please provide the source of this statement and some indication as to the area of impact. There is the potential that such statements may suggest greater problem than exists. **F-29**

If we are talking of 3 meters of sea rise by 2300 it will not impact much beyond the railroad tracks although the freeway will need to be raised **F-30**

3.3.3

(Pages 26 to 28)

It is not clear what criteria the City is using to evaluate their buildings. The criteria may vary depending on the intended usage. Provide more clarity regarding the criteria to be used. **F-31**

The City needs to have a clear criteria that leased buildings must satisfy before the building will be leased by the city. UC Berkeley has such a policy. What is that criteria for the City of Berkeley? Do the existing City Buildings meet that criteria? **F-32**

Provide a list of the city buildings that need to be assessed to determine their vulnerability. Appendix B does not do that. In fact it appears that Appendix B is incomplete suggesting that the City's does not have this issue in hand. (pg 28) **F-33**

The Plan states that the Ratcliff Building will be used to coordinate the Public Works Departments Operation Center. This would normally indicate the need to comply with the code provisions for an essential services building. The concern is that for buildings such as the Ratcliff Building it is generally not feasible to bring these buildings into full compliance with new building standards let alone up to the standards for an essential services building. Thus I am concerned that the write up implies a greater level of performance than was provided by the retrofitted building. I am also concerned that this building may not be able to fulfill the role assigned to it after a major earthquake. (pg 28) **F-34**

I find it hard to believe that the Ratcliff Building fully complies with the criteria for an essential services building. I am suspicious that some individuals that do not fully understand the facts have inadvertently mislead the authors of this report.

In the write-up of the North Branch Library it was stated that "…the building was seismically retrofitted to governing standards." There are no explicit mandatory standards as to the level of retrofitting when undertaking a voluntary seismic upgrade which this was. Thus the quoted statement is misleading. My expectation is that the building was retrofitted to a level that was a compromise. This would be consistent with the recommendations made in the reports regarding **F-35**

the original building that were used by the city in developing their strategy. (pg 29) Please note that I was personally involved in the evaluations performed for the old libraries which also discussed options for retrofitting.

The comment regarding the North Branch Library are also applicable to the Claremont Branch Library. (pg 30)

(pg 37 discussion of URM's)
The point needs to be made that even when reinforced these URM buildings will perform poorly and will likely collapse in a major seismic event. **F-36**

(pg 37 discussion of Map 3.9)
There is a need for studies regarding extent of and severity of damage due to liquefaction. While elsewhere in this plan it is recognized that not all sites within the liquefaction hazard planning zone are of significant risk this discussion sends a clear message that all buildings within this zone are likely to experience failures associated with liquefaction. There is a need to coordinate the message you want to send. **F-37**

(pg 39 discussion of Tilt-Up Concrete Construction.)
There cannot be an ordinance to mandate retrofit of these buildings until the state passes legislation authorizing such a local ordinance. **F-38**

Because Tilt-Up buildings will likely suffer significant damage we should put planning policies in place that will recognize that different uses for the property may be more appropriate when these buildings have to be torn down. Planning regulations that try to protect existing buildings and uses will be irrelevant when these buildings collapse or have to be torn down.

(Table 3.3)
Missing from the table are the roads in Berkeley. **F-39**

(pg 45 Storm Drain System)
Mention was made of the potential for flooding in areas that have not previously seen flooding. Since most of these properties will not have flood insurance, the City should notify the impacted property owners of this potential and recommend that they get flood insurance. Without flood insurance much of the damage may not be covered. **F-40**

(pg 46 Electricity)
Reference was made to the fact that most solar systems do not provide power if the grid is down. This does not have to happen. Suggest that installers of photovoltaic panels be required to offer customers an installation option that allows use of solar power when the grid is down. The idea is to provide power to several outlets and or to charge batteries not to power the whole house. **F-41**

(pg 50 PG&E)
Mention was made of a First Responders Safety website. What happens when the internet is down and the emergency responders need the information? **F-42**

PG&E talks about there ability to respond but am concerned that the system that works well for local problems may not work when communication lines are down and the roads are blocked. This is especially a problem in the first day or two when it is necessary to identify safety problems and to turn off services. After the first week it probably does not make any difference. **F-43**

(pg 51 Aviation Fuel Pipeline)
Mention is made to automatic and remote control valves. Are these valves dependent on external power or lines of communication that may be down or inoperational due to earthquake damage? **F-44**

(pg 55 Caltrans) (pg 72)
Did Caltrans not evaluate the potential for liquefaction of their roads and structures in and around Berkeley? What did they find? **F-45**

Table 3.8: The lower right cell in the table does not read in a way that makes sense. **F-46**

(pg 57 Key Communication Partners)
Suggest we discuss the fact that after a disaster we may have communication for a few hours but that this will end when fuel for backup generators runs out. **F-47**

Each of the providers should be asked how long they can operate on backup power.

(pg 64 & 65 Life Long)
To the extent that we look to providers such as LifeLong to provide post earthquake healthcare services we should be concerned about the quality of the buildings in which they will be housed. Without some data to the contrary it is likely that the buildings could have seismic vulnerabilities. While the city cannot dictate the building a private entity choses to use the City should be aware that depending on the building in question the City may want to assume that such facilities will not be available after a major disaster. **F-48**

(pg 66 Discussion of private schools.)
I have engineered a number of public schools and am familiar with the applicable regulations. While there are concerns about some of the buildings private schools much of the discussion is biased. It is wrong to categorically make the statement that private school buildings are not as safe as public school buildings. **F-49**

Many older public school buildings have real problems because they were built at a time when our codes and understanding were not as good as they are today. This is recognized in the Plan when it discusses the problems with public schools.

If we look at the difference in the code provisions for new public school buildings and new private school buildings in California we find relatively few differences and the differences in most cases do not explain any differences in performances. The key differences have to do with the quality of the plan check review in the permitting process and the inspection oversight during construction.

The Private Schools Building Act addresses the problem of the plan check by requiring the structural plan check be performed by a structural engineer. Depending on the structural engineer the City has perform such a review you could have a better review that provided by DSA plan checkers. Thus if the plan check is inadequate it is because the City is not doing its job.

A dirty secret is that on public school buildings no plan check is performed related to electrical and mechanical systems since DSA (the agency regulating public schools) does not have authority over these aspects of the building's design. Instead they rely on the skills of the inspector of record.

The other key contributor to building performance has to do with how well does the Contractor conform to the permit documents. On public schools there is a requirement that there be an Inspector of Record who is always present when work is being done. To compensate for the lack of an Inspector of Record he City inspectors can provide more oversight related to compliance by the frequency and quality of the inspections provided by the City building department.

The net result is that it is irresponsible to make categorical statements that private school buildings are not as safe as public school buildings. There is no reason to believe that a well designed private building that was built in conformance with the code will not perform as well as a public school subject to DSA oversight. All that DSA oversight does is to make this more likely.

Similarly the discussion regarding community colleges is more nuanced than stated in the plan. It should be noted that the students who attend community colleges are of the same age as individuals who attend public and private colleges which are not governed by the Field Act.

(pg 67 Berkeley City College)
The plan states that the EOC of the College will be connected to the Community College district offices and the sheriff's office by short wave radio. Does the reference to shortwave radio mean amateur radio or some other radio service? If this really means amateur radio then there is a problem between the amateur radio groups that needs coordination. **F-50**

A more basic concern regarding Berkeley City College communicating directly with the AC Sheriff is that they appear to be bypassing the City's EOC.

(pg 67 UC Berkeley Campus)
The City of Berkeley should learn from UC which has a more sophisticated plan for actively managing their buildings and for responding to disasters. **F-51**

3.3.4

The more up to date HAZUS reports mentioned did not include the consideration of faulting on the San Andreas fault (Ref footnote 61). Because these studies only peripherally address Berkeley there is a real concern that our risks are underestimated. (pg 70) **F-52**

The plan states that after an earthquake there could be 6 to 12 fires. It needs to be noted that BFD only has the ability to fight 2 maybe 3 fires at one time without outside aid. Because of blocked streets and other problems BFD may not be able to effectively respond to some of these fires. After a major disaster there will be no mutual aid for likely several days since our neighbors will have similar problems. This creates the potential that fires may burn out of control and spread to the rest of the city. (pg 70) **F-53**

(pg 71)
The concern about buildings in the commercial corridors is not limited to URM buildings. Many of these buildings are old (think old codes) and have non-optimum structural configurations. Our planning efforts should consider the likelihood that many of these buildings will not be operational after a major earthquake and in many cases may have to be rebuilt. This will have an impact on the economic recovery of the city after a major earthquake. **F-54**

(pg 72 Discussion of BART)
Discussion of BART inexplicably segues into a discussion of roadways and the Bay Bridge. **F-55**

3.4 Wildland-Urban Interface Fire

Much of the discussion regarding WUIF has to do with an out of control fire in the Berkeley Hills. It is suggested that while such a fire could be caused by a wildland fire it could also be caused by an out of control fire originating in the urban portion of the hills. We should appreciate that such fires could be initiated as a result of due to broken gas lines resulting from faulting or land slides caused by an earthquake and that BFD may not be able to reach the fire before it spreads. **F-56**

Our whole thinking changes when we think of this fire as being initiated by a wildland fire as opposed to being caused by an earthquake.

3.4.3

(pg 81-83 Egress from Panoramic Hill Area)
There needs to be discussion of plans for an alternate exit path from the panoramic hills area and the fact that it is on hold. One of the mitigation measures should be to facilitate the implementation of this alternate exit path. **F-57**

(pg 85 Improving Firefighting Readiness)
The previous Fire Chief stated that the fire department did not have a plan for how to deal with the situation where there are more fires than they have the resources to fight in a conventional manner. This is a real possibility after a major earthquake when there is no mutual aid for several days. The fire department needs to have a strategy to deal with this even if that means to let some buildings burn while concentrating on evacuation. In the absence of such a plan there is a concern that the City Council will not appreciate the problem. **F-58**

(pg 89 mitigation activities for landslides)

Because the landslides encompass multiple properties and city streets it will be necessary for multiple property owners and the city to work together to reduce the potential for damage. In general it will not be possible for individual home owners to mitigate the potential for sliding solely by doing work on their property. Even if homeowners can protect their property by doing work on their property the city streets and the utilities in them will be still at risk. This may involve the creation of special districts to finance and do the work. **F-59**

3.6

(pg 94 Storm Drain Overflow Exposure)
It should be noted that the lack of models for the other watersheds will make it difficult to identify trouble spots.. **F-60**

(pg 97 National Flood Insurance Program)
To help enforce NFIP compliance the California Building Code includes design requirements. Berkeley then adopts a local ordinance including the local FIRM maps into the building code. Suggest asking the Building Official which maps will be adopted as part of the 2013 Building Code. The Plans description of the appropriate maps should be coordinated with what is in the 2013 building code. **F-61**

When the City develops the hydraulic models of the watersheds consider modifying the flood maps to include areas indicated by the models that are not reflected in the FIRM maps. **F-62**

(pg 98 Notable Mitigation Activities)
The provisions of BMC 17.12.090 that address standards of construction address issues addressed in the California Building Code and thus these provisions should be considered Building Regulations. As building regulations these provisions would be considered modifications to the California Building Code which would have to be filed with the California Building Standards Commission if they are to be legally enforceable. My belief is that this has not been done. **F-63**

To prevent confusion and duplication suggest provisions in BMC 17.12.090 that duplicate provisions in the California Building Code or conflict with provisions in BMC Title 19 be deleted from Title 17. As appropriate move the relevant provisions to BMC Title 19. This would recognize that this issue can be better enforced by the Building Department.

3.8.2

(pg 114)
The concerns about problems with fresh water can be mitigated with desalinization plants. Note that several locations in Southern California are installing desalinization plants for fresh drinking water. **F-64**

(pg 115)

Adding a living roof to most buildings is not feasible because this requires an essentially flat roof and because most roofs do not have the capacity to carry the additional loads. The added weight on existing roofs would likely require the building be seismically upgraded. F-65

Table 3.15
The fact that the same issues are discussed or summarized in multiple locations makes it difficult to coordinate what is said. This table contributes to that problem and does not really add anything. F-66

4.1 City Buildings and Systems

More should be said about the lack of any resources dedicated to retrofitting City buildings. F-67

4.2 Privately Owned Buildings

(pg 2 Technical Assistance)

This portion should be written by somebody who understands the building permitting process. For example this paragraph as written implies that the Contractor is in charge of obtaining approval. With the exception of small work or a design build contract the responsibility for the design resides with the Owner and his consultants. F-68

This mitigation plan should reference the latest edition of the California Building Code without listing a date. By state law this code is re-adopted every three years. As a matter of fact the local amendments to the California Building Code were adopted by Berkeley on 11/9/2010 not in August as the Draft states. If you mention the 2013 California Building Code then in 2017 the Plan will be out of date.

Plan Set A is not a standard for any purpose other than to obtain economic assistance. When Plan Set A is used the Owner is undertaking a voluntary upgrade and as such the City is not in a position to require conformance with Plan Set A. As long as the changes do not make the building worse and new work complies with the certain provisions of the code the City will have to accept the proposed design.

(pg 2 Soft Story Building Program)
The Building Official should be consulted to assist with a rewrite of this section to reflect the current status of what the City is requiring. F-69

5.3 Effects on Berkeley's Risks and Vulnerabilities

The draft says that state law requires site surveys because they are in an area subject to liquefaction. It is not clear what state law is being referred to. Please provide a specific reference. Chapter 18 of the California building code requires a geotechnical investigation that include an assessment of the liquefaction potential based on the seismic design category, not on any map. The need to perform a geotechnical investigation is not tied to the size of the building. F-70

The issuance of a building permit is considered a ministerial, not a discretionary, act.

The sentence "These site surveys mean that a structural engineer develops structural elements of the building to meet structural standards of the building code." needs to be deleted or rewritten by somebody who understands what engineers do. Note that state licensing law only requires a Civil Engineering license to do the design for most buildings. Cities are not allowed to require a structural engineer perform this work with regards to a building permit application.

Appendix A

Action A-2(e):- It is misleading to state that these provisions were locally adopted since the California Building Code containing these provisions would apply to construction in the City of Berkeley even if Berkeley had taken no action. **F-71**

Action A-5(e):- The references to URM buildings seems to be inappropriate for an item dealing with soft story wood buildings. **F-72**

Action A-5(e):- It is disturbing that City personnel are ignorant to the fact that the California Building Code is automatically adopted for all Cities in the state every 3 years regardless of what the City does. The City is limited to adopting local modifications that meet certain criteria. **F-73**

Action A-6(a):- The dates 1/1/08 and 1/1/11 are wrong. The City Council did not meet on these dates and thus could not have adopted anything on these dates. The dates mentioned do correspond to the dates that the 2007 and 2010 versions of the California building Code become effective. **F-74**

The changes to Chapter 34 of the CBC should be reviewed as to their impact on post earthquake funding by FEMA. My understanding is that when a jurisdiction requires a higher quality of design and/or construction after an earthquake than required for work performed prior to the earthquake that FEMA funds will not be available to cover the additional repair costs.

Action A-6(c):- The Draft states "When additional technical assistance is needed, plan check engineers provide staff consultations." This statement miss-states the role of the City's plan check engineers. The City's role is to verify that the submitted design complies with the regulations, not to develop designs. While the City's engineers may try to be helpful, if they were to have a formal obligation to providing recommendations on what is needed the City could have liability for the consequences of the advice. **F-75**

Action A-7(f):- I find it hard to classify this as "completed" when no progress was made. **F-76**

Action A-8(a):- Since this report will be finalized after Dec 2013 the Plan should reflect the status at that time. This report should be made available to the public. The current data in he appendix is inadequate to support any contention that the buildings have been reviewed. **F-77**

Need to define the criteria for evaluating the seismic performance of City owned and leased buildings. F-78

Action A-8(b):- Clarify what is meant by "Facility condition assessment will inform necessary mitigation activities". This sounds like a way to avoid doing anything. F-79

Action A-8(c):- What are the remaining seismically unsafe public buildings that do not have funding? F-80

Action A-8(d):- This response says that we will take no action because funding is not easily available. I believe this position may find the City liable if individuals get damaged in these buildings as a result of an earthquake. F-81

Action B-1:- The City's response should be that they did not accomplish the goal of planning for post disaster recovery and in response have decided to indefinitely suspend any effort to make progress in this area. F-82

It does not appear that a recovery ordinance is an essential prerequisite to making progress in recovery planning. F-83

The statement regarding the multi-department team evaluating procedures for inspecting and reopening buildings after an earthquake should be followed up with an honest assessment as to their ability to carry out such a program along with a realistic plan for making such a program real. F-84

Action B-1(f):- Need to see a list of designated shelters and criteria for designating such facilities as shelters. Because earthquake is one of the primary risks all of the designated shelters should be evaluated for their ability to resist the expected seismic forces. F-85

Action B-3- Without a plan for funding the additional hydraulic models will not get done. The response should reflect the fact. Why is this item not included in the action items for the new plan. F-86

Appendix B

It was stated that the Ratcliff building was retrofitted to essential service standards. Given that this is a historical building with URM construction it is not clear that this is feasible. Strongly suggest that this statement be independently verified. Suggest checking with the structural engineer for the project. Upgrading a historic building of this nature to essential service standards would be so unique that one would expect this to be talked about in the structural community, yet I have heard nothing. F-87

The list of City buildings lacks much data regarding the expected seismic performance of the buildings. Based on the data provided, the City does not have a comprehensive understanding of the seismic risk to city buildings and hence to the occupants. F-88

LETTER F Mark Gilligan 12-05-13

RESPONSE F-1: This Plan used the best available information to assess potential earthquake impacts. The Plan draws from predefined scenario earthquakes to describe different consequences (liquefaction, building damage, etc.) Because these scenarios were not developed by the same entity, they do not all utilize the same scenario earthquake. It logically follows that a greater magnitude earthquake will have greater impacts. Opinion regarding the value of a new HAZUS analysis is noted.

RESPONSE F-2: This is a Mitigation Plan, and is not intended to encapsulate all details of emergency management in the City of Berkeley. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-3: Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-4: Training and exercise is part of response planning, not mitigation. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-5: Table A.2 lists where *deferred* or *in progress* actions from the 2004 Plan are reflected in the 2014 LHMP.

RESPONSE F-6: The Building and Safety Division of the Planning Department collaborates closely with the Public Works Department and provides expertise where appropriate.

RESPONSE F-7: Section 3.3.2.3 addresses fire following earthquake. Section 3.3.4 includes HAZUS analysis and dollar estimates of additional damage from post-earthquake fires.

RESPONSE F-8: The Executive Summary is not intended to provide detailed analysis of building damage.

RESPONSE F-9: This section is intended to identify accomplishments.

RESPONSE F-10: Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-11: While this particular action is focused on disaster recovery, the LHMP is not intended to be a recovery plan. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-12: Comments regarding necessary collaboration among property owners are noted.

RESPONSE F-13: See Section 2: Implementing, Monitoring and Updating the Plan for details on the City's plans to keep the Disaster and Fire Safety Commission updated on the status of plan implementation.

RESPONSE F-14: See General Response re: Action Prioritization.

RESPONSE F-15:
This project is intended to be an initial assessment to inform the maintenance and replacement plans for City facilities. Structures included in this contract are:

Live Oak Community Center
Civic Center Building Annex
Health Clinic, 830 University
North Berkeley Senior Center
South Berkeley Senior Center
West Berkeley Senior Center
Frances Albrier Center
Grove Recreation Center
Cedar Rose Park Building
Equipment Maintenance Building
Tipping Building/Transfer Station
Administration Building, 1201 2nd St
Marina Corporation Yard
Berkeley Yacht Club
Restroom 4 - Marina
Restroom - Cragmont Park

For elements of the analysis, see pp. 13-16 of the City's contract with Kitchell below. Public Works intends to take the full report to Council on 2/25/14.

Appendix A
Scope of Services

The scope of services for this Facilities Condition Assessment is to conduct a comprehensive review of the maintenance and repair (M&R) needs of City-owned capital facilities.

The City's primary objectives for the Facilities Condition Assessments are to:

1. Establish a list of M&R priorities and incorporate said list into a short-term (1-5 years) and long-term (5-10; 10-15; 15-20 year periods) M&R schedule;
2. Analyze budget implications based in part on a facility life-cycle cost analysis prepared for each facility;
3. Develop a protocol for on-going monitoring of facility conditions, work performed and record information for City facilities.

Task 1 – Project Start Up

(1.1) Meet with the City to collect all the available data using Attachment I (listing of facilities) to develop the list of facilities that will be reviewed and inspected. Available data to include such information as:

a. address and area;
b. drawings of the buildings and systems;
c. information of the major systems, such as, maintenance history; and any known problems.

(1.2) Kitchell will review regulatory requirements to be followed during the evaluation with the City, in addition to any long range funding strategies and the prioritization categories, so as the draft report is developed, Kitchell can ensure they are prioritizing each deficiency accurately.

(1.3) Once all of the available data from the City has been received, Kitchell will review the provided information to identify the previous work done on each building.

(1.4) Kitchell will review the past maintenance history to understand the parameters that already exist for sizes and quantities of building systems

(1.5) Kitchell will also develop a detailed schedule for the site visit to each building—developing efficient routes so that we can minimize interruptions to City staff.

(1.6) Kitchell will also refine the project schedule that includes meetings with City staff prior to and after each weekly building assessment.

(1.7) During the project start-up phase Kitchell will be gathering the available building, system and equipment information and drawings of the buildings and infrastructure. In lieu of field teams carrying paper pads or notebooks to capture field information and tote paper rolls of drawings for reference, Kitchell will use computer tablets to capture the data directly into a spreadsheet while in the field.

(1.8) After Kitchell has reviewed the available information, develop a building survey schedule and project schedule, and developed the format for the report, we will facility a project kick-off meeting with the City. During the project kick-off meeting with the City.

During the project kick-off meeting we need to clearly understand the following:

- Goals and objectives
- Scope, overall schedules and deliverables
- Roles and responsibilities
- Review completeness of data provided
- Review of buildings,; functional use, age, general condition, maintenance history
- Review long-range funding and prioritization categories
- Review the report's format

Task 1- Project Start up Deliverable – Meeting minutes including goals and objectives, long-range funding strategies and prioritization categories; building survey schedule; project schedule

Task 2 - Inventory

(2.1) Kitchell's team will consist of a registered architect and licensed electrical engineer or a licensed mechanical engineer.

(2.2) Kitchell will require a building maintenance person to escort the team throughout our assessment, preferably individuals knowledgeable of the maintenance history of the major systems. Kitchell finds these individuals have a wealth of knowledge that can assist in the development of the assessment report. They should also have access to all mechanical and electrical rooms, roofs, central plants and other secured areas. Kitchell's architect and electrical engineer of mechanical engineer will be escorted by the building maintenance person. Our surveys will be conducted during normal business hours. Our team is courteous and professional, and will be wearing badges to identify them as part of an assessment team.

(2.3) During the building assessment, Kitchell will evaluate the architectural, structural, mechanical and electrical building components.

(2.4) Kitchell will interview City maintenance staff with regard to their knowledge of building systems.

(2.5) Photographs will be taken of the building systems, along with major deficiencies.

(2.6) Kitchell will then barcode every asset that requires preventive maintenance. Upon completion of our building assessment, we will meet with the City to inform you of any fire/life/health safety issues that need immediate attention, in addition

to providing an update of our surveying progress.

Task 2 – Inventory Deliverables – Weekly trip reports consisting of any immediate fire/life/health safety issues.

Task 3 Evaluations and Findings

(3.1) Upon completion of the building assessment, the field team will spend the following four weeks analyzing the field data into the report.

a. The report will encompass photos and detailed description of the building and the major systems (structural, mechanical, plumbing, fire protection and electrical).

b. The detailed description will include the remaining useful life of the building and its major systems.

c. Following the detailed description, the report will identify the system and component deficiencies along with our recommendations for repair/replacement.

d. Kitchell will also develop suggestions for value improvements to the building including suggested energy conservation improvements.

(3.2) A budget level cost estimate will be generated that captures all of the field team's recommendations for repair/replacement and value improvements(s) to the building accompanied by a prioritization (agreed to with the City) for each recommendation.

(3.3) Kitchell will also calculate the replacement cost of the buildings, so we can generative facility condition index (FCI) for each building or structure. The generally accepted FCI is shown below:

FCI Range	Condition Rating
0 to 0.05	Good
0.06 to 0.10	Average
Over 0.10	Poor

(3.4) The cost estimate will also identify if the repair/ replacement falls in the major maintenance, capital renewal or capital replacement budget. For the value improvements we will identify phasing and funding strategies, along with cash flow projections.

(3.5) Our project manager will be responsible for ensuring the field team(s) maintains consistency between assessments of the buildings by meeting with them weekly to review their field data, evaluations and findings.

(3.6) Using industry best practices, we will prepare recommendations for the completion of current deferred maintenance. Kitchell will also advise the City in

its ongoing maintenance policies and procedures. Our data will incorporate a replacement schedule for all major systems and equipment over the chosen term of the assessment forecast

(3.7) As users of facilities maintenance software on over 14 million square feet of public facilities, we will also make a knowledge be and experienced recommendations to the City on various software applications that will help the City in operating and maintaining their real estate portfolio.

Task 4 Reporting

(4.1) Once Kitchell has completed the field assessment Kitchell will develop a pilot report for the City's review.

(4.2) Once the City has reviewed the report, Kitchell will meet with you to review your comments, if any, before we complete the city-wide draft report. Kitchell will then modify the report per your input and continue with the generation of the draft report.

(4.3) Once Kitchell has completed the draft review cycle of the draft report with the City, Kitchell will make any necessary adjustments and present our final report to the City.

(4.4) Kitchell will also provide the City with an Excel file of the assessment that can be manipulated. This will allow the City to update information in the assessment reports as costs for certain items change.

(4.5) Prior to submission of any reports, Kitchell's Project Manager, will review and sign the report(s). The Project Manager will ensure that the reports cover the contracted scope of work and either meet or exceed the City's expectations by following Kitchell's Total Quality Management Program.

Task 4 – Reporting Deliverables: Pilot Report, Draft Report, Final Report, Excel Spreadsheets

Schedule

Task	Weeks
Notice to Proceed (NTP)	
Project Start Up	NTP + 2 Weeks (2 Weeks)
Inventory	NTP + 6 Weeks (4 Weeks)
Evaluations and Findings	NTP + 10 Weeks (4 Weeks)
Pilot Report	NTP + 10 Weeks (4 Weeks)
Draft Report	NTP + 12 Weeks (2 Weeks)
City Review	NTP + 14 Weeks (2 Weeks)
Final Report	NTP + 16 Weeks (2 Weeks)

RESPONSE F-16: Contracts for leased buildings include language requiring buildings to be kept in good working condition, but do not generally include specific requirements about meeting particular seismic standards.

RESPONSE F-17: Commenter's statement that local modifications require time and cost by staff is noted. Changes in the 2013 California Building Code, along with Berkeley's close proximity to major earthquake faults, necessitated Technical Amendments to Structural Standards in the 2013 Berkeley Building Code. The Berkeley Building Official has actively participated in meetings of the Tri-Chapter Uniform Code Committee comprised of the East Bay ICC, Peninsular ICC and Monterey Bay ICC Chapter members. The Tri-chapter Uniform Code Committee recommended four structural amendments to the California Building and Residential Codes, which were included in the local amendments for Berkeley. The four amendments are basically carryover of the amendments from the previous code cycle, with some revisions in code language and code sections, and reflect the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Joint Task Force that investigated the poor performance observed in 1994 Northridge earthquake. The amendments are specifically intended to enhance regional consistency in application and enforcement of the Building Code.

RESPONSE F-18: See General Response re: Action Prioritization.

RESPONSE F-19: This issue is regulated by the California Public Utilities Commission.

RESPONSE F-20: See Map 3.18 *Berkeley Tsunami Inundation*. The area of potential tsunami exposure is not an isolated element of the City.

RESPONSE F-21: Commenter is not a member of the Disaster and Fire Safety Commission, and cannot speak on the Commission's behalf.

Measure GG funds staff to perform preparedness efforts. Collaboration with the California Office of Emergency Services to define Berkeley's different areas of inundation for different tsunami scenarios, as well as to document potential mitigation measures both fall under this category.

RESPONSE F-22: All levels of government have a role in addressing climate change impacts. Berkeley's Mitigation Plan addresses Berkeley's role as a local government.

RESPONSE F-23: The Streamline Rebuild Action addresses residential and commercial structures. The scope of the Action is the Zoning process, not the building permitting process.

RESPONSE F-24: The scope of the Disaster and Fire Safety Commission's involvement with the Mitigation Plan has not changed since 2004.

The remainder of this comment is not within the scope of this plan document. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-25: Edited 2011 to 2010.

RESPONSE F-26: Commenter is correct. Reference to Richter Scale has been replaced with moment magnitude.

RESPONSE F-27: Endnote 9 attributes the statements to Charles Real with the California Geological Survey, and is not intended to provide additional detail.

Endnote 7 provides additional detail on the Acts of State Legislature related to these maps and the way that the City uses these maps.

RESPONSE F-28: Section 3.3.2.2 states that the liquefaction hazard planning zone does not show the effects of a particular earthquake. Map 3.6 is a liquefaction hazard scenario map, and demonstrates the difference in the liquefaction hazard in different areas of the City.

RESPONSE F-29: Reference has been added:
Yasuhara K., Komine H., Murakami S., Chen G., Mitani Y. (2010) Effects of climate change on geo-disasters in coastal zones. Journal of Global Environmental Engineering, JSCE 15, 15–23.

Area of impact is unknown at this time, and would be dependent on degree of sea-level rise.

RESPONSE F-30: This Plan does not make sea-level rise projections for 2300. See Section 3.8.1 - *Direct and Secondary Climate Change Impacts*.

RESPONSE F-31: See response F-16.

RESPONSE F-32: See response to question F-17.

RESPONSE F-33: Appendix B is intended to be an overview of City facilities.

RESPONSE F-34: The Ratcliff Building is an essential service building and was upgraded to meet essential services standards.

RESPONSE F-35: The libraries were constructed to meet seismic standards of the 2010 Uniform Building Code.

RESPONSE F-36: Commenter is correct that collapse of retrofitted URM is possible in a major quake. Statement has been clarified to include the statement: "they may still sustain moderate or greater damage, including possible collapse." Commenter does not provide evidence for statement that all retrofitted URM buildings will perform poorly/collapse in a major earthquake.

RESPONSE F-37: These studies need to be performed on a site-by-site basis.

RESPONSE F-38: Opinion regarding possible post-disaster zoning changes is noted.

RESPONSE F-39: Roads are covered under Table 3.6: *Key Berkeley Transportation Systems.*

RESPONSE F-40: All areas of Berkeley are susceptible to flooding, although to varying degrees. Community members outside of the 100- and 500-year-flood hazard areas are eligible to purchase flood insurance through the National Flood Insurance Program.

RESPONSE F-41: This issue is regulated by the California Public Utilities Commission.

RESPONSE F-42: The First Responders Safety Website is a disaster preparedness effort. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-43: Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-44: Partners' valve information has been provided in this plan as it was provided to the City.

RESPONSE F-45: Partner information has been provided in this plan as it was provided to the City. Map 3.6: *Liquefaction Scenario Map* considers liquefaction predicted to occur in a 7.1 magnitude earthquake.

RESPONSE F-46: Edited: Cellular telephone antennae ~~owned by~~ distributed throughout the City

RESPONSE F-47: Comment regarding systems' reliance on power is noted. Partners' energy assurance information has been provided in this plan as it was provided to the City.

RESPONSE F-48: Comment regarding possible seismic vulnerabilities of partner facilities is noted.

RESPONSE F-49: Discussion of schools has been edited to remove references to private schools, as the scope of the section is key critical response facility partners. Public schools are part of this category because of their status as potential shelter sites. Private schools are not.
The following text has been deleted:
~~While private schools are not subject to the Field Act, that are covered under the Private Schools Building Act of 1986, with the legislative intent that children attending private schools be afforded life safety protection similar to that of children attending public schools. However, due to a number of differences between the Field Act and Private Schools Building Act, private school buildings are not as safe as public school buildings. Private schools located in buildings built before 1986 can pose a serious risk to their students' life-safety.~~

RESPONSE F-50: Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-51: Comment regarding sophistication of UC Berkeley building management is noted.

RESPONSE F-52: As stated in endnote 61, descriptions were based on a San Andreas Fault earthquake and the general level and type of impacts are expected to be similar for a Hayward Fault event.

RESPONSE F-53: Statement has been added: "The City's Fire Department is equipped to respond to one two-alarm fire or two single-alarm fires simultaneously. Outside fire departments may not be able to provide mutual aid."

RESPONSE F-54: Deleted sentence "Commercial corridors will see damage to URM buildings." Comment on recovery considerations is noted.

RESPONSE F-55: Deleted for clarity: ~~Roadways and bridges may be functional, with damage in select locations. However, the Bay Bridge is vulnerable to damage until the retrofit and reconstruction activities currently underway are completed.~~

RESPONSE F-56: Fire Following Earthquake is addressed in Section 3.3.2.3, which states that most residential areas in Berkeley are at high risk of fire following a major earthquake.

RESPONSE F-57: See the Hills Evacuation Action. The City is focusing on evacuation routes using City-owned land. The City also plans to coordinate with UC Berkeley and the Berkeley Lab to assess how paths on UC and Lab property could be integrated into evacuation routes. There are no specific projects "on hold" at this time.

RESPONSE F-58: Fire response does not fall under the scope of this mitigation plan. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE F-59: Comments regarding necessary collaboration among property owners are noted. The City does not have the resources to undertake creation of special districts at this time.

RESPONSE F-60: Historical flooding data informs the City's knowledge of flood-prone areas exposure. Watershed modeling is used to help develop system improvement plans, but is not necessary to identify trouble spots.

RESPONSE F-61: Berkeley uses 2009 Flood Insurance Rate maps, as shown on Map 3.16: *Digital Flood Insurance Rate Map.*

RESPONSE F-62: The federal government monitors and runs the National Flood Insurance Program. The City is not pursuing revisions to federal Program maps.

RESPONSE F-63: BMC 17.12.080 states that the Director of Public Works or his or her designee shall be the Floodplain Administrator (FPA) of the City of Berkeley, and that (s)he will coordinate with the Building Official. The location of these provisions does not impact the Building Official's ability to enforce regulations outlined in BMC 17.12.090.

RESPONSE F-64: Desalinization is an option that other communities are pursuing. Desalinization is cost- and energy-intensive. This Plan emphasizes emissions reduction in approaches to climate change adaptation.

RESPONSE F-65: Living roofs are not appropriate for every building. The City's role is, where appropriate, to help building owners install living roofs consistent with the Building Code.

RESPONSE F-66: Table 3.15 provides a 13-page summary of the 124 pages in the Hazard Analysis and links those 124 pages to the 49 pages of content in the Mitigation Strategy. It serves to summarize key findings and mitigation approaches for those who do not have time or inclination to review 175+ pages of content.

RESPONSE F-67: Resources required to retrofit City buildings, along with potential funding sources, are described in the *Strengthen and Replace City Buildings* Action.

RESPONSE F-68: This section has been revised as follows:

Building Codes. The City enforces disaster-resistant development through the application of the ~~State-mandated~~ California Building Code, as well as more stringent local code amendments. The Provisions of the California Building Code ~~must be applied~~ are applicable to all new construction, ~~and to~~ additions, alterations and repairs

~~substantial renovations. It requires the most up-to-date earthquake- and fire-resistant design and materials, exceeding current State standards. Homes in the hill areas are required to apply stringent landslide and fire prevention features. Codes are updated regularly. Numerous inspections and re-inspections are conducted each year by City building inspectors under the Building Official, by staff of the Division of Fire Prevention, and private firms contracted to do this work.~~

City Transfer Tax Rebate Program. 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. The process begins once the homeowner makes seismic safety improvements. 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. ~~In February 2007, the City developed updated standards to ensure all work qualifying for this program improves seismic safety.~~ Since July 2002, the City has distributed over $9 million to homeowners through this program.

Home Rehabilitation Loan Program. The Senior and Disabled Home Rehabilitation Loan Program assists very-low-income senior and disabled homeowners in repairing their homes, to eliminate conditions that pose a threat to their health and safety, and to help preserve the City housing stock. Qualified borrowers can receive interest-free loans of up to $35,000. Financial assistance is in the form of a deferred payment loan that is due and payable upon the sale or transfer of title to the property.

Technical Assistance. The City has developed more options and technical standards to seismically strengthen single-family homes and multi-unit apartment buildings. ~~In August of 2010, t~~ The City has adopted International Building Code standards for seismic strengthening of wood-frame buildings. In addition, the City has implemented ABAG ~~adopted~~ Standard Plan Set A as a guide that provides typical details and other ~~guidance~~ recommendations for wood-frame homes of two stories or less. This plan set assists building owners and their contractors in the preparation of permit documentation and assists the City's plan checkers in their review of permit submittals. ~~simplifies the design of cripple wall retrofits for many homes in Berkeley. Contractors' adherence to this Standard simplifies the City's plan review and inspection process.~~ The City has its own URM ordinance tailored specifically to Berkeley, which has structural engineering and prescriptive guidelines providing technical assistance for design professionals. ~~For URM buildings, there is a technical prescriptive standard developed specifically for the City of Berkeley which would allow a contractor to undertake URM retrofits without spending substantial money on engineering design, provided the building meets the limitations of the Standard.~~ The City has published guidelines for Transfer Tax Reductions to ~~establish~~ clarify the types of voluntary seismic strengthening work that qualify for a Transfer Tax Rebate.

RESPONSE F-69: This section was up-to-date at the time the First Draft was published in October 2013. The content has again been updated:

On December 3, 2013, City Council adopted Ordinance No. 7,318-N.S. amending Berkeley Municipal Code Chapter 19.39 to require property owners of soft, weak or open front buildings with five or more dwelling units to retrofit their buildings within the

next five years. Owners have three years to apply for a building permit and two years to complete the work after submitting their permit application. The law applies to buildings constructed prior to 1978 and takes effect January 4, 2014. This is the second phase of the Soft Story Program.
Soft story buildings are characterized as wood-frame buildings with more than one story, typically with extensive ground story windows, garage doors, or open-air spaces such as parking with little or no enclosing solid wall, that lead to a relatively soft or weak lateral load resisting system in the lower story.
Under the first phase of the soft story program, since 2005, soft-story building owners have been required to submit an engineering evaluation report identifying their building's weaknesses and ways to remedy those weaknesses, to post an earthquake warning sign and notify their tenants of the building's potentially hazardous condition. Since 2005, thirty-five percent of soft-story building owners voluntarily retrofitted their buildings.

~~In February of 2001, the City obtained a FEMA grant to assess multi-unit soft-story residential buildings and develop a program to reduce their vulnerability, building on an earlier effort in 1996. Under the direction of the City's Seismic Technical Advisory Group, a team of staff, outside experts and University of California students assessed soft-story residential buildings with five or more residential units. Commercial tilt-up buildings were also identified and mapped.~~
~~The team found that nearly half (over 200) soft-story structures were expected to be red-tagged, uninhabitable and likely to require extensive repair or total replacement. Further, over 95 percent of these soft-story units may not have been livable immediately following a large Hayward Fault earthquake . This effort led to the City's current soft-story building program. A City ordinance passed in 2005 requires owners of soft-story buildings with five or more units to hire professional engineers to evaluate their buildings' seismic vulnerability and to submit evaluation reports to the City. The 2005 ordinance has a 94% compliance rate. Since 2005, thirty-five percent of soft-story building owners voluntarily retrofitted their buildings. As of July 2013, 158 soft-story buildings with 1,611 residential units remain unretrofitted.~~

RESPONSE F-70: Section has been revised as follows:
New development generally 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, and elevation above flood levels. Replacing or significantly renovating older structures significantly increases the Berkeley community's protection from natural hazards. For example, pursuant to the Seismic Hazards Mapping Act codified in the Public Resources Code as Division 2, Chapter 7.8 and Guidelines for Evaluations and Mitigating Seismic Hazards in California (Special Publication 117), much of the new construction in the City's west must have site-specific geological and geotechnical investigations ~~site surveys per State law~~, due to the area's mapped potential liquefaction hazard. These investigations result in recommendations for design professionals to design new or rehabilitated buildings for human occupancy to mitigate the potential effects of liquefaction caused by earthquakes to a level that does not cause the collapse of the buildings ~~site surveys mean that a structural engineer~~

~~develops structural elements of the building to meet structural standards of the building code. Geotechnical surveys are required for larger buildings before discretionary permits are issued.~~ This means that a new or rehabilitated building will be ~~much better able~~ equipped to better withstand potential liquefaction impacts than an old building.

RESPONSE F-71: This goal was accomplished in Berkeley.

RESPONSE F-72: URM reference has been deleted:

~~For URM buildings, there is a technical prescriptive standard developed specifically for the City of Berkeley which would allow a contractor to undertake URM retrofits without spending substantial money on engineering design, provided the building meets the limitations of the Standard.~~

RESPONSE F-73: Language in the referenced section has been clarified:

- On August 16, 2010, the California Building Standards Commission ~~City~~ Appendix A3 of the 2009 International Building Code – "Prescriptive Provisions for the Seismic Strengthening of Cripple Walls and Sill Plate Anchorage of Light, Wood-Frame Residential Buildings," which became effective immediately statewide as an emergency supplement to the 2010 California Building Code and was codified as Chapter A3 into the California Existing Building Code ~~as amendment into the 2007 and 2010 California Existing Building Code~~.
- In addition, the City ~~has adopted~~ uses Standard Plan Set A as a prescriptive guide to facilitate design of cripple wall retrofits for wood frame homes of two stories or less ~~that provides typical details and other guidance~~. This plan set simplifies the design of cripple wall retrofits for many homes in Berkeley.

RESPONSE F-74: Date references have been clarified:

~~On 01/01/08 and 01/01/11, as~~ **As** part of the local **2007 and 2010** code adoption, the city adopted the following standards of the International Existing Building Code:
• Earthquake Hazard Reduction in Existing Reinforced Concrete and Reinforced Masonry Wall Buildings with Flexible Diaphragms,
• Earthquake Hazard Reduction in Existing Wood-frame Residential Buildings with Soft, Weak or Open-front walls,
• Earthquake Hazard Reduction in Existing Concrete Buildings and Concrete with Masonry Infill Buildings.

Furthermore, ~~on 01/01/08 and 01/01/11,~~ as part of the local code adoption, the City amended California Building Code Chapter 34 Existing Structures by adding a new Section "Repairs to Existing Buildings and Structures by the Occurrence of a Natural Disaster," which establishes seismic evaluation and design procedures for damaged buildings based on ASCE 31 Seismic Evaluation of Existing Buildings and ASCE 41 Seismic Rehabilitation of Existing Building.

Article 6 of the Berkeley Building Code (BMC Chapter 19.28) addresses post-disaster *Repairs to Existing Buildings and Structures*. This section establishes regulations for the

repairs of damaged structures to comply with the Stafford Act. The Stafford Act authorizes FEMA to fund the repair and restoration of eligible facilities damaged in a declared disaster and requires that the repair and restoration be "on the basis of the design of such facility as it existed immediately prior to the major disaster and in conformity with current applicable codes, specifications and standards."

RESPONSE F-75: The plan check engineers do not advise on structural design development. This statement refers to technical assistance regarding project overview and other code requirements that may be triggered by a project, such as potential retroactive disabled access upgrades, parking modifications, energy upgrades, private sewer lateral replacement requirements, automatic gas shutoff valve installation requirements, waste diversion, CALGreen provisions for existing buildings, other requirements which may be triggered by a permit issuance process.

RESPONSE F-76: Action A-7(f) was to assist the PHA to obtain funding. This action was completed.

RESPONSE F-77: Public Works intends to take the full report to Council on 2/25/14.

This project is intended to be an initial assessment to inform the maintenance and replacement plans for City facilities.

RESPONSE F-78: See response F-16.

RESPONSE F-79: Condition assessments will identify building vulnerabilities. Mitigation actions reduce vulnerabilities. Condition assessments will identify the mitigation actions that need to be performed to reduce vulnerabilities.

RESPONSE F-80: Detailed seismic vulnerability assessments have not been performed for all City buildings. See *Strengthen and Replace City Buildings* Action and Appendix B: *List of City-Owned and -Leased Buildings* for available information.

RESPONSE F-81: Opinion is noted.

RESPONSE F-82: See definition of "Deleted" in Table A.1: Progress Categories. Recovery planning is deleted from this LHMP because progress has not been made since 2004, and the activity is not in the scope of this mitigation plan.

RESPONSE F-83: See response F-82.

RESPONSE F-84: See response F-82.

RESPONSE F-85: The City's Senior Centers and Recreation Centers may be used as disaster shelters. Earthquake shelters are not designated until after an earthquake.

RESPONSE F-86: Per Table A.2, *In Progress* and *Deferred* elements of Action B-3 have been carried over into the 2014 Stormwater System Action, which also indicates current funding status and additional resources required.

RESPONSE F-87: The Ratcliff Building was upgraded to meet essential services standards.

RESPONSE F-88: This is correct. Detailed seismic vulnerability assessments have not been performed for all City buildings.

Lana, Sarah

From: Matthew Mitchell [ms2@ix.netcom.com]
Sent: Saturday, October 26, 2013 2:56 PM
To: Mitigation
Cc: Lee, Aaron; Neil Goldstein; Dong, Gil
Subject: Attn: Sarah Lana

Categories: Red Category

Hi Sarah,

I have done a quick review of the executive summary of the LHMP, and have these comments, strictly for myself and not for the Disaster and Fire Safety Commission.

Relationship between electric power and fuel availability.

I am particularly concerned about an extended power outage (days or weeks) which could result from terrorist activity (there have been numerous examples of power transmission lines sabotaged by malcontents) or from earthquake, coronal mass ejection, sabotage of power plants, or even extreme weather.

We are enormously dependent upon electricity not just for communication, lighting and direct heating through electric stoves and appliances. Nowadays, most gas-fired appliances will not start without electrical power because they depend upon electric igniters. Moreover, it is my understanding that the gas pumps at filling stations use electric motors to pump gas. Thus, when the electric power goes out, so does access to our other main sources of energy.

Emergency generators can provide a source of power until their fuel runs out. Likewise, vehicles can provide light, shelter, and heat until their fuel and batteries run out. But without access to fuel, the availability of power from emergency generators and vehicles is short-lived. I hope that the city has foreseen this difficulty and made provision for auxiliary power to operate at least the gas pumps that fuel City emergency vehicles. It would be good if commercial gas stations around the city were likewise equipped. G-1

I suspect that most generators supplied by the City to neighborhood cache groups will run out of gas very fast, if they can be started at all. It would be particularly helpful during a power outage if additional, fresh fuel were available for those generators, either from commercial sources, or through the City?s emergency responders. G-2

Please consider this in connection with the energy assurance plan, page 32 of the first draft. Please also consider whether this subject deserves higher priority than, for example, climate change impacts.

WUI fire risk reduction

Wildland fire is dealt with at page 18 (high priority) and 38 (medium priority) but neither section appears to contemplate any effort to educate homeowners in steps that they can take to reduce the risk that their homes will burn in a WUI fire. Although it is difficult to get people?s attention, continual educational efforts could pay dividends. I attribute survival of my home in the 1991 fire to removal of eucalyptus and pine trees near my back fence, and absence of readily flammable leaves and litter closer to the house. It may be coincidence, but the fire stopped 30ft. from my home, the exact measure of ?defensible space? recommended in fire prevention literature. G-3

When we had a Fire Safety Commission, we spent serious time and effort trying to determine how best to reach out to homeowners in the high risk areas. Reducing fuel loads, particularly immediately adjacent to buildings, will significantly mitigate the risk that fire will propagate through populated neighborhoods. Despite the difficulties in getting people?s attention, a continuing educational effort seems worthwhile. Traditionally, that has been the responsibility of the Fire Department and its OES.

This is more than a ?zero waste? problem. People need to understand that the chipper program, green cans, and related activities are primarily designed to reduce wildfire risk and that they are most effective when homeowners understand their purpose and utilize them accordingly.

Table of Contents and Index **G-4**

The first draft and ?details of actions? that were supplied to the D&FSC are already very long. I am assuming that the complete LHMP will be much longer. If this document is to be useful, you will need a good table of contents and a detailed index.

I hope this is helpful.

Best regards,

Matt Mitchell

Matthew Mitchell
ms2@ix.netcom.com

LETTER G Matthew Mitchell 10-26-13

RESPONSE G-1: The Energy Assurance Plan Action is designed to identify and address gaps in the City's fuel availability. Benefit of generators at commercial gas stations is noted.

RESPONSE G-2: Benefit of fuel provision to power cache generators is noted. In an emergency, distribution of available fuel will be conducted based on operational response priorities.
Please see General Response re: Prioritization of Actions.

RESPONSE G-3: Vegetation Management Action has been changed to high priority. See General Response re: Action Prioritization.
The Vegetation Management Action has been expanded to include pursuit of external funding for community outreach for fire fuel reduction.

RESPONSE G-4: Following receipt of this comment, a table of contents was provided for the First Draft Plan, available on www.cityofberkeley.info/Mitigation.

LETTER H

Sarah Moni Law (I'll add online comments also)

Hazard Disaster plan

Excellent job!!!!

(1) p. 4 → consider adding:

- add outside toxic fumes danger — i.e. Chevron Fire ✓ (not just Berkeley toxics) **H-1**
- "URM bldg" - 16-20 noncompliant
- soft story > Bldg safety sec. 3.8
  - Enfct. action
  - Enfct. officer rehired

(2) Disaster Cache Prgm (p.5) **H-2**

- 87 caches of equipment — should be 100-150 (needs assessment, rehired, need for more)
- (add CERT classes)
- more in most district (4) So. Berkeley
- FEMA grants available

(3) Seismic gas shutoff (e.g. Fukishima) **H-3**

- RHSP adding to their annual inspection form Schedule "A"

(announced at city council mtg. last night)

LETTER H Moni Law 11-20-13

RESPONSE H-1: See Section 3.9.3: *Hazardous Materials Sources Outside of Berkeley*.

RESPONSE H-2: Storage of disaster supplies and disaster response training do not fall under the scope of this mitigation plan. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE H-3: In preparation for Phase Two of the Soft-Story Retrofit Program, which mandates retrofit of soft-story residential buildings with 5 or more units, and in response to Public and Commission Comments that some soft-story buildings do not have earthquake warning signs posted at building entrances, the Building and Safety Division has printed signs with an adhesive backing and mailed them to property owners, reminding them of their obligation to post the signs. In the period of October through December 2013 all non-retrofitted soft-story buildings were inspected to verify that the signs have been posted. Building owners who did not have the signs posted were issued administrative citations. This effort is not part of Schedule A inspections.

LETTER I

COMMENTS ON THE DRAFT HAZARD MITIGATION PLAN

From: Neighbors for Fire Safety

"The community group that brought you Fire Station 7"

Barbara Allen, Bob Allen, Bob Flasher, Tom Edwards, Eric Arens, Trudy Washburn, Gloria Bowles, Jean Dewitt, Genevieve Dreyfus

Our group of neighbors has reviewed the Local Hazard Mitigation Plan Update and has these perspectives for you to consider:

Although the Hazard Analysis Summary lists earthquakes and wildland-urban interface fires as equally likely and catastrophic, the focus of the update is on earthquake prep. Since it is four times more likely that we will have wildland-urban interface fires than 7.0 earthquakes, both should be in the highest priority category. Hazard mitigation measures for fire, as currently proposed, are only in the moderate priority category. This needs to be corrected. **I-1**

We realize that the prioritizations are based on feasibility of achieving significant results within 5 years, not on the level of threat. But to accept the fact that we can't achieve significant improvements in fire resistance within 5 years is taking a huge risk with citizen lives and property. This is unacceptable. We feel strongly that better fire safety and resistance can be accomplished by implementing the following:

- Focus our efforts in the fire hazard area on inspection and brush clearing, with special attention to hazardous areas such as eucalyptus forests, brush-filled canyons, and along major escape routes. **I-2**
- Improve our residential fire hazard area inspection program to include a higher percentage of property inspections every year and apply more follow-through to ensure that corrective action is taken. Send an annual report to the DFSC and City Council on what has been accomplished. If we don't have enough staff and/or time to do this effectively, student interns or prospective firefighters might be trained to do the inspections. **I-3**
- Look for grant monies to reduce hazardous vegetation on city property, as Oakland, LBL and EBRPD have done through FEMA. **I-4**

- Set City standards to limit the types of new trees permitted that discourage the planting of Eucalyptus, Monterey Pine, etc. **I-5**
- Ensure that the emergency and evacuation network routes are really effective by undergrounding all the electric lines that cross them. **I-6**
- Mark the main escape routes, similar to signs denoting tsunami zones and bicycle boulevards. **I-7**
- Create escape routes to the east on Canon Dr., Sunset, Shasta and Park Hills, as fires after large earthquakes can come from the west, burning uphill from the Hayward Fault and making the current westward escape routes inaccessible. **I-8**
- Revisit the costly debris bin program. It is expensive and abused by many from outside our neighborhoods who dump all sorts of unacceptable items in the bins. The chipper program should be continued. **I-9**
- Create a new CERT class on home fire safety and prevention. Offer it, with volunteer staff or the new disaster prep employees, at all apartment buildings with over 10 units, to ensure that as many citizens as possible are in the loop. **I-10**
- Create and enforce “red zones” on narrow streets to ensure that fire engines and evacuating citizens can get past parked cars. Two dozen people died in the 1991 Tunnel Fire because of impassible streets. **I-11**
- Encourage Neighborhood Watch groups and apartment managers to invite firefighters to speak on fire safety and prep. Re-institute the fire-resistant garden demos that showed neighborhoods how to prune their trees and hedges for fire safety. **I-12**
- Distribute fire safety pamphlets to residences on an annual basis, similar to what we already do with our recycling and chipping program postcards, to encourage citizens to be aware of dangers and better prepared for them. **I-13**

We hope these suggestions will help Berkeley modify the Hazard Mitigation Plan in a way that works effectively for the entire city. An effective Hazard Mitigation Plan needs equal weigh on earthquake resilience and fire prevention.

LETTER I Neighbors for Fire Safety12-19-13

RESPONSE I-1: Fire Code Action was listed as high priority. Vegetation Management Action has been changed to high priority. See General Response re: Action Prioritization.

RESPONSE I-2: Fire Code Action has been expanded to include evaluation of inspection procedures to achieve greater Fire Code compliance. Inspections occur on private land. Vegetation Management Action references the Fire Fuel Abatement Program on Public Land.

RESPONSE I-3: Fire Code Action has been expanded to include evaluation of inspection procedures to achieve greater Fire Code compliance.

Annual reporting of progress on vegetation management will be included as part of the status reports on LHMP actions, as outlined in Section 2.1: Implementing Actions and Reporting on Progress.

RESPONSE I-4: Suggestion to pursue external grant funding for fire fuel reduction is noted. See Vegetation Management Action. The PDM and LPDM grants listed under "Possible Funding Sources" are both FEMA grants.

RESPONSE I-5: The Fire Code Action outlines how the City plans to create a standard for written vegetation management plans for major construction projects in Fire Zones 2 and 3. This standard will provide guidance to discourage planting pyrophitic plants

RESPONSE I-6: See General Response re: Overhead Utility Lines.

RESPONSE I-7: Edited Hills Evacuation Action to read:

Ensure that all public pathways **and associated signage** are maintained to **identify and** provide safe and accessible pedestrian evacuation routes from the hill areas.

RESPONSE I-8: See the Hills Evacuation Action. The City is focusing on evacuation routes using City-owned land. The City also plans to coordinate with UC Berkeley and the Berkeley Lab to assess how paths on UC and Lab property could be integrated into evacuation routes.

RESPONSE I-9: City Council recommended that the Fire Department look into reinstating the “Debris Box” program, originally run by the Police Department. At its June 25, 2013 meeting, City Council approved $25,000 allocations to the program for FY2014 and FY2015.

RESPONSE I-10: The Community Emergency Response Team (CERT) program offers a hands-on course in Fire Safety. This course includes a section on Reducing Fire Hazards in the Home and Workplace. CERT courses are open to all community members.

RESPONSE I-11: The Public Works Transportation Division and the Fire Department evaluate requests for additional red zones or parking restrictions on a case-by-case basis. Community members can submit requests to designate new red zones through the City’s Customer Service Center (3-1-1).

RESPONSE I-12: The City has recently reinstated its Dumpster Program, which incentivizes community groups to gather to plan for disasters and emergencies. The program awards dumpsters to groups that have had qualifying meetings in the last 12 months. These meetings include 5 Critical Steps presentations from Fire Department personnel.

Additionally, Community Emergency Response Team (CERT) program offers a hands-on course in Fire Safety. This course includes a section on Reducing Fire Hazards in the Home and Workplace. CERT courses are open to all community members.

The Vegetation Management Action has been expanded to include pursuit of external funding for community outreach for fire fuel reduction.

RESPONSE I-13: The Vegetation Management Action has been expanded to include pursuit of external funding for community outreach for fire fuel reduction.

Lana, Sarah

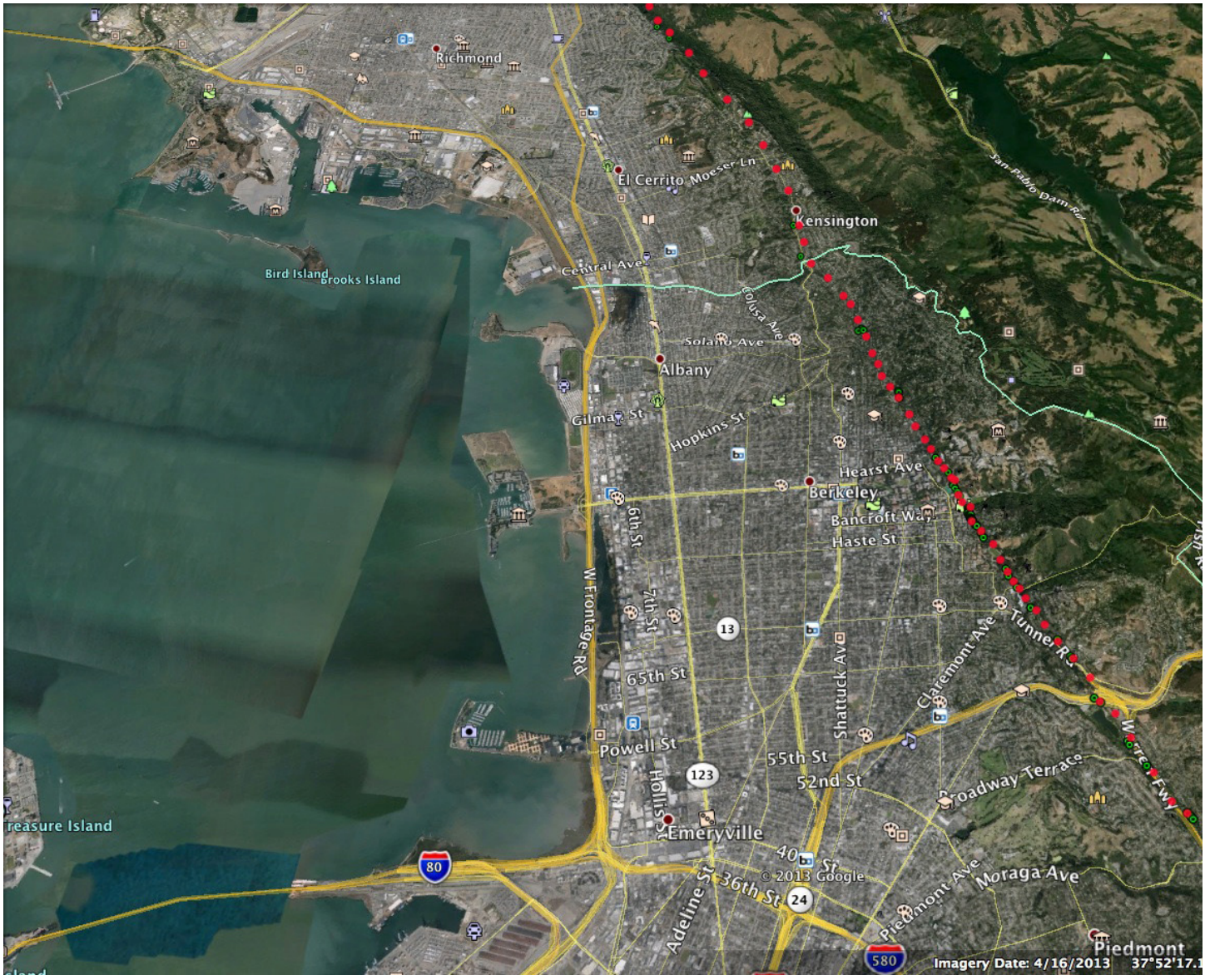
From: Pam Grossman [pam@grossmanfamily.com]
Sent: Saturday, November 30, 2013 1:28 PM
To: Mitigation
Subject: 2014 Mitigation Plan

Hello,

J-1

As I am sure you are aware, the location of the Hayward Fault Line has been clarified since the last version of the Mitigation document was published. I am attaching it here. It is shown on Google Earth.

Sincerely,
Pam Grossman
Disaster Preparedness Trainer
City of Berkeley



LETTER J Pam Grossman 11-30-13

RESPONSE J-1: Map 3.1: *Regional faults and their location with respect to Berkeley* has been replaced with an updated map from the California Geological survey.

LETTER K

Lana, Sarah

From: SusanSchwa@aol.com
Sent: Monday, December 16, 2013 7:13 AM
To: Mitigation
Cc: berkeleyclimate@googlegroups.com
Subject: Commend on First Draft Local Hazard Mitigation Plan

To: Those concerned with Berkeley's Hazard Mitigation Plan
From: Susan Schwartz

Thank you for the opportunity to comment on the City of Berkeley's draft revision of its plan for mitigating local hazards, the first such revision in 10 years (suggesting that it may not be revised again until 2024).

I have lived in Berkeley for almost 30 years, close to the Hayward Fault and in the wildland-fire-risk zone. I also head a local volunteer organization concerned with maintaining and revitalizing local watersheds and natural areas; a significant part of our work is removing fire-prone and flood-promoting invasives.

My concern with this plan may seem to be a quibble over terms, but terms and definitions can influence both clear thinking and action. The Executive Summary, p. 6, states that "Berkeley's hazards of greatest concern" are "earthquake and wildland-urban interface fire." I believe that it would be more accurate to just say that these are the disasters most likely to occur in the immediate future. They could have extremely serious consequences, but history shows that communities can and do recover from them relatively quickly. They also may not occur at all. **K-1**

Climate change and resulting sea-level rise, by contrast, seem to have a much higher degree of certainty. Big effects are not likely in the short term. But long-term, effects may be more severe and recovery may take much longer and be difficult if not impossible except over centuries.

Thus, it might be better to re-phrase, saying something like, "Berkeley's hazards of most immediate concern are earthquake and wildland-urban interface fire, because they can occur at any time and have reasonably high likelihood of causing costly and sudden damage."

Similarly, I would re-phrase what strikes me as the somewhat circular explanation grouping mitigation actions as "high," "medium," and "low" priority. High and medium priority actions seem to be defined as those that can be achieved in a relatively short time with resources that seem likely to be available. Lower priority ones would take longer and resources may not be available. **K-2**

Those are reasonable and realistic ways to group actions. One does what one can, and the perfect should not be the enemy of the good. But there is a large body of research showing that humans tend to focus on short-term threats and discount long-term threats.

Suppose I am an old person slowly dying of hunger, with no money for food, and also at high risk of contracting flu or falling and breaking a hip. What is my highest priority? I believe it is an apples-to-oranges comparison, and that one is better off being clear about the rationale behind choices.

Using more modest and accurate terms may or may not change what is in the plan. Perhaps it might lead to a small investment in what seem like long-term and uncertain strategies. To continue the analogy above, for my hypothetical malnourished oldster, a program that gives out flu shots and Fosamax is great, and if that's what Medicare pays for, I should get them. But that doesn't make those measures the most important.

Thank you for considering these rather philosophical reflections -- rather obviously from someone who is old myself.

Susan Schwartz
1236 Oxford St.
510 848 9358

LETTER K Susan Schwartz 12-16-13

RESPONSE K-1: In a given day, climate change is certain and earthquake and WUI fire are very unlikely. Over time, earthquake and WUI fire have a greater potential to cause catastrophic damage, injuries and death than climate change, because of their relatively instantaneous nature. This is why they are listed as Berkeley's hazards of greatest concern.

RESPONSE K-2: See General Response re: Action Prioritization.

LETTER L

Local Hazard Mitigation Plan
Feedback memo
Berkeley Food and Housing Project
Dec 9, 2013

I am writing as the Executive Director of Berkeley Food and Housing Project (BFHP). BFHP provides shelter, feeding services and support services to low income and homeless residents of Berkeley. As a provider of residential services to the homeless and disabled of Berkeley, we value safety and security in our facilities as a high priority. Since 1984, BFHP has operated our men's shelter in the basement of 1931 Center Street a City owned building

We saw that the 2004 Hazard Mitigation Plan had prioritized as part of the city plan to either strengthen or replace seismically unsafe City owned structures. In the 2004 plan this activity was given high priority and was put on a 5-7 year timeline. We had hoped, that by now, that the City owned building at 1931 would have been made structurally sound or that our critical and life saving shelter services would have been relocated.

In this current proposed plan, we see that the priority to retrofit city owned buildings has been downgraded from a high priority to a medium priority. We also understand that the price to retrofit 1931 Center St and other City owned buildings is prohibitive and time consuming and there has been no funding to do this work.

We are concerned that without a plan by the City that our clients residing in our shelter at 1931 Center Street will continue to live in harm's way.

We propose that there be a new plan that is a replacement plan: that the City instead of retrofitting the 1931 Center St building, instead replace the shelter functions in a new location. We understand that the City Manger is currently exploring the feasibility of building a shelter facility on the Berkeley way parking lot. We think that this is a much more cost effective solution than the retrofitting solution. **L-1**

To reiterate, we believe the highest priority for your plan should be saving lives and in this particular case we are talking about creating a plan that saves the lives of our most vulnerable population who have no other housing options.

Terrie Light
Executive Director
Berkeley Food and Housing Project

LETTER L Terrie Light/Berkeley Food and Housing Project 12-09-13

RESPONSE L-1: Commenter's concern regarding the seismic stability of the Veteran's Memorial Building is noted. Section 3.3.3 identifies this building as one of three City-owned buildings known to be seismically vulnerable.

Commenter's suggestion to build a shelter facility on the Berkeley Way parking lot is noted. The possible development of the Berkeley Way site is currently under consideration by multiple City Commissions; its future has not yet been determined through established processes. It is not in the scope of this Mitigation Plan to commit to a specific site use proposal for this public land.

LETTER M

To: Christine Daniel, City Manager
From: Community Environment Advisory Commission
Subject: Comments on the City of Berkeley 2014 Hazard Mitigation Plan Draft

BACKGROUND

The Community Environmental Advisory Commission (CEAC) believes that the City of Berkeley does a commendable job in regards to passive hazard mitigations like earthquake retrofitting and clearing brush, however, the CEAC also believes that poorly addressed in this category is the utmost important task of pre-disaster notification to Berkeley citizens and visitors. **M-1**

RECOMMENDATION

Because the plan is hundreds of pages long, it is difficult to know exactly what has been addressed, nonetheless, the CEAC believes that in the plan, the following items or steps to achieve them must be addressed. **M-2**

1) The City must explain what emergency notifications systems exist as well as which do not and include how citizens are educated about BENS and CERT; the method for citizens to opt in; the reason for CERT being neighborhood-led and the City resources provided to citizens without neighborhood CERT leaders; places for citizens to find CERT information digitally; and the reason the City has made the deliberate choice to not have sirens or stationary klaxons like its neighbors Alameda, Oakland, Richmond, San Leandro, San Francisco, UC Berkeley, and multiple Contra Costa County cities. **M-3**

2) The City must explain the current BENS system in regards to the number of citizens that have opted in; the number of hours a day it is staffed; the percentage of the City that can be reached simultaneously as well as the amount of time needed to reach a vast majority of Berkeley's residents, workers, and visitors; the percentage of citizens signed up compared to the population; and the statistics of opted-in residents with only landlines, only cell phones, or both.

3) The City's emergency warning systems must be capable of the challenges of rapid notification to a vast majority of citizens in the case of rapidly impending emergencies and natural disasters including rapidly spreading fires and noxious gases as well as transmission of any 60-second, advance earthquake warnings received from other authorities.

CONTACT PERSON

Nabil Al-Hadithy

LETTER M Community Environmental Advisory Commission 12-05-13

RESPONSE M-1: Emergency notification systems do not provide passive protection following a disaster, and thus do not fall under the scope of this mitigation plan. Please see General Response re: Scope and Detail of the Mitigation Plan.

RESPONSE M-2: The City agrees that the plan is long and very detailed. For this reason, an Executive Summary was provided for the entire First Draft Plan, and Section 3.11 *Hazard Analysis and Actions Summary* was provided to summarize key details of the 120+ pages of the Hazard Analysis. The Plan was provided for public review for over two months to ensure that community members with interest in Plan details had adequate time to review the document.

RESPONSE M-3: See response M-1. Emergency notification system descriptions are not in the scope of this plan.

Emergency Notification Systems available in Berkeley are outlined on the Emergency Alerting page of the City of Berkeley's website:
http://www.cityofberkeley.info/emergencyalerting/

The CERT organization is primarily focused on emergency response training. CERT information is available on the City of Berkeley website:
http://www.cityofberkeley.info/cert/

LETTER N

Energy Commission

December 18, 2013

Sarah Lana
Fire Department - Office of Emergency Services
Attn: Mitigation Plan
2100 Martin Luther King, Jr. Way, 2nd Floor
Berkeley, CA 94704

Re: City of Berkeley Energy Commission, Comments on the 2014 Local Hazard Mitigation Plan Update

Dear Ms. Lana:

Thank you for the opportunity to comment on the 2014 Update to the Local Hazards Mitigation Plan (LHMP). The Energy Commission appreciates the recognition of the impact that climate change will have on our community. Additionally, we congratulate the City for being recognized by the Rockefeller Foundation as a member of its Resilient Cities Network. We look forward to the advancements that this assistance will bring.

The Energy Commission would like to submit the following suggestions for strengthening the LHMP.

The City's support for distributed / on-site electricity generation (e.g., solar power, fuel cells, etc.) should be called out as a specific action in the plan. The importance of such systems is referenced tangentially on page 32, as they relate to the need to "Develop an Energy Assurance Plan for City Operations." However, increases in distributed electricity generation, especially from renewable resources, would have benefits throughout the community and not just in City facilities. Such systems, if properly engineered, could allow local businesses and residences to continue to operate with an uninterrupted on-site source of power in the event of an occurrence that disrupts the local electrical grid (e.g., fire, earthquake, terrorist event, or other brown/black-outs).

On-site renewable power generation provides residences and businesses with electricity at significantly lower greenhouse gas emissions than the grid. Such local sources also help support the local electrical grid and reduce the potential for overload, decreasing the likelihood of blackouts, especially during heat waves that will likely increase in frequency with climate change (as recognized on page 42, "Extreme Heat").

Similarly, energy efficiency in the community (residences, businesses, and institutions) is important to highlight as a way to reduce greenhouse gas emissions, help minimize stresses on the electrical grid that lead to blackouts, and minimize the energy demands that need to be replaced in the event of power loss due to natural or human caused

disaster. This is referenced in the "Extreme Heat" section on page 42, but efficiency increases resilience to hazards beyond just extreme heat events.

N-1

To address the previous two points, we recommend that the plan **include a section on energy assurance for the community** as well as for City operations. This section could also address issues such as working with PG&E to ensure that adequate plans exist to restore power post disaster and promote the undergrounding of electricity lines - thereby decreasing the likelihood of power disruption due to storms, earthquakes, or other events.

N-2

Additionally, the "**Gas Safety**" section (on page 34) should include references to decreasing natural gas demand in homes and businesses through improving appliance efficiency as well as through improving building weatherization, insulation, and heating efficiency. This will decrease natural gas demand and the need to restore services post disaster - and this decreased demand could help mitigate against other hazards related to the gas distribution network itself (e.g., local leaks, explosions as seen in San Bruno).

N-3

The plan should also include a section addressing **post disaster recommendations**. The hazards outlined in the plan will have significant impacts on greenhouse gas emissions and energy use, and will provide the City with new opportunities to meet its commitments in those areas. For example:

- The disasters described in the plan will produce significant amounts of amounts of construction and demolition waste. Experiences after the Loma Prieta and Northridge earthquakes highlighted the need to have plans in place to deal with debris produced. These materials can be recycled and reused with proper planning - thereby reducing greenhouse gas emissions associate with landfilling these materials and the manufacture of new building materials (i.e., using recycled concrete and other recycled produces in construction uses less energy than producing new materials).
- Rebuilding after a disaster should support the City's environmental and energy use commitments and the principles outlined in the Climate Action Plan. By rebuilding to the highest standards and not suspending these rules, these disasters can provide opportunities to continue to improve efficiency within the City. Page 48, "Streamline Rebuild," calls out the need to expedite the process, but it is equally important to ensure that rebuilding occurs in a logical fashion that does not undermine other City priorities.
- The City should support alternative work arrangements (telecommuting, mobile work) and connectivity both within its operations and throughout the community. Having procedures, technologies, and infrastructure in place to support remote work not only reduces transportation related fuel use and energy use, but supports the continuity of operations for City services and local businesses in the event of disruption to transportation and other systems after a disaster.

Thank you for your consideration of these points. Please contact Neal DeSnoo, Secretary to the Energy Commission if you have any questions.

LETTER N Energy Commission 12-18-13

RESPONSE N-1: The City is actively working with PG&E on post-disaster power restoration planning. This topic is part of disaster response and is not in the scope of this Mitigation Plan.

Underground utility lines are vulnerable to rupture in an earthquake. The benefit of underground utility lines is primarily related to removing the hazard of toppling utility poles and live wires.

RESPONSE N-2: Reduction in energy demand due to appliance efficiency will improve Berkeley's resilience to supply outages, but commenter does not identify how a decrease in gas demand will mitigate the hazard posed by line ruptures

RESPONSE N-3: Commenter statements regarding post-disaster GHG emissions and energy use are noted. Debris management, post-disaster rebuilding, and alternative work arrangements are disaster response, recovery and preparedness considerations, and are not within the scope of this Plan. Please see general response re: Scope and Detail of the Mitigation Plan.

LETTER O

MEMORANDUM

To: The City of Berkeley
Attn: Office of Emergency Services

From: Housing Advisory Commission

Date: December 9, 2013

Re: Recommendations on 2014 Draft Local Hazard Mitigation Plan

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At its regularly scheduled and noticed meeting of December 5, 2013, the City of Berkeley Housing Advisory Commission considered the 2014 Draft Local Hazard Mitigation Plan.

Recommendation:

That the Housing Advisory Commission expresses its support for the 2014 Local Hazard Mitigation Plan, in particular the following actions as outlined in the plan:

1. **Improve natural gas delivery system**
   Improving the disaster resistance of the natural gas delivery system may prevent a significant delay in residential services, in turn mitigating the effects of a natural disaster. The HAC supports pursuit of automatic shutoff valves for gas transmission lines and master shutoff valves in multifamily buildings.

2. **Complete retrofits on the remaining 10% of unreinforced masonry buildings**
   This should continue to be a high priority item as it is close to being completed; completion of this item can help prevent further damage from an earthquake.

3. **Continue to support the implementation of Phase Two of the Soft-Story Ordinance**
   As with item 2, this should continue to be a high priority item as it is close to completion. After implementation, the City should continue to work with building owners to ensure its success.

4. **Increase the Transfer Tax Rebate Program and other incentive programs**
   The Transfer Tax Rebate Program is just one example of the many ways the city can incentivize building owners, homeowners, and businesses to upgrade their properties to prevent further damage from a natural disaster.

5. **Streamline the permitting process to rebuild residential and commercial structures following disasters**
   Streamlining this process will help the city rebuild quickly in the wake of disaster. Though it is not as urgent as other items since it only becomes effective *after* a disaster, it is still important that steps be taken now to make sure it can be put in place.

6. **Vegetation Control**
   Vegetation management and control inspections in high-risk properties are a simple way to reduce the risk of large fire. This is important for protecting the assets of home and building owners, as well as the interests of tenants.

7. **Rehabilitate the City's storm water system**
   This will help to reduce local flooding due to unsatisfactory storm drainage.

8. **Maintain City participation in the National Flood Insurance Program**
   This will help to further protect the City from the effects of a flood.

9. **As applicable, incorporate the goals and strategies of the Berkeley Climate Action Plan into the Berkeley General Plan, specific plans, and the Zoning Code** O-1
   The Berkeley Climate Action Plan (BCAP) sets an aggressive goal of reducing greenhouse gas emissions and other environmental impacts that have been demonstrated to lead to or accelerate climate change and associated disasters. Comprising a significant element of BCAP are strategies for urban resilience to cope with sea level rise and other natural disasters that may be partially influenced by climate change. However, the BCAP may be inconsistent with the Berkeley policy goals enumerated in the General Plan and specific plans and, at times, may conflict with the Berkeley Zoning Code. For example, the Zoning Code does not explicitly state that detriment due to the shadow a proposed building casts on a neighboring building may not only affect the shading of windows, but may reduce the sunlight received by a neighbor's rooftop solar panel (the BCAP encourages solarization as a strategy to combat climate change) or edible garden (the BCAP encourages the creation of edible gardens as a tool for resiliency). Any conflicts between the BCAP and other plans and codes should be analyzed and, over time, resolved.

10. **Incentivize the maintenance of residential housing stock and associated life safety codes by explicitly defining "fault."** O-2
    Resolution No. 65,920, adopted by the Berkeley City Council in October 2012, exempts buildings destroyed by fire from the Affordable Housing Mitigation Fee if the property owner is not at fault for the fire. However, the resolution does not explicitly define what constitutes "fault." For purposes of this ordinance, the term "fault" should include not only intentional acts of the property owner, but also gross negligence or other conduct by the owner or his/her agents which constitutes the predominant cause of the destruction. Defining "fault" in this fashion would set clear expectations for property owners and hold them accountable to maintain a safe residential housing stock.

11. **Undergrounding Utilities near Large Multi-Unit Properties Located Along Major Thoroughfares** O-3
    The City should prioritize the use of 20A funds to be used near large multi-unit properties located along major thoroughfares. In the event of a major disaster, strategically using 20A funds to minimize the impact of fallen utilizes will save lives. Although the Public Works Commission periodically recommends to the City Council where to use 20A funds, undergrounding utilities is also a housing issue. As such, the HAC strongly recommends prioritizing 20A funds to be used near and around large multi-units located along major thoroughfares.

These actions are essential to ensuring that residents suffer the least amount of damage and have the highest chance of a quick and straightforward recovery.

LETTER O Housing Advisory Commission 12-09-13

LETTER O-1: The Climate Action Plan and the Local Hazard Mitigation Plan are consistent. As an Annex to the General Plan, the Mitigation Plan is designed to advance particular CAP strategies. For example, the Climate Change Integration Action supports the inclusion of climate change issues in City activities. With regards to the Zoning Code particular, the Sea-Level Rise Action includes creation of development review procedures that account for future sea-level rise impacts. Separate from this Mitigation Plan, other work is underway through the City's Office of Energy and Sustainable Development to integrate CAP strategies into City processes.

LETTER O-2: Suggestion is noted. As of this writing on January 27, 2014, this issue is agendized for City Council consideration at its February 11, 2014 meeting.

LETTER O-3: See General Response re: Overhead Utility Lines.

LETTER P

To: Sarah Lana, Emergency Services Coordinator

From: Paul Church, Secretary, Commission on Disability

Date: 12/9/13

Re: Local Hazard Mitigation Plan

At its November 13, 2013 meeting, the Commission on Disability reviewed the 2014 Local Hazard Mitigation Plan (LHMP). After discussing the plan, a motion was made to accept the recommendations and add a general comment that the plan needs to act upon issues of concern to people with disabilities in all of the different hazard scenarios (M/S/C Commissioners Weiss/Leeder, Ayes, Commissioners Weiss, Leeder, Trahan, Kramer-Castello; No, none; Abstain, none.

Any natural or man-made disasters occurring in Berkeley will impact vulnerable populations and people with disabilities as well as children. The only mention of possible impact of people with disabilities occurs in the section titled *Wildland-Urban Interface Fire,* where it states "The flatlands are densely-covered with old wooden buildings housing low-income and vulnerable populations, including isolated seniors, persons with disabilities and students." People with disabilities live in all areas of the City. Many seniors with disabilities live in the hills, children with disabilities can be found in all parts of the City. It is a serious mistake to assume any demographic group is limited to certain areas. **P-1**

The Commission on Disabilities appreciates the work the Office of Emergency Services, and in particular the work of Ms. Sarah Lana, in the development of this plan. The Commission looks forwards to future rewrites of the plan with greater emphasis on the impacts a disaster will have on all of Berkeley's citizens, and in particular those with disabilities.

LETTER P Commission on Disability 12-09-13

RESPONSE P-1: Comment that Berkeley community members with disabilities live throughout Berkeley is acknowledged. Section has been edited to remove the statement: "~~They often house vulnerable populations, including the elderly, persons with disabilities, and students.~~"

LETTER Q

Lana, Sarah

From: Patterson, Carol
Sent: Friday, December 13, 2013 10:54 AM
To: Mitigation
Subject: Comments on the Local Hazard Mitigation Plan

I presented the first draft of the Local Hazard Mitigation Plan during Staff Announcements & Updates at the Mental Health Commission meeting last night. The comments were as follows:

Q-1

1. It would be a really good idea to include a mental health component to the plan. For example, professionals could teach relaxation techniques to deal with the stress caused by a hazard.
2. When a hazard impacts Berkeley, how will mental health consumers be able to get their medications?
3. How can the plan meet the continuing treatment needs of the very vulnerable client served by Berkeley Mental Health?
   How can the plan address the mental health needs of the community impacted by the disaster?
4. The Mental Health Commission would like to discuss the plan at a future meeting and provide input as a Commission.

Carol Patterson
Community Services Specialist II
Berkeley/Albany Mental Health Commission Secretary
3282 Adeline Street
Berkeley, CA 94703
(510) 981-7721
(510) 981-5255 (FAX)
cpatterson@cityofberkeley.info

LETTER Q Mental Health Commission 12-13-13

RESPONSE Q-1: Provision of mental health services after a disaster, access to medications are not in the scope of this mitigation plan. Please see General Response re: Scope and Detail of the Mitigation Plan.

City of Berkeley
2014 Local Hazard Mitigation Plan

First Draft

Public Works Commission Response
December 9, 2013

LETTER R, CONTINUED

The City is preparing its 2014 Local hazard Mitigation Plan and it has asked for responses to the first draft from appropriate Public Commissions. The Public Works Commission (PWC) response focuses on one area omitted in the first draft. Resources and planning need to focus on overhead utility wires and the risk they pose to individual citizens and the ability of 'first responders' to act in the face of earthquakes and extreme weather[1]. Overhead utilities potential failing may pose a danger and have application to all four foci of the 2014 Hazard Mitigation Plan. **R-1**

That Plan has four stated objectives for reducing disaster risk in Berkeley:

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, and their secondary impacts.
B. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.
C. Protect Berkeley's unique character and values from being compromised by hazard events.
D. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to Berkeley's functioning.

Additionally, the 2014 Plan has three priority action response levels: *High, medium and low*.

- ***"High*** and ***medium*** priority actions can be completed in the five-year time frame covered by this strategy and actions address Berkeley's hazards of greatest concern—earthquake and wildland-urban interface fire."
- "Implementation of ***medium*** **and** ***low*** actions is dependent on outside sources of funding becoming available. Resource availability will strongly influence the pace of achievements."
    - Three of the Medium Priority Actions identified in the draft Plan that are related to our proposed area of recommended actions:
        - Develop an Energy Assurance Plan for City operations.
        - Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.
        - "Reduce Berkeley's vulnerability to severe storms and associated hazards."
    - The PWC recommends that mitigation plans for overhead utility wires be specifically added to this list of Medium Priority Actions[2]. **R-2**

[1] The Christchurch, New Zealand 2011 earthquake saw 184 people die and a contributing factor to some deaths was the inability of first responders to effectively act in face of utility disruption. More recently our experience high winds preceding 2013 Thanksgiving saw two people die in the East Bay. One death was from downed utility wires.
[2] The PWC drafted and passed a recommendation on 'priorities' for Undergrounding of Utilities in January of 2010. The Secretary of PWC, when asked in 2011 about the status of our drafted recommendation, the response was "there was no interest" and it was never agenized for the City Council to review. The 2010 drafted recommendation of 'priorities' was constrained by the current 20 A funding from PG&E (about $1M a year and which would mean 35 years to complete the entire city at current completion rates). The PWC hopes that a comprehensive plan for overhead utility wires can be addressed with new thinking on funding alternatives and that we have some current alternatives to propose and recommend.

LETTER R Public Works Commission 12-09-13

RESPONSE R-1: See General Response re: Overhead Utility Lines.

RESPONSE R-2: See General Response re: Overhead Utility Lines.

LETTER S

From: Fogarty, David
Sent: Thursday, November 14, 2013 12:50 PM
To: Lana, Sarah
Subject: FW: comments on the 2014 LHMP draft
Attachments: 11112013agenda.doc

Sarah,
The Solano BID Advisory Board had the LHMP on its agenda for November 11, 2013. See attached. A Commissioner, Kevin Suto, volunteered to read the Plan and commented below. The Plan itself had little to do with Solano Avenue in particular.

From: Kevin Suto [mailto:kevin@zacharys.com]
Sent: Wednesday, November 13, 2013 10:36 AM
To: Fogarty, David
Subject: comments on the 2014 LHMP draft

Hello David-

I read over the hazard mitigation plan. A few thoughts and comments:

Being as prepared as possible for earthquakes, fires, and disasters related to extreme weather is obviously a smart thing to do.

From a business persons perspective, the concern would be the impact of any new mandated regulations would have on existing businesses. Sometimes well intended policies can be heavy handed, impossible to regulate, and not thought through completely. The details of any mandated regulations would be the concern. Significant changes in occupancy, or expenses to be brought "up to new code or regulation", can be crippling.

One question I have regarding the LHMP that really is more out of curiosity from a taxpayer than from the perspective of a business district (forgive me for my ignorance regarding city disaster procedures):

- Is a new plan written every 10 years or so? The reason I ask is because what is the potential for loss of life, and economic damage due to "climate change" over the next 10 years? The record high temperature was 107 degrees in Berkeley in 2000. Was there loss of life or economic damage during that heat wave? Are significant city funds going to be spent "integrating climate change research and adaption into City operations and services"? Is there not already a plan in place regarding how to deal with flooding, mudslides, freezes, and heat waves? **S-1**

Thanks! - Kevin

LETTER S Solano Business Improvement District Advisory Board 12-13-13

RESPONSE S-1: Local Hazard Mitigation Plans should be updated and adopted every 5 years. This plan is out of date. Climate change is increasing the areas of Berkeley that are exposed to existing hazards (such as flooding), as well as the intensity/frequency of those hazard events (such as heat waves, severe storms, etc.). City resources are being utilized to better understand these hazards, how climate change will exacerbate their effects, and the City can protect the community and its infrastructure from future disaster events.

LETTER T

Local Hazard Mitigation Plan Comment from the Community Health Commission

This Community Health Commission thanks the City Manager's Office for the opportunity extended to review the 1st draft of the City of Berkeley's 2014 Local Hazard Mitigation Plan; and thinks it is a very thorough and careful document detailing mitigation for the most likely natural and manmade disasters to affect Berkeley. However, as the Community Health Commission, we have seen that infectious disease disasters are potentially the most feared and economically consequential disasters that the city might face, particularly in this vibrant, culturally diverse population which is a gateway to immigration and international visitors. **T-1**

We realize that mitigations of the nature required to prepare a response to infectious disasters are not within the scope of this plan, but we feel that it is imperative as the Community Health Commission to emphasize that an infectious disease disaster is possibly one of the most dangerous, catastrophic and likely disasters that this community could face, in terms of human life and economic impacts, and that preparations to mitigate the impact of such infections would be beneficial to include in this plan.

LETTER T Community Health Commission

RESPONSE T-1: Commenter statement regarding the infectious disease outbreak hazard is noted. As the commenter states, naturally-occurring communicable disease outbreaks (e.g. a flu pandemic; SARS) do pose a significant risk to the Berkeley community, but are not in the scope of this plan. The City's Public Health Division leads Berkeley's communicable disease and public health emergency preparedness planning, in conjunction with State and Bay Area local health departments.

LETTER U

Staff Notes from 12/4/13 Disaster and Fire Safety Commission Meeting

Commissioners' Feedback on First Draft Local Hazard Mitigation Plan

Matthew Mitchell

Takes issue with structure used for Action prioritization. Thinks that cost-benefit analysis should be primary driver of action priority. **U-1**

Ruth Grimes

Streamline Rebuild Action: Concerned that Action will provide blanket approval for reconstruction in areas that are highly exposed to natural hazards, where further consideration should be given before rebuilding. **U-2**

Vegetation Management Action: Wants to increase inspections in the hills. Concerned that vegetation has been building up. **U-3**

Lynn Zummo

Vegetation Management Action: Thinks vegetation is out of control and could be addressed with proper funding and staffing. **U-4**

Hills Evacuation Action: Concerned that pedestrian evacuation paths will be made inaccessible by overhead utility lines falling on them. **U-5**

Neil Goldstein

Thinks liquefaction hazard needs to be added to the Hazardous materials section of the Hazard analysis. **U-6**

Hills Evacuation Action: Does not want reliance on pathways, as stairway are steep and do not have acceptable rise-to-run ratio. Concerned about risk of power lines. Says pathways are built above sewers and that's why they're in the right-of-way. Concerned that sewer breaks after earthquake will render pathways unusable. Wants an assessment of path safety in light of these concerns. **U-7**

Hazard Information Action: Information needs to be shared with the public. How does the public access this information? **U-8**

Bob Flasher

Concerned about evacuation route map that is in General Plan. Evacuation routes as reflected in the Plan will not necessarily be accessible after a disaster. **U-9**

Hills Evacuation Action: Considers pathways dangerous, especially in the dark. People will evacuate in their cars so that they can save their possessions, until the traffic backs up, at which point they will get out of their cars and evacuate on foot. **U-10**

Jack Hamm

LETTER U, CONTINUED

Concerned about train derailments causing hazardous materials release during earthquakes and flooding. Maps in Hazard Analysis section show that tracks cross lots of east/west evacuation routes, which would be the egress routes to the highway. Recommend highlighting this hazard. **U-11**

LETTER U Disaster and Fire Safety Commission 12-04-13

RESPONSE U-1: See General Response re: Action Prioritization.

RESPONSE U-2: To address approval of reconstruction in natural hazard-exposed areas, the following text has been added to the Streamline Rebuild Action:

- Consider different treatment for buildings in high-risk areas, such as:
    - Imposing higher standards of building construction for rebuilding
    - Excluding buildings in these areas from the amendment

RESPONSE U-3: Fire Code Action has been expanded to include evaluation of inspection procedures to achieve greater Fire Code compliance. The Vegetation Management Action has been expanded to include pursuit of external funding for community outreach for fire fuel reduction.

RESPONSE U-4: See response U-3.

RESPONSE U-5: See General Response re: Pedestrian Evacuation Routes in the Hills.

RESPONSE U-6: 3.9 *Hazardous Materials Release, Links to Berkeley's Hazards of Concern* mentions that liquefaction is a potential cause of hazardous materials release. Natural gas pipeline rupture secondary to liquefaction is addressed in *Electricity and Natural Gas Systems: Earthquake Exposure and Vulnerability* on p. 46 in Section 3 of the First Draft Plan.

RESPONSE U-7: See General Response re: Pedestrian Evacuation Routes in the Hills.

RESPONSE U-8: Hazard information is shared with the community in a variety of ways. This Plan itself is a comprehensive assessment of the natural hazards present in the community, and has been available online and at public libraries. The Hazard Information Action describes that the City plans to collect and share information updates as they become available. The particular information would likely be shared through the City's website. Depending on the information type and audience, it could possibly be printed for distribution, shared through in-person trainings, or posted in other public spaces.

RESPONSE U-9: The commenter's statement that evacuation routes presented in the Evacuation Route Map in the General Plan may not be available during a disaster is correct. The Map is intended as a general guide to inform development and mitigation activities. Evacuation routes for a particular emergency can and will be established at the time of the emergency, based on the needs and impacts of the particular event. At that time, the Evacuation Route Map will also be consulted as a general guide, but it should not be considered prescriptive.

RESPONSE U-10: See General Response re: Pedestrian Evacuation Routes in the Hills.

RESPONSE U-11: See response to comment E-1.

LETTER V

Staff Notes from 11/14/13 Zoning Adjustments Board Meeting

Board Members' Feedback on First Draft Local Hazard Mitigation Plan

• Items that relate to building code should be written into the code so that protections can be enforced (ex. Soft story building would need to be reinforced before it could go before ZAB for another type of permit); **V-1**

• Page 42: Integration of goals of climate action plan into zoning code; **V-2**

• Measure M funds could/should seek to find more money to fun watershed management projects; **V-3**

• Page 48: Allow commercial, industrial and multi-family buildings to rebuild by right if owners not at fault; **V-4**

• Page 49: Sea level rise is low priority, reconsider elevating to medium priority given sea level rise projections and possible impacts to I-80 freeway in the near future. **V-5**

LETTER V Zoning Adjustments Board 12-14-13

RESPONSE V-1: Pursuant to BMC 19.39.110 all owners of potentially hazardous soft story buildings have a five-year compliance deadline for completion of seismic retrofit work. This deadline is accelerated to 18 months if any one or more of the following occurs: (1) the building is to be reoccupied after being vacant for six months or longer; (2) the building is to undergo a remodel, alteration, addition or structural repairs valued at more than $50,000 per unit; (3) the title of the building is transferred in whole or part or the building is sold to a new owner; (4) additional financing is obtained which is secured by a deed of trust or mortgage recorded on the title to the building; (5) the building is to undergo a change of occupancy; (6) the building is declared by the Building Official to be an Unsafe Building. The ZAB's concern about enforcement of the soft-story ordinance for projects that come under its purview beyond the types of projects specified above will not become actionable until the soft-story retrofit deadlines have passed, which is five years from now. This timeframe is outside the scope of this plan, which is to be updated every five years.

RESPONSE V-2: The Climate Action Plan and the Local Hazard Mitigation Plan are consistent. As an Annex to the General Plan, the Mitigation Plan is designed to advance particular CAP strategies. For example, the Climate Change Integration Action supports the inclusion of climate change issues in City activities. With regards to the Zoning Code particular, the Sea-Level Rise Action includes creation of development review procedures that account for future sea-level rise impacts. Separate from this Mitigation Plan, other work is underway through the City's Office of Energy and Sustainable Development to integrate CAP strategies into City processes.

RESPONSE V-3: Measure M funds can be used as local matching funds to leverage larger State and federal grants as needed.

RESPONSE V-4: This idea is covered in the Streamline Rebuild Action.

RESPONSE V-5: Sea-Level Rise Action has been moved to Medium Priority.

LETTER W

Staff Notes from 11/20/13 Planning Commission Meeting

Staff Notes: Planning Commission Questions on Local Hazard Mitigation Plan

Streamline Rebuild Action:

What happens if changes are made to the building after the owner has submitted the drawings to the City? What provision will be made to ensure that the latest version of the drawings is the version that the City has on file? **W-1**

Soft-Story Action:

Will there be a pass-through of retrofit costs from soft-story building owners to building tenants? **W-2**

Will there be a loan program to support landlords in doing soft-story retrofits? **W-3**

LETTER W Planning Commission 11-20-13

RESPONSE W-1: Building permits must be issued to make changes to a building. Through the permitting process, the City can ensure that the latest building status is on file.

RESPONSE W-2: See Soft-Story Action: Activities include "The Rent Board will review requests for pass-through of capital improvement expenses for seismic retrofits. They will determine on a case-by-case basis if rent increases to tenants can be approved."

RESPONSE W-3: See Soft-Story Action. Activities include "Explore establishment of a loan program to assist landlords who cannot access financing to retrofit their buildings."

LETTER X

Staff Notes from 11/7/13 Landmarks Preservation Commission Meeting

Commissioners' Feedback on First Draft Local Hazard Mitigation Plan

Olson

Remembering the Fire and how many buildings were lost, most were not restored back to original. Suggest LPC take on a project documenting and photographing the entire City:

- Photograph Landmarks
- Photograph significant blocks that don't want to be Landmarked

Wagley

X-1

Risks- Concerned that plan does not mention the Jet Fuel pipeline with potential to cause a lot of damage to the City.

Hall

Many buildings are still not seismically retrofitted, however recent Structural Alteration Permits, such as 48 Shattuck Square, have included seismic retrofit. Maybe we need to set a subcommittee.

Olson

Commissioners just need to take pictures and submit them to the City.

LETTER X Landmarks Preservation Commission 11-07-13

RESPONSE X-1: Section 3: *Hazard Analysis* includes information about the Kinder Morgan fuel pipeline. See *Aviation Fuel Pipeline* on p. 51. Map 3.11 shows in red lines the location of pipelines carrying aviation fuel, and overlays the pipeline map with the seismic hazard planning zones.

In Section 1: *Mitigation Strategy* the Partnerships Action includes reference to the City's intention to coordinate mitigation efforts with private sector organizations in Berkeley. Kinder Morgan is included in this group.

Summary of Changes to the First Draft 2014 Local Hazard Mitigation Plan

This document outlines the revisions made to Berkeley's First Draft 2014 Local Hazard Mitigation Plan (FIRST DRAFT LHMP) that are present in the Final Draft 2014 Local Hazard Mitigation Plan. When revisions were made in response to community feedback, the revisions are also noted in *Public Comments and Staff Responses for the First Draft 2014 Local Hazard Mitigation Plan.*

FIRST DRAFT LHMP Executive Summary

On Executive Summary Page 2, the text of the sixth paragraph has been modified to read as follows:

> "As in 2004, earthquake and wildland-urban interface fire are the two hazards of greatest concern. These hazards have the potential for catastrophic impacts to Berkeley."

On Executive Summary Page 5, the second sentence of the fourth bullet has been modified to read as follows:

> "Berkeley was the first city in the nation to inventory the community's soft-story buildings. In December 2013, City Council adopted an ordinance requiring soft-story buildings with five or more units to be retrofitted within five years. ~~The City Council has directed staff to prepare an ordinance mandating retrofit of all of these buildings.~~"

On Executive Summary Page 7, the first bullet of under Medium Priority Actions ("Strengthen or replace City buildings in the identified prioritized order as funding is available.") has been moved to be the second bullet under High Priority Actions.

On Executive Summary Page 7, the fifth bullet of under Medium Priority Actions ("Reduce fire risk in existing development through vegetation management.") has been moved to be the seventh bullet under High Priority Actions.

On Executive Summary Page 9, the second sentence of the sixth bullet has been modified to read as follows:

> "The City has updated the plan to describe Berkeley's progress on mitigating earthquake vulnerabilities in soft-story buildings. Data gathered through the City's 2005 soft-story ordinance (Phase I) are used to describe the ordinance's impacts on retrofit activities, as well as the current number and locations of soft-story buildings in Berkeley."

FIRST DRAFT LHMP Section 1: Mitigation Strategy

On Section 1: Mitigation Strategy Page 1, Item 2 under *Disaster Mitigation Approaches and Objectives* has been modified to read as follows:

> "The City will establish and maintain incentive programs and standards to encourage local residents and businesses to upgrade the hazard resistance ~~vulnerabilities~~ of their own properties."

On Section 1: Mitigation Strategy Page 1, the second header sentence under *Disaster Mitigation Approaches and Objectives* has been modified to read as follows:

> "Four ~~mitigation~~ objectives guide the mitigation strategy:"

In Section 1: Mitigation Strategy, the following Actions have been moved from Table 1.2 *Medium-Priority Actions in mitigation strategy* to Table 1.1 *High Priority Actions in mitigation strategy*:

Strengthen and Replace City Buildings	Strengthen or replace City buildings in the identified prioritized order as funding is available.	Earthquake Wildland-Urban Interface Fire Tsunami Landslide Floods Climate Change

Vegetation Management	Reduce fire risk in existing development through vegetation management.	Wildland-Urban Interface Fire

In Section 1: Mitigation Strategy, in the Building Assessment Action, the text in the second bullet of the Proposed Activities Section has been modified to read as follows:

> "Prioritize analysis of remaining structures based on occupancy and structure type, taking historic significance into consideration. ~~and~~ Use analysis to make recommendations for structural and nonstructural improvements."

In Section 1: Mitigation Strategy, in the Building Assessment Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

"General Plan Policy UD-7, Actions A and B

General Plan Policy UD-12, Actions A and C"

In Section 1: Mitigation Strategy, in the Soft-Story Action, the Proposed Activities Section has been modified as follows:

- ~~**"Phase II, Part 1: Complete Public Review and Adopt a Mandatory Retrofit Ordinance**~~
- ~~Pass ordinance to amend the Berkeley Municipal Code 19.39 to require owners of soft-story buildings to retrofit their buildings~~
- ~~Identify and address related zoning issues (e.g., parking elimination requirements, demolitions, etc.)~~
- ~~Outreach to impacted property owners and tenants~~
- ~~**Phase II, Part 2 – Implementation of Mandatory Soft-story Retrofit Ordinance**~~

In Section 1: Mitigation Strategy, in the Soft-Story Action, the Special Environmental Concerns Section has been modified as follows:

"All building upgrade activities will include efforts to minimize impacts to existing residential and commercial tenants, and historic resources."

In Section 1: Mitigation Strategy, in the URM Action, the Special Environmental Concerns Section has been modified to read as follows:

"All building upgrade activities will include efforts to minimize impacts to existing residential and commercial tenants, and historic resources."

In Section 1: Mitigation Strategy, in the Buildings Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

"General Plan Policy UD-7, Actions A and B

General Plan Policy UD-12, Actions A and C"

In Section 1: Mitigation Strategy, in the Buildings Action, the Special Environmental Concerns Section has been modified to read as follows:

"All building upgrade activities will include efforts to minimize impacts to existing residential and commercial tenants, and historic resources."

In Section 1: Mitigation Strategy, in the Fire Code Action, the Proposed Activities Section has been modified to add the following text:

"Evaluate inspection procedures and adjust inspection cycle annually based on changing climatic conditions."

In Section 1: Mitigation Strategy, in the Fire Code Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

"General Plan Policy UD-7, Actions A and B

General Plan Policy UD-12, Actions A and C

Climate Action Plan – Adaptation, Goal 1D, Action 3"

In Section 1: Mitigation Strategy, in the Fire Code Action, the Timeline Section has been modified as follows:

"Inspection system evaluation: Ongoing"

In Section 1: Mitigation Strategy, in the Hazard Information Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

"General Plan Policy UD-12, Actions A and C"

In Section 1: Mitigation Strategy, in the Partnerships Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

"General Plan Policy UD-7, Actions A and B

General Plan Policy UD-12, Actions A and C"

In Section 1: Mitigation Strategy, in the Hills Evacuation Action, the Proposed Activities Section has been modified as follows:

"Ensure that all public pathways and associated signage are maintained to identify and provide safe and accessible pedestrian evacuation routes from the hill areas."

In Section 1: Mitigation Strategy Pages, the Strengthen and Replace City Buildings Action has been moved to Section 1.2.4.1 *High Priority Actions.*

In Section 1: Mitigation Strategy, in the Strengthen and Replace City Buildings Action, Associated LHMP Objective(s) Section has been modified as follows:

"Protect Berkeley's unique character and values from being compromised by hazard events."

In Section 1: Mitigation Strategy, in the Strengthen and Replace City Buildings Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

"General Plan Policy UD-12, Actions A and C"

In Section 1: Mitigation Strategy, in the Strengthen and Replace City Buildings Action, the Priority Section has been modified to read as follows:

"~~Medium~~ High"

In Section 1: Mitigation Strategy, in the Energy Assurance Action, the third sub-bullet in the Proposed Activities Section has been modified as follows:

"Identify potential actions to mitigate those vulnerabilities (e.g., photovoltaic-supplemented emergency generation, energy efficiency activities, and/or mobile charging stations)."

In Section 1: Mitigation Strategy, the Vegetation Management Action has been moved to Section 1.2.4.1 *High Priority Actions.*

In Section 1: Mitigation Strategy, in the Vegetation Management Action, the Proposed Activities Section has been modified as follows:

"Pursue external funding to increase education and awareness of vegetation management standards for fire fuel reduction"

In Section 1: Mitigation Strategy, in the Vegetation Management Action, the Lead Organization and Staff Lead Section has been modified as follows:

"Fire Department – Division of Support Services (Funding for education)

Staff Lead: Deputy Fire Chief (Fire Marshal)"

In Section 1: Mitigation Strategy, in the Vegetation Management Action, the Priority Section has been modified to read as follows:

"~~Medium~~ High"

In Section 1: Mitigation Strategy, in the Vegetation Management Action, the Potential Funding Sources Section has been modified as follows:

"Assistance to Firefighters Grant"

In Section 1: Mitigation Strategy, in the Tsunami Action, the second bullet of the Proposed Activities Section has been modified as follows:

> "Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to document and ~~implement~~ explore potential tsunami hazard mitigation measures for Berkeley's maritime communities."

In Section 1: Mitigation Strategy, in the Extreme Heat Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

> "Climate Action Plan - Adaptation Goal 1, ~~Policy~~ Policies A and D"

In Section 1: Mitigation Strategy, in the Severe Storms Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

> "Climate Action Plan - Adaptation Goal 1, ~~Policy~~ Policies A and C"

In Section 1: Mitigation Strategy, in the NFIP Action, the Special Environmental Concerns Section has been modified as follows:

> "All activities will take steps to minimize impacts to historic resources to the extent feasible."

In Section 1: Mitigation Strategy, in the Streamline Rebuild Action, the Proposed Activities Section has been modified to read as follows:

- ~~Adopt~~ Explore a Zoning Amendment to BMC 23C.04.100 that streamlines the Zoning permitting process to allow industrial and commercial buildings, and multiple-family dwellings to rebuild by right following disasters. Consider different treatment for buildings in high-risk areas, such as:
  - Imposing higher standards of building construction for rebuilding
  - Excluding buildings in these areas from the amendment
- 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.
- Define the process for the City to accept and file this documentation.
- Outreach to property owners about this documentation process. ~~Develop a process and information required for residential and commercial property owners to document their buildings' current conditions, to enable them to rebuild by right (in conformity with current applicable codes, specifications and standards) following disasters.~~

In Section 1: Mitigation Strategy, in the Streamline Rebuild Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

"General Plan Policy UD-7, Action C"

In Section 1: Mitigation Strategy, in the Sea-Level Rise Action, the Related Policies from the General Plan or Climate Action Plan Section has been modified as follows:

"Climate Action Plan, Adaptation ~~Policy~~ Policies A and C"

In Section 1: Mitigation Strategy, in the Sea-Level Rise Action, the Special Environmental Concerns Section has been modified as follows:

"Policy changes to development regulations in areas exposed to sea-level rise will take steps to minimize impacts to coastal habitat and historic resources."

FIRST DRAFT LHMP Section 2: Implementing, Monitoring and Updating the Plan

Section 2 has not been modified.

FIRST DRAFT LHMP Section 3: Hazard Analysis

On Section 3: Hazard Analysis Page 5, the last sentence of the fourth paragraph has been modified as follows:

"The regional hazard mitigation plan developed by the Association of Bay Area Governments in ~~2011~~ 2010 contains additional information and analysis relevant to the city and informed portions of this update."

On Section 3: Hazard Analysis Page 10, Map 3.1 *Regional faults and their location with respect to Berkeley* has been replaced with an updated map.

On Section 3: Hazard Analysis Page 11, the third sentence of the first paragraph has been modified as follows:

"To provide a historical context, the 1994 Northridge earthquake, which caused an economic loss of $40 ~~28~~ billion dollars ~~in losses~~,[i] was a magnitude 6.7 earthquake.[ii]"

On Section 3: Hazard Analysis Page 11, the second sentence of the sixth paragraph has been modified as follows:

"Magnitude is measured using ~~the Richter scale~~ moment magnitude (M)."

On Section 3: Hazard Analysis Page 21, the following reference has been added to the last sentence on the page:

> "[15] Yasuhara K., Komine H., Murakami S., Chen G., Mitani Y. (2010) Effects of climate change on geo-disasters in coastal zones. Journal of Global Environmental Engineering, JSCE 15, 15–23."

On Section 3: Hazard Analysis Page 34, the following modifications have been made to the text under the "Notable Mitigation Activities" header:

> "On December 3, 2013 City Council adopted Ordinance No. 7,318-N.S. amending Berkeley Municipal Code Chapter 19.39 to require property owners of soft, weak or open front buildings with five or more dwelling units to retrofit their buildings within the next five years. Owners have three years to apply for a building permit and two years to complete the work after submitting their permit application. The law applies to buildings constructed prior to 1978 and takes effect January 4, 2014. This is the second phase of the Soft Story Program.
>
> Under the first phase of the soft story program, a ~~A~~ City ordinance passed in 2005 ~~requires~~ required owners of soft-story buildings with five or more units to hire professional engineers to evaluate their buildings' seismic vulnerability and to submit evaluation reports to the City."

On Section 3: Hazard Analysis Page 37, the third sentence of the second paragraph has been modified as follows:

> "Following strong earthquakes, retrofitted URM buildings are likely to remain stable, but they may still sustain moderate or greater damage, including possible collapse."

On Section 3: Hazard Analysis Page 57, the third bullet in the table has been modified as follows:

> "Cellular telephone antennae ~~owned by~~ distributed throughout the city"

On Section 3: Hazard Analysis Page 66, the first header on the page has been modified as follows:

> "Key Critical Response Facility Partner: Public Schools"

On Section 3: Hazard Analysis Page 66, the third full paragraph has modified as follows:

> ~~"While private schools are not subject to the Field Act, that are covered under the Private Schools Building Act of 1986, with the legislative intent that children~~

~~attending private schools be afforded life safety protection similar to that of children attending public schools. However, due to a number of differences between the Field Act and Private Schools Building Act, private school buildings are not as safe as public school buildings. Private schools located in buildings built before 1986 can pose a serious risk to their students' life-safety.[iii]"~~

On Section 3: Hazard Analysis Page 70, the second bullet has modified as follows:

"In the first day following the earthquake[iv], fires could ignite in six to twelve[v] different locations around the city. The City's Fire Department is equipped to respond to one two-alarm fire or two single-alarm fires simultaneously. 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 $30 to $60 million[vi] of damage to structures in Berkeley. "

On Section 3: Hazard Analysis Pages 72-73, the first paragraph of the BART write-up has been modified as follows:

"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. Roadways and bridges may be functional, with damage in select locations. However, the Bay Bridge is vulnerable to damage until the retrofit and reconstruction activities currently underway are completed. Additional ferries and bus lines could be established within a week to provide substitutes for BART."

On Section 3: Hazard Analysis Page 81, the first paragraph has been modified as follows:

"While much of the concern for fire is placed on the hills, Berkeley's flatlands are at risk as well. The flatlands are densely covered with old wooden buildings that have narrow side yards and dense vegetation. Most of these houses are old and not built with modern, fire-resistant materials. They have a high risk of damage in an earthquake, which could spark multiple ignitions, for example, by damaging gas/electric lines. ~~They often house vulnerable populations, including the elderly, persons with disabilities, and students.~~"

FIRST DRAFT LHMP Section 4: Mitigation Programs and Resources

On Section 4: Current Mitigation Programs and Resources Page 1-3, have been modified as follows:

"Building Codes. The City enforces disaster-resistant development through the application of the ~~State-mandated~~ California Building Code, as well as more stringent local code amendments. The Provisions of the California Building Code

~~must be applied~~ are applicable to all new construction, ~~and to~~ additions, alterations and repairs ~~substantial renovations~~. ~~It requires the most up-to-date earthquake- and fire-resistant design and materials, exceeding current State standards. Homes in the hill areas are required to apply stringent landslide and fire prevention features. Codes are updated regularly. Numerous inspections and re-inspections are conducted each year by City building inspectors under the Building Official, by staff of the Division of Fire Prevention, and private firms contracted to do this work.~~

City Transfer Tax Rebate Program. 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. The process begins once the homeowner makes seismic safety improvements. 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. ~~In February 2007, the City developed updated standards to ensure all work qualifying for this program improves seismic safety.~~ Since July 2002, the City has distributed over $9 million to homeowners through this program.

Home Rehabilitation Loan Program. The Senior and Disabled Home Rehabilitation Loan Program assists very-low-income senior and disabled homeowners in repairing their homes, to eliminate conditions that pose a threat to their health and safety, and to help preserve the City housing stock. Qualified borrowers can receive interest-free loans of up to $35,000. Financial assistance is in the form of a deferred payment loan that is due and payable upon the sale or transfer of title to the property.

Technical Assistance. The City has developed more options and technical standards to seismically strengthen single-family homes and multi-unit apartment buildings. ~~In August of 2010, t~~ The City has adopted International Building Code standards for seismic strengthening of wood-frame buildings. In addition, the City has implemented ABAG ~~adopted~~ Standard Plan Set A as a guide that provides typical details and other ~~guidance~~ recommendations for wood-frame homes of two stories or less. This plan set assists building owners and their contractors in the preparation of permit documentation and assists the City's plan checkers in their review of permit submittals. ~~simplifies the design of cripple wall retrofits for many homes in Berkeley. Contractors' adherence to this Standard simplifies the City's plan review and inspection process.~~ The City has its own URM ordinance tailored specifically to Berkeley, which has structural engineering and prescriptive guidelines providing technical assistance for design professionals. ~~For URM buildings, there is a technical prescriptive standard developed specifically for the City of Berkeley which would allow a contractor to undertake URM retrofits without spending substantial money on engineering design, provided the building meets the limitations of the Standard.~~ The City has published guidelines for Transfer Tax Reductions to ~~establish~~ clarify the types of voluntary seismic strengthening work that qualify for a Transfer Tax Rebate."

On Section 4: Current Mitigation Programs and Resources Page 2, the Soft Story Building Program description has been modified as follows:

> "Soft-Story Building Program. On December 3, 2013, City Council adopted Ordinance No. 7,318-N.S. amending Berkeley Municipal Code Chapter 19.39 to require property owners of soft, weak or open front buildings with five or more dwelling units to retrofit their buildings within the next five years. Owners have three years to apply for a building permit and two years to complete the work after submitting their permit application. The law applies to buildings constructed prior to 1978 and takes effect January 4, 2014. This is the second phase of the Soft Story Program.
>
> Soft story buildings are characterized as wood-frame buildings with more than one story, typically with extensive ground story windows, garage doors, or open-air spaces such as parking with little or no enclosing solid wall, that lead to a relatively soft or weak lateral load resisting system in the lower story.
>
> Under the first phase of the soft story program, since 2005, soft-story building owners have been required to submit an engineering evaluation report identifying their building's weaknesses and ways to remedy those weaknesses, to post an earthquake warning sign and notify their tenants of the building's potentially hazardous condition. Since 2005, thirty-five percent of soft-story building owners voluntarily retrofitted their buildings.
>
> ~~In February of 2001, the City obtained a FEMA grant to assess multi-unit soft-story residential buildings and develop a program to reduce their vulnerability, building on an earlier effort in 1996. Under the direction of the City's Seismic Technical Advisory Group, a team of staff, outside experts and University of California students assessed soft-story residential buildings with five or more residential units. Commercial tilt-up buildings were also identified and mapped.~~
>
> ~~The team found that nearly half (over 200) soft-story structures were expected to be red-tagged, uninhabitable and likely to require extensive repair or total replacement. Further, over 95 percent of these soft-story units may not have been livable immediately following a large Hayward Fault earthquake[vii]. This effort led to the City's current soft-story building program. A City ordinance passed in 2005 requires owners of soft-story buildings with five or more units to hire professional engineers to evaluate their buildings' seismic vulnerability and to submit evaluation reports to the City. The 2005 ordinance has a 94% compliance rate. Since 2005, thirty-five percent of soft-story building owners voluntarily retrofitted their buildings. As of July 2013, 158 soft-story buildings with 1,611 residential units remain unretrofitted.~~"

On Section 4: Current Mitigation Programs and Resources Page 17, the final row has been added to the table:

January 2014	Soft-Story Phase II Ordinance takes effect	Owners of soft, weak or open front buildings with five or more dwelling units required to retrofit their buildings within the next five years

FIRST DRAFT LHMP Section 5: Community Profile and Trends

On Section 5: Community Profile and Trends Page 2, the fourth paragraph has been modified as follows:

> "New development generally 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, and elevation above flood levels. Replacing or significantly renovating older structures significantly increases the Berkeley community's protection from natural hazards. For example, pursuant to the Seismic Hazards Mapping Act codified in the Public Resources Code as Division 2, Chapter 7.8 and Guidelines for Evaluations and Mitigating Seismic Hazards in California (Special Publication 117), much of the new construction in the City's west must have site-specific geological and geotechnical investigations ~~site surveys per State law~~, due to the area's mapped potential liquefaction hazard. These investigations result in recommendations for design professionals to design new or rehabilitated buildings for human occupancy to mitigate the potential effects of liquefaction caused by earthquakes to a level that does not cause the collapse of the buildings ~~site surveys mean that a structural engineer develops structural elements of the building to meet structural standards of the building code. Geotechnical surveys are required for larger buildings before discretionary permits are issued.~~ This means that a new or rehabilitated building will be ~~much better able~~ equipped to better withstand potential liquefaction impacts than an old building."

On Section 5: Community Profile and Trends Page 3, the sixth paragraph has been modified as follows:

> "The City has a strong value for 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."

FIRST DRAFT LHMP Appendix A: 2004 Actions

On Appendix A: 2004 Actions Pages 15-17, the text has been modified as follows:

a) "Explore development of an ordinance to require owners of soft-story structures to strengthen them. (Completed)

On December 3, 2013 City Council adopted Ordinance No. 7,318-N.S. amending Berkeley Municipal Code Chapter 19.39 to require property owners of soft, weak or open front ("SWOF") buildings with five or more dwelling units to retrofit their buildings within the next five years. Owners have three years to apply for a building permit and two years to complete the work after submitting their permit application. The law applies to buildings constructed prior to 1978 and takes effect January 4, 2014. This is the second phase of the Soft Story Program.

In Phase I of the Soft-Story Program, the ~~The~~ City passed an ordinance requiring owners of soft-story buildings with five or more units to:

- Submit an engineering report analyzing the building's seismic safety within two years of notice
- Post the building with a warning sign, and
- Notify tenants of the building's seismic weaknesses.

Alternately, owners ~~can~~ could ch~~o~~ose to retrofit without submitting the detailed engineering analysis.

Owners of all 321 identified soft-story wood frame buildings were sent Notices and Orders in 2006. 51 buildings were removed upon further investigation as not being within the scope of the ordinance.

Of the remaining 270 buildings, 94 percent are in compliance with Phase I of ~~with~~ the ordinance:

- 112 have been retrofitted or are in the process of being retrofitted
- 140 have submitted engineering evaluation reports that have been approved by the City, verifying their status as soft-story buildings

18 buildings are not in compliance with Phase I of the ordinance.

~~The City is in the process of evaluating the current ordinance and is exploring options for Phase II: Mandatory Compliance."~~

b) Provide technical assistance in seismically strengthening these types of structures. (Completed)

~~"For URM buildings, there is a technical prescriptive standard developed specifically for the City of Berkeley which would allow a contractor to undertake URM retrofits without spending substantial money on engineering design, provided the building meets the limitations of the Standard.~~

The City has developed more options and technical standards to seismically strengthen single-family homes and multi-unit apartment buildings.

- On August 16, 2010, the California Building Standards Commission ~~City~~ Appendix A3 of the 2009 International Building Code – "Prescriptive Provisions for the Seismic Strengthening of Cripple Walls and Sill Plate Anchorage of Light, Wood-Frame Residential Buildings," which became effective immediately statewide as an emergency supplement to the 2010 California Building Code and was codified as Chapter A3 into the California Existing Building Code ~~as amendment into the 2007 and 2010 California Existing Building Code~~.
- In addition, the City ~~has adopted~~ uses Standard Plan Set A as a prescriptive guide to facilitate design of cripple wall retrofits for wood frame homes of two stories or less ~~that provides typical details and other guidance~~. This plan set simplifies the design of cripple wall retrofits for many homes in Berkeley.

The City has published guidelines for Transfer Tax Reductions to establish the types of voluntary seismic strengthening work that qualify for a Transfer Tax Rebate.

On Appendix A: 2004 Actions Page 19, the text has been modified as follows:

a) Recommend adoption of a retrofit standard for these types of buildings. (Completed)

- Concrete tilt-up
- Non-ductile frame
- Wood frame

~~On 01/01/08 and 01/01/11, as~~ As part of the local 2007 and 2010 code adoption, the city adopted the following standards of the International Existing Building Code:

- Earthquake Hazard Reduction in Existing Reinforced Concrete and Reinforced Masonry Wall Buildings with Flexible Diaphragms,
- Earthquake Hazard Reduction in Existing Wood-frame Residential Buildings with Soft, Weak or Open-front walls,
- Earthquake Hazard Reduction in Existing Concrete Buildings and Concrete with Masonry Infill Buildings.

Furthermore, ~~on 01/01/08 and 01/01/11,~~ as part of the local code adoption, the City amended California Building Code Chapter 34 Existing Structures by adding a new Section "Repairs to Existing Buildings and Structures by the Occurrence of a Natural Disaster," which establishes seismic evaluation and design procedures for

damaged buildings based on ASCE 31 Seismic Evaluation of Existing Buildings and ASCE 41 Seismic Rehabilitation of Existing Building."

FIRST DRAFT LHMP Appendix B: List of City Owned and Leased Buildings

In Appendix B: List of City Owned and Leased Buildings, Building Square Footage and Building Replacement Value has been updated for the following buildings:

Category	Building Name	Square Feet – First Draft	Replacement Value – First Draft	Square Feet – Final Draft	Replacement Value – Final Draft
Corporation Yard	Equipment Maintenance Building	~~11,277~~	~~$1.65 million~~	12,922	$ 5.90 million
Key Civic Building	Civic Center Building Annex		~~$33.2 million~~	116,450	$45.7 million
Recreation and Parks	Frances Albrier Center	13,260	~~$3.6 million~~	13,260	$3.68 million
Recreation and Parks	Grove Recreation Center	~~10,601~~	~~$2.7 million~~	10,600	$6.70 million
Recreation and Parks	James Kenney Community Center	~~8,200~~	~~$2.2 million~~	13,825	$9.2 million
Recreation and Parks	Live Oak Community Center	14,860	~~$4.0 million~~	14,860	$9.9 million
Senior Center	North Berkeley Senior Citizens Center	~~20,880~~	~~$5.2 million~~	20,760	$14.57 million
Senior Center	South Berkeley Senior Citizens Center	17,156	~~$4.3 million~~	17,156	$12.04 million
Senior Center	West Berkeley Senior Citizens Center	10,245	~~$2.6 million~~	10,245	$7.19 million

Solid Waste Transfer Buildings	Tipping Building/Transfer Station	21,000	~~$2.1 million~~	21,000	$5.31 million
Solid Waste Transfer Buildings	Vehicle Maintenance Facility	6,280	~~$777,200~~	6,280	$2.87 million
Marina	Berkeley Yacht Club	~~6,507~~	~~$1.6 million~~	6,100	$2.14 million
Marina	Marina Corporation Yard	3,170	~~$790,000~~	3,170	$2.23 million
Public Health	Health Clinic	~~6,739~~	~~$2.5 million~~	7,362	$6.79 million
Recreation and Parks	Art & Garden Center	1,800	~~$447,550~~	1,800	$1.14 million
Recreation and Parks	Cedar Rose Park Building	5,814	~~$1.3 million~~	5,814	$3.06 million

FIRST DRAFT LHMP Appendix C: Plan Development Process

In the First Draft Plan, content that was to be updated for the Final Draft Plan was highlighted. Where that content has been completely updated, the highlighting has been removed. The Final Draft Plan contains highlighted content. Highlighted content will be updated before the Plan is made final.

On Appendix C: Plan Development Process Page 1, the first line has been modified as follows:

> "As of the ~~First~~ Final Draft Plan release ~~on October 21, 2013~~, highlighted activities are planned but have not yet occurred"

On Appendix C: Plan Development Process Page 1, the note has been modified as follows:

> ~~*"Note: Plan development process documentation is provided in Appendix D.*~~
> Note: Appendix D is organized to follow the flow of this Appendix, and documentation of the activities described in this Appendix is provided in Appendix D."

On Appendix C: Plan Development Process Page 1, the second paragraph in the *Planning Process Overview* section has been modified as follows:

> "In 2011, the City convened an interdepartmental planning team, which reviewed and updated the 2004 goals and objectives. Over the next two years, the Project Manager and Chief Technical Advisor collaborated with numerous City staff, partner representatives and hazard experts to update the hazard analysis (Section 3), ~~and~~ progress on 2004 actions (Appendix A), and to develop the 2014 mitigation strategy (Section 1). The Planning Team then provided the First Draft Plan to the Berkeley community for review and feedback. The Planning Team responded to public comments and incorporated appropriate feedback into the Final Draft Plan. Staff then brought the Final Draft Plan to public Commissions and City Council for adoption as an Annex to the Disaster and Fire Safety Element of the City of Berkeley's General Plan."

On Appendix C: Plan Development Process Pages 1-2, the Public Review Process Section has been modified as follows:

> "From October through mid-December, 2013, the City posted the First Draft Plan on the City website and at City libraries for review and comment by the Berkeley community. All of the City's 30+ commissions were invited to provide feedback on the plan, and d~~. D~~uring this time, ~~staff presented~~ the First Draft Plan was discussed at meetings of ~~'s development process, hazard analysis updates, and mitigation strategy at three~~ 19 commissions and boards ~~meetings~~, all of which were held in public. Following receipt of Commission and community feedback, the City incorporated appropriate community comments to develop the 2014 Final Draft Plan."

On Appendix C: Plan Development Process Page 2, the Public Review Process Section has been modified as follows:

> "Staff presented the Final Draft Plan and a summary of plan changes to the Disaster and Fire Safety Commission at its February 26, 2014 meeting and to the Planning Commission ~~and the Disaster and Fire Safety Commission at their January~~ at its March 19, 2014 meeting~~s~~. At these meetings, staff requested the Commissions' recommendations to Council on the 2014 Final Draft Plan."

On Appendix C: Plan Development Process Page 2, the Adoption Process Section has been modified as follows:

> "Staff presented the Final Draft Plan and a summary of plan changes to the Disaster and Fire Safety Commission at its February 26, 2014 meeting and to the Planning Commission ~~and the Disaster and Fire Safety Commission at their January~~ at its March 19, 2014 meeting~~s~~. At these meetings, staff requested the Commissions' recommendations to Council on the 2014 Final Draft Plan."

On Appendix C: Plan Development Process Page 3, the Disaster and Fire Safety Commission, Planning Commission, and Other Commissions Sections have been modified as follows:

Disaster and Fire Safety Commission

"In 1989, Berkeley established a Disaster Council of experts and concerned citizens to monitor disaster mitigation and preparedness activities in the city. In 2006, the Disaster Council and the Fire Safety Commission were combined by the City Council to form the Disaster and Fire Safety Commission. It is an advisory body that provides the City Council with advice and information relating to disasters. For this reason, in ~~January~~ February 2014, staff requested the Commission's recommendation to Council on the Final Draft Plan. Its members are appointed by the City Council, per the guidance of a local ordinance. This Commission meets in public monthly.

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 will be an annex to the City of Berkeley's General Plan, in ~~January~~ March 2014, staff requested the Commission's recommendation to Council on the Final Draft Plan.

Other 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 October 21 – December ~~9~~20, 2013. In addition to the Planning Commission and the Disaster and Fire Safety Commission, 19 commissions~~, boards and committees~~ reviewed the plan's executive summary and mitigation strategy in detail and discussed it at a public meeting during this period, as outlined in the table on the following page."

On Appendix C: Plan Development Process Page 4, Table C.1 *LHMP Commission Meetings During the First Draft Plan Public Comment Period* has been updated as follows:

Date/Time	**Commission**
October 23, 7:00 p.m.	Disaster and Fire Safety Commission
November 7, 7:00 p.m.	Housing Advisory Commission

November 7, 7:00 p.m.	Public Works Commission
November 7, 7:00 p.m.	Landmarks Preservation Commission
November 11	Solano BID Advisory Board
November 13, 7:00 p.m.	Parks and Waterfront Commission
November 13, 6:30 p.m.	Commission on Disability
November 13, 7:00 p.m.	Homeless Commission
November 13, 7:00 p.m.	Police Review Commission
November 14, 7:00 p.m.	Zoning Adjustments Board
November 20, 1:30 p.m.	Commission on Aging
November 20, 7:00 p.m.	Planning Commission
November 20, 7:00 p.m.	Human Welfare & Community Action Commission
November 20, 7:00 p.m.	Commission on Labor
November 21, 7:00 p.m.	Transportation Commission
December 2, 7:00 p.m.	Personnel Board
December 4, 7:00 p.m.	Disaster and Fire Safety Commission
December 5, 7:00 p.m.	Housing Advisory Commission
December 5, 7:00 p.m.	Community Environmental Advisory Commission
December 12, 7:00 p.m.	Mental Health Commission
December 18, 6:30 p.m.	Energy Commission

On Appendix C: Plan Development Process Page 5, Section C.3 Public Input to the 2014 Plan Update has been modified as follows:

"~~Public~~ Partner Input to the 2014 Plan Update

As the Project Team updated Section 3: Hazard Analysis, members engaged institutional key partners to include detailed information about partners' hazard and risk assessments and mitigation initiatives in the hazard analysis section of

the plan. The Project Team worked with partner representatives to identify opportunities for collaboration on Actions in the 2014 mitigation strategy."

On Appendix C: Plan Development Process Pages 7-8, Section C.4 *Public Review Process* has been updated as follows:

"Public input is a way of life in Berkeley's City governance. Berkeley has a long tradition of an involved and active public. Disaster mitigation planning in the city is no exception: all of Berkeley's mitigation programs have involved extensive community involvement; often, they were initiated by the community itself rather than City government. Public input to this plan occurred in numerous ways:

From 2011 – ~~2013~~2012, City staff provided updates and presentations to three Commissions regarding the update process and the status of the plan's development:

- ~~On~~ September 28, 2011 – Disaster and Fire Safety Commission
- ~~On~~ January 15, 2012 – Planning Commission
- January 25, 2012 – Disaster and Fire Safety Commission
- ~~On~~ March 14, 2012 – Commission on Disability
- March 28, 2012 – Disaster and Fire Safety Commission

On September 30, 2013, the City Manager sent ~~letters~~ memos to City Council and secretaries of all City Commissions notifying them of the upcoming public review process for the 2014 plan. The ~~letters~~ memos outlined the purpose of the plan, the release date and the update process for the plan. The ~~letters~~ memos invited recipients to communicate with their stakeholders about the effort.

On October 21, 2013, the City made the 2014 First Draft Plan a public document for review and comment by the Berkley community. The City Manager sent a memo to City Council members, outlining the process for Commissions to provide feedback and including the First Draft Plan's Executive Summary and Actions. City staff provided memos from the City Manager to secretaries of all City Commissions. The memos included the First Draft Plan's Executive Summary and Actions, and invited all Commissions to provide feedback.

From October 21 through December ~~9~~20, 2013:

- The City posted the plan on the City website and at City libraries, and community members were invited to provide feedback on the plan.
- ~~City staff provided the First Draft Plan's Executive Summary and Actions to secretaries of all City Commissions, and invited all Commissions to provide feedback.~~
- At the October 23 Disaster and Fire Safety Commission meeting, staff presented the updated hazard analysis to Commissioners and community members. At the December 4 Disaster and Fire Safety Commission

meeting, staff presented the 2014 mitigation strategy for review and feedback by Commissioners and community members.

- At the November 20 Planning Commission meeting, staff presented the planning process, the updated hazard analysis, and the 2014 mitigation strategy for review and feedback by Commissioners and community members.

Following the December ~~9~~ 20 comment deadline, City staff reviewed feedback from Commissions and community members, and incorporated appropriate changes into the Final Draft Plan."

On Appendix C: Plan Development Process Page 8, Section C.5 *Adoption Process* has been updated as follows:

"~~Staff presented the Final Draft Plan and a summary of plan changes to the Disaster and Fire Safety Commission at its February 26, 2013 meeting. At this meeting, staff requested the Disaster and Fire Safety Commission's recommendation to Council on the 2014 Final Draft Plan.~~

Staff presented the Final Draft Plan and a summary of plan changes to the Planning Commission at its ~~January 15~~March 19, 2014 meeting. This meeting also served as the first Public Hearing for the 2014 plan. At this meeting, staff requested the Planning Commission's recommendation to Council on the 2014 Final Draft Plan.

~~Staff presented the Final Draft Plan and a summary of plan changes to the Disaster and Fire Safety Commission at its January 22, 2013 meeting. At this meeting, staff requested the Disaster and Fire Safety Commission's recommendation to Council on the 2014 Final Draft Plan.~~

Staff brought the Final Draft Plan to City Council for approval at its meeting [DATE], 2014. At this meeting, staff presented planning process and the Final Draft Plan, reviewing major updates to the hazard analysis and mitigation strategy since the 2004 plan, as well as highlights from the public review process. This meeting served as the second Public Hearing for the 2014 plan."

FIRST DRAFT LHMP *Appendix D: Public Documentation*

Appendix D was not developed as a part of the First Draft Plan. All of the content in the Appendix is new to the Final Draft Plan.

FIRST DRAFT LHMP Appendix E: Prioritization Structure

On Appendix E: Prioritization Structure Page 3, the third full row has been modified as follows:

3. Funding availability**	Funding has not been secured, but the action is grant eligible under identified grant programs ~~Has secured funding~~	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

[i] Southern California Earthquake Center. *A Comparison of the February 28, 2001, Nisqually, Washington, and January 17, 1994, Northridge, California Earthquakes*. http://www.scec.org/news/01news/feature010313.html

~~[ii] Schwab et al. Planning for Post-Disaster Recovery and Reconstruction. Planning Advisory Service Report Number 483/484. Federal Emergency Management and American Planning Association, December 1998.~~

~~[iii] California Seismic Safety Commission. *Seismic Safety in California's Schools: Findings and Recommendations on Seismic Safety Policies and Requirements for Public, Private, and Charter Schools.* December 2004.~~

[iv] 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.

Risk, S. P. A. "Enhancements in HAZUS-MH Fire Following Earthquake, Task 3: Updated Ignition Equation pp. 74pp. *SPA Risk LLC, Berkeley CA. Principal Investigator C. Scawthorn. Prepared for PBS&J and the National Institute of Building Sciences, San Francisco* (2009).

[v] Estimation derived from Ch. 10, particularly Eqn. 10-1, of HAZUS Earthquake Tech Manual MR 4:

FEMA, 2003. Multi-hazard Loss Estimation Methodology, Earthquake Model, HAZUS-MH MR4 Technical Manual. Developed by: Department of Homeland Security, Federal Emergency Management Agency, Mitigation Division, Under a contract with: National Institute of Building Sciences Washington, D.C., p. 712.

[vi] In 2004, estimate was $20 million damage from 5 estimated fires. This plan estimates 6-12 fires. If $4 million/ignition assumed, $24 million - $48 million damage is estimated in 2004 dollars. This figure was then updated for 2013 to $30 million - $60 million using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

~~[vii] Findings of a 2001 study of soft-story buildings in Berkeley conducted for the Building Department.~~

Department of Fire and Emergency Services

Agenda
For the Regular Meeting of the
Disaster and Fire Safety Commission

DATE: Wednesday, February 26, 2014
TIME: 7:00 PM
PLACE: Fire Department Training Facility - 997 Cedar Street

Preliminary Matters

Call to Order.

Approval of the Agenda

Public Comment on Non-Agenda Matters.

1. Fire Department and Office of Emergency Services Staff Report

Consent Items

2. Approval of Draft Minutes of Meeting of December 4, 2013.*

Action Items

3. Annual Election of Chair and Vice Chair

4. Local Hazard Mitigation Plan Update

Discussion Items

5. Discussion of the City's Disaster Service Worker Volunteer Enrollment Procedures

6. Discussion of Mandatory Emergency Supplies for Senior or Dependent Housing

7. Report on Status of Rent Board Actions on Proposals for Disaster Preparedness for Multi-Unit Buildings

8. Future Agenda Items

Adjournment
(*Material attached for Commissioners for this month's meeting)

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.

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 981-6346(v) or 981-7075(TDD) at least three business days before the meeting date.
Please refrain from wearing scented products to this meeting.

2014 Local Hazard Mitigation Plan

Final Draft Plan

Disaster and Fire Safety Commission

February 26, 2014

Goal and Agenda

- Meeting Goal: Commission recommendation to Council on Final Draft 2014 Local Hazard Mitigation Plan (LHMP)

- Mitigation and Berkeley's 2014 LHMP update
- Public Outreach Process
  - Phase I: First Draft Plan
  - Feedback and Resulting Plan Changes
  - Phase II: Final Draft Plan and Path Forward

Mitigation and the 2014 LHMP

- What is mitigation?
- City of Berkeley 2014 Local Hazard Mitigation Plan update
  - Hazard Analysis
  - Mitigation Strategy
  - Federal/State financial incentives

- See Section 1: *Mitigation Strategy*
- See Section 3: *Hazard Analysis*

Public Outreach, Phase I

- First Draft Plan update
- Public Review: October 21 – December 20, 2013
- Commissions/Boards
  - 3 staff presentations
  - 19 discussed
  - 12 submitted feedback
- 24 letters with 170+ comments/questions

- See Appendix C: *Plan Development Process*

Feedback and Resulting Plan Changes

- General Feedback Trends
  - Comments outside the scope of the Mitigation Plan
  - Action Prioritization
  - Vegetation management
  - Undergrounding utility lines

- See Appendix D: *Documentation – Public Comments and Staff Responses for the First Draft 2014 Local Hazard Mitigation Plan*

Feedback and Resulting Plan Changes

- Additional DFSC concerns
  - Hills Evacuation Action
  - Streamline Rebuild Action
  - Hazard Information Action
  - Train derailments/hazardous materials release

- See Appendix D: *Documentation – Public Comments and Staff Responses for the First Draft 2014 Local Hazard Mitigation Plan*

Public Outreach, Phase II

- Final Draft Plan
- Disaster and Fire Safety Commission Recommendation to Council

- Next steps
  - Planning Commission Recommendation
    - March 19 (***First Public Hearing***)
  - California Office of Emergency Services and FEMA
    - Technical review, est. 2 months
  - City Council
    - July (est.) (***Second Public Hearing***)

Department of Fire and Emergency Services

Date: February 18, 2014

To: Members of the Disaster and Fire Safety Commission

From: Aaron Lee, Deputy Chief, Secretary – Disaster and Fire Safety Commission

Subject: Final Draft 2014 Local Hazard Mitigation Plan

RECOMMENDATION

Recommend to the City Council that the Final Draft 2014 Local Hazard Mitigation Plan be adopted.

SUMMARY

In 2004, the City adopted its first Disaster Mitigation Plan. The 2004 document has expired, and the City has developed an updated version: the 2014 Local Hazard Mitigation Plan (LHMP). The LHMP identifies Berkeley's natural hazard vulnerabilities and outlines a five-year strategic plan to reduce those vulnerabilities. Adoption of the LHMP is required for the City to receive mitigation grant funding, and maximizes the City's post-disaster recovery funding.

The 2014 LHMP update is the result of a 2.5-year-long planning process that involved consultation with hazard experts and key institutional partners. In fall 2013, Commissions and community members participated in an in-depth public review process for the First Draft 2014 LHMP. Staff reviewed comments and incorporated appropriate feedback into the Final Draft 2014 LHMP.

FISCAL IMPACTS OF RECOMMENDATION

Following City Council's adoption of the 2014 Local Hazard Mitigation Plan, the City of Berkeley will be eligible to:

1) Spend approximately $727,000 of federal funding already received through a *Legislative Pre-Disaster Mitigation Program* grant. The City is not permitted to move forward on approved mitigation projects until a current LHMP is adopted.

2) Apply for additional funding through federal mitigation grant programs.

2100 Martin Luther King Jr. Way, Second Floor, Berkeley, CA 94704 Tel: 510.981.3473 TDD: 510.981.5799 Fax: 510.981.5579
E-mail: fire@ci.berkeley.ca.us

3) Receive additional post-disaster recovery funding from the State of California. Following a disaster, recovery costs are generally borne as: 75% federal, 18.75% State, 6.25% City. If the City has a current, adopted LHMP, the Governor and State Legislature can vote to authorize the State to cover the 6.25% City share. In a catastrophic disaster with public infrastructure losses in the hundreds of millions of dollars, this 6.25% cost share would be very significant.

BACKGROUND

The City of Berkeley's Disaster Mitigation Plan was originally adopted by the City Council on June 22, 2004. The plan must be updated once every five years. The LHMP identifies natural hazards and their possible impacts on the Berkeley community and outlines a five-year strategic plan to protect the Berkeley community from future disasters. To update the Plan for 2014, staff followed the same multi-phased and broadly-inclusive process used to develop the original plan in 2004. The resulting plan reflects community concerns.

Description of Local Hazard Mitigation Plan

The LHMP has two functions. First, it identifies natural hazards in Berkeley and their possible impacts on Berkeley's people, buildings, infrastructure, and environment. Because of their potential to catastrophically impact Berkeley, earthquake and wildland-urban interface fire are considered to be Berkeley's hazards of greatest concern. Other hazards of concern include landslide, flooding, tsunami, and climate change. Tsunami and climate change are newly-introduced in the 2014 LHMP.

Second, the Plan outlines a five-year strategy to reduce Berkeley's vulnerabilities to these potential impacts. The multi-faceted strategy builds on collaboration among City government, external partners, and community members to implement mitigation programs. Proposed Actions include strengthening Berkeley building stock, reducing fire risk through code enforcement and vegetation management, and continuing research to better understand all hazards, including newly-added hazards like tsunami and climate change.

Plan Development Process

In 2011, the City convened an interdepartmental planning team, which reviewed and updated the 2004 goals and objectives. Over the next two years, this Core Planning Team collaborated with numerous partner representatives, scientists, and hazard experts to update information in the 2004 Hazard Analysis (Section 3). The 2014 LHMP accounts for new scientific research on hazards that could affect Berkeley, their areas of exposure, and their potential impacts.

City and partner representatives worked with the project manager to identify Berkeley's progress mitigation actions identified in 2004 (Appendix A). Next, the project manager, City representatives, and partner representatives combined information on the success of 2004 actions, updates to the hazard analysis, and guidance from the City's General Plan to identify "pre-draft" actions for the 2014 Mitigation Strategy (Section 1).

These pre-draft actions were initially vetted by the City's Core Planning Team in September 2013. They were then further vetted by a diverse group of partner representatives at the October 2013 Institutional Community Partner Meeting. The Core Planning Team revised actions to reflect feedback received from institutional partners, then incorporated the actions into a complete 2014 First Draft Plan.

Public Outreach Process

City staff has provided updates and presentations to the community throughout the 2014 LHMP development process. In 2011 and 2012 City staff provided updates and presentations to three Commissions over five meetings:

- September 28, 2011 – Disaster and Fire Safety Commission (DFSC)
- January 15, 2012 – Planning Commission
- January 25, 2012 – DFSC
- March 14, 2012 – Commission on Disability
- March 28, 2012 – DFSC

To prepare for the release of the First Draft Plan, on September 30, 2013 the City Manager sent memos to City Council and secretaries of all City Commissions notifying them of the upcoming public review process for the 2014 plan. The memos outlined the purpose of the plan, the release date and the update process for the plan. The memos invited recipients to communicate with their stakeholders about the effort.

On October 21, 2013, the City made the 2014 First Draft Plan a public document for review and comment by the Berkley community. The City Manager sent a memo to City Council members and to secretaries of all City Commissions. The memos outlined the process for Commissions to provide feedback and attached the First Draft Plan's Executive Summary and Actions.

From October 21 through December 20, 2013:

- The City posted the plan on the City website and at City libraries, and community members were invited to provide feedback on the plan.
- At the October 23rd DFSC meeting, staff presented the updated Hazard Analysis to Commissioners and community members. At the December 4th DFSC meeting, staff presented the 2014 Mitigation Strategy for review and feedback by Commissioners and community members.
- At the November 20th Planning Commission meeting, staff presented the planning process, the updated Hazard Analysis, and the 2014 Mitigation Strategy for review and feedback by Commissioners and community members.

Following the December 20, 2013 comment deadline, City staff reviewed feedback from commissions and community members. Staff provided responses, as documented in *Public Comments and Staff Responses for the First Draft 2014 Local Hazard Mitigation Plan*. Based on that feedback, staff incorporated appropriate changes into the Final Draft Plan, as documented in *Summary of Changes to the First Draft 2014 Local Hazard Mitigation Plan*. Both of these documents are available at www.CityofBerkeley.info/Mitigation and at City libraries (see attachment: *Guide to 2014 LHMP Final Draft Review*).

First Draft LHMP: Community Feedback Trends

Four topics emerged repeatedly in community responses to the First Draft Plan:

1. Scope and Detail of the Mitigation Plan
   Community comments included a number of questions and suggestions regarding hazards, topics, and programs to consider for inclusion in the LHMP. *Many of those suggestions related to emergency management, but were not within the scope of the LHMP.*

   Mitigation describes pre-disaster activities that reduce the impact of a disaster by providing passive protection at the time of disaster impact. If an activity or system creates a steady state of protection that exists both before and after a disaster occurs, then it is likely a mitigation activity. If the activity creates a system that can be "activated" after a disaster to reduce vulnerability, then it is likely not considered a mitigation activity.

2. Action Prioritization
   The federal government requires that Actions in the Mitigation Strategy be prioritized, but does not stipulate a particular prioritization structure. In the First Draft Plan, the Planning Team prioritized Actions by emphasizing the likelihood of Action implementation over the five years that will be covered by the 2014 LHMP's Mitigation Strategy. The result was that the availability of funding largely dictated the Actions' assigned priorities. Community responses indicated that resource availability should not play as large a role in defining an Action's priority.

   To address this opinion, the Planning Team revised the prioritization structure used for the Final Draft Plan to allow Actions that do not have secured funding at this time, but that are eligible for identified grant programs, to be categorized as high priority. This change resulted in the reprioritization of two actions from medium to high priority: *Vegetation Management* and *Strengthen and Replace City Buildings*.

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   The 2014 LHMP highlights paths in the hills areas as important elements of Berkeley's evacuation network. At its December 4 meeting, individual DFSC members identified concerns about the rustic state of these pathways, specifically their lack of lighting and the rise-to-run ratio of some of the stairs.

The *Hills Evacuation* Action focuses on paths as an important supplement to the limited evacuation routes currently available to community members in the hills, but does not consider paths to be the only means of evacuation.

Additionally, individual DFSC members expressed concern about the usability of the paths following an earthquake, including fallen utility poles/lines obstructing the paths and rupture of sewer lines that could possibly exist under the paths. These concerns are acknowledged. Like City streets, paths are vulnerable to earthquake impacts. Evacuation from the hills could be necessary due to disasters other than earthquake, such as Wildland-Urban Interface Fire, which is the other Hazard of Greatest Concern in the 2014 LHMP.

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   Community members advocated for the LHMP Mitigation Strategy to highlight undergrounding utility lines. Each year, Pacific Gas & Electric credits the City of Berkeley with 525,000 credits for use in undergrounding utilities. Under Rule 20A, the City utilizes these credits on utility undergrounding projects that PG&E performs. Currently, two projects are in the queue for undergrounding: Grizzly Peak Boulevard ($4.1 million) and Vistamont Avenue ($5.0 million). These projects will take 2-5 years to implement, and will utilize future credits. Because of these costs and use of future credits, Berkeley currently has no other planned underground utility districts that would fall within the scope of the 2014 LHMP.

CONCLUSION

Development of the 2014 LHMP update involved a highly-collaborative process with hazard experts, scientists, key Berkeley institutions, City Commissions, and individual community members. This inclusive process has resulted in a cutting-edge document that describes the risks our community faces, as well as a path forward to protect our people, buildings, infrastructure, and environment in the next disaster.

When adopted by City Council, the 2014 LHMP will serve as an Appendix to the General Plan's Disaster Preparedness and Safety Element. Adopting the 2014 LHMP will provide a roadmap for the City to continue its work to make the community safer. It will also enable the City to use external resources for the effort. The Final Draft 2014 LHMP meets the technical needs of City government and reflects the will of the community.

Attachment: Guide to 2014 LHMP Final Draft Review

Guide to 2014 LHMP Final Draft Review

The complete Final Draft 2014 Local Hazard Mitigation Plan (LHMP) is almost 600 pages long. For this reason, it has not been printed and appended to this letter. The complete Final Draft 2014 LHMP is available for review at www.CityofBerkeley.info/Mitigation, and hard copies have been placed at all City libraries.

In addition to the complete Final Draft Plan, the webpage also provides the following documents for download. These documents are also included in the Final Draft Plan as part of Appendix D: *Documentation*:

1) **Public Comments and Staff Responses for the First Draft 2014 Local Hazard Mitigation Plan**

   This document provides all feedback received as part of the community review process for the 2014 Local Hazard Mitigation Plan, along with staff responses to this feedback. When feedback resulted in modifications to the Plan, those modifications are described as part of the staff response.

2) **Summary of Changes to the First Draft 2014 Local Hazard Mitigation Plan**

   This document outlines the revisions made to the First Draft LHMP that are present in the Final Draft 2014 Local Hazard Mitigation Plan.

PLANNING COMMISSION

NOTICE OF PUBLIC HEARING

MARCH 19, 2014

2014 Local Hazard Mitigation Plan (LHMP)

The Planning Commission, of the City of Berkeley, will hold a Public Hearing on the above matter, on **Wednesday, March 19, 2014,** at the North Berkeley Senior Center, 1901 Hearst Ave. (at Martin Luther King, Jr. Way), Berkeley, California (wheelchair accessible). The meeting starts at 7:00 p.m.

PROJECT DESCRIPTION: Consider an update to the Disaster Mitigation Plan (DMP) adopted in 2004. The 2014 Local Hazard Mitigation Plan (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 LHMP would be an amendment to the City's Disaster Preparedness and Safety Element of the General Plan.

LOCATION: Citywide.

ENVIRONMENTAL REVIEW STATUS: The proposed change would be exempt from the California Environmental Quality Act pursuant to Guideline Sections 15183(d), 15262, 15306, and 15061(b)(3) because a) the Plan is consistent with the General Plan; b) the Plan involves feasibility and planning studies for possible future actions; c) the Plan involves basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource; and d) it can be seen with certainty that the proposed amendment would not have a significant effect on the environment.

PUBLIC COMMENT & FURTHER INFORMATION

Comments may be made verbally at the Public Hearing, and in writing before the hearing. Those wishing to speak at the hearing must submit a speaker card. Written comments or questions concerning this project should be directed to:

Alex Amoroso
Planning Commission Secretary
City of Berkeley
Land Use Planning Division
2120 Milvia Street, 2nd Floor
Berkeley, CA 94704

E-mail: aamoroso@CityofBerkeley.info
Telephone: (510) 981-7520

To assure distribution to Commission members prior to the meeting, ***correspondence must be received by 12:00 noon, seven (7) days before the meeting.*** For items with more than ten (10) pages, fifteen (15) copies must be submitted to the Secretary by this deadline. For any item submitted less than seven (7) days before the meeting, fifteen (15) copies must be submitted to the Secretary prior to the meeting date.

COMMUNICATION ACCESS

To request a meeting agenda in large print, Braille, or on audiocassette, or to request a sign language interpreter for the meeting, call (510) 981-7410 (voice) or 981-6903 (TDD). Notice of at least five (5) business days will ensure availability. Agendas are also available on the Internet at: *www.ci.berkeley.ca.us*.

FURTHER INFORMATION

Questions should be directed to Alex Amoroso, at 981-7520, or *aamoroso@CityofBerkeley.info*.

Notice of Public Hearing

Proof of Publication

STATE OF CALIFORNIA
Alameda County, as

Katharine Giteck of said county does hereby certify

That he is and was during all times herein mentioned a citizen of the United States over the age of 18 years and neither a party nor in any way interested in the matter or action herein set forth and is competent to be a witness in said matter or action.

That he is now and at all times herein mentioned was the principal clerk of The Independent Berkeley Student Publishing Co., Inc., publishers of The Daily Californian, which is and was at all times herein mentioned a newspaper of general circulation printed in the English language and published daily in the City of Berkeley, County of Alameda, State of California, and as such principal clerk has now and at all times had charge of all legal notices and advertisements in said newspaper, that said The Daily Californian is now and was at all times herein mentioned a newspaper of general circulation as defined by the laws of the State of California as determined by this Court's order, dated August 26, 1977, in the action entitled In the Matter of the Application of the Independent Berkeley Student Publishing Co., Inc. Establishing "The Daily Californian" To Be A Newspaper Of General Circulation, Case Number 497113-5. Said order orders that "The Daily Californian" is a newspaper of general circulation, as defined in Section 6000 et seq. of the Government Code, for the City of Berkeley, the County of Alameda, and The State of California. Said order has not been revoked.

THAT THE **Notice of Public Hearing**

Of which the annexed is a printed copy, was published in said newspaper and not in any supplement thereof the following dates to wit:
3/7/14

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated at Berkeley, California this 7th Day of Mar. 2014

Signed Katharine Giteck

Notice of Public Hearing
March 19, 2014

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Item 9
March 19, 2014

Planning and Development Department
Land Use Planning Division

STAFF REPORT

DATE: March 19, 2014

TO: Members of the Planning Commission

FROM: Elizabeth Greene, Senior Planner

SUBJECT: 2014 Local Hazard Mitigation Plan

RECOMMENDATION

Recommend approval to the City Council of the 2014 Local Hazard Mitigation Plan (LHMP). This Plan is an update of the Disaster Mitigation Plan, adopted in 2004, and an amendment to the General Plan. Findings for the General Plan amendment are included in this report.

BACKGROUND

There are three steps the Planning Commission must take to address the staff recommendation to have the LHMP adopted into the General Plan (by reference):

- Hold a Public Hearing and consider public input;
- Recommend that the General Plan be changed to include the proposed language, which references the LHMP into the General Plan; and
- Recommend the LHMP as drafted, or with additional changes, to the Council for adoption as part of the General Plan.

Note: General Plan amendment findings are included in this report.

This report provides steps, process and findings for the Commission to consider. Attachment 2 is the report from the LHMP staff (Fire Department – Office of Emergency Services), which describes the details of the LHMP and process to date.

The Commission reviewed an earlier draft of the LHMP on November 20, 2013. At the March 5th Commission meeting, the Commission was informed that the Final Draft LHMP was available for review on the City's website and at libraries. Public Notice was posted in the Daily CAL to meet public notification requirements (Attachment 4).

DISCUSSION

Local Hazard Mitigation Plan Essentials

Purpose of the LHMP –
The LHMP identifies and suggests actions to reduce a wide range of Berkeley's hazard vulnerabilities. The document follows a standardized outline and process mandated by the State and Federal government. Once a city has adopted an LHMP, opportunities for State and Federal funding become available. The City of Berkeley has received approvals for funding for certain programs based on adoption of the LHMP.

The LHMP and the General Plan –
The 2004 Disaster Mitigation Plan is considered part of the Disaster Preparedness and Safety Element of the General Plan. The 2014 LHMP is to be appended to the General Plan by reference. Attachment 1 is a paragraph to be inserted into the Disaster Preparedness and Safety Element of the General Plan (page S-3). The paragraph recognizes that the City adopted its first Hazard Mitigation Plan in 2004 (title has been changed by the State/Federal lead agencies). In addition, it references the City's adoption of this 2014 LHMP update, assuming that the Commission and City Council act in the affirmative.

LHMP Project Management and Plan Development –
The LHMP update process was managed through the Fire Department – Office of Emergency Services, which focuses on disaster readiness. The Fire - OES report (Attachment 2) describes the LHMP mandate, Berkeley LHMP basics, and the public process completed over the last two years. The LHMP Executive Summary (Attachment 3) is also provided to guide Commission discussion. Fire-OES staff is available as subject experts to address any questions the Commission may have regarding the details of the LHMP.

Environmental Review

The environmental impacts of the LHMP, from a CEQA standpoint, are inconsequential. CEQA is used to evaluate the environmental impact of a jurisdiction's action. The action can result in direct physical changes in the environment (such as the approval of a new building), or indirect change that is reasonably foreseeable (such as the approval of a General Plan).

In this case, the action is the adoption of a plan that identifies natural hazards in Berkeley and outlines a five-year strategy of possible future efforts to further protect Berkeley's citizens, buildings, infrastructure and environment from those hazards. Much of the plan's mitigation strategy focuses on studies and inter-agency programs, for which the City of Berkeley is not the Lead Agency as defined by CEQA. Other mitigation programs that may be undertaken would require specific CEQA review, once they are better understood and a scope is set.

The LHMP project can be considered "exempt" from CEQA based on four different sections of the CEQA Guidelines:

Section 15183(d): "The project is consistent with…a general plan of a local agency, and an EIR was certified by the lead agency for the...general plan."

Section 15262: "A project involving only feasibility or planning studies for possible future actions which the agency, board or commission has not approved, adopted, or funded does not require the preparation of an EIR or negative declaration but does require consideration of environmental factors. This section does not apply to the adoption of a plan that will have a legally binding effect on later activities."

Section 15306: "(Categorical Exemption) Class 6 consists of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource. These may be strictly for information gathering purposes, or as part of a study leading to an action which a public agency has not yet approved, adopted or funded."

Section 15601(b)(3): "...CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA."

General Plan Amendment Findings:

1. **The proposed amendment is in the public interest.**
   The LHMP and General Plan amendment open the opportunity for the City to better protect itself from natural disasters. The update of the LHMP incorporates state of the art knowledge regarding potential disasters, and makes the City eligible to receive funding.

2. **The proposed amendment is consistent and compatible with the rest of the General Plan.**
   Four of the six Objectives of the General Plan's Disaster Preparedness and Safety Element refer to the need to mitigate and reduce potential for damage from disasters:

   2. Improve and develop City mitigation programs to reduce risks to people and property from natural and man-made hazards to socially and economically acceptable levels.
   4. Reduce the potential for loss of life, injury, and economic damage resulting from earthquakes and associated hazards.
   5. Reduce the potential for loss of life, injury, and economic damage resulting from urban and wild land fire.
   6. Reduce the potential for loss of life and property damage in areas subject to flooding.

   The LHMP responds to these General Plan objectives and focuses attention on resolving them. In addition, the LHMP is a part of the Disaster Preparedness and Safety Element of the General Plan; a required Element under State General Plan Law.

3. **The potential effects of the proposed amendment have been evaluated and have been determined not to be detrimental to the public health, safety, or welfare.**
   The potential effects of the LHMP and General Plan amendment are all positive. The LHMP suggests preemptive programs and activities (some with other agencies) to make Berkeley less susceptible to natural disaster.

4. **The proposed amendment has been processed in accordance with the applicable provisions of the California Government Code and the California Environmental Quality Act.**
   The General Plan amendment is processed in accordance with Chapter 22.04.020 of the Berkeley Municipal Code. The amendment was submitted to the Planning Commission for consideration; a public hearing was set for March 19, 2014, with at least 10 days' notice given; and a notice was published in a newspaper of record according to the applicable procedures.

   The LHMP is also subject to review per FEMA guidelines (Code of Federal Regulations, Title 44, Part 201, Mitigation Planning Regulations). After review by the Planning Commission, the LHMP will be sent for review to the Governor's Office of Emergency Services (OES). State OES will comment and forward to FEMA for review. The LHMP will be ready for consideration by the City Council when FEMA returns the document with an Approval Pending Adoption letter.

CONCLUSION

Staff recommends that the Planning Commission make the General Plan findings and recommend amending the General Plan so that it includes the 2014 LHMP.

Attachments:

1. Proposed General Plan Language
2. Staff report from Fire Department – Office of Emergency Services
3. 2014 Final Draft LHMP Executive Summary
4. Public Hearing Notice

Item 9 – Attachment 1
Planning Commission
March 19, 2014

‘

DATE: March 19, 2014

TO: Members of the Planning Commission

FROM: Elizabeth Greene, Senior Planner

SUBJECT: 2014 Local Hazard Mitigation Plan, Proposed General Plan Language

The language below is proposed to be a new paragraph in the General Plan. It would be inserted on page S-3 of the Disaster Preparedness and Safety Element, between the current fourth and fifth paragraphs, and would read as follows:

> *In 2004, the City adopted its first Hazard Mitigation Plan. It is part of the Disaster Preparedness and Safety Element of the General Plan. The City updated the Disaster Mitigation Plan in 2014 and renamed it the Local Hazard Mitigation Plan (LHMP). On ##/##/##, the City Council adopted the LHMP (by reference) into the General Plan.*

Item 9 – Attachment 2
Planning Commission
March 19, 2014

Department of Fire and Emergency Services

Date: March 19, 2014

To: Members of the Planning Commission

From: Sarah Lana, Emergency Services Coordinator

Subject: Final Draft 2014 Local Hazard Mitigation Plan

Summary
The City of Berkeley's Disaster Mitigation Plan was originally adopted by the City Council on June 22, 2004. The 2004 document has expired, and the City has developed an updated version: the 2014 Local Hazard Mitigation Plan (LHMP). The LHMP identifies Berkeley's natural hazard vulnerabilities and outlines a five-year strategic plan to reduce those vulnerabilities. Adoption of the LHMP is required for the City to receive mitigation grant funding, and maximizes the City's post-disaster recovery funding.

To update the Plan for 2014, staff followed the same multi-phased and broadly-inclusive effort used to develop the original plan in 2004. In the fall of 2013, commissions and community members participated in an in-depth public review process for the First Draft 2014 LHMP. Staff reviewed comments and incorporated appropriate feedback into the Final Draft 2014 LHMP. The resulting plan reflects this robust community feedback process.

At its February 26, 2014 meeting, the Disaster and Fire Safety Commission unanimously approved the motion to recommend adoption of the Final Draft 2014 LHMP.

Fiscal Impacts of Plan Adoption
Following City Council's adoption of the 2014 Local Hazard Mitigation Plan, the City of Berkeley will be eligible to:

1) Spend approximately $727,000 of federal funding already received through a *Legislative Pre-Disaster Mitigation Program* grant. The City is not permitted to move forward on approved mitigation projects until a current LHMP is adopted.

2) Apply for additional funding through federal mitigation grant programs.

2100 Martin Luther King Jr. Way, Second Floor, Berkeley, CA 94704 Tel: 510.981.3473 TDD: 510.981.5799 Fax: 510.981.5579
E-mail: fire@ci.berkeley.ca.us

3) Receive additional post-disaster recovery funding from the State of California. Following a disaster, recovery costs are generally borne as: 75% federal, 18.75% State, 6.25% City. If the City has a current, adopted LHMP, the Governor and State Legislature can vote to authorize the State to cover the 6.25% City share. In a catastrophic disaster with public infrastructure losses in the hundreds of millions of dollars, this 6.25% cost share would be very significant.

Description of Local Hazard Mitigation Plan

The LHMP has two functions. First, it identifies natural hazards in Berkeley and their possible impacts on Berkeley's people, buildings, infrastructure, and environment (LHMP Section 3). Because of their potential to catastrophically impact Berkeley, earthquake and wildland-urban interface fire are considered to be Berkeley's hazards of greatest concern. Other hazards of concern include landslide, flooding, tsunami, and climate change. Tsunami and climate change are newly-introduced in the 2014 LHMP.

Second, the Plan outlines a five-year strategy to reduce Berkeley's vulnerabilities to these potential impacts (LHMP Section 1). The multi-faceted strategy builds on collaboration among City government, external partners, and community members to implement mitigation programs. Proposed actions include strengthening Berkeley building stock, reducing fire risk through code enforcement and vegetation management, and continuing research to better understand all hazards, including newly-added hazards like tsunami and climate change.

Plan Development Process

In 2011, the City convened an interdepartmental planning team, which reviewed and updated the 2004 goals and objectives. Over the next two years, this Core Planning Team collaborated with numerous partner representatives, scientists, and hazard experts to update information in the 2004 Hazard Analysis. The 2014 LHMP accounts for new scientific research on hazards that could affect Berkeley, their areas of exposure, and their potential impacts.

City and partner representatives worked with the project manager to identify Berkeley's progress mitigation actions identified in 2004 (LHMP Appendix A). Next, the project manager, City representatives, and partner representatives combined information on the success of 2004 actions, updates to the hazard analysis, and guidance from the City's General Plan to identify "pre-draft" actions for the 2014 Mitigation Strategy (LHMP Section 1).

These pre-draft actions were initially vetted by the City's Core Planning Team in September 2013. They were then further vetted by a diverse group of partner representatives at the October 2013 Institutional Community Partner Meeting. The Core Planning Team revised actions to reflect feedback received from institutional partners, then incorporated the actions into a complete 2014 First Draft Plan.

Public Outreach Process

City staff has provided updates and presentations to the community throughout the 2014 LHMP development process. In 2011 and 2012 City staff provided updates and presentations to three Commissions over five meetings:

- September 28, 2011 – Disaster and Fire Safety Commission (DFSC)
- January 15, 2012 – Planning Commission
- January 25, 2012 – DFSC
- March 14, 2012 – Commission on Disability
- March 28, 2012 – DFSC

To prepare for the release of the First Draft Plan, on September 30, 2013 the City Manager sent memos to City Council and secretaries of all City Commissions notifying them of the upcoming public review process for the 2014 plan. The memos outlined the purpose of the plan, the release date and the update process for the plan. The memos invited recipients to communicate with their stakeholders about the effort.

On October 21, 2013, the City made the 2014 First Draft Plan a public document for review and comment by the Berkley community. The City Manager sent a memo to City Council members and to secretaries of all City Commissions. The memos outlined the process for Commissions to provide feedback and attached the First Draft Plan's Executive Summary and Actions.

From October 21 through December 20, 2013:

- The City posted the plan on the City website and at City libraries, and community members were invited to provide feedback on the plan.
- At the October 23rd DFSC meeting, staff presented the updated Hazard Analysis to Commissioners and community members. At the December 4th DFSC meeting, staff presented the 2014 Mitigation Strategy for review and feedback by Commissioners and community members.
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At its February 26, 2014 meeting, the Disaster and Fire Safety Commission unanimously approved the following motion recommending adoption of the Final Draft 2014 LHMP:

> Motion to Recommend Adoption of the Local Hazard Mitigation Plan Update to City Council: J. Gage
>
> Second: R. Grimes
>
> Vote: (7 Ayes: Grimes, Mitchell, Flasher, Gage, Zummo, Goldstein, Hamm; 0 Absent; 0 Noes; 0 Abstain)

First Draft LHMP: Community Feedback Trends

Four topics emerged repeatedly in community responses to the First Draft Plan:

1) Scope and Detail of the Mitigation Plan
   Community comments included a number of questions and suggestions regarding hazards, topics, and programs to consider for inclusion in the LHMP. *Many of those suggestions related to emergency management, but were not within the scope of the LHMP.*

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specifically their lack of lighting and the rise-to-run ratio of some of the stairs. The *Hills Evacuation* action focuses on paths as an important supplement to the limited evacuation routes currently available to community members in the hills, but does not consider paths to be the only means of evacuation.

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Conclusion

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Attachments:

1) **Guide to 2014 LHMP Final Draft Review**

2) **Executive Summary of 2014 LHMP Final Draft LHMP**

Attachment 1: Guide to 2014 LHMP Final Draft Review

The complete Final Draft 2014 Local Hazard Mitigation Plan (LHMP) is almost 600 pages long. For this reason, it has not been printed and appended to this letter. The complete Final Draft 2014 LHMP is available for review at www.CityofBerkeley.info/Mitigation, and hard copies have been placed at all City libraries.

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2) **Summary of Changes to the First Draft 2014 Local Hazard Mitigation Plan**

   This document outlines the revisions made to the First Draft LHMP that are present in the Final Draft 2014 Local Hazard Mitigation Plan.

Office of the City Manager

September 30, 2013

To: Honorable Mayor and Members of the City Council

From: Christine Daniel, City Manager

Subject: 2014 Update to the City's Local Hazard Mitigation Plan (LHMP); Public Comment Process

In 2004, the Berkeley City Council adopted the Disaster Mitigation Plan as an annex to the Disaster Preparedness and Safety Element of the City's General Plan. Staff has been working on the required update to this plan (now called the Local Hazard Mitigation Plan, LHMP) and is ready to present the 2014 LHMP update for public comment. This memorandum provides background information about the LHMP as well as information about the upcoming public comment process. The LHMP will ultimately be submitted to the City Council in spring 2014 for adoption as an amendment to the General Plan. This will enable the City to maintain compliance with (and eligibility for) federal mitigation assistance programs and other State funding opportunities.
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 summer 2011. This update effort will allow Berkeley to apply for federal mitigation grant programs and State funding, and is anticipated to be complete in spring of 2014.

The First Draft of the LMHP Update is scheduled for release on October 21. Staff will be inviting City Commissions to review this draft, identify any significant areas of concern and provide written feedback through their Commission Secretaries. The Disaster and Fire Safety Commission and the Planning Commission will be asked to make formal recommendations to City Council regarding Plan adoption.

The Plan will also be posted on the City's website and will be available at City libraries for community review and comment. We encourage you to communicate with your constituents about this review opportunity. **Staff is requesting that all feedback on the First Draft Plan be received in writing by Monday, December 9 at 5:00 p.m.** The Final Draft Plan will incorporate all appropriate comments and feedback and will then be presented to the Council for adoption as an annex to the Disaster Preparedness and Safety Element of the General Plan in spring 2014.

2180 Milvia Street, Berkeley, CA 94704 • Tel: (510) 981-7000 • TDD: (510) 981-6903 • Fax: (510) 981-7099
E-Mail: manager@CityofBerkeley.info Website: http://www.CityofBerkeley.info/Manager

A detailed outline of the Plan update process is attached. Please let me know if you have any questions.

Attachment: Local Hazard Mitigation Plan Update Process

cc: William Rogers, Deputy City Manager
Gil Dong, Fire Chief
Ann-Marie Hogan, City Auditor
Mark Numainville, City Clerk
Matthai Chakko, Assistant to the City Manager

Local Hazard Mitigation Plan Update Process

The Local Hazard Mitigation Plan (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 summer 2011. This update effort will allow Berkeley to apply for federal mitigation grant programs and State funding, and is anticipated to be complete in spring of 2014.

Hazard Mitigation

Mitigation activities reduce or eliminate risk prior to a disaster and are an important element of the disaster life cycle. Examples of mitigation include:

- Seismic retrofitting of structures to prevent damage or collapse in earthquakes
- Vegetation management to prevent spread of wildfire

Mitigation does **not** include disaster preparedness activities, such as:

- Purchasing equipment to use in emergency response
- Conducting drills
- Storage of disaster supplies for post-disaster relief

Berkeley's Local Hazard Mitigation Plan

The City of Berkeley adopted its first Local Hazard Mitigation Plan in 2004. The Plan is comprised of two distinct components:

1. Hazard Analysis: Identifies the hazards facing the community, the likelihood that each hazard will impact the community, and how people, buildings, infrastructure and environment are vulnerable to each hazard.
2. Objectives and Mitigation Actions: Identifies objectives for reducing disaster risk in Berkeley, along with specific mitigation actions to meet those objectives.

Update Process

Just as in the Plan's original development, the Plan update process is being led by a Core Project Team of City staff. The Team is updating the Plan in consultation with the numerous organizations, businesses and individuals who make up the Berkeley community.

Community Engagement

Engagement of the Berkeley community is critical to this plan update. Since 2011, the Core Project Team has been working with hazard researchers and institutional community partners to update the Plan's Hazard Analysis. The Plan uses the most current scientific research to present Berkeley's hazards and their potential impacts. The document includes information about vulnerabilities and mitigation actions undertaken by nongovernmental institutions in Berkeley. In early October, the Core

Project Team will meet with these institutional partners to ensure that the Plan's Draft Mitigation Actions are aligned with our partners' mitigation work plans.

The Core Project Team will also engage Berkeley community representatives and the public in Plan review. As leaders in the Berkeley community, Commissioners and City Council members will be requested to help the City publicize the First Draft Plan, which will be posted on October 21 on the City of Berkeley website and at City libraries. Members of the public will be invited to provide written feedback on the document until Monday, December 9 at 5:00 p.m.

Commission Engagement

In 2004, Berkeley City Council adopted the Disaster Mitigation Plan as an annex to the Disaster Preparedness and Safety Element of the City's General Plan. This 2014 Plan Update must be adopted by City Council, so that the City can maintain compliance with (and eligibility for) federal mitigation assistance programs and other State funding opportunities.

When the First Draft Plan is posted for public review on October 21, all Commissions will be requested to agendize the First Draft Plan at their meetings and to provide written feedback on any areas of significant concern. Written feedback on the First Draft Plan will be accepted until Monday, December 9 at 5:00 p.m.

During this public comment period, the Planning Commission and Disaster and Fire Safety Commission will play specific roles in the Plan update. Because the Plan is an annex to the City's General Plan, the Planning Commission must make a recommendation to Council on the Draft Plan. Because the Disaster and Fire Safety Commission closely monitors the City's preparedness and mitigation efforts, the Core Planning team will request that the Commission make a recommendation to Council on the Draft Plan. Staff will present the plan to these Commissions on these dates:

- October 23: Staff presents Plan's Hazard Analysis Section to Disaster and Fire Safety Commission
- November 20: Staff presents Plan to Planning Commission and requests recommendation to City Council
- December 4: Staff presents Plan Actions to Disaster and Fire Safety Commission and requests recommendation to City Council

Following the public comment period for the First Draft Plan, the Core Project Team will review and incorporate appropriate feedback from Commissions and community members. The Core Project Team will then consult with the State of California Office of Emergency Services and the Federal Emergency Management Agency to make any additional adjustments required.

Following these plan edits, the Core Project Team will present the Final Draft Plan to City Council for adoption.

Local Hazard Mitigation Plan Key Dates

- October 21: First Draft Plan released on City website and at City libraries
- October 23: Disaster and Fire Safety Commission presentation #1
- November 20: Planning Commission presentation
- December 4: Disaster and Fire Safety Commission presentation #2
- December 9: Deadline for written feedback from community members and Commissions
- Spring 2014: Final Draft Plan posted on City website. Staff presents Final Draft Plan to City Council to for review and adoption.

Office of the City Manager

September 30, 2013

To: Commission Secretaries

From: Christine Daniel, City Manager

Subject: 2014 Update to the City's Local Hazard Mitigation Plan (LHMP); Public Comment Process

In 2004, the Berkeley City Council adopted the Disaster Mitigation Plan as an annex to the Disaster Preparedness and Safety Element of the City's General Plan. Staff has been working on the required update to this plan (now called the Local Hazard Mitigation Plan, LHMP) and is ready to present the 2014 LHMP update for public comment. This memorandum provides background information about the LHMP as well as information about the upcoming public comment process. The LHMP will ultimately be submitted to the City Council in spring 2014 for adoption as an amendment to the General Plan. This will enable the City to maintain compliance with (and eligibility for) federal mitigation assistance programs and other State funding opportunities.

The Local Hazard Mitigation Plan (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 summer 2011. This update effort will allow Berkeley to apply for federal mitigation grant programs and State funding, and is anticipated to be complete in spring of 2014. Staff requests that Commissions communicate with their stakeholders about this important effort.

The First Draft Plan is scheduled for release on October 21. Staff is inviting Commissions to review this draft, identify any significant areas of concern and provide written feedback through their Commission Secretaries. Staff will provide the First Draft Plan's Executive Summary and Actions for inclusion in Commission packets. The Plan will also be posted on the City's website and at City libraries for community review and comment. **Staff is requesting that all Commission and community feedback on the First Draft Plan be received in writing by Monday, December 9 at 5:00 p.m.** The Final Draft Plan will incorporate all appropriate comments and feedback and will then be presented to the Council for adoption as an annex to the Disaster Preparedness and Safety Element of the General Plan in spring 2014.

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E-Mail: manager@CityofBerkeley.info Website: http://www.CityofBerkeley.info/Manager

A detailed outline of the Plan update process is attached. Please direct any questions to Sarah Lana, Emergency Services Coordinator, at SLana@cityofberkeley.info.

Attachment: Local Hazard Mitigation Plan Update Process

cc: William Rogers, Deputy City Manager
Gil Dong, Fire Chief
Ann-Marie Hogan, City Auditor
Mark Numainville, City Clerk
Matthai Chakko, Assistant to the City Manager
Sarah Lana, Emergency Services Coordinator

Local Hazard Mitigation Plan Update Process

The Local Hazard Mitigation Plan (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 summer 2011. This update effort will allow Berkeley to apply for federal mitigation grant programs and State funding, and is anticipated to be complete in spring of 2014.

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Update Process

Just as in the Plan's original development, the Plan update process is being led by a Core Project Team of City staff. The Team is updating the Plan in consultation with the numerous organizations, businesses and individuals who make up the Berkeley community.

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Engagement of the Berkeley community is critical to this plan update. Since 2011, the Core Project Team has been working with hazard researchers and institutional community partners to update the Plan's Hazard Analysis. The Plan uses the most current scientific research to present Berkeley's hazards and their potential impacts. The document includes information about vulnerabilities and mitigation actions undertaken by nongovernmental institutions in Berkeley. In early October, the Core

Project Team will meet with these institutional partners to ensure that the Plan's Draft Mitigation Actions are aligned with our partners' mitigation work plans.

The Core Project Team will also engage Berkeley community representatives and the public in Plan review. As leaders in the Berkeley community, Commissioners and City Council members will be requested to help the City publicize the First Draft Plan, which will be posted on October 21 on the City of Berkeley website and at City libraries. Members of the public will be invited to provide written feedback on the document until Monday, December 9 at 5:00 p.m.

Commission Engagement

In 2004, Berkeley City Council adopted the Disaster Mitigation Plan as an annex to the Disaster Preparedness and Safety Element of the City's General Plan. This 2014 Plan Update must be adopted by City Council, so that the City can maintain compliance with (and eligibility for) federal mitigation assistance programs and other State funding opportunities.

When the First Draft Plan is posted for public review on October 21, all Commissions will be requested to agendize the First Draft Plan at their meetings and to provide written feedback on any areas of significant concern. Written feedback on the First Draft Plan will be accepted until Monday, December 9 at 5:00 p.m.

During this public comment period, the Planning Commission and Disaster and Fire Safety Commission will play specific roles in the Plan update. Because the Plan is an annex to the City's General Plan, the Planning Commission must make a recommendation to Council on the Draft Plan. Because the Disaster and Fire Safety Commission closely monitors the City's preparedness and mitigation efforts, the Core Planning team will request that the Commission make a recommendation to Council on the Draft Plan. Staff will present the plan to these Commissions on these dates:

- October 23: Staff presents Plan's Hazard Analysis Section to Disaster and Fire Safety Commission
- November 20: Staff presents Plan to Planning Commission and requests recommendation to City Council
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Following the public comment period for the First Draft Plan, the Core Project Team will review and incorporate appropriate feedback from Commissions and community members. The Core Project Team will then consult with the State of California Office of Emergency Services and the Federal Emergency Management Agency to make any additional adjustments required.

Following these plan edits, the Core Project Team will present the Final Draft Plan to City Council for adoption.

Local Hazard Mitigation Plan Key Dates

- October 21: First Draft Plan released on City website and at City libraries
- October 23: Disaster and Fire Safety Commission presentation #1
- November 20: Planning Commission presentation
- December 4: Disaster and Fire Safety Commission presentation #2
- December 9: Deadline for written feedback from community members and Commissions
- Spring 2014: Final Draft Plan posted on City website. Staff presents Final Draft Plan to City Council to for review and adoption.

Office of the City Manager

October 21, 2013

To: Honorable Mayor and Members of the City Council

From: Christine Daniel, City Manager

Subject: 2014 Update to the City's Local Hazard Mitigation Plan (LHMP); Public Comment Process

The First Draft of the City's 2014 Local Hazard Mitigation Plan (LHMP) update has been released on the City's website (www.CityofBerkeley.info/Mitigation) and at City libraries. Members of the public are invited to provide written feedback on the document until Monday, December 9 at 5:00 p.m.

All Commissions have been requested to agendize the First Draft Plan at their meetings, and to provide written feedback on any areas of significant concern before Monday, December 9 at 5:00 p.m. From October - December 2103, staff present the Plan's development process, hazard analysis, and proposed mitigation strategy First at meetings of the Planning Commission and 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.

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 present the Final Draft Plan to the Planning Commission at its January 15 meeting. 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 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 Draft Plan. Staff will present the Final Draft Plan to the Disaster and Fire Safety Commission at its January 22 meeting. At this meeting, staff will request the Commission's recommendation to Council on the Final Draft Plan. The Final Draft Plan will be brought to City Council for review and adoption in spring 2014.

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E-Mail: manager@CityofBerkeley.info Website: http://www.CityofBerkeley.info/Manager

The Executive Summary and Actions for the First Draft LHMP update are attached. Please let me know if you have any questions.

Attachment: 2014 Local Hazard Mitigation Plan: First Draft Executive Summary and Actions

cc: William Rogers, Deputy City Manager
Gil Dong, Fire Chief
Ann-Marie Hogan, City Auditor
Mark Numainville, City Clerk
Matthai Chakko, Assistant to the City Manager
Sarah Lana, Emergency Services Coordinator

Office of the City Manager

October 21, 2013

To: Aaron Lee, Secretary, Disaster and Fire Safety Commission

From: Christine Daniel, City Manager

Subject: 2014 Update to the City's Local Hazard Mitigation Plan (LHMP); Public Comment Process

The First Draft of the City's 2014 Local Hazard Mitigation Plan (LHMP) update has been released on the City's website (www.CityofBerkeley.info/Mitigation) and at City libraries. The document's Executive Summary and Actions are attached to this letter.

As the Disaster and Fire Safety Commission Secretary, please:

- Ensure that the Local Hazard Mitigation Plan is agendized as an Information Item for your October 23 and December 4 meetings
- Include the attached information in your December 4 Commission meeting packet
- Ensure that the Local Hazard Mitigation Plan is agendized as an Action Item for your January 22 meeting

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 summer 2011. This update effort will allow Berkeley to apply for federal mitigation grant programs and State funding, and is anticipated to be complete in spring of 2014.

Commission Review

All City Commissions are being invited to review the First Draft Plan. Commission feedback will be due to Mitigation@CityofBerkeley.info by December 9 at 5:00 p.m. Staff will review Commission feedback and incorporate appropriate edits into the Final Draft Plan.

Staff will present the First Draft Plan's development process, hazard analysis, and proposed mitigation strategy at the Disaster and Fire Safety Commission's October and

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December meetings. Additionally, staff will present the document at the Planning Commission's November 20 meeting.

Community Review

The First Draft Plan has been posted for review and comment at City libraries and on the City website (www.CityofBerkeley.info/Mitigation). Members of the public are invited to provide written feedback on the document until Monday, December 9 at 5:00 p.m.

Written feedback can be submitted:

a) Via email to Mitigation@CityofBerkeley.info
b) Via postal mail to:
   Fire Department - Office of Emergency Services
   Attn: Mitigation Plan
   2100 Martin Luther King, Jr. Way, 2nd Floor
   Berkeley, CA 94704
c) In-person during business hours to the Fire Department - Office of Emergency Services at the address above.

Staff will review community member feedback and will incorporate appropriate edits into the Final Draft Plan.

Adoption

For the Disaster and Fire Safety Commission's January 22 meeting packets, staff will provide the Final Draft Plan, an outline of edits made based on Commission and community feedback, and the written feedback of other Commissions. At this meeting, staff will request that the Disaster and Fire Safety Commission make a recommendation to Council on the Final Draft Plan.

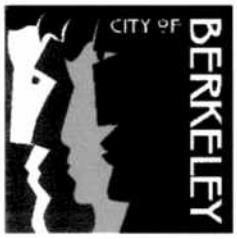
Staff will present the Final Draft Plan at the Planning Commission's January 15 meeting, which will also serve as a Public Hearing for the plan. Staff will request a recommendation to Council on the Final Draft Plan from the Planning Commission at this meeting.

The Final Draft Plan will be brought to City Council for review and adoption in spring 2014.

Commission Secretaries will serve as their Commissions' point of contact for this project. Please contact Sarah Lana, Emergency Services Coordinator (981-5576; slana@cityofberkeley.info) with questions.

Attachment: 2014 Local Hazard Mitigation Plan: First Draft Executive Summary and Actions

cc: William Rogers, Deputy City Manager
Gil Dong, Fire Chief
Ann-Marie Hogan, City Auditor
Mark Numainville, City Clerk
Matthai Chakko, Assistant to the City Manager
Sarah Lana, Emergency Services Coordinator



Office of the City Manager

October 21, 2013

To: Alex Amoroso, Secretary, Planning Commission

From: Christine Daniel, City Manager

Subject: 2014 Update to the City's Local Hazard Mitigation Plan (LHMP); Public Comment Process

The First Draft of the City's 2014 Local Hazard Mitigation Plan (LHMP) update has been released on the City's website (www.CityofBerkeley.info/Mitigation) and at City libraries. The document's Executive Summary and Actions are attached to this letter.

As the Planning Commission Secretary, please:

- Include the attached information in your November 20 Commission meeting packet
- Agendize the Local Hazard Mitigation Plan as an Information Item at your November 20 meeting
- Agendize the Local Hazard Mitigation Plan as an Public Hearing/Action Item at your January 15 meeting

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 summer 2011. This update effort will allow Berkeley to apply for federal mitigation grant programs and State funding, and is anticipated to be complete in spring of 2014.

Commission Review

All City Commissions are being invited to review the First Draft Plan. Commission feedback will be due to Mitigation@CityofBerkeley.info by December 9 at 5:00 p.m. Staff will review Commission feedback and incorporate appropriate edits into the Final Draft Plan.

Staff will present the First Draft Plan's development process, hazard analysis, and proposed mitigation strategy at the Planning Commission's November 20 meeting.

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Additionally, staff will present elements of the document at the Disaster and Fire Safety Commission's October and December meetings. The October 23 presentation will focus on the plan's hazards and potential impacts; the December 4 presentation will focus on the First Draft Plan's development process and proposed mitigation strategy.

Community Review

The First Draft Plan has been posted for review and comment at City libraries and on the City website (www.CityofBerkeley.info/Mitigation). Members of the public are invited to provide written feedback on the document until Monday, December 9 at 5:00 p.m.

Written feedback can be submitted:

a) Via email to Mitigation@CityofBerkeley.info
b) Via postal mail to:

   Fire Department - Office of Emergency Services
   Attn: Mitigation Plan
   2100 Martin Luther King, Jr. Way, 2nd Floor
   Berkeley, CA 94704

c) In-person during business hours to the Fire Department - Office of Emergency Services at the address above.

Staff will review community member feedback and will incorporate appropriate edits into the Final Draft Plan.

Adoption

For the Planning Commission's January 15 meeting packets, staff will provide the Final Draft Plan, an outline of edits made based on Commission and community feedback, and the written feedback of other Commissions. This meeting will serve as a Public Hearing for the Final Draft Plan, and staff will request that the Planning Commission make a recommendation to Council on the document at this meeting.

Staff will request a recommendation to Council on the Final Draft Plan from the Disaster and Fire Safety Commission at its January 22 meeting.

The Final Draft Plan will be brought to City Council for review and adoption in spring 2014.

Commission Secretaries will serve as their Commissions' point of contact for this project. Please contact Sarah Lana, Emergency Services Coordinator (981-5576; slana@cityofberkeley.info), with questions.

Attachment: 2014 Local Hazard Mitigation Plan: First Draft Executive Summary and Actions

cc: William Rogers, Deputy City Manager
Gil Dong, Fire Chief
Eric Angstadt, Planning and Development Department Director
Ann-Marie Hogan, City Auditor
Mark Numainville, City Clerk
Matthai Chakko, Assistant to the City Manager
Sarah Lana, Emergency Services Coordinator

Office of the City Manager

October 21, 2013

To: Commission Secretaries

From: Christine Daniel, City Manager

Subject: 2014 Update to the City's Local Hazard Mitigation Plan (LHMP); Public Comment Process

The First Draft of the City's 2014 Local Hazard Mitigation Plan (LHMP) update has been released on the City's website (www.CityofBerkeley.info/Mitigation) and at City libraries. The document's Executive Summary and Actions are attached to this letter.

As a Commission Secretary, please agendize the Local Hazard Mitigation Plan Update as an Information Item at your next Commission meeting, and include the attached information in your next Commission packet. At your next meeting, please:

- Review the contents of the attachment, including the topic areas covered by the plan actions
- Identify any plan actions pertaining to your Commission's area of expertise
- If your Commission has any significant concerns about these actions or the First Draft Plan generally, please capture them in writing and submit them to Mitigation@CityofBerkeley.info by December 9 at 5:00 p.m.

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 summer 2011. This update effort will allow Berkeley to apply for federal mitigation grant programs and State funding, and is anticipated to be complete in spring of 2014.

Commission Review

All Commissions are being invited to provide feedback on the First Draft Plan. Commission feedback will be due to Mitigation@CityofBerkeley.info by December 9 at 5:00 p.m. Staff will review the feedback and incorporate appropriate edits into the Final Draft Plan.

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From October - December 2103, staff will be making public presentations about the First Draft Plan at meetings of the Planning Commission and the Disaster and Fire Safety Commission. The following presentations are scheduled:

- October 23: Disaster and Fire Safety Commission: Hazard Analysis updates
- November 20: Planning Commission: Plan development process, Hazard Analysis updates and mitigation strategy
- December 4: Disaster and Fire Safety Commission: Plan Development Process and Mitigation Strategy

Community Review

The First Draft Plan has been posted for review and comment at City libraries and on the City website (www.CityofBerkeley.info/Mitigation). Members of the public are invited to provide written feedback on the document until Monday, December 9 at 5:00 p.m.

Written feedback can be submitted:

a) Via email to Mitigation@CityofBerkeley.info
b) Via postal mail to:

Fire Department - Office of Emergency Services
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Staff will review community member feedback and will incorporate appropriate edits into the Final Draft Plan.

Adoption

The Planning Commission and Disaster and Fire Safety Commission will play specific roles in the Plan update. Because the Plan is an annex to the City's General Plan, the Planning Commission must make a recommendation to Council on the Final Draft Plan. 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.

If your Commission provides feedback on the Plan before the December 9, 2013 deadline, that feedback will be included in these Commissions' January meeting packets. Staff will present the Final Draft Plan to the Disaster and Fire Safety Commission at its January 22 meeting, and to the Planning Commission at its January 15 meeting. The January 15 Planning Commission meeting will be the first Public

Hearing for the Final Draft Plan. At these January meetings, staff will request these Commissions' recommendations to Council on the Final Draft Plan.
The Final Draft Plan will be brought to City Council for review and adoption in spring 2014.
Commission Secretaries will serve as their Commissions' point of contact for this project. Commission Secretaries with questions should contact Sarah Lana, Emergency Services Coordinator (981-5576; slana@cityofberkeley.info).

Attachment: 2014 Local Hazard Mitigation Plan: First Draft Executive Summary and Actions

cc: William Rogers, Deputy City Manager
Gil Dong, Fire Chief
Ann-Marie Hogan, City Auditor
Mark Numainville, City Clerk
Matthai Chakko, Assistant to the City Manager
Sarah Lana, Emergency Services Coordinator

Office of the City Manager

November 15, 2013

To: Honorable Mayor and Members of the City Council

From: Christine Daniel, City Manager

Subject: Deadline Extension: First Draft 2014 Update to the City's Local Hazard Mitigation Plan (LHMP)

The feedback deadline for the First Draft of the City's 2014 Local Hazard Mitigation Plan (LHMP) update has been extended from December 9 to **December 20 at 5:00 p.m.** This extension has been made to accommodate Commissions' holiday scheduling adjustments. The December 20 deadline applies to feedback from Commissions and community members.

The First Draft of the City's 2014 Local Hazard Mitigation Plan (LHMP) update has been posted since October 21 on the City's website (www.CityofBerkeley.info/Mitigation) and at City libraries. All Commissions have been invited to provide feedback on the First Draft Plan.

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. The Final Draft Plan will be brought to City Council for review and adoption in spring 2014.

cc: William Rogers, Deputy City Manager
Gil Dong, Fire Chief
Ann-Marie Hogan, City Auditor
Mark Numainville, City Clerk
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Office of the City Manager

February 18, 2014

To: Honorable Mayor and Members of the City Council

From: Christine Daniel, City Manager

Subject: Final Drafted Posted: 2014 Update to the City's Local Hazard Mitigation Plan (LHMP)

The Final Draft of the City's 2014 Local Hazard Mitigation Plan (LHMP) update has been posted on the City's website (www.CityofBerkeley.info/Mitigation) and at City libraries. Staff will present the Final Draft Plan at two commission meetings, at which community members are invited to provide their feedback:

1) February 26, 2014 -- Disaster and Fire Safety Commission
2) March 19, 2014 -- Planning Commission

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 at the Commission's March 19th meeting. This meeting will serve as the First Public Hearing for the 2014 LHMP.

Following these Commission meetings, staff will work with the California Office of Emergency Services to submit the Final Draft Plan to the Federal Emergency Management Agency (FEMA) for review and "approval pending adoption." When FEMA issues this approval, staff will bring the FEMA-approved Final Draft Plan to Council for adoption (est. summer 2014).

This is the second phase of the LHMP public review process. From October 21 – December 20, 2013, the First Draft Plan was posted on the City website and at City libraries for review and comment by the Berkeley community. All commissions were invited to provide feedback on the First Draft Plan, and 19 commissions and boards chose to review the plan at a meeting. In total, eleven Commissions, one Board, and twelve community representatives provided written feedback on the First Draft Plan.

Following receipt of Commission and community feedback, staff incorporated appropriate community comments to develop the 2014 Final Draft Plan.

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Please let me know if you have any questions.

cc: William Rogers, Deputy City Manager
Gil Dong, Fire Chief
Ann-Marie Hogan, City Auditor
Mark Numainville, City Clerk
Matthai Chakko, Assistant to the City Manager
Sarah Lana, Emergency Services Coordinator

FIRE DEPARTMENT

Fire Department

2014 Local Hazard Mitigation Plan

Currently, the City is updating its Local Hazard Mitigation Plan (LHMP). 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 summer 2011. This update effort will allow Berkeley to apply for federal mitigation grant programs and State funding, and is anticipated to be complete in spring of 2014.

First Draft Plan

Community Feedback

Plan Presentations

Additional Commission Meetings

First Draft Plan (Available October 21 through December 9)

Complete First Draft Plan

Download sections of the 2014 First Draft Plan:

Executive Summary

Section 1: Mitigation Strategy

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Appendix C: Plan Development Process

Appendix D: Public Outreach Documentation (Under development, will be included in Final Draft Plan)

Appendix E: Prioritization Structure

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Community Feedback

Members of the public are invited to provide written feedback on the First Draft Plan until Monday, December 9 at 5:00 p.m. Written feedback can be submitted:

a. Via email to Mitigation@CityofBerkeley.info

b. Via postal mail to:

Fire Department - Office of Emergency Services
Attn: Mitigation Plan
2100 Martin Luther King, Jr. Way, 2nd Floor
Berkeley, CA 94704

c. In-person during business hours to the Fire Department - Office of Emergency Services at the address above.

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Plan Presentations

Staff will make presentations about the First Draft Plan at the following commission meetings:

Date/Time	Commission	Topic
October 23, 7:00 p.m.	Disaster and Fire Safety Commission	Hazard analysis updates Presentation
November 20, 7:00 p.m.	Planning Commission	Hazard analysis updates, plan development process and mitigation strategy
December 4, 7:00 p.m.	Disaster and Fire Safety Commission	Plan development process and mitigation strategy

After December 9, staff will review and incorporate appropriate feedback into the Final Draft Plan. Staff plans to present the Final Draft Plan at the following meetings:

- January 15: Planning Commission – First Public Hearing
- January 22: Disaster and Fire Safety Commission

The Final Draft Plan will be brought to Council after these Commissions issue recommendations on the document.

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Additional Commission Meetings

Additional commissions plan to discuss the First Draft Plan's Mitigation Strategy during the public comment period. Updates will be provided as new information becomes available. **Please use the links below** to verify meeting dates and agendas directly with each Commission.

Housing Advisory Commission – November 7

Parks and Waterfront Commission – November 13

Commission on Disability – November 13

Community Environmental Advisory Commission – December 5

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FIRE DEPARTMENT

Fire Department

2014 Local Hazard Mitigation Plan

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November 14 Update: Per City Commission requests, the public comment period for the First Draft Plan has been extended from Monday, December 9 until Friday, December 20 at 5:00 p.m.

Download the First Draft Plan How to Provide Feedback Key Dates and Meetings

First Draft Plan (Available October 21 through December 20)

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Download the First Draft Plan

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November 11	Solano BID Advisory Board	Commission Discussion
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The Final Draft Plan will be brought to Council following the completion of this process.

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TTY: (510) 981-6903

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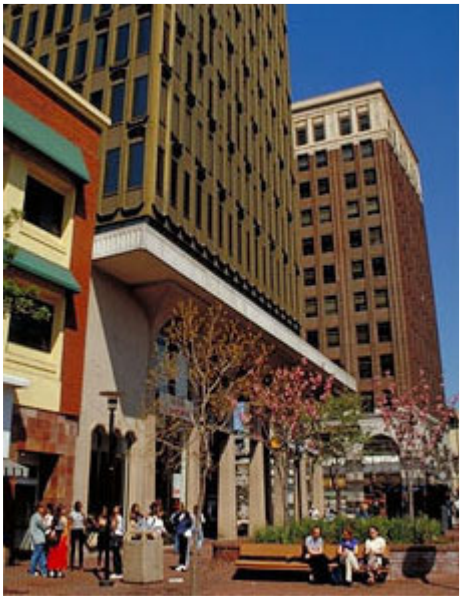

Berkeley is a city with a small population and a big reputation. In California alone, there are more than 30 cities bigger than Berkeley. In Alameda County, Berkeley is ranked fourth in population behind Oakland, Fremont, and Hayward. And yet, we are famous around the globe as a center for academic achievement, scientific exploration, free speech and the arts.

Berkeley is a constantly changing mix of long-time residents and new neighbors, and whether you just arrived from Albany or Azerbaijan, you are welcome here.

Please visit About Berkeley to learn more about the City.

2014 Local Hazard Mitigation Plan - We want Berkeley to be ready for natural disasters. Community-wide participation will help to reduce a disaster's impact. This is our plan to reduce our physical vulnerabilities -- before a disaster strikes. These vulnerabilities include soft-story apartments, unreinforced brick buildings and overgrown vegetation. This report has information about the disasters we may experience, what we're doing to lessen their impacts and how you might help. Please read this draft plan, encourage others to do the same and **let us know by Friday December 20 at 5 p.m.** how we can make the strategy more effective. [more...]

The Rockefeller Foundation Names Berkeley as an Inaugural City of the 100 Resilient Cities Network - The Rockefeller Foundation today announced that Berkeley was selected as an inaugural member of the 100 Resilient Cities Network. Berkeley was one of nearly 400 cities across six continents to apply for The Rockefeller Foundation's 100 Resilient Cities Centennial Challenge, and one of only 33 cities to be selected. An additional 67 cities will be selected over the next two years. [more...]

Berkeley changes parking meter rules downtown and two districts - The City of Berkeley is changing parking meter rates and extending time limits starting October 15 to make it easier to dine, shop and enjoy the arts in three of City's most vibrant districts: downtown, the Elmwood and the southside of the UC Berkeley campus around Telegraph Avenue. [more...]

[for more news about Berkeley, visit the Berkeley News main page]

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OFFICE CLOSURES

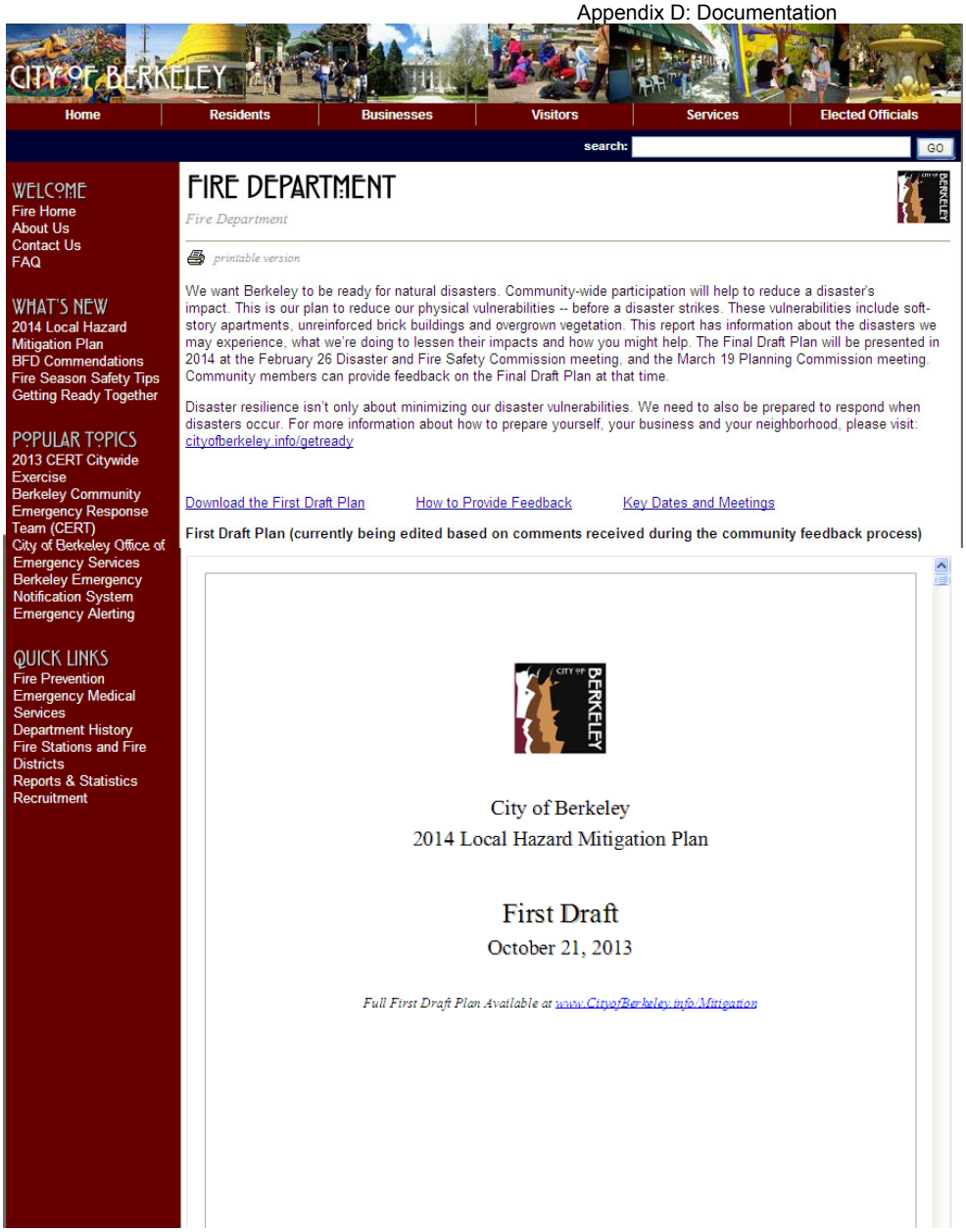
City of Berkeley offices will be closed on Monday, December 23, 2013 as a cost-savings measure. Some City services may be available. Please visit the Holiday and Reduced Service Day Schedule for more information. Additional days of office closure:

Dec 24	Reduced Service Day
Dec 25	Christmas Day
Dec 26	Reduced Service Day
Dec 27	Reduced Service Day

UPCOMING EVENTS

Dec 16	Rent Stabilization Board Regular Meeting (live webcast avail)
Dec 17	City Council Meeting (live webcast avail)
Dec 17	City Council Special Meeting (live webcast avail)
Dec 17	City Council Special Worksession (live webcast avail)
Dec 18	Energy Commission Meeting
Dec 18	Planning Commission Meeting

[view full Community Calendar]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Fire Home
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FAQ
WHAT'S NEW
2014 Local Hazard Mitigation Plan
BFD Commendations
Fire Season Safety Tips
Getting Ready Together
POPULAR TOPICS
2013 CERT Citywide Exercise
Berkeley Community Emergency Response Team (CERT)
City of Berkeley Office of Emergency Services
Berkeley Emergency Notification System
Emergency Alerting
QUICK LINKS
Fire Prevention
Emergency Medical Services
Department History
Fire Stations and Fire Districts
Reports & Statistics
Recruitment
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Fire Department
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Download the First Draft Plan
How to Provide Feedback
Key Dates and Meetings
First Draft Plan (currently being edited based on comments received during the community feedback process)
City of Berkeley
2014 Local Hazard Mitigation Plan
First Draft
October 21, 2013
Full First Draft Plan Available at www.CityofBerkeley.info/Mitigation

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Download the Final Draft Plan How to Provide Feedback Key Dates and Meetings

Download the Final Draft Plan

Download the Complete 2014 Final Draft Plan (12 MB)

Download the Complete 2014 Final Draft Plan without Appendix D: Documentation (5 MB)

Download individual sections of the Final Draft Plan:

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Appendix D: Documentation (7 MB)

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The Final Draft Plan will be presented in 2014 at the February 26 Disaster and Fire Safety Commission meeting, and the March 19 Planning Commission meeting (see "Key Dates and Meetings" below). Community members can provide feedback on the Final Draft Plan at these meetings. Staff estimates that the Final Draft Plan will be brought to City Council for formal adoption in early summer 2014.

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First Draft Plan: Public Review Process

The First Draft Plan was provided to the community for review and feedback from October 21 through December 20, 2014. The first two documents below outline all community feedback received, and the associated changes that staff made to the Final Draft Plan. Please note that the first two documents are incorporated into the Final Draft Plan under Appendix D: *Documentation*.

Public Comments and Staff Responses for the First Draft Plan

Summary of Changes to the First Draft Plan

Complete 2014 First Draft Plan

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Early Summer 2014 (est)	City Council	*Second Public Hearing* Staff Presentation: Final Draft Plan Council Discussion and Plan Adoption

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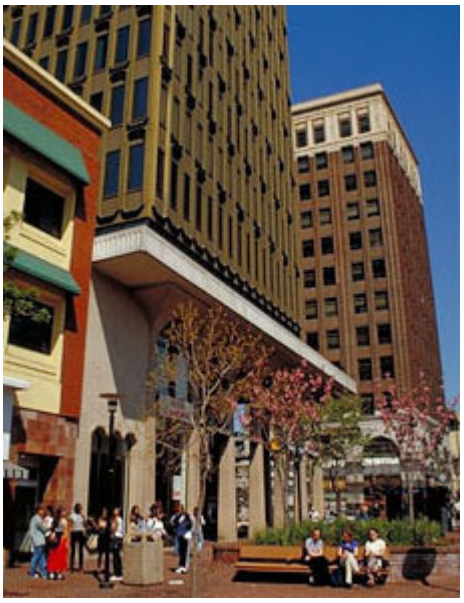

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Free Disaster Supplies for Neighborhoods - Berkeley neighborhoods can now apply to get a free container stocked with important supplies - including a fire hose, radios, a 50-person first aid kit and a portable generator -- that can help them survive the aftermath of an earthquake or other natural disaster. [more...]

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Berkeley Tuolumne Campers Find a Home at Echo Lake - The nearly century-old tradition of Berkeley Tuolumne Family Camp will continue this summer at a temporary location at the City's Echo Lake Camp. This new family camp program in the High Sierra near South Lake Tahoe will blend many of the traditions of both Echo Lake as well as Tuolumne Camp, whose site suffered extensive damage in the August 2013 Rim Fire. [more...]

Measles Case Potentially Exposed People in the City of Berkeley, UC Berkeley and Contra Costa County - Some people in the San Francisco Bay Area were potentially exposed to measles last week when a UC Berkeley student identified with measles attended class and commuted to school on BART from home in Contra Costa County. [more...]

It's not too late for a flu shot - With the flu virus on the rise locally and throughout California, Berkeley Public Health advises residents to get a flu shot. [more...]

[for more news about Berkeley, visit the Berkeley News main page]

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UPCOMING EVENTS

Feb 24	Children, Youth, and Recreation Commission
Feb 24	Council Agenda Committee Meeting
Feb 25	City Council Meeting (live webcast avail)
Feb 25	City Council Special Worksession (live webcast avail)
Feb 25	Music Throughout History: James Kenney African American History Celebration

[view full Community Calendar]

PLEASE NOTE: City of Berkeley services are sometimes not available on holidays or Reduced Services Days throughout the year. Please visit the Holiday and Reduced Service Day Schedule to see the full schedule of office closures for the current calendar year.

E. Prioritization Structure

The City incorporated seven key factors into the prioritization strategy used for 2014 mitigation actions. These criteria are described below and summarized in the table that follows.

E.1. *Key Factors*

1. Support of goals and objectives

Actions that support multiple goals and objectives are prioritized.

2. 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.

3. Funding availability

Actions with secured funding are prioritized.

4. Hazards addressed

Actions addressing the Plan's hazards of greatest concern (earthquake and wildland-urban interface fire) are prioritized.

5. Public and political support

Actions with public and political support are prioritized.

6. Adverse environmental impact

Actions with low environmental impact are prioritized.

7. Environmental benefit

Actions that provide an environmental benefit are prioritized.

8. 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.

E.2. *2014 Action Prioritization Structure*

Factors	Priority		
	High	**Medium**	**Low**
1. Support of goals and objectives	Supports multiple goals and objectives	Supports goals and objectives	Will mitigate the risk of a hazard
2. Cost/benefit relationship*	Benefits exceed cost	Has benefits that exceed costs	Benefits do not exceed the costs or are difficult to quantify
3. Funding availability**	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
4. Hazards addressed	Addresses hazards of greatest concern	May not address hazards of greatest concern	Addresses hazards identified in Hazard Analysis
5. Public and political support	Has public and political support	Has public and political support	May not have public and political support
6. Adverse environmental impact	No environmental impact	Low environmental impact	May not have a low environmental impact
7. Environmental benefit	Environmental benefit	No environmental benefit	No environmental benefit
8. 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)

*Actions that address other hazards, but for which benefits exceed costs, may also be considered high priority.

**Medium priority projects will become high priority projects once funding is secured.

E.3. *2014 Changes in Priorities*

In 2004, Actions were assigned one of three prioritization categories: *Very High*, *High*, or *Important*. Numerous factors were considered while assigning these priorities:

1. Only those actions with strong community support were given Very High or High priority ratings.
2. Actions addressing earthquakes and wildfires were given priority, as those hazards were identified has having the greatest potential to cause large human and economic losses.
3. Actions focusing on preserving life and reducing injury were given highest priority.
4. Actions strengthening the city's ability to provide essential emergency services to the entire community after a disaster were also weighted highly.
5. Emphasis was given to actions aimed at ensuring that the city's economic, educational and governmental systems will resume normal functioning within 30 days of a major disaster.

In 2014, the City is using a new, clarified structure to categorize Actions into *High*, *Medium*, or *Low* priorities. Key differences in the 2004 and 2014 structures are:

- 2014 structure more specifically prioritizes actions with favorable cost/benefit ratios
- 2014 structure prioritizes actions with secured funding
- 2014 structure prioritizes actions with no or low environmental impact
- 2014 structure prioritizes ongoing and short-term projects that can be completed in 1-5 years.

City of Berkeley

2019 Local Hazard Mitigation Plan

First Draft

December 18, 2018

Executive Summary

Berkeley is a vibrant and unique community. But every aspect of the city – its economic prosperity, social and cultural diversity, and historical character – could be dramatically altered by a disaster. While we cannot predict or protect ourselves against every possible hazard that may strike the community, we can anticipate many impacts and take steps to reduce the harm they will cause. We can make sure that tomorrow's Berkeley continues to reflect our current values.

City government and community members have been working together for years to address certain aspects of the risk – such as strengthening structures, distributing disaster supply caches, and enforcing vegetation management measures to reduce fire risk. The 2004 Disaster Mitigation Plan formalized this process, ensuring that these activities continued to be explored and improved over time. The 2014 Local Hazard Mitigation Plan continued this ongoing process to evaluate the risks that different hazards pose to Berkeley, and to engage the community in dialogue to identify the most important steps that the City and its partners should pursue to reduce these risks. Over many years, this constant focus on disasters has made Berkeley, its residents and businesses, much safer.

The federal Disaster Mitigation Act of 2000 (DMA 2000) calls for all communities to prepare mitigation plans. The City adopted a plan that met the requirements of DMA 2000 on June 22, 2004, and an update on December 16, 2014. This is the 2019 update to that plan, called the 2019 Local Hazard Mitigation Plan (2019 LHMP).

Plan Purpose

The 2019 LHMP serves three functions:

1. The 2019 LHMP documents our current understanding of the hazards present in Berkeley, along with our vulnerabilities to each hazard – the ways that the hazard could impact our buildings, infrastructure, community, and environment.
2. The document presents Berkeley City government's Mitigation Strategy for the coming five years. The Mitigation Strategy reflects a wide variety of both funded and unfunded actions, each of which could reduce the Berkeley's hazard vulnerabilities.
3. By fulfilling requirements of the DMA 2000, the 2019 LHMP ensures that Berkeley will remain eligible to apply for mitigation grants before disasters, and to receive federal mitigation funding and additional State recovery funding after disasters.

Plan Organization

Unlike prior versions of the plan, the 2019 LHMP has been structured to specifically address DMA 2000 requirements. The 2019 LHMP is organized as follows:

Element A: Planning Process
This section of the 2019 LHMP describes the process used to develop the document, including how partners, stakeholders, and the community were engaged. It also addresses the City's approach to maintaining the 2019 LHMP over the five-year planning cycle.

Element B: Hazard Analysis
This section of the 2019 LHMP outlines the different hazards present in Berkeley. Analysis of each hazard includes the areas of Berkeley with exposure to the hazard, the potential impacts of each hazard, and Berkeley's vulnerabilities to each hazard.

Element C: Mitigation Strategy
The Mitigation Strategy section first documents the authorities, policies, programs, and resources that the City brings to bear in implementing mitigation actions. Second, this section outlines a comprehensive range of specific mitigation actions and projects designed to reduce Berkeley's hazard vulnerabilities. This section also describes how the 2019 LHMP is integrated with other City plans.

Element D: Plan Review, Evaluation, and Implementation
This section describes how changes in development have influenced updates to the 2019 LHMP. It also provides a detailed description of Berkeley's progress on the Mitigation Strategy proposed in 2014.

Element E: Plan Adoption
This section will be used to document formal adoption of the Final Draft 2019 LHMP by the Berkeley City Council.

In the pages that follow, this Executive Summary describes highlights from Element B: *Hazard Analysis* and Element C: *Mitigation Strategy*, as well as any key updates that were made to the section since the 2014 version.

Element B: Hazard Analysis

To become disaster resilient, a community must first understand the existing hazards and their potential impacts. Berkeley is exposed to a number of natural and human-caused hazards that vary in their intensity and impacts on the city. This mitigation plan addresses six natural hazards: earthquake, wildland-urban interface (WUI) fire, flood, landslide, and tsunami. Each of these hazards can occur independently or in combination, and can also trigger secondary hazards.

Although this plan is focused on natural hazards, four human-caused hazards of concern are also discussed: hazardous materials release, climate change,[i] extreme heat events, and terrorism. They are included because of their likelihood of occurrence and the magnitude of their potential consequences, as outlined in the table below.

Table 1. Summary of Hazard Analysis

Hazard	Likelihood	Severity of Impact
Earthquake	Likely	Catastrophic
Wildland-Urban Interface Fire	Likely	Catastrophic
Rainfall-Triggered Landslide	Likely	Moderate
Floods	Likely	Minor
Tsunami	Possible	Moderate
Climate Change	Likely	Unknown*
Extreme Heat	Likely	Unknown*

**Consequence levels for climate change and extreme heat have not been assigned values, as adequate information to make this determination is not yet available.*

Hazards of Greatest Concern

Earthquake

We do not know when the next major earthquake will strike Berkeley. The United States Geological Survey states that 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.[ii] There is a 33% chance that a 6.7 or greater will occur on the Hayward fault system between 2014 and 2043.[iii] This means that many Berkeley residents are likely to experience a severe earthquake in their lifetime.

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 utilities and gas lines that cross the fault. Landslides are expected in the Berkeley hills during the next 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 pavements and dislodge foundations.

Shaking and ground failure is likely to create impacts that ignite post-earthquake fires. Firefighting 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, one hundred 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.

Wildland-Urban Interface Fire

Berkeley is vulnerable to a wind-driven fire starting along the city's eastern border. The fire risk facing the people and properties in the eastern hills is compounded by the area's mountainous topography, limited water supply, 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. The flatlands are densely-covered with old wooden buildings housing low-income and vulnerable populations, including isolated seniors, people with disabilities, and students.

The high risk of wildland-urban interface (WUI) fire in Berkeley was clearly demonstrated in the 1991 Tunnel Fire, which destroyed 62 homes in Berkeley and more than 3,000 in Oakland. In 1923, an even more devastating fire burned through Berkeley. It began in the open lands of

Wildcat Canyon to the northeast and, swept by a hot September wind, penetrated residential north Berkeley and destroyed nearly 600 structures, including homes, apartments, fraternities and sororities, a church, a fire station and a library. The fire burned downhill all the way to Shattuck Avenue in central Berkeley.[iv]

If a fire occurred today that burned the same area, the loss to structures would be in the billions of dollars.[v] Destruction of contents in all of the homes and businesses burned would add hundreds of millions of dollars[vi] to fire losses. Efforts to stabilize hillsides after the fire to prevent massive landslides would also add costs. Depending on the speed of the fire spread, lives of Berkeley residents could also be lost. Many established small businesses, homes, and multi-family apartment buildings, particularly student housing, would be completely destroyed, changing the character of Berkeley forever.

Natural Hazards of Concern

This plan identified three additional natural hazards of concern: rainfall-triggered landslide, floods, and tsunami. These hazards could cause significant damage and losses in Berkeley. However, unlike earthquake and WUI fire, their impacts are likely to be smaller, and confined to specific areas.

Rainfall-Triggered Landslide

Berkeley has a number of deep-seated landslides that continuously move, with the rate of movement affected by rainfall and groundwater conditions. Significant localized areas of the Berkeley hills face risk from landslide, and a major slide could endanger lives and impact scores of properties, utilities and infrastructure.

Floods

Floods also could damage property and cause significant losses in Berkeley. Flooding can occur when stormwater exceeds the capacity of a creek channel, or the capacity of the storm drain system. Creek flooding in Berkeley has the potential to affect about 675 structures, mainly in the western, industrial area of the city. It is unlikely that floodwaters will reach higher than three feet, but damages to homes, businesses, and their contents could total over $160 million. Storm drain overflow creates localized flooding in many known intersections in Berkeley. With few properties covered by flood insurance, these costs would be borne primarily by Berkeley residents and businesses.

Tsunami

Tsunamis, though rare inside the San Francisco Bay, can occur from large offshore subduction style earthquakes around the Pacific Rim. Small, local tsunamis can also result from offshore strike-slip Faults such as parts of the San Andreas Fault of the Peninsula and the Hayward Fault through San Pablo Bay. 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. 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.

Manmade Hazards of Concern

While the focus of the 2019 LHMP is on natural hazards as emphasized in the Disaster Mitigation Act of 2000 (DMA 2000),[vii] the plan provides analysis of four manmade hazards of concern. Climate change is described because its impacts are likely to exacerbate the natural hazards of concern identified in the plan. The 2019 LHMP specifically addresses the hazard of extreme heat events because they are projected to increase exponentially in the next century as climate change continues. Hazardous materials release is addressed in this mitigation plan as a potential impact from a natural hazard. Terrorism is identified as a hazard of concern but is not analyzed in-depth.

Climate Change

Like regions across the globe, the San Francisco Bay Area is already experiencing negative impacts of climate change. These impacts will continue to grow in intensity and will disproportionately affect vulnerable communities such as the elderly, children, people with disabilities, and people with low incomes.

The severity of these impacts will depend on the amount of greenhouse gas emissions produced worldwide over the coming decades. Mitigation of further emissions will reduce Berkeley's exposure to climate change. Berkeley's Climate Action Plan[viii] identifies the City's plan for emissions reductions, known as climate change mitigation. Simultaneously, we are already experiencing climate change impacts that will intensify over time—including sea level rise, drought, severe storms, and extreme heat – so it is also critical that Berkeley adapt to current and projected impacts in order to protect Berkeley's community, infrastructure, buildings, and economy, known as climate change adaption.

Climate change will have direct impacts and will also exacerbate the natural hazards of concern outlined in this plan. Rising sea levels have the potential to impact infrastructure and community members in west Berkeley and the Berkeley waterfront. This will increase Berkeley's exposure to tsunami inundation and to flooding of critical infrastructure in these areas, which includes sanitary sewers, state highways, and railroad lines. Increased temperatures, when coupled with prolonged drought events, can increase the intensity of wildfires that may occur, and pose significant health and safety risks to vulnerable communities. By 2100, most of the Bay Area will average six heat waves per year, each an average length of ten day.[ix] Shorter, more intense wet seasons will make flooding more frequent, and may increase the landslide risk in the Berkeley hills. California may experience greater water and food insecurity, and drought will become a more persistent issue as the effects of climate change deepen.

Extreme Heat Events

Multiple factors contribute to the extreme heat hazard, including very high temperatures, nights that do not cool down, consecutive days of extreme heat, and extreme heat during unexpected times of the year. Extreme heat events impact public health, increase fire risk, damage critical facilities and infrastructure, and worsen air quality.

Social factors play a key role in vulnerability to extreme heat events, meaning that people with disabilities, chronic diseases, the elderly, and children under five are the most at risk to heat-

related illnesses.[x] Across California, the highest risk of heat-related illness occurs in the typically cooler regions found in coastal areas like Berkeley.

Projections indicate that the number of extreme heat days, warm nights, and heat waves will increase exponentially: by 2099, the City of Berkeley is expected to average 18 days per year with temperatures over 88.3 degrees F.

Hazardous Materials Release
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. The City has identified fifteen facilities in Berkeley with sufficiently large quantities of toxic chemicals to pose a high risk to the community. Hazardous materials also travel through Berkeley by truck and rail. Natural hazards identified in the plan could trigger the release of hazardous materials.

Terrorism
It is not possible to estimate the probability of a terrorist attack. Experts prioritize terrorism readiness efforts by identifying critical sites and assessing these sites' vulnerability to terrorist City officials are currently working with State and regional groups to prevent and prepare for terrorist attacks.

Summary of Changes to the Hazard Analysis

The 2019 LHMP contains numerous updates to facts, figures, and descriptions. The City has incorporated the newest-available hazard data, including impact maps for particular scenarios. The City and its partners have provided additional descriptions, details and definitions to explain the science of these hazards and their potential impacts. Advances in GIS mapping technology have enabled the City to present maps that help to visualize information.

Institutional community partners have updated information regarding their vulnerabilities to the described hazards, as well as significant mitigation activities that they have completed, are in progress, or planned for the coming five years.

Within the historical section for each hazard, the City has added information about any instances of the hazard affecting Berkeley since 2014. Throughout the plan, the City has updated financial loss estimates for inflation.

Hazards Described in the 2014 Plan

For the first time, the plan identifies extreme heat events as a hazard of concern. Significant changes and updates to the analysis of each hazard are described below:

Earthquake (Section B.5)

- The 2019 LHMP integrates the 2018 HayWired scenario developed by the USGS to help illustrate the potential impacts of a catastrophic earthquake near Berkeley. The plan now includes five maps with data from the scenario.
- Berkeley's liquefaction hazard is now mapped using both overall levels of susceptibility and probability of liquefaction in the 7.0M HayWired scenario.
- The seismic stability of City-owned and leased buildings has been updated to reflect significant retrofit and rebuilding efforts since 2014.
- The City has updated the plan to describe Berkeley's progress on mitigating earthquake vulnerabilities in privately-owned buildings. Detailed analysis along with three new maps have been provided to describe and illustrate the locations of potentially seismically vulnerable buildings, including unreinforced masonry buildings, soft story buildings, non-ductile concrete buildings, and tilt-up or other rigid-wall flexible diaphragm buildings.
- The Earthquake section includes updated descriptions from Key Institutional Partners about mitigation efforts completed or planned. Updated partner profiles include UC Berkeley, Berkeley Lab, Berkeley Unified School District, East Bay Municipal Utility District, AT&T, and Alta Bates Summit Medical Center.
- Earthquake risk and loss estimates have been updated to integrate regional estimates from the 2018 HayWired earthquake scenario.

Wildland-Urban Interface Fire (Section B.6)

The 2019 LHMP integrates hazardous fire zones as defined by the City of Berkeley and the California Department of Forestry onto one map.

The 2019 LHMP presents a new map overviewing the locations of pedestrian pathways in Berkeley. These pathways are key resources for pedestrian evacuation from wildland-urban interface fire.

Rainfall-Triggered Landslide (Section B.7)
This section has been updated to describe hazard occurrences in Berkeley since 2014.

Floods (Section B.8)
The Floods section has been updated to include newly-revised flood exposure maps for Berkeley from the FEMA National Flood Insurance Program.

Tsunami (Section B.9)
The Tsunami section now includes a map of Tsunami Evacuation Playbook zones. These zones, developed by the California Geological Survey, California Governor's Office of Emergency Services, and the National Ocean and Atmospheric Administration (NOAA), reflect more refined and detailed planning, in which forecasted tsunami amplitudes, storm surge, and tidal information can help guide what areas might be inundated.

The Tsunami section also includes new information about infrastructure vulnerabilities of the Berkeley Marina, based on recent tsunami inundation modeling by the California Geological Survey, University of Southern California, California State Lands Commission, and California Governor's Office of Emergency Services.

Climate Change (Section B.10)
The Climate Change section has been updated to use the latest available science and policy guidance on the direct and secondary impacts of climate change. It describes recent events that demonstrate climate change impacts that we are already experiencing.

The section provides new analysis of amounts of sea-level rise anticipated under different projected carbon emissions scenarios, as well as new maps of expected levels of inundation from 2-ft, 4-ft, and 5.5-ft sea level rise scenarios using the Adapting to Rising Tides Bay Shoreline Flood Explorer.

Extreme Heat Events (Section B.11)
Extreme heat events are a newly-introduced hazard of concern for the 2019 LHMP. The extreme heat events section describes factors that contribute to the extreme heat hazard, and describe how the Urban Heat Island Effect can further exacerbate impacts of extreme heat events. The section outlines the secondary hazards created by extreme heat, including public health impacts, fire, damage to critical facilities and infrastructure, and worsened air quality.

The section also describes the predicted average number of extreme heat days in Berkeley through the end of the century.

Hazardous Materials Release (Section B.12)
The Hazardous Materials Release section contains updated figures on the number of sites with hazardous materials in Berkeley. Additionally, the section has been updated since 2014 to reflect Berkeley industrial sites with large quantities of extremely hazardous materials. These sites have been mapped for reference.

Element C: Mitigation Strategy

Authorities, Policies, Programs and Resources

Through many years of diligent effort by City government and the community, Berkeley has developed many innovative initiatives to increase our disaster resilience. The authorities, policies, programs and resources that Berkeley will use to support execution of the 2019 LHMP Mitigation strategy include:

- The City has strengthened its ability to serve the community during and after disasters by seismically upgrading or replacing buildings that house critical City functions. In 2017, work was completed on the James Kenney Recreation Center and the Center Street Garage. Since 2004 the City has strengthened or rebuilt all seven of the City's fire stations, the historic Ratcliff Building (which houses the Public Works Department Operations Center), the Civic Center (which houses many key government functions), the Public Safety Building, a new animal shelter, and all libraries.
- The Berkeley Unified School District, supported by voter-approved bonds, has strengthened all public schools.
- 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 was the first city in the nation to inventory the community's soft-story buildings. In 2014 Berkeley mandated retrofit of soft story buildings with five or more dwelling units. Since then, 61 percent of these identified buildings have had retrofits completed.
    - Over 99% of Berkeley's 700 unreinforced masonry buildings have been retrofitted or demolished since a City mandate began in 1991.
- The City offers a comprehensive suite of programs to encourage the community to strengthen buildings to be more hazard-resistant.
    - 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).
    - Since July 2002, the City has distributed over $12 million to homeowners through the Transfer Tax Rebate Program, which reduces the real estate transfer tax to building owners who perform seismic safety work.
    - 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 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 with strict building and fire code provisions, as well as more restrictive local amendments for new and renovated construction;
  - Enforcement programs including annual inspections of over 1,200 high-risk properties annually;
  - Natural resource protection through four different vegetation management programs;
  - Improvement of access and egress routes;
  - Infrastructure maintenance and improvements to support first responders' efforts to reduce fire spread.
- The Disaster Cache Program incentivizes community-building for disaster readiness. To date, the City has awarded caches of disaster response equipment to neighborhoods, congregations, and UC Berkeley Panhellenic groups that have undertaken disaster readiness activities.
- Berkeley's 2009 Climate Action Plan has served as a model for jurisdictions across the nation. The Climate Action Plan also guides the City's new climate adaptation strategy.

These programs, and many others, place Berkeley as a leader in disaster management. Long-term maintenance and improvements to these programs will support execution of the 2019 LHMP Mitigation strategy, and will help to protect the Berkeley community in our next disaster.

Disaster Mitigation Goals and Objectives

Berkeley will focus on three goals to reduce and avoid long-term vulnerabilities to the hazards identified in Element B: *Hazard Analysis*:

1. The City will evaluate and strengthen all City-owned properties and infrastructure, particularly those needed for critical services, to ensure that the community can be served adequately after a disaster.
2. The City will establish and maintain incentive programs and standards to encourage local residents and businesses to upgrade the hazard resistance of their own properties.
3. The City will actively engage other local and regional groups to collaboratively work towards mitigation actions that help maintain Berkeley's way of life and its ability to be fully functional after a disaster event.

Five objectives guide the mitigation strategy:

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. Preserve Berkeley's unique character and values from being compromised by hazardous 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.

Overview of Actions

This plan identifies and analyzes 27 mitigation actions to reduce the impacts from hazards described in Element B: *Hazard Analysis.* This suite of actions addresses every natural hazard posing a threat to Berkeley, with an emphasis on new and existing buildings and infrastructure.

Tables 1, 2, and 3 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) and each action addresses.

Table 2. High-Priority Actions in mitigation strategy

Name	Action	Hazards
Building Assessment	Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Strengthen and Replace City Buildings	Strengthen or replace City buildings in the identified prioritized order as funding is available.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Buildings	Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.	Earthquake Wildland-Urban Interface Fire Landslide Floods

Name	Action	Hazards
Retrofit Grants	Implementation of the Retrofit Grants Program which helps Berkeley building owners increase safety and mitigate the risk of damage caused by earthquakes	Earthquake
Soft Story	Continued Implementation of the Soft Story Retrofit Program, which mandates seismic retrofit of soft story buildings with 5+ residential units.	Earthquake
Unreinforced Masonry (URM)	Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.	Earthquake
Concrete Retrofit Ordinance Research	Monitor passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices.	Earthquake
Gas Safety	Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.	Earthquake Wildland-Urban Interface Fire Landslide Tsunami
Fire Code	Reduce fire risk in existing development through fire code updates and enforcement.	Wildland-Urban Interface Fire
Vegetation Management	Reduce fire risk in existing development through vegetation management.	Wildland-Urban Interface Fire Climate Change
Hills Pedestrian Evacuation	Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Earthquake Wildland-Urban Interface Fire
Hills Roadways and Parking	Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Earthquake Wildland-Urban Interface Fire
Undergrounding	Coordinate with PG&E for the construction of undergrounding in the Berkeley Hills within approved Underground Utility Districts (UUDs).	Earthquake Wildland-Urban Interface Fire
EBMUD	Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.	Earthquake Wildland-Urban Interface Fire

Name	Action	Hazards
Extreme Heat	Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Climate Change Extreme Heat
Hazardous Materials	Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami
Air Quality	Define clean air standards for buildings during poor air quality events and use those standards to assess facilities for the Berkeley community.	Wildland-Urban Interface Fire Extreme Heat
National Flood Insurance Program (NFIP)	Maintain City participation in the National Flood Insurance Program.	Floods
Hazard Information	Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Partnerships	Coordinate with and encourage mitigation actions of key City partners.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat

Table 3. Medium-Priority Actions in mitigation strategy

Name	Action	Hazards
Severe Storms	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 Climate Change
Energy Assurance	Implement energy assurance strategies at critical City facilities.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Climate Change Integration	Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.	Climate Change Extreme Heat
Sea Level Rise	Mitigate the impacts of sea level rise in Berkeley.	Climate Change
Water Security	Collaborate with partners to increase the security of Berkeley's water supply from climate change impacts.	Climate Change

Table 4. Low-Priority Actions in mitigation strategy

Name	Action	Hazards
Tsunami	Mitigate Berkeley's tsunami hazard.	Tsunami
Streamline Rebuild	Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami

[i] Human action directly influences the probability that climate change will occur. Climate change is referenced as a natural hazard here because of its potential to exacerbate natural hazards described in this plan.

[ii] Detweiler, Shane and Wein, A., 2018, The HayWired Earthquake Scenario – Earthquake Hazards: U.S. Geological Survey Scientific Investigations Report 2017-5013-A-H, p.3.
[iii] Detweiler, Shane and Wein, A., 2018, The HayWired Earthquake Scenario – Earthquake Hazards: U.S. Geological Survey Scientific Investigations Report 2017-5013-A-H, p.4.
[iv] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[v] Total square footage of buildings in burn area is 9,386,281 square feet.

[vi] In 2004, estimate was $500 million.

[vii] Public Law 106-390

[viii] Berkeley Climate Action Plan (City of Berkeley, 2009) www.cityofberkeley.info/climate/
[ix] San Francisco Bay Area 2017 Risk Profile (ABAG, 2017, p58-59) http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/RiskProfile_4_26_2017_optimized.pdf
[x] San Francisco Bay Area 2017 Risk Profile (ABAG, 2017) http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/RiskProfile_4_26_2017_optimized.pdf

Element 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. To create the 2019 LHMP update, Berkeley followed the same multi-phased, broadly-inclusive process used to update the Plan in 2014.

LHMP Kickoff Meeting

On August 24, 2017, the City of Berkeley hosted a special USGS Earthquake Hazard Briefing about the HayWired earthquake scenario, and used this gathering to kick off the 2019 Local Hazard Mitigation Plan process. Earthquake is one of Berkeley's hazards of greatest concern; presenters included the United States Geological Survey (USGS). At this meeting, City staff and key partners learned together about the latest earthquake science, anticipated impacts, and experts' proposed mitigation actions to consider for the 2019 LHMP.

Development of First Draft Plan

Throughout 2018, the Project Manager collaborated with numerous City staff, partner representatives and hazard experts to update the plan's hazard analysis, progress on 2014 actions, and to develop the 2019 mitigation strategy. During this time City leaders provided guidance to the Project Manager through participation in the Core Project Team. As the Project Team created the First Draft 2019 LHMP, members engaged institutional key partners to include detailed information about partners' hazard and risk assessments and mitigation initiatives in the hazard analysis section of the Plan. The Project Team worked with partner representatives to identify opportunities for collaboration on Actions in the 2019 mitigation strategy.

Institutional Community Partner Meeting

In December 2018, the Core Team hosted an Institutional Community Partner Meeting to provide the 2019 LHMP Draft Mitigation Strategy for feedback by partner agencies. This event was the culmination of a yearlong collaboration to develop the First Draft 2019 LHMP. Meeting participants were provided the 2019 mitigation strategy's pre-draft objectives and actions. Attendees helped the City to ensure that the 2019 mitigation strategy aligned with their agencies' strategic program goals. Partner representatives and City staff discussed mitigation approaches proposed in the pre-draft mitigation actions, identifying actions that were most supportive of their agencies' missions, as well as opportunities for partnership to implement mitigation initiatives. The City incorporated feedback from those partner agencies.

Public Review of First Draft Plan

From December 18, 2018 through February 28, 2019 the City posted the First Draft Plan on the City website and at City libraries for review and comment by the Berkeley community. All of the City's 30+ commissions were invited to provide feedback on the Plan, as well as all community members.

This public review process is considered a key step in the City Council's adoption of the 2019 Local Hazard Mitigation Plan. See Element E: *Plan Adoption* for details on the public review 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.2 *Stakeholder Engagement*

The Project Team relied heavily on input from neighboring communities, fellow government agencies, and institutional key partners throughout the 2019 plan development process.

The City of Berkeley's planning process termed neighboring communities, local, and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, as well as other interested parties as "Institutional Key Partners." 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, Institutional Key Partners were invited to review and provide comment on proposed actions as part of the process to develop the First Draft 2019 LHMP. Institutional Key Partners were invited to participate in person in the planning process at the Institutional Community Partner Meeting on December 3, 2018.

Institutional Key Partners were also invited to provide feedback on the First Draft Plan as part of the public process. See A1: *Public Review of First Draft Plan*.

Stakeholders were contacted through email, phone, and in-person meetings. Participation was multi-phased and included opportunities to contribute to and provide feedback:

- At the 2019 LHMP Kickoff Meeting, before plan development began
- Through the Disaster Questionnaire (see A3 for details)
- Throughout drafting of the First Draft 2019 LHMP, through
    - Contribution of narratives to the Hazard Analysis
    - Opportunities to provide feedback on the internal draft Mitigation Strategy both online and in-person at the Institutional Community Partner Meeting
- During the Public Review of the First Draft Plan (see A1 for details)

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.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 designed and distributed a questionnaire. It included seven open-ended questions about hazard concerns, preparedness, perceptions about the role of government, and suggestions for what the City could do better. There were also seven demographic questions to capture who answered the survey and how responses may differ, depending on personal identities and or where one lives or visits in Berkeley.

The questionnaire was available on Berkeley Considers, an online forum the City uses for community discussion and commentary, from June until September 2018. The questionnaire was announced on the City website and forwarded to partners for distribution. Over 500 people responded to the questionnaire. The responses were aggregated and categorized into themes. The Core Project Team used and referenced these results when developing the hazard analysis and mitigation strategy.

Note: Questionnaire documentation is provided for State and federal reviewers in Attachment 1: *Documentation*.

A.4 *Update of Technical Information*

The Project Manager worked with City staff to update information in the 2014 hazard analysis, accounting for new scientific research on hazards that could affect Berkeley, their areas of exposure and their potential impacts.

To update hazard analysis references to key infrastructure and programs not operated by the City, the Project Manager also worked with Institutional Key Partners outside of City government: both those identified in the 2014 Plan, as well as new partners identified for the 2019 Plan.

The Endnotes Section of the Element B: *Hazard Analysis* provides a detailed listing of technical information incorporated into the plan.

A.5 *Ongoing Public Participation and Plan Maintenance*

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 mitigation strategy implementation to this group on an annual basis.

The City will maintain the www.CityofBerkeley.info/Mitigation website and the Mitigation@CityofBerkeley.info email address. Community members will be able to submit feedback during the implementation of this plan through this website and email address.

Additionally, 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 as one means of reporting implementation progress to the community.

A.6 *Plan Monitoring and Updates*

Each action in the Mitigation Strategy identifies a Staff Lead. The Staff Lead will be responsible for monitoring and reporting on progress of their assigned action(s). As part of their day-to-day work, Staff Leads will monitor, evaluate and report on the progress of LHMP actions at necessary meetings with other staff, institutional community partners, the Disaster Council, relevant City commissions, and the Berkeley City Council.

The Office of Emergency Services will monitor progress of these actions as they relate to the LHMP overall. At the beginning of each calendar year, each identified Staff Lead will meet with OES to provide a specific progress report. In these meetings, the Staff Lead will:

- Provide qualitative and quantitative evaluation of City progress on actions
- Identify any necessary changes to existing Plan actions in order to more effectively achieve stated purpose and goals
- Identify new Plan actions to be incorporated into the Strategy

In this way the individual actions in the plan will be updated during the five-year cycle. The Office of Emergency Services will maintain this information during this five-year cycle in order to facilitate the update process for the 2024 LHMP.

Contents

Tables in Section B: Hazard Analysis

Maps in Section B: Hazard Analysis

B. Hazard Analysis

To become disaster resilient, a community must first understand the existing hazards and their potential impacts. Berkeley is exposed to a number of natural and human-caused hazards that vary in their intensity and impacts on the city. This mitigation plan addresses six natural hazards: earthquake, wildland-urban interface (WUI) fire, flood, landslide, tsunami, and extreme heat. Each of these hazards can occur independently or in combination, and can also trigger secondary hazards.

Although this plan is focused on natural hazards, three human-caused hazards of concern are also discussed: hazardous materials release, climate change,[1] and terrorism. They are included because of their likelihood of occurrence and the magnitude of their potential consequences.

The analysis of hazards in this plan has the following components:

- Historical Events. Within recent history the city has experienced the effects of all hazards addressed in this plan. Descriptions of the impacts of these disasters help illustrate some of the types of damage they can cause.

- Hazard. Describes the ways that each hazard can damage the community, and maps the locations in Berkeley that are particularly prone to specific hazards, such as the "one-percent annual chance" floodplain. Areas that could experience secondary hazards, such as liquefaction following earthquakes, are also discussed.

- Exposure and Vulnerability. This plan identifies the people, buildings and infrastructure that exist in hazard zones. Vulnerability refers to the susceptibility to physical injury, harm, damage, or economic loss of the exposed people, buildings and infrastructure. City elements exposed to each hazard are listed and mapped, and their vulnerability is discussed. This section includes discussion of cascading hazards and impacts created by the primary hazard, for example utility disruption caused by damage from earthquake shaking.

- Risk and Loss Estimates. The expected damage to be caused by future hazard events is estimated quantitatively, when possible. For most hazards, specific figures are estimated for the damage and losses that could occur. Consequences of damage on city residents and visitors are explored.

The best available technical methods were used to estimate possible losses caused by various hazards. The City's detailed GIS databases, which include carefully gathered information about building types, natural features, and important property uses, were extensively used to characterize the city's hazards.

B.1 *Hazard Analysis Summary*

First, this section summarizes the relative likelihood and severity of impact of each of the hazards identified in Sections B.5 – B.13. Next, Berkeley's key vulnerabilities to each hazard are summarized.

B.1.a Hazards Description

Sections B.5 – B.13 present hazards in Berkeley, describing their likelihood and detailing their potential consequences. 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

Rainfall-Triggered Landslide	Likely	Moderate
Floods	Likely	Minor
Tsunami	Possible	Moderate
Climate Change	Likely	Unknown*
Extreme Heat	Likely	Unknown*

**Consequence levels for climate change and extreme heat have not been assigned values, as adequate information to make this determination is not yet available.*

Hazardous materials release is described only as a cascading impact of a natural hazard. Because this plan focuses on natural hazards as emphasized in DMA 2000, likelihood and consequence levels for hazardous materials release and terrorism are not defined.

B.1.b Identification of Hazards

B.1.b.i *Natural Hazards*

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 Commission[2]. 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.

In 2019, extreme heat was added as a specific hazard to the mitigation plan.

B.1.b.ii *Manmade Hazards*

The focus of this mitigation plan is on natural hazards as emphasized in the Disaster Mitigation Act of 2000 (DMA 2000).[3] However, the plan addresses four manmade hazards—climate change, resulting extreme heat events, hazardous materials release, and terrorism.

Climate change was specifically identified as a hazard of concern in the City's 2009 Climate Action Plan, and in 2014, climate change was added to the mitigation plan. Newly-available maps and information now allow us to identify potential climate change impacts, and to consider related mitigation actions. The 2019 LHMP specifies extreme heat events as an additional hazard of concern.

Hazardous materials release is addressed in this mitigation plan as a potential impact from a natural hazard. Terrorism is identified as a hazard of concern but is not analyzed in depth. Other

manmade hazards that could occur in Berkeley, such as ground water contamination, are not included in this plan, but may be addressed by other City programs in ongoing regulatory processes, such as activities of the Toxics Management Division.

The worst potential disaster that Berkeley could face involves multiple hazards happening at the same time. A major earthquake could trigger significant landslides, spark fires and release toxic chemicals. If an earthquake occurred during the rainy winter season, landslides would be worsened and flooding could occur, exacerbated by damaged creek culverts and storm drains. City staff conducts planning and training to respond to challenging, multi-hazard events such as these. In addition to looking at each hazard individually, this plan explores how the hazards interact, and how mitigation activities for each hazard impact the overall disaster risk in Berkeley.

B.1.b.iii *Public Health Impacts of Identified Hazards*

The City's Public Health and Environmental Health Divisions have provided guidance on the public health impacts associated with hazards included in this plan. For example, drinking water quality is likely to be impaired after a major earthquake or flood, and air quality can be affected by a fire. Impure water and poor air quality have public health impacts, and providing accurate and timely information along with disease prevention measures are core public health functions.

In 2014, the Public Health Division participated in the Bay Area Regional Risk-Based Assessment of public health impacts of a variety of hazards. The assessment for Berkeley focused on the health impacts of a severe or moderate earthquake, a wildland/urban interface fire, and a moderate influenza pandemic. In addition to evaluating these categories of risk, the assessment focused on three sub-populations considered most vulnerable in a disaster: 1) seniors and homebound individuals with disabilities, 2) individuals with mental/behavioral health illness, and 3) UC Berkeley students in multi-unit residential housing. The assessment helps to inform our public health emergency preparedness and mitigation efforts. It also helped to engage our partners with recommendations for improving their own preparedness plans as they serve these most vulnerable populations.

B.1.b.iv *Hazards Not Considered in the Plan*

Other natural hazards that are extremely rare in Berkeley are not included in this plan; these include severe storms, which can produce prolonged low temperatures, heavy rainfall and hail; severe heat; high winds; 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 storms and extremes of cold and heat. 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.

Naturally-occurring communicable disease outbreaks (e.g. a flu pandemic; measles; norovirus) do pose a significant risk to the Berkeley community, but are not addressed in this plan. Mitigation activities for communicable disease include, for example, measures to provide and

promote a high baseline level of immunization in the community, both for routine childhood immunizations and for annual seasonal flu vaccination. The City's Public Health Division leads Berkeley's communicable disease and public health emergency preparedness planning, in conjunction with State and Bay Area local health jurisdictions.

B.1.c Hazard Location

Sections B.5 – B.13 detail the locations of all hazards addressed in this hazard analysis.

B.1.d Hazard Extent

Sections B.5 – B.13 detail the extent of all hazards addressed in this hazard analysis.

B.2 *Previous Occurrances and Future Probabilities*

Sections B.5 – B.13 detail the previous occurrences in Berkeley of each hazard in this hazard analysis and examine the propbability of future hazard events in Berkeley. Probabilities are summarized in Table 1 above.

B.3 *Vulnerabilities*

For each hazard presented in Sections B.5 – B.13, the following list summarizes Berkeley's key vulnerabilities to the structures, systems, populations, and other community assets that are susceptible to damage and loss from hazard events. For each hazard, the following information is identified:

Numbers (1, 2, 3, etc.) define the category of the vulnerability being described. If the City of Berkeley does not own or control the category, the responsible entity is included. Below each number, letters (a, b, c, etc.) highlight vulnerabilities identified in this plan.

This list identifies both primary and cascading vulnerabilities. Primary vulnerabilities are directly related to the primary natural hazard, such as building vulnerabilities to earthquake shaking. Cascading vulnerabilities result from primary vulnerabilities, and are included in the list below. For example, structures that are not seismically sound have increased vulnerability to fire following earthquake. This format demonstrates how mitigating primary vulnerabilities can also mitigate cascading impacts.

This list highlights key vulnerabilities identified through this planning process; but it is not all-inclusive.

List of Vulnerabilities:

B.3.a.i ***Earthquake (Including shaking, surface fault rupture, liquefaction, seismically- triggered landslides, and fire following earthquake)***

1. Structures
    a. City buildings vulnerable to collapse from exposure to earthquake shaking:

i. Old City Hall
ii. Veterans Memorial Building
iii. Un-assessed City buildings may be vulnerable to earthquake shaking and ground failure

b. Privately-owned buildings
   i. Soft-story buildings: 70 unretrofitted soft-story buildings vulnerable to damage/collapse from exposure to earthquake shaking
   ii. 6 unretrofitted unreinforced masonry (URM) buildings vulnerable to collapse from exposure to earthquake shaking. 274 retrofitted URM buildings vulnerable to moderate or greater damage from exposure to earthquake shaking
   iii. Non-ductile concrete buildings are vulnerable to collapse and perform poorly during earthquakes.
   iv. Ridid wall flexible diaphragm buildings including tilt up buildings may also be highly sustceptible to adverse affects from earthquakes, such as collapse during ground shaking.
   v. If buildings are damaged/collapse from exposure to earthquake shaking or ground failure:
      1. Buildings are more vulnerable to gas line rupture at service connections
      2. Buildings are more vulnerable to fire following earthquake
      3. People more vulnerable to injury/death from exposure to building damage/collapse
      4. People are more vulnerable to illness from exposure to asbestos or encapsulated asbestos, which may dislodge in an earthquake

c. Healthcare Facilities (Alta Bates Summit)
   i. Five Alta Bates Campus buildings are vulnerable to damage from exposure to earthquake shaking
   ii. Four buildings on the Herrick campus are vulnerable to major damage from earthquake shaking
   iii. People in and around four buildings on the Herrick campus are vulnerable to injury or death from exposure to seismic building damage

d. School Facilities (Berkeley Unified School District)
   i. Unreinforced Masonry Building at BUSD Corporation Yard vulnerable to damage from earthquake shaking
   ii. People in and around Unreinforced Masonry Building at BUSD Corporation Yard are vulnerable to injury/death from exposure to seismic building damage

e. BART
   i. BART tracks in Berkeley vulnerable to damage from earthquake shaking

f. Railroad (Union Pacific)
   i. Railroad infrastructure vulnerable to damage from exposure to earthquake shaking and liquefaction (specific vulnerability unknown)
   ii. If railroad infrastructure is damaged due to earthquake shaking and/or liquefaction:
      1. Trains more vulnerable to accidents
      2. People more vulnerable to illness/injury from exposure to hazardous

materials, if trains carrying hazardous materials

g. Highways and Interstate (Caltrans)
    i. Interstate 80 vulnerable to damage from exposure to liquefaction
    ii. Parts of Highways 13 and 24 vulnerable to damage from exposure to liquefaction
    iii. Overpasses at Ashby and University Avenues vulnerable to damage from exposure to earthquake shaking (but are not expected to collapse).
    iv. If roads are damaged from earthquake shaking and/or liquefaction:
        1. People in vehicles more vulnerable to injury/death in accidents
        2. People vulnerable to injury/death from exposure to hazardous materials, if transportation accidents occur involving vehicles carrying hazardous materials

h. Streets/Curbs/Solano Tunnel
    i. Solano Tunnel vulnerable to isolation if fault rupture or earthquake- induced landslide in surrounding areas cause road blocks
    ii. Streets and curbs vulnerable to damage from exposure to liquefaction, fault rupture and earthquake-induced landslides
    iii. If significant street damage impedes access by emergency responders to fight fires, perform rescues, access utilities or perform other emergency response actions:
        1. People vulnerable to additional injuries/death
        2. Structures and infrastructure vulnerable to additional damage

i. Hazardous Materials
    i. If earthquake shaking causes lab spills, storage tank failures and/or industrial equipment problems, people in Berkeley vulnerable to injury/death from exposure to hazardous materials release

2. Systems
    a. Water system (EBMUD)
        i. Water pipes vulnerable to rupture from exposure to liquefaction, landslide-induced earthquake and fault rupture
        ii. If water pipes rupture due to earthquake shaking or ground failure, structures more vulnerable to damage/destruction from fire following earthquake.
        iii. Depending on the severity of earth movement, water and sewer lines may break, and the safety of the drinking water supply may be compromised.
    b. Sanitary Sewer System
        i. Sanitary sewer system vulnerable to blockage/pipe rupture/damage from exposure to liquefaction, landslide-induced earthquake and fault rupture
        ii. If sanitary sewer system is blocked/ruptured/damage from seismic ground failure, roads and buildings more vulnerable to sinkhole
    c. Storm Drain System
        i. Storm drain system vulnerable to blockage/rupture/other damage from exposure to liquefaction, landslide-induced earthquake and fault rupture
    d. Electricity System (PG&E)
        i. Utility poles vulnerable to toppling from exposure to earthquake shaking and from exposure to liquefaction, landslide-induced earthquake and fault rupture

ii. Aboveground utility lines vulnerable from exposure to falling trees and structure collapse from earthquake shaking and from exposure to liquefaction, landslide-induced earthquake and fault rupture
iii. PG&E Electrical substations vulnerable to damage from exposure to earthquake shaking and from exposure to liquefaction, landslide- induced earthquake and fault rupture
iv. Underground cables vulnerable to rupture from exposure to liquefaction, landslide-induced earthquake and fault rupture
v. If power is lost, there will be many impacts to vulnerable City and private infrastructure.

e. Natural Gas System (PG&E)
   i. Gas transmission pipeline, distribution lines and service lines and valves in west Berkeley vulnerable rupture from exposure to liquefaction
   ii. Gas distribution lines, service lines and valves vulnerable to rupture from exposure to earthquake-induced landslides and fault rupture
   iii. If gas system ruptures occur, fire following earthquake is more likely, and:
      1. Infrastructure/buildings are more vulnerable to damage/destruction
      2. People are more vulnerable to injury/death

f. Aviation Fuel System (Kinder Morgan)
   i. Exposed to liquefaction (specific vulnerability unknown)

g. Communication Systems
   i. Land line telephone distribution system and cable system use utility poles, which are vulnerable to toppling from exposure to earthquake shaking and ground failure
   ii. Underground communication lines vulnerable to rupture from exposure to earthquake-induced landslides, fault rupture and liquefaction
   iii. Mobile phone system antennae vulnerable to:
   iv. Damage from earthquake shaking
   v. Power outage from damage to electrical infrastructure (vulnerability increased if generators not onsite)
   vi. If communication systems are damaged due to earthquake shaking and ground failure:
      1. Cellular voice communication may be unusable due to earthquake impacts, combined with high demand. Voice communication is more vulnerable than SMS text messaging systems.
      2. Cable customers may experience a total loss of video service, and total loss or severe network congestion of voice and data services.

3. Populations
   a. People in Berkeley are exposed to ground shaking, landslides, liquefaction, in addition to fire following earthquake.
   b. A number of the cascading impacts of earthquake on people are mentioned above in the relevant section.

B.3.a.ii *Wildland-Urban Interface Fire*

1. Structures
   a. 8,300 properties in Fire Zones 2 and 3 vulnerable to damage/destruction from

exposure to WUI fire
   b. 215 dwelling units in Fire Zone 3 - Panoramic Hill area (280 including Oakland units) especially vulnerable to damage/destruction from exposure to WUI fire, due to undersized water main and limited access routes for firefighters
   c. Wooden buildings with narrow side yards and dense vegetation in Fire Zone 1 vulnerable to damage/destruction from exposure to a WUI fire beginning in Fire Zone 2 or 3
2. Populations
   a. Residents and firefighters in Fire Zone 2 vulnerable to injury/death from exposure to WUI fire
   b. 520 residents in Panoramic Hill area (620 including Oakland residents) especially vulnerable to injury and death from exposure to WUI fire, due to limited access/egress routes
   c. Berkeley residents and visitors vulnerable to eye and respiratory illnesses from exposure to air pollution caused by large WUI fires
3. Electricity system (PG&E)
   a. Cascading Vulnerabilities
      i. If exposed to extreme heat from WUI fire:
         1. Utility poles vulnerable to toppling
         2. Aboveground utility lines vulnerable to burning
         3. Underground cables vulnerable to melting
4. Natural Gas System (PG&E)
   a. Gas service connections vulnerable to rupture in buildings exposed to WUI fire
   b. Structures, Infrastructure and People/Natural Gas System (PG&E)
   c. People, structures and infrastructure in areas exposed to gas line rupture vulnerable to additional fire exposure
5. Communication Infrastructure (AT&T)
   a. Land line telephone distribution system uses utility poles, which are vulnerable to toppling if exposed to heat from WUI fire
6. Streets and curbs
   a. Streets and curbs in Fire Zones 2 and 3 vulnerable to damage/destruction from exposure to WUI fire
7. Storm drain system
   a. Drainage structures in Fire Zones 2 and 3 vulnerable to damage/destruction from exposure to WUI fire
8. Structures and Infrastructure
   a. Structures and infrastructure in fire-burned areas in Fire Zones 2 and 3 vulnerable to damage/destruction from exposure to landslide and flooding

B.3.a.iii ***Rainfall-triggered landslides***

1. Structures
   a. Approximately 6,000 structures vulnerable to damage or destruction from exposure to landslide
2. Systems
   a. Water system (EBMUD)
      i. Water pipes vulnerable to rupture from exposure to landslide

b. Sanitary Sewer System
    i. Sanitary sewer system pipes vulnerable to rupture from exposure to landslide
c. Storm Drain System
    i. Storm drain system vulnerable to blockage/rupture/other damage from exposure to landslide
d. Electricity System (PG&E)
    i. Utility poles and aboveground utility lines vulnerable to toppling from exposure to landslide
    ii. Underground cables vulnerable to rupture from exposure to landslide
e. Natural Gas System (PG&E)
    i. Gas distribution and service lines and valves in Berkeley hills vulnerable to rupture from exposure to landslide

B.3.a.iv ***Floods***

1. Structures
    a. 475 structures vulnerable to damage to first floor and basement finishes, contents and appliances from exposure to up to 1 foot of flooding. 200 additional structures, also primarily in the City's west, are vulnerable to damage from exposure from up to two feet of flooding.
    b. Streets, structures and infrastructure in the Potter Watershed are vulnerable to damage from exposure to localized flooding in the following locations:
        i. San Pablo Avenue between Ward and Murray
        ii. California Street between Woolsey and Harmon
        iii. Woolsey Street between California and Adeline
        iv. Woolsey Street at Dana
        v. Ashby Avenue between California and King
        vi. Martin Luther King, Jr. Way between Russell and Woolsey
        vii. Parker Street between Seventh and Fourth
        viii. Fulton Street at Derby
        ix. Ellsworth Street between Blake and Parker
        x. Telegraph Avenue between Ashby and Woolsey
        xi. Telegraph Avenue at Stuart
        xii. College Avenue at Dwight
    c. Streets, structures and infrastructure in the Cordonices Watershed are vulnerable to damage from exposure to localized flooding in the following locations:
        i. Second Street, Creek corridor to Gilman
        ii. Railroad tracks, Creek corridor to Gilman and to Albany
        iii. Gilman Street between Sixth and Second
        iv. Codornices Creek at Sixth, at most street crossings east of San Pablo, at Glen
        v. Ninth Street between Harrison and Creek Corridor
        vi. Monterey Ave between Posen and Hopkins
        vii. Hopkins Street at Carlotta
        viii. The Alameda between Napa and Yolo
        ix. Sonoma Ave between Fresno and Hopkins
        x. Spruce Street, Eunice to Creek corridor
        xi. Euclid Ave, Cragmont to Codornices Park

xii. Cragmont, Euclid to Regal
xiii. Various locations on La Loma, Glendale, Campus Drive, Queens, Shasta Road

B.3.a.v *Tsunami*

1. Structures
    a. City buildings exposed to tsunami inundation (the extent of each building's vulnerability is unknown)
        i. Dona Spring Animal Shelter
        ii. Marina Boat Docks
        iii. Berkeley Yacht Club
        iv. Shorebird Nature Center
        v. Marina Corporation Yard
        vi. Marina Administration Building
    b. Privately-owned structures in the Marina and on the western edge of Berkeley exposed to tsunami inundation. The extent of each building's vulnerability is unknown.
2. Populations
    a. Estimated 23 traditional households and over 200 individual Marina boat residents are exposed to tsunami inundation. Specific vulnerability is unknown.
    b. Estimated that staff/customers at 77 businesses are exposed to tsunami inundation. Staff and guests at the DoubleTree hotel alone may account for 600+ people.
    c. Estimated that 1,664 employees at four government offices are exposed to tsunami inundation. Specific vulnerability unknown.
3. Systems
    a. Gas Dock, Docks B-K, and Dock O have moderate vulernability to some tsunami events
    b. Key roads exposed to tsunami inundation:
        i. Ramps to University Avenue Bridge
        ii. Frontage road north to Gilman Street
        iii. Frontage road south to Ashby Avenue/CA-13
        iv. Interstate 80
        v. Ramps to I-80 Bicycle/Pedestrian overcrossing: Specific vulnerability is unknown.
4. Other community assets
    a. 1,000 boats in Marina slips exposed to tsunami inundation. Specific vulnerability unknown.

B.3.a.vi *Climate Change*

1. Structures
    a. Structures in low-lying areas around Berkeley Aquatic Park, as well as land around the Berkeley Marina and infrastructure east of the highway along 2nd Street, are exposed to sea level rise. Specific vulnerability is unknown.
    b. Sea level rise will cause the groundwater table and stream water levels to rise, increasing the structures exposed to liquefaction in an earthquake. Specific

increase in vulnerability unknown.
   c. Rising sea levels will increase the structures exposed to tsunami inundation. Specific increase in vulnerability unknown.
   d. Increases in the intensity and frequency of winter storms due to climate change will increase exposure to landslides for structures in the Berkeley hills. Specific increase in vulnerability unknown.
   e. More structures will become vulnerable to damage from exposure to flooding
2. Systems
   a. Flooding resulting from sea level rise in combination with severe storms may threaten natural gas pipelines regionally. This 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.
   b. Drought affects local water supply for urban, agricultural, and environmental uses, and can also increase wildfire hazard, and may be correlated with high heat conditions.
3. Populations
   a. People vulnerable to increased incidences of West Nile virus, human hanta virus, and Lyme disease from increased exposure to disease vectors, caused by increases in air temperature and changes in precipitation.
   b. Climate change is likely to exacerbate the natural hazards of concern identified in the plan, making more people vulnerable to their impacts.

B.3.a.vii ***Extreme Heat***

1. Structures
   a. High temperatures can damage critical transportation infrastructure, such as roads.
2. Populations
   a. People with disabilities, chronic diseases, the elderly, and children under five are the most at risk to heat-related illnesses.
   b. Communities of color and the poor suffer during extreme because of lack of access to common heat adapation strategies.
3. Systems
   a. Extreme heat often leads to power outages because of the extra demand on the power grid.
4. Other community assets
   a. Extreme heat can cause stagnant air conditions and ground-level ozone.
   b. Extreme heat dries out vegetation.
      i. Cascading Vulnerability
         1. Dry vegetation can act as fire fuel, promoting spread of WUI fires.

B.4 *NFIP-Insured Structures*

The City of Berkeley does not have NFIP-insured structures that have been repetitively damaged by floods.

SECTION I: HAZARDS OF GREATEST CONCERN

Earthquakes and wildland-urban interface (WUI) fires are the hazards of greatest concern to Berkeley. Both of these hazards have a relatively high likelihood of occurrence and the potential for widespread damage within the city and the greater east bay region. Berkeley is committed to reducing the impact of these hazards on the city, and therefore they are the primary focus of the mitigation actions identified in Element C: *Mitigation Strategy* of this plan.

B.5 *Earthquake*

B.5.a Historical Earthquakes

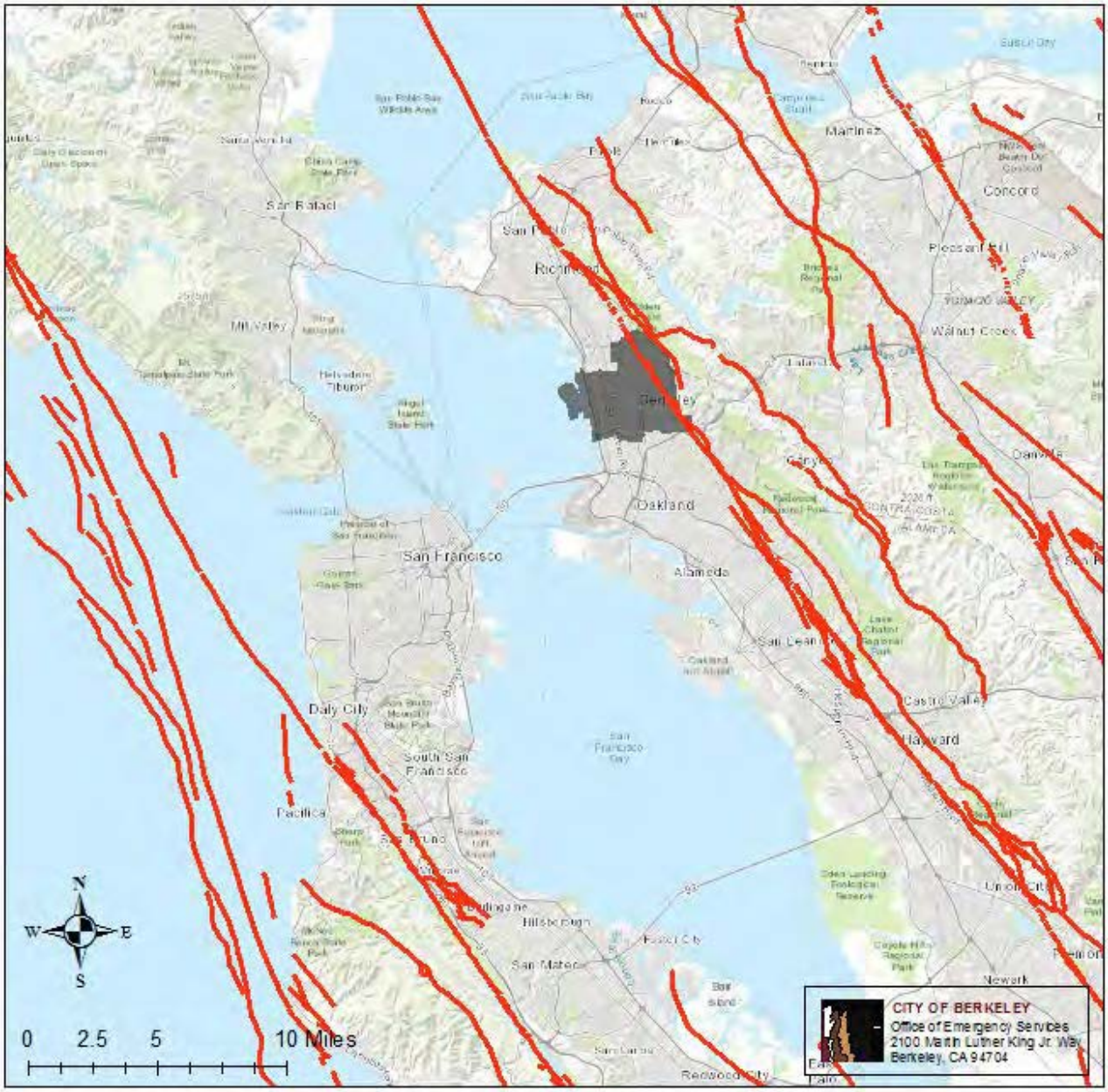
Destructive earthquakes struck the Bay Area in 1838, 1868, 1898, 1906, 1911, 1989, and 2014. Impacts of the earlier earthquakes in Berkeley are not well documented, but the damage of the 2014 Magnitude (M) 6.0 South Napa Earthquake is fresh in the memory of many Berkeley residents. It took the lives of two people, injured 300 others, and caused moderate to severe damage to more than 2,000 structures.[4] 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.

B.5.b Earthquake Hazard

Map 1 shows the city of Berkeley and its proximity to known active geologic faults in the San Francisco Bay Region. Faults are indicated with red lines. The Hayward fault, of particular concern, stretches from the middle of San Pablo Bay, runs directly beneath Berkeley, and terminates in Hayward. However, 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 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

City of Berkeley

USGS states that 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.[5] There is a 33% chance that a 6.7 or greater will occur on the Hayward fault system between 2014 and 2043.[6] This means that many Berkeley residents will experience a severe earthquake in their lifetime.

To provide a historical context, the 1994 Northridge earthquake, which caused an economic loss of $40 billion dollars,[7] was a M 6.7 earthquake. This strength of earthquake in the Bay Area would produce strong shaking and ground failure throughout the region, causing significant damage in nearly every Bay Area city and county.

Earthquake Scenarios

Scenarios are used to help us understand and prepare for disasters, by painting a detailed, vivid, realistic picture of what it would be like if such an event occurred under current social and economic conditions. Scenarios are not predictions, and should be treated as a tool to drive and support the hazard mitigation planning process.

HAZUS, an earthquake loss estimation program developed by FEMA, was used to estimate damage to buildings, economic losses, deaths and injuries, and shelter requirements after an earthquake. This plan includes information from both a 2004 earthquake scenario and the 2018 HayWired scenario developed by the USGS to help illustrate the potential impacts of a catastrophic earthquake near Berkeley.

B.5.b.i *Ground Shaking*

The most significant physical characteristic of a major earthquake is 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 underlying a city, 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.

Weak soils, such as bay mud and fill at the city's waterfront, also experience strong shaking in earthquakes, even from distant quakes. According to the USGS, as seismic waves pass from rock to soil, they slow down but get bigger. Hence a soft, loose soil may shake more intensely than hard rock at the same distance from the same earthquake. An extreme example for this type of amplification was in the Marina district of San Francisco during the 1989 Loma Prieta earthquake. That earthquake was 100 kilometers (60 miles) from San Francisco, and most of the Bay Area escaped serious damage. However, some sites on landfill or soft soils, like San Francisco's Marina district, experienced significant shaking.

Magnitude and Intensity[8]
Two commonly-used scales represent different earthquake characteristics: magnitude and intensity.

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.

As shown in Table 2, 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.

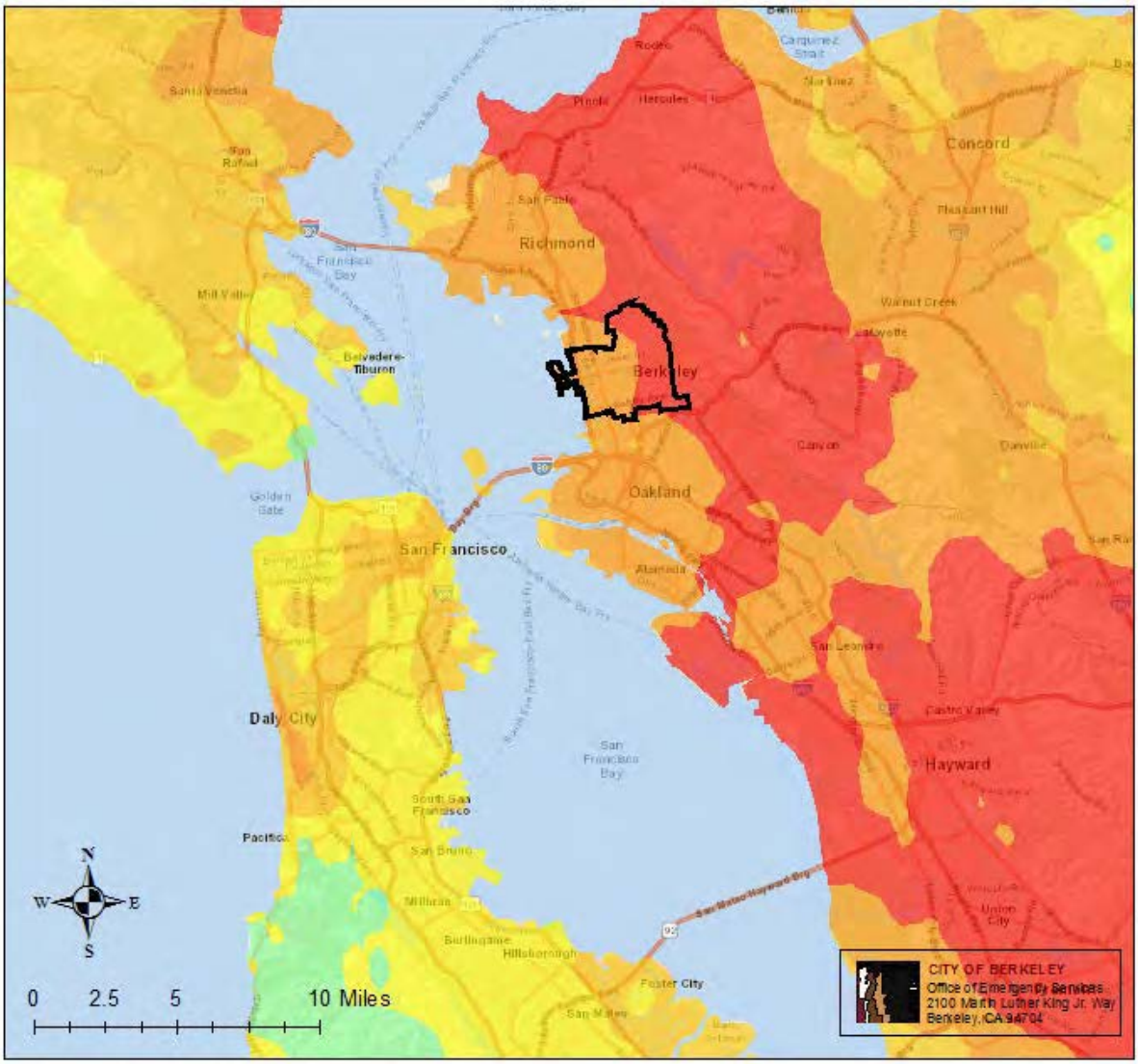
Table 2. MMI descriptions[9]

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 build 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.

Map 2 shows the different levels of intensity anticipated across the Bay Area in the HayWired Scenario. The map shows that most intense shaking will be felt along the East Bay, stretching from Pinole to south of Hayward.

Map 2 depicts Berkeley in orange and red, indicating that in this scenario, Berkeley will experience severe and violent shaking, associated with MMI Levels VIII and IX.

Map 2. ***Modified Mercalli Intensity for HayWired Earthquake Scenario***



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

City of Berkeley

I (Not Felt)
II - III (weak shaking)
IV (light shaking)
V (moderate shaking)
VI (strong shaking)
VII (very strong shaking)
VIII (severe shaking)
IX (violent shaking)
X+ (extreme shaking)

B.5.b.ii *Ground Failure*

Earthquakes can cause the ground to fail in several ways: through surface fault rupture, liquefaction, and seismically-triggered landslides.

Ground Failure Maps
This section presents maps to explore Berkeley's exposure to different types of ground failure. When a map is presented, the title indicates whether it is a:

- General Susceptibility Map
- Seismic Hazard Planning Zone Map
- Scenario Map

These maps present different information from different sources and cannot always be compared side-by-side. Each of these map types is describe below; readers are encouraged to refer back to these definitions when reviewing maps in this section.

General Susceptibility Maps
General susceptibility maps show areas that are exposed to a particular hazard. They show areas that are more prone to experiencing the hazard over time. These maps do not refer to any specific event circumstances, like a particular earthquake with a specific epicenter, Magnitude, and depth.

Seismic Hazard Planning Zone Maps[10]
Seismic Hazard Planning Zone Maps are a type of General Susceptibility map that deals with ground failure. These State regulatory maps do not consider a particular earthquake event, and instead are used:

- To support land use decisions by identifying areas where future earthquake-induced ground failure is more likely to occur, and
- To determine whether approval of more in-depth site-specific hazard investigation and mitigation may be required for certain projects during the construction permitting process.[11]

HayWired Scenario Maps
HayWired maps show the three types of ground failure in a specific earthquake scenario. This type of map helps planners to consider the general impacts of a catastrophic earthquake on the Hayward fault. However, these maps should be used carefully and not be considered an accurate predictor of the future. The data used to make these maps is not granular enough to predict an earthquake's impact at a specific address or location. Further, the specific location and magnitude of Berkeley's next big earthquake is unlikely to match this scenario exactly.

B.5.b.iii *Surface Fault Rupture*

Fault slip describes movement of the earth at fault lines. The movement can be very slow (fault creep) or very sudden (coseismic slip, which is part of all earthquakes).

Generally this movement occurs miles below the surface. When the fault slips all the way to the surface, this is called surface fault rupture. In surface fault rupture, one side of a fault can shift by several feet vertically and horizontally from its previous location. This can severely damage structures that cross the fault, including buildings, roads, pipelines, and train tracks.

The Earthquake Fault Planning Zone in Berkeley is indicated in red on Map 3. The Zone includes an area approximately ¼-mile wide along the Hayward fault, which runs in the northwest-southeast direction along the base of the hills in the eastern portion of the city. This Zone indicates the area of Berkeley that is exposed to surface fault rupture.

Fault rupture may not occur in every earthquake, but when it does, it is likely to be concentrated in a narrow zone, with small parallel surface ruptures occurring over a wider area. If fault rupture occurs, potential impacts include damage to:

- Underground and aboveground utilities (electricity, water, sewer) and communications conduits that cross the fault
- Gas lines that cross the fault, causing fire ignitions
- Important east-west streets, making travel between the hills and flatland areas difficult where displacements are large
- The Solano Tunnel, which is an important transportation connection in the north-south direction
- Buildings, due to ground displacement.

Map 3. ***California Geological Survey Earthquake Fault Planning Zone***

Source: California Geological Survey, Earthqauke 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

Earthquake Fault Zone

City of Berkeley

B.5.b.iv *Seismically-Triggered Landslides*

Rainfall-triggered landslides are described in detail in Section B7.

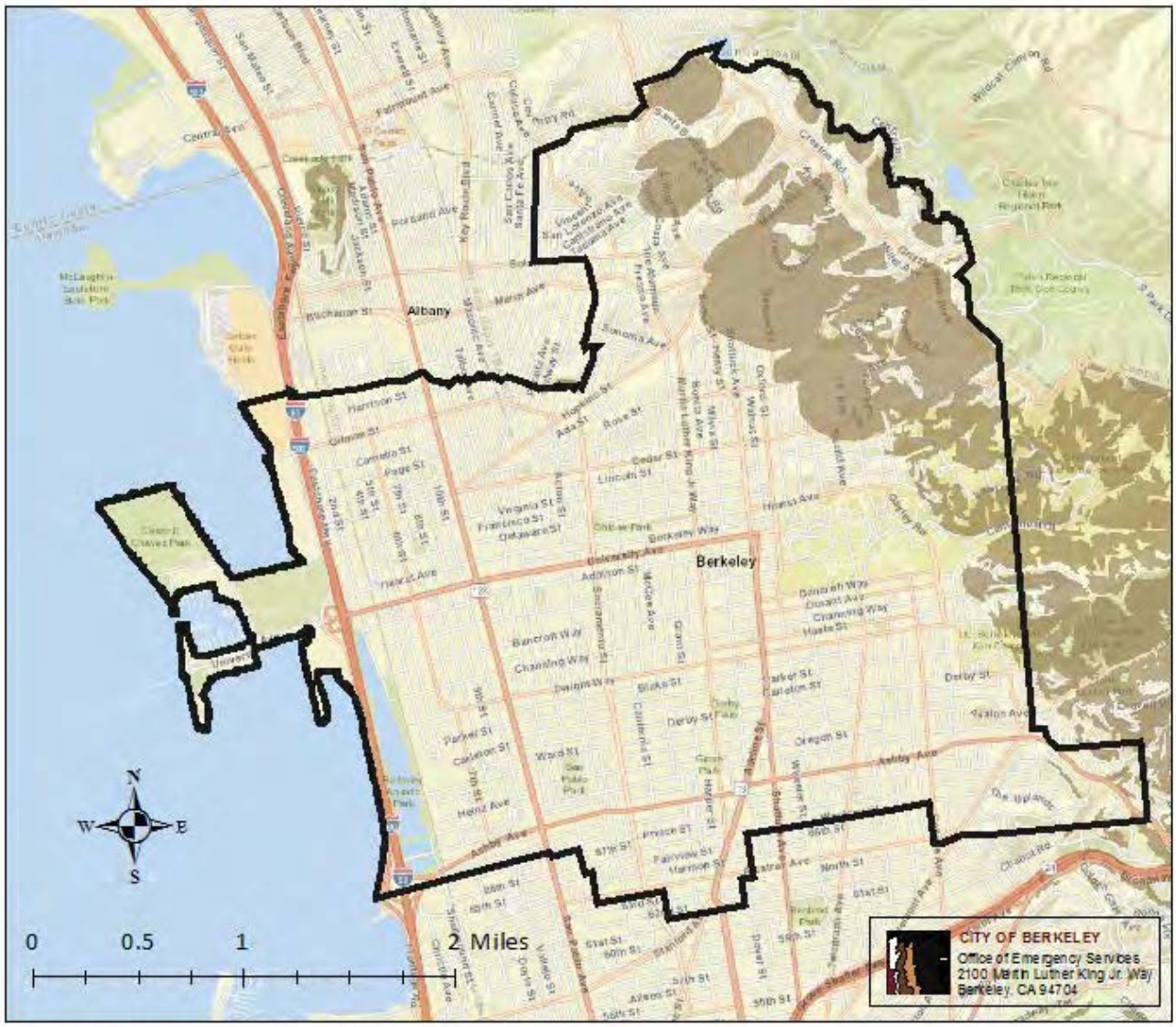
Seismically-triggered landslides can result in significant property damage, injury and loss of life. Berkeley expects to experience landslides during the next earthquake, particularly if the earthquake occurs during the rainy winter months. While rainy weather or earthquakes could cause small landslide events that would impact a few homes, strong earthquake shaking coincident with wet, saturated hills presents a worst-case scenario.

Movement could range from a few inches to tens of feet, but ground surface displacements as small as a few inches are enough to break typical foundations. Even small aftershocks could continue to cause slides for weeks and months after a quake, blocking roads and damaging homes. Even small landslide displacements caused by earthquake shaking can open surface cracks, which allow subsequent rainfall to infiltrate the slide mass and cause instability long after the earthquake.

In Berkeley, the potential for landslide from seismic activity is high in the hill areas and along creek banks. Areas of Berkeley that are exposed to seismically-triggered landslides are displayed in increasing levels of detail on the three maps described below.

The California Geological Survey has identified the areas of Berkeley with potential to experience earthquake-induced landslide. These areas are shown in brown on Map 4. These areas are identified by combining information on rock or soil strength, slope gradient (steepness), and anticipated future shaking levels. All areas underlain by known active or dormant landslides are included in the zone. Map 4 indicates that significant portions of the Berkeley hills have the potential to experience earthquake-induced landslide.

Map 4. ***California Geological Survey Earthquake-Induced Landslide Planning Zone***



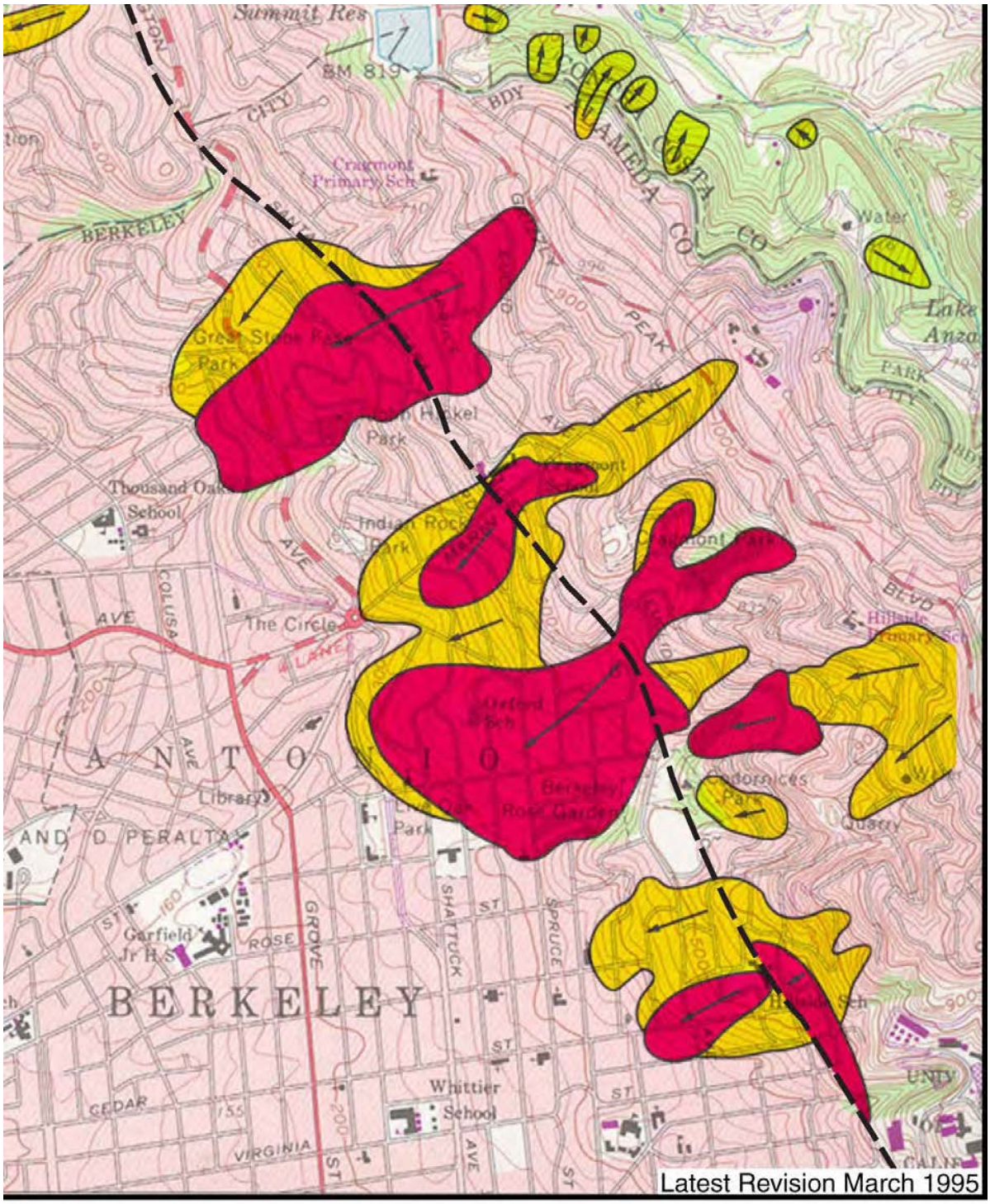
Source: California Geological Society, Earthquake-Induced Landslide Planning Zone.
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

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. This map illustrates this area in particular because the area 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.

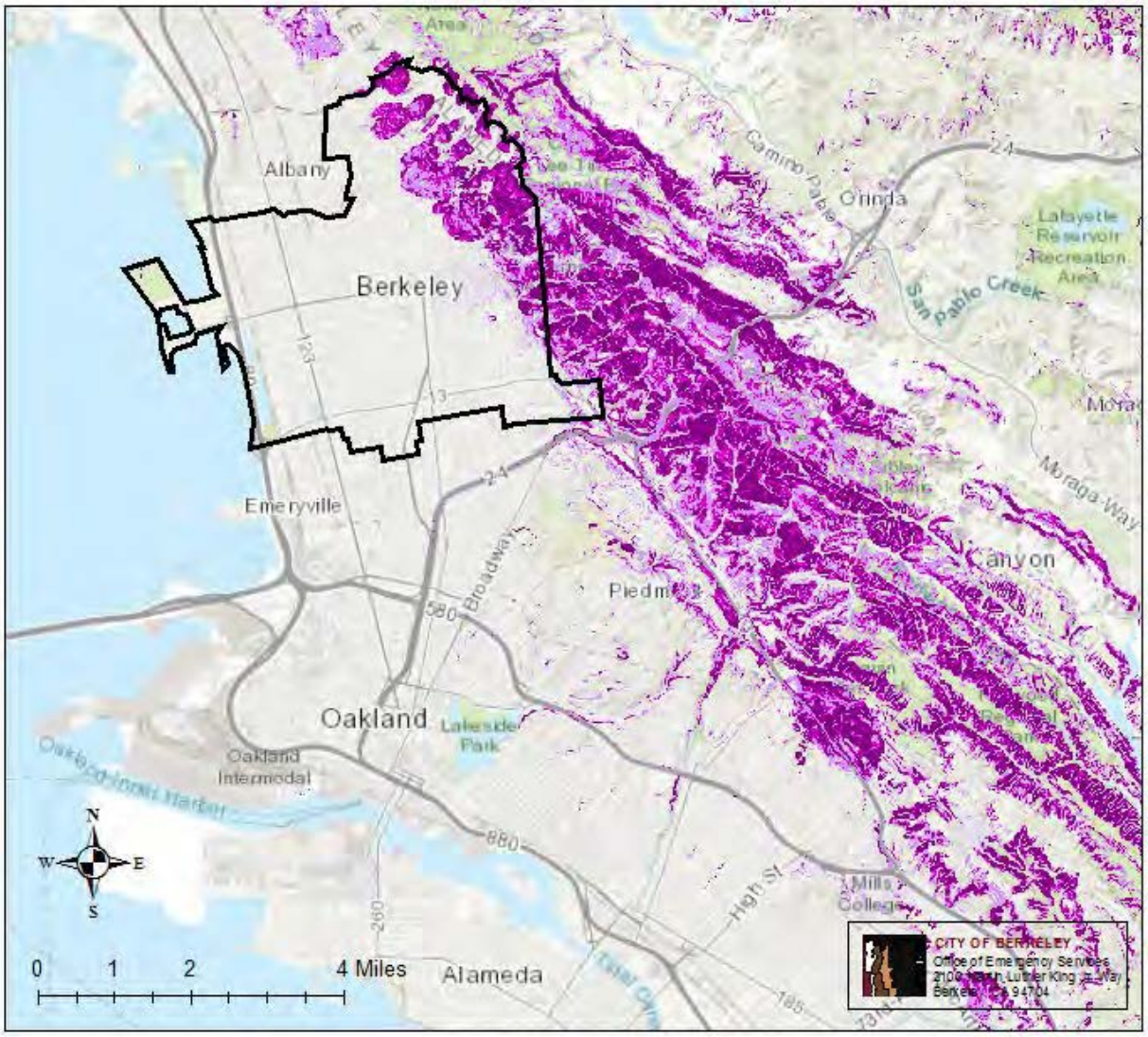
Map 5. ***Active and potentially-active landslides in Berkeley hills (developed by Alan Kropp Associates and used with permission)***



Map 6 shows where landslides are most likely to occur during the mainshock of the HayWired scenario earthquake. To make this prediction, scientists at USGS considered ground shaking intensity, the geology of the study area, and elevation. Probability of landslide is presented as Medium (lavender areas), High (magenta areas), and Very High (dark purple areas). The maps shows that in Berkeley, the chance of landslide exists only in the hills, with probabilities ranging from 2% to greater than 32% in some places.

Map 6 is presented at a scale that is appropriate to ensure accuracy of the data. Presenting data at a parcel level could produce inaccurate results.

Map 6. ***Probability of Landslide in HayWired Earthquake Scenario***



Source: USGS, HayWired Scenario, August 2017.
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, © OpenStreetMap contributors,

City of Berkeley
Medium (2-15%)
High (15-32%)
Very High (>32%)

There are few generally-accepted methods to estimate damage from landslides caused by earthquakes.

Earthquake-induced slides may occur at the time of a major earthquake, or in subsequent aftershocks or rainstorms. Residents may have some warning that slides are imminent, helping to reduce damage and casualties. Landslide consequences would be seen primarily in the hills areas of Berkeley, and would likely include:

- Damage to structures, primarily residences. Damage homes could vary considerably, depending on their location and the quality of their foundations, and if there are any retaining walls. Some houses could be entirely destroyed or moved down the hill, while others could see minimal, repairable damage.

- Gas line rupture, igniting multiple fires

- Water line rupture, reducing water supply to fight fires

- Rupture of other underground and aboveground utility and communication systems

- Distortion of major and minor roads. This would make access difficult or impossible for firefighters and other emergency responders. It would also make egress difficult for residents of impacted areas.

B.5.b.v ***Liquefaction***

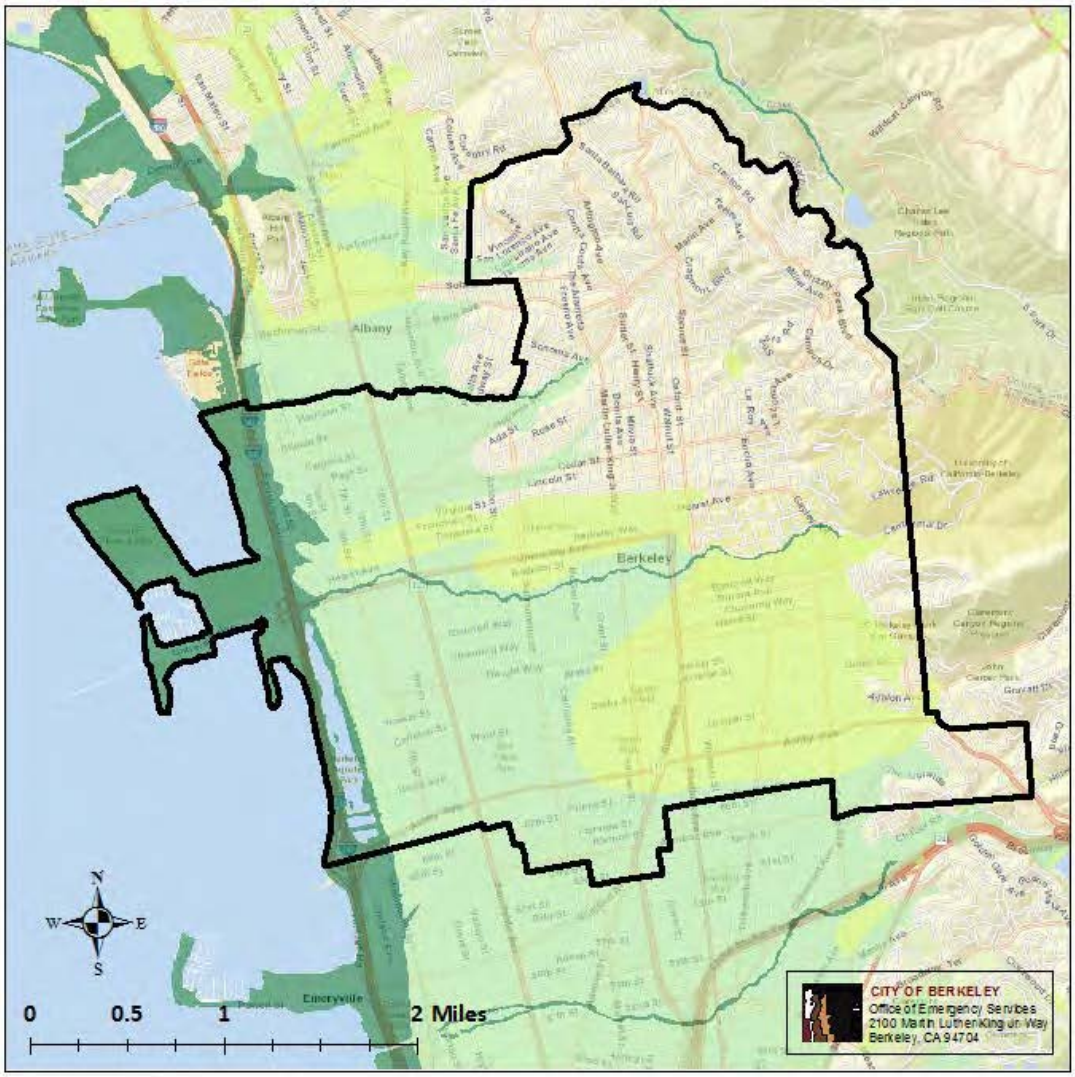
Liquefaction is a phenomenon that occurs in wet, sandy or silty soils. When shaken, the soil grains consolidate, pushing water towards the surface and causing a loss of strength in the soil. The ground surface may sink or spread laterally. Structures located on liquefiable soils can sink, tip unevenly, or even collapse. Pipelines and paving can tear apart.

Three ingredients are necessary for liquefaction to occur:

1. Liquefiable sediments
2. Ground shaking
3. Groundwater within three meters of the surface

In an earthquake, liquefiable soils need to be shaken hard and long enough to trigger liquefaction. The USGS classified sediments in the Bay Area based on their susceptibility to liquefaction. Map 7 depicts in various shades of green the areas in Berkeley where soil types and groundwater conditions are more or less susceptible to liquefaction.

Map 7. ***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

City of Berkeley
Very low
Low
Moderate
High
Very high

Map 8 shows the liquefaction predicted to occur in Berkeley in a magnitude 7.0 earthquake on the Hayward fault, as explored in the HayWired scenario.

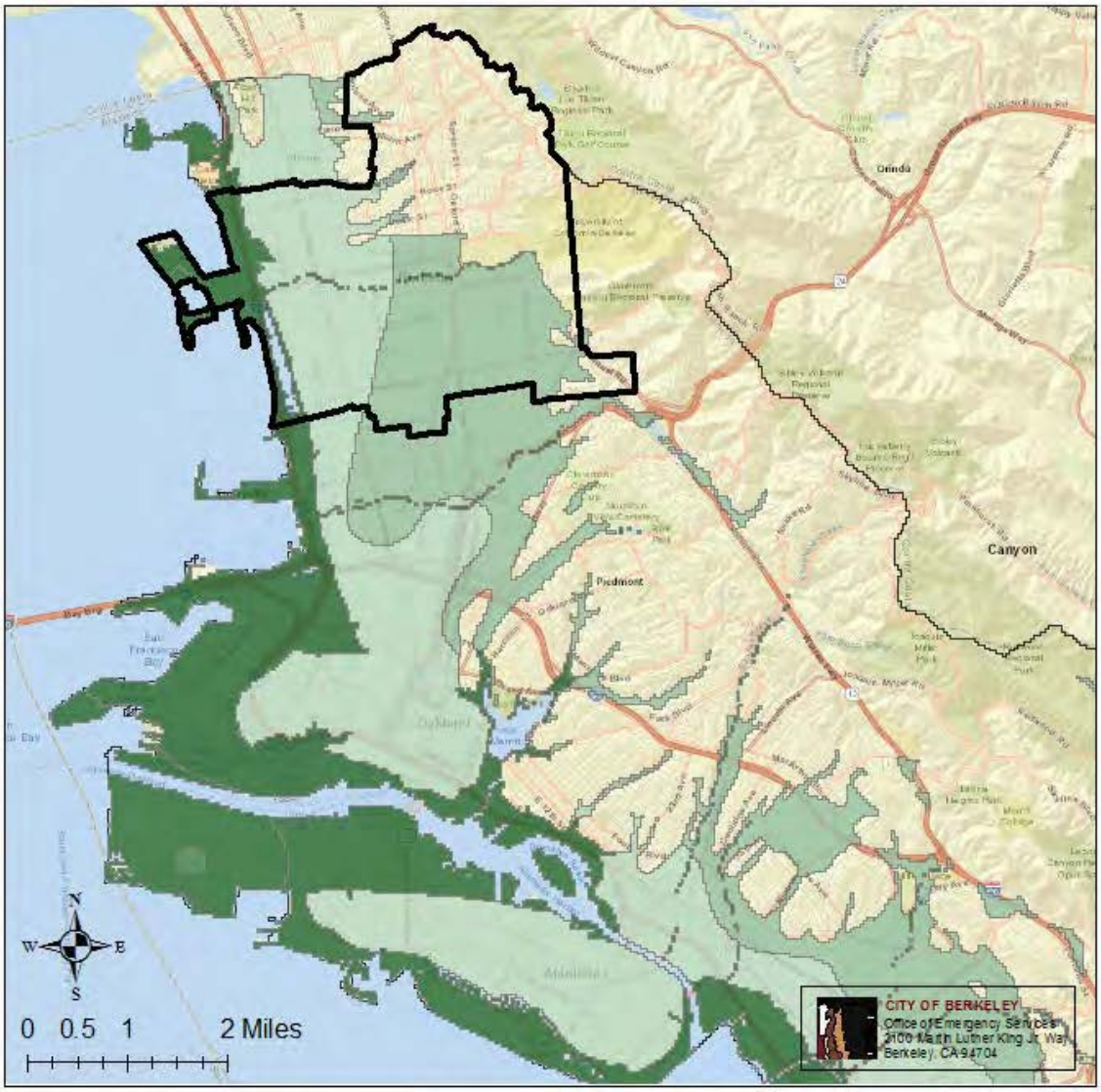
To make this prediction the USGS considered areas' general susceptibility to liquefaction (as shown above in Map 7) and expected levels of ground shaking in the HayWired scenario earthquake. The resulting map divides Berkeley and surrounding areas by their likelihood of experiencing liquefaction.

The probability is highest in west Berkeley along the Bay at 40% or greater, shaded in dark green. This area includes Interstate 80, Aquatic Park, and the Berkeley Marina. The probability decreases to 10% or less in the central and southern parts of Berkeley.

Percentages in this map can also be interpreted as the likelihood that any particular location within an area will experience liquefaction in the HayWired scenario.

Sea-level rise resulting from climate change may raise the water table in Berkeley and increase the areas of Berkeley that are susceptible to liquefaction.[12]

Map 8. ***Probabiliy of Liquefaction in Berkeley in HayWired Earthquake Scenario***



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

- City of Berkeley
- Not assessed
- Less than 5%
- 5% to 10%
- 10% to 20%
- 20% to 30%
- 30% to 40%
- Greater than 40%

B.5.b.vi *Fire Following Earthquake*

Significant portions of the following section were originally developed for the City of San Francisco through the Community Action Plan for San Francisco (CAPSS)[13]. While the report was developed for San Francisco, many of the findings are relevant to Berkeley. Both cities have potential for high earthquake shaking, which increases the risk of post-earthquake fire ignitions. Both cities also have dense multi-family housing, which facilitates fire spread.

Additionally, Fire Following Earthqake was analyzed in the HayWired earthquake scenario. Expected impacts are described later in the Earthquake Risk and Loss section.

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. There are many examples from around the world of fire following earthquake:

Earthquake	**Impacts of Earthquake-Caused Fire**
2014 South Napa Earthquake[14]	Nine fires erupted post-earthquake. Immediately after the earthquake, the City of Napa continued pushing water through the damaged system to maintain firefighting and other critical functionality. Although this resulted in an estimated total loss of 100-acre feet of water (about 7% of monthly water usage), it also ensured that water was available for firefighting at all but one of the nine post-earthquake fires.
1995 Kobe Earthquake	More than 100 fires broke out following the 1995 Kobe earthquake, during which broken water mains left the fire department helpless, and fires destroyed more than 7,000 buildings. Fire was also a major contributor to the death toll.
1994 Northridge Earthquake	More than 100 fires broke out following the 1994 Northridge earthquake, severely impacting area fire departments, even though it largely affected only the edge of greater Los Angeles.
1989 Loma Prieta Earthquake	Thirty-six fires broke out in San Francisco. Natural gas line rupture was responsible for some of the fire ignitions. Failure of the city's electrical systems may have actually reduced the number of fire ignitions. Fires in the Marina District claimed four structures in the area, but lack of wind that night assisted in preventing the fires from spreading. Overall, the shaking experienced in the Loma Prieta earthquake was moderate, as the epicenter was 70 miles away.

1906 Great Earthquake	The earthquake was followed by a firestorm that lasted for three days, and in that time swept over an area of over 3.5 square miles.[15] It is estimated that 80 percent of San Francisco's property value was lost in the fire.

B.5.b.vi.1 Fire following earthquake hazard

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

In the 1994 Northridge earthquake in Los Angeles, over half of the ignitions were due to electrical systems, and about a quarter were fueled by gas.

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.

Earthquakes can also damage the systems we have in place to stop fires. Earthquake shaking 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, fire doors).

Post-earthquake fires can also spread quickly due to spilled flammable chemicals.

Fires also spread more quickly after major earthquakes because earthquakes damage the infrastructure needed to fight fires. Earthquake shaking and ground failure due to liquefaction, surface fault rupture and landslide can simultaneously:

- Break water mains, causing a drop in water pressure
- Damage electrical systems necessary to provide energy to pump water
- Damage communication infrastructure
- Impede transportation routes with debris or landslides
- Jam firehouse doors, preventing apparatus from responding.

B.5.b.vi.2 Exposure and vulnerability

Soft-story and unreinforced masonry buildings are more prone to earthquake damage (see Section B.5.c.iii), and thus are 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. Even buildings that survive earthquake shaking can succumb to fire, including those buildings that have been seismically retrofitted.

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. Earthquakes in places with this type of construction have caused the two largest peacetime urban fires in history: in 1923 in

Tokyo; and in 1906 in San Francisco, where 80% of the 28,000 destroyed buildings were lost due to fire.

The Berkeley Fire Department today is a well-prepared, professional organization that trains for earthquake-caused fires. However, after the next large earthquake, there are likely to be more fires than Berkeley's firefighters can respond to at one time.

Compounding this challenge, fire personnel will not only be fighting fires, but will also be responding to needs for search and rescue and emergency medical services.

Firefighters in nearby cities will be struggling to address response needs in their own jurisdictions, and State and federal resources may not be able to help the City for many hours. The 1991 East Bay Hills Fire destroyed 3,354 structures in only a few hours and overwhelmed the capacity of local fire departments, even though neighboring departments were available to assist.

Fires in Berkeley could burn out of control, and may threaten entire neighborhoods. Fire damage will add to the city's overall earthquake damage, making recovery more difficult and lengthy by increasing the number and severity of damaged buildings, lengthening the time required to repair and replace damaged buildings, displacing residents, and weakening neighborhoods.

B.5.c Exposure and Vulnerability

This section describes Berkeley's built environment and its earthquake vulnerabilities. It contains three parts:

- Buildings
- Infrastructure (systems for utilities, transportation and communications)
- Critical response facilities

This section describes earthquake vulnerabilities for each component of the built environment. In some instances, a system's earthquake vulnerability could potentially create a secondary hazard (e.g., if earthquake shaking were to result in a hazardous materials spill.)

Much of Berkeley's built environment is owned and operated by other public and private entities and is not under the City's direct authority. The City works with other public agencies and companies on disaster planning, and this section includes information about some of the activities that the City's key community partners are undertaking to mitigate the hazards that may impact or originate on their own property.

B.5.c.i *Buildings*

Ground shaking produces most building losses in typical earthquakes. Buildings are also vulnerable to ground displacements associated with primary fault rupture, liquefaction and landslides.

This section first addresses the earthquake exposure and vulnerability for City-controlled buildings. Secondly, it describes earthquake exposure and vulnerability for buildings *not* controlled by the City, including private residences and commercial buildings.

Retrofitting vs. New Construction

Building codes are continually improved, incorporating new knowledge about building methods that effectively resist seismic forces.

Buildings built using older techniques can be especially vulnerable to earthquake damage. Buildings are usually retrofitted with the goal of reducing loss of life, but damage can still be expected in many retrofitted buildings. Building retrofit is often preferable to building replacement, as retrofitting an existing building can be more cost-effective and environmentally-friendly, while preserving historic architecture.

New building construction is expected to perform better than retrofitted buildings in an earthquake. However, the goal of the building code is to reduce loss of life in an earthquake, not to ensure the continued use of the building. This means that a large earthquake will damage even new buildings, which may remain unusable for long periods of time.

B.5.c.ii ***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 of City buildings need to be assessed to determine their level of vulnerability to seismic events. Some may pose some risks to life and emergency operations. Four of these vulnerable buildings are explored further below.

North Berkeley Senior Center, 1901 Hearst Street

The North Berkeley Senior Center is a dynamic community gathering place offering a wide array of services and social events, including classes, a senior lunch program, and field trips. The Center also serves as a gathering place for community and commission meetings, and as an affordable rental for other organizations looking to host a gathering in a large community hall. During emergencies the Center has also been identified as one of the City's mass care and shelter sites.

In February 2016, FEMA awarded the City a Pre-Disaster Mitigation Grant of $1.875 million to mitigate the Center's seismic vulnerabilities, including possible collapse. With the passage of Bond Measure T1 in the fall of 2016, the City has secured funding for the retrofit of the North Berkeley Senior Center.

Mandatory safety upgrades will be performed during this retrofit, including structural seismic upgrades so that the building can be immediately occupied after a major earthquake; upgrades for compliance with current building codes, including ADA and Fire codes; and deferred maintenance including exterior, roof replacement, and first floor restroom upgrades. The Center will also have a hookup for a generator, increasing the facility's ability to provide services in the event the grid is down.

Live Oak Community Center, 1301 Shattuck Avenue

The Live Oak Community Center currently houses youth and family recreation programs and public events during evenings and on weekends. The building is also used as a shelter in the event of emergencies.

The Live Oak Community Center Seismic Retrofit project will include seismic upgrades, needed repairs to building systems, including plumbing, mechanical, electrical, accessibility, and architectural features, and energy and water efficiency upgrades to meet current building codes.

Project work will improve the building's expected post-earthquake damage state performance level from collapse prevention to either life safety or immediate occupancy. This change will allowing the facility to be used as mass care site in the event of an earthquake.

Old City Hall, 2134 Martin Luther King, Jr. Way

This recognized historic building is a potential collapse hazard that needs to be retrofitted. There is no identified funding source to retrofit this building. As of December 2018, plans are underway to use the site as Berkeley's Emergency Storm Shelter, which will operate when it's raining or under 40 degrees.

Veterans' Memorial Building, 1931 Center Street

This historically landmarked building, used for public assembly, as a homeless shelter, and for daytime homeless services, is a potential collapse hazard that needs to be retrofitted.
A homeless shelter currently operates in the building. During the day, the Dorothy Day House, Berkeley Food and Housing Project, Options Recovery, and Building Opportunities for Self Sufficiency (BOSS) use the building for their homeless service programs. There is no identified funding source to

retrofit this building.

Notable Mitigation Activities
The City has strengthened many important buildings for emergency response and recovery. Since 2014, the City has continued its program to strengthen or replace key at-risk structures, including the Center Street Garage and James Kenney Recreation Center.

Center Street Garage, 2025 Center Street
The replacement of the Center Street Garage has been one of the City's high priority downtown projects. The preexisting 5-story structure did not meet current seismic standards and retrofit was determined to be infeasible. The new 8-story facility opened in October 2019 and meets current seismic standards. It has 720 parking spaces, secure bicycle parking, office space for parking management, and commercial and art display space on the first floor. Construction was funded through 2016 Parking Revenue Bond Fund ($28.3 million) and the Off Street Parking Fund (Fund 835) ($8.2 million).

James Kenney Recreation Center, 1720 Eighth Street
The James Kenney Community Center currently houses daycare, afterschool children's programs, day camps, various teen recreation programs, open gym, and public events during evenings and on weekends. The site is the City's best equipped mass care and shelter site in the event of a disaster.

In 2017, a retrofit of the facility was completed at a total cost of $3.05 million. The James Kenney Community Center Seismic Retrofit project involved seismic strengthening of the Recreation and Gym Building, as well as fire protection sprinklers throughout the building, and necessary ADA upgrades.

This work was made possible by a Pre-Disaster Mitigation Program grant for $727,499, provided by the State Office of Emergency Services and the Federal Emergency Management Agency, as well as a Department of Housing and Community Development Grant for over $1 million.

B.5.c.iii *Privately-Owned and Other Structures*

Berkeley has about 43,636 housing units[16], serving the city's population of 112,580[17]. 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.

Older houses constructed with a crawl space or aboveground basement below the first floor can have several weaknesses, because older building codes were inadequate to resist seismic forces, or because codes were not followed properly. The bottom of the wood frame exterior walls may not be adequately bolted to the foundation, meaning the house can slide off the foundation during strong shaking. The foundation itself may be constructed of weak or deteriorated materials, like brick or very old concrete. Also, the wall that encloses the crawl space, known as a cripple wall, may be weak and vulnerable to collapse due to inadequate bracing and deterioration of wood members from termite attack and dry rot. Hillside houses can suffer from any of these weaknesses, but have increased risks of failure to cripple walls and poorly braced extra-tall walls along the sloping sides.

Notable Mitigation Activities

A number of City incentive programs and educational efforts promote seismic strengthening activities.

Plan Set A

The City's adoption of Standard Plan Set A[18] 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. The initial wood-frame SWOF inventory included 321 buildings. The inventory has since increased to 332 buildings, containing 3,665 units.

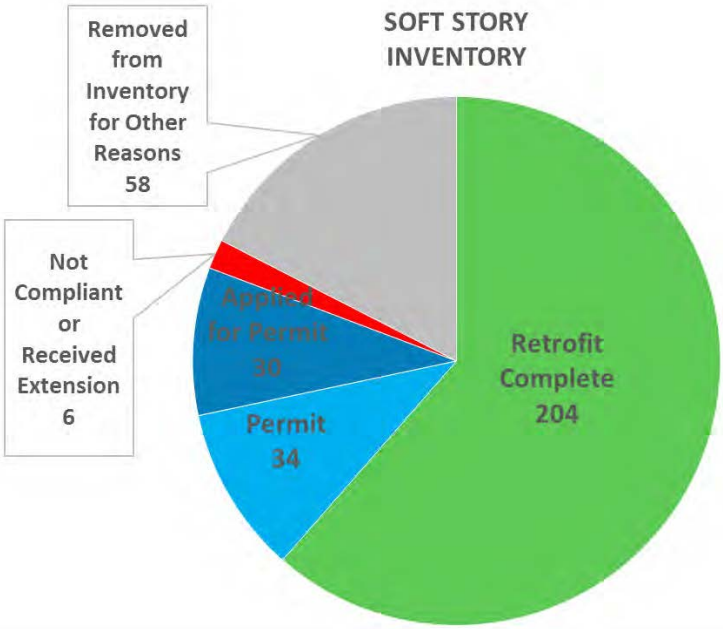
On December 3, 2013, Council adopted amendments to Berkeley Municipal Code Section 19.39.110 establishing mandatory seismic retrofit requirements for soft story buildings with five or more dwelling units. The ordinance established December 31, 2016 as the deadline for property owners to apply for a building permit. Owners must complete retrofits within two years of submitting the permit application. Table 3 describes the status of the 332 soft story buildings subject to mandatory retrofit as of December 2018.

Table 3. Berkeley Soft-Story Building Status as of December 2018

Number of buildings	**Percent***	**Status**
204	61	Retrofit Complete
34	10	Permit
30	9	Applied for Permit
6	2	Not Compliant or Received Extension
58	17	Removed from Inventory for Other Reasons
332	*100%*	*Total buildings identified as soft-story*

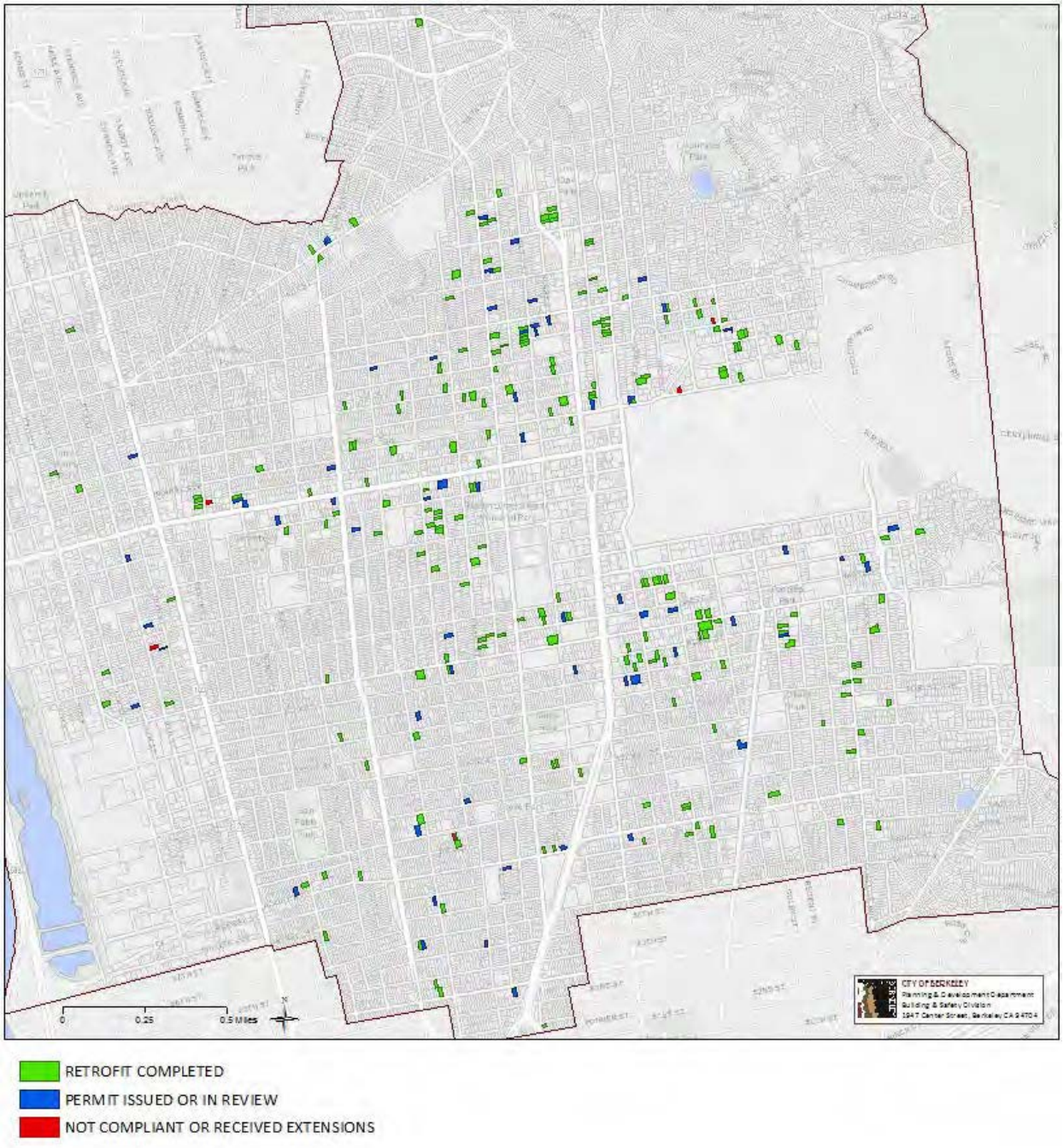
*Due to rounding, percentages do not add up to 100 percent.

Table 4. Chart of Berkeley Soft-Story Building Status as of December 2018



Map 9 shows the retrofit status of soft story buildings subject to mandatory retrofit, as of December 2018. Green symbols depict parcels with retrofit buildings, blue indicates parcels containing one or more buildings with permits issued or currently under review, and red shows parcels with extensions filed or buildings out of compliance.

Map 9. ***Status of Soft Story Buildings Subject to Mandatory Retrofit (December 2018)***



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 with inadequate reinforcement (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.

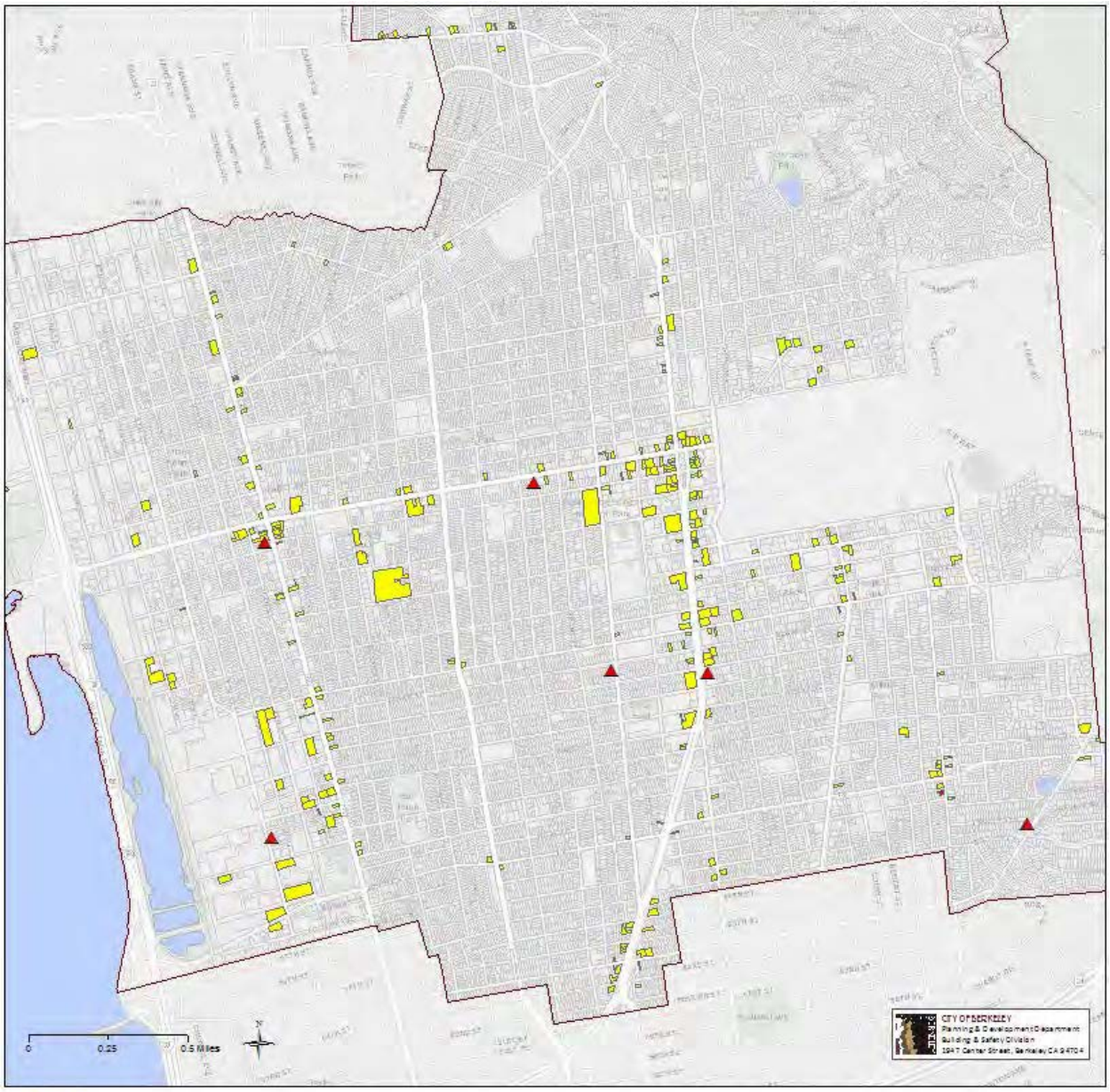
Although unreinforced masonry buildings are no longer constructed today, existing URM buildings can be retrofitted to reduce risks caused by earthquake activity. If these buildings are not retrofitted and suffer major damage in an earthquake, the costs of repair after the earthquake could be prohibitively 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 August 2018, six buildings are still required to retrofit in order to avoid further penalties. Five of the six building owners have applied for retrofit permits.

Map 10 shows the unreinforced masonry (URM) inventory as of June 2018. 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 10. ***Berkeley Parcels with Unreinforced Masonry Building Types (June 2018)***



Financial Incentives

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). In the first round of the Retrofit Grants program, the City offered grants of up to $25,000 to owners of soft story buildings with five or more units, and unreinforced masonry buildings. During the first round of the grant program, owners of 48 buildings containing over 400 housing units applied for grants, amounting to over $1 million in federal funding.

The Building and Safety Division launched the second round of grant funding in May 2018, offering design and construction grants to owners of other seismically vulnerable buildings: rigid wall - flexible diaphragm buildings (RWFD) with walls made of concrete or masonry and wood or steel roofs, non-ductile concrete buildings (NDC), and soft story buildings with 3-4 residential units and non-residential uses, which are not covered under the mandatory soft story retrofit program. In the second round of the grant program, as of August 2018, owners of 66 buildings applied for an additional $1.3 million in FEMA funding. These buildings contain almost 300 housing units in addition to a variety of retail, commercial, and educational occupancies.

In the spring of 2018, City staff conducted outreach to promote the second round of grant funding and assist owners with the application process. Information packets, including applications, fact sheets about relevant building types and grant program details were mailed to property owners of nearly 1,000 potentially vulnerable buildings. The application deadline for the second phase of the Retrofits Grants Program was June 25, 2018.

Although single-family homes and duplexes were not eligible for this program, other programs are available for property owners and are detailed below.

Transfer Tax Rebate Program
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. The process begins once the homeowner makes seismic safety improvements. 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 $12 million to homeowners through this program as outlined in Table 5 below.

Table 5. Transfer Tax Rebate Program

Fiscal Year	Property Transfer Rebates	Total Funds Issued
2003	382	$1,133,047
2004	467	$ 1,539,738
2005	385	$ 1,459,510
2006	262	$ 1,168,654
2007	144	$ 611,433
2008	152	$ 681,002
2009	138	$ 533,061
2010	150	$ 592,539
2011	157	$ 593,974
2012	166	$ 623,502
2013	159	$ 766746
2014	164	$ 798,370
2015	138	$ 773,697
2016	147	$ 859,831
2017	55	$ 423,586
2018[1]	31	$ 165,010
Total (FY 2003-2018)	3,097	$12,723,700

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

[1] As of September 2018. Taxpayers may still claim seismic-related refunds for properties purchased in FY 2018.

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.

Property Assessed Clean Energy (PACE)
Additionally, the PACE program provides financing for seismic improvements, and allows owners to pay back costs over time on their property tax bills with no upfront costs.

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 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. Since the initial phase of the project, the grant program has expanded to include Soft Story buildings with 3-4 residential units, and some mixed-use or nonresidential Soft Story buildings that are not mandated to retrofit.

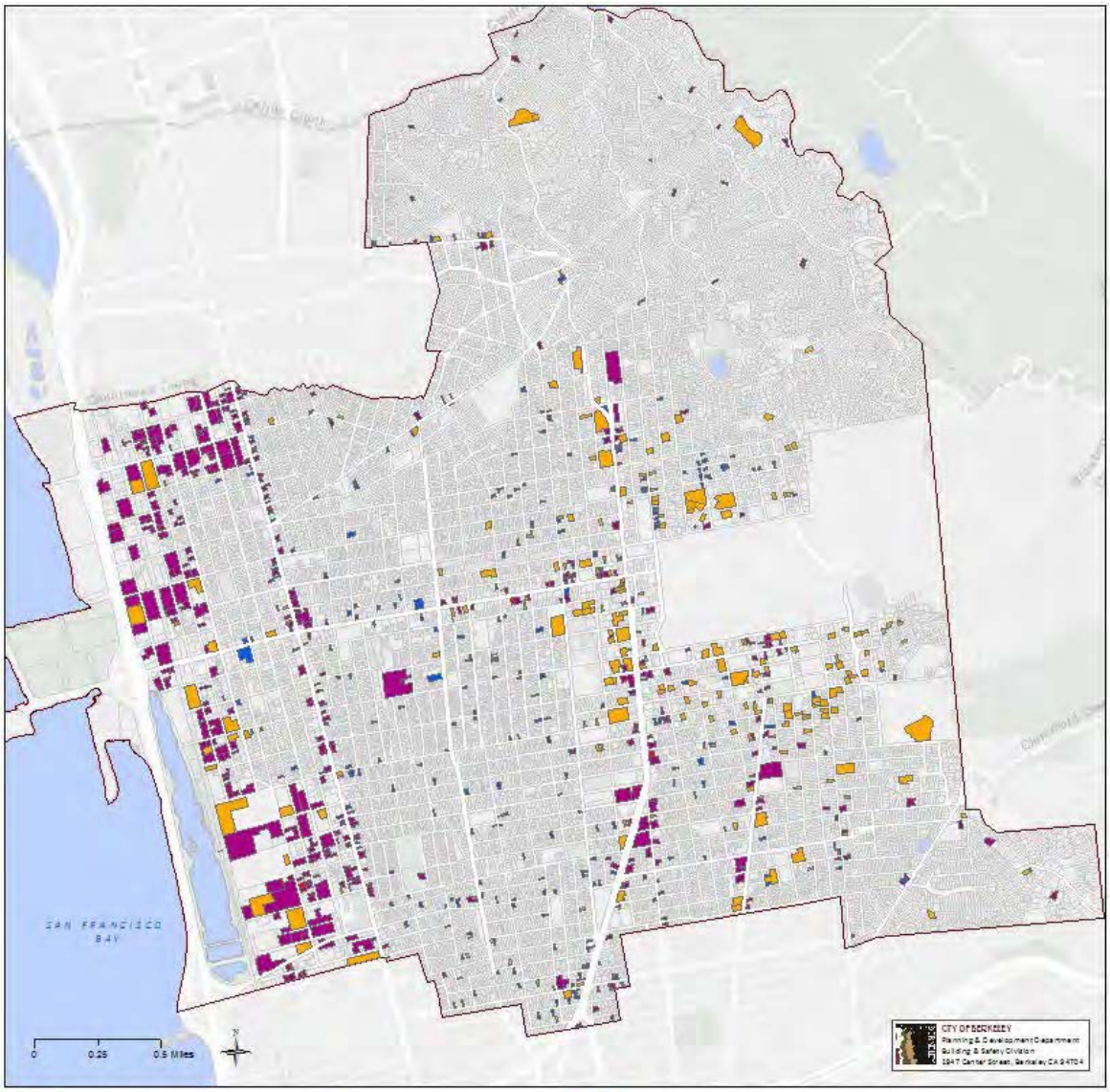
Process for Updating the Inventory of Seismically Vulnerable Buildings
The City has worked diligently to update and broaden its inventory of seismically vulnerable buildings to include non-ductile concrete buildings, rigid wall-flexible diaphragm buildings, and soft story buildings with 3-4 residential units or commercial uses. This effort began with extensive staff research to identify vulnerable buildings using City and other data sources.[19] 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[20], and a "virtual survey" to identify potential soft story buildings.[21]

Updated Inventory of Seismically Vulnerable Buildings (2018)
As of June 2018, the City identified 1,047 potentially seismically vulnerable buildings that did not already appear on the soft story or URM inventories. The updated inventory includes 230 potentially non-ductile buildings and nearly 550 buildings that may be rigid wall-flexible diaphragm, including tilt-ups. The City has also added to the inventory approximately 240 soft story buildings not subject to mandatory retrofit under Chapter 19.39 of the Berkeley Municipal Code.

Map 11 shows Berkeley's updated Inventory of Seismically Vulnerable buildings, as of June 2018. Soft story 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 are eligible for the Cal OES/FEMA Grant Program.

Map 11. ***Updated Inventory of Potentially Seismically Vulnerable Buildings (June 2018)***



B.5.c.iv *Infrastructure*

This section examines the earthquake exposure and vulnerability of Berkeley's infrastructure. It is organized into three components: utilities, transportation and communications.

Infrastructure described in this section provides 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 from a major earthquake.

Many of these systems are also significant because their failure in an earthquake could create secondary hazards, compounding the challenge to Berkeley's disaster response and recovery activities.

Much of the City-owned infrastructure was built before World War II when the city was growing and modernizing. After over 90 years in service, much of the infrastructure requires extensive maintenance, repair or enhancements.

Electrical, natural gas, petroleum, telecommunications, and potable water supply infrastructures are not under the City's control, but rather are owned and managed by other quasi-governmental, private or special district entities.

The following three sections (Utilities, Transportation and Communications) describe these key infrastructure systems and their vulnerabilities, demonstrated by the earthquake hazard exposure depicted on Maps 3, 4, and 7. These sections also outline how these vulnerabilities may create secondary hazards following an earthquake. Included in each section are the City's key partners and their mitigation activities.

The Department of Public Works has an up-to-date database describing elements, characteristics and conditions of all roads, storm drains, and sewer pipelines. The database includes specific information on these systems and their conditions for maintenance and management purposes. This type of information will also facilitate Public Assistance applications after a disaster, as federal repair guidelines attempt to apportion damage due to the hazard event and damage from normal wear and tear.

Disputes over existing element conditions can lead to additional expense and delays in making needed repairs.

Utility Systems: Earthquake Exposure and Vulnerability

The table below shows owners of key utility system infrastructure in Berkeley.

Table 6. Key Berkeley Utility Systems

Owner/Manager	Infrastructure
City of Berkeley	• Storm drains • Retaining walls in right-of-way • Sanitary sewer collection system that links to the EBMUD system • Creeks, open channels and creek culverts in right-of-way and on City property • Street Lights and traffic lights on poles or utility poles and above- and below-ground conduits supplied from the PG&E system • Transfer Center, city waste disposal and recycling, located at Second and Gilman streets
EBMUD	• Potable and fire suppression water supply system consisting of pipelines, pumping plants, flow/pressure control facilities, and storage tanks and reservoirs owned by the East Bay Municipal Utility District • Sanitary sewer transmission pipeline (EBMUD wastewater interceptor) and pumping station
PG&E	• Electric distribution system, including substations, mains, laterals and meters, owned by the Pacific Gas and Electric Company • Natural gas distribution system, including main pipelines, lateral pipelines and meters
AT&T, Comcast and others	• Telecommunications aerial and underground conduits
Kinder Morgan Corporation	• Aviation fuel and multi-product pipelines buried under the right-of-way of the Union Pacific railroad tracks
Various	• 513 sites in the city storing more than 55 gallons, 200 cu ft or 500 lbs accumulated hazardous materials and hazardous waste

Liquefaction is a significant contributor to utility failure after an earthquake. When soil liquefies, the effective stress of a soil is reduced to essentially zero, which corresponds to a complete loss of shear strength or shear resistance. Sloping ground and ground next to creeks and the Bay may slide on a liquefied soil layer, opening large cracks or fissures in the ground. This can cause significant damage to infrastructure lines such as water, natural gas, sewage, storm, electrical and telecommunications systems installed in the affected ground. Buried tanks, pipelines, conduits, and manholes may float in the liquefied soil due to their buoyancy.

Landslides, liquefaction, or subsidence caused by earthquakes may subject pipelines to significant displacement, causing the pipelines to develop leaks or breaks.

The following systems are described in further detail:

- Water System
- Sanitary Sewer System
- Storm Drain System
- Natural Gas and Electricity Systems
- Aviation Fuel Pipeline
- Hazardous Materials Management

Water System: Earthquake Exposure and Vulnerability

Key Partner: East Bay Municipal Utility District (EBMUD)[22]

The East Bay Municipal Utility District (EBMUD) provides drinking water to approximately 1.4 million people and sewer services to 640,000 in the East Bay. After an earthquake, EBMUD is responsible for maintaining and providing water and sewer services to its customers, including water for post-earthquake fire suppression. Much of the water for the East Bay comes through the Claremont Tunnel. This water is stored in a network of reservoirs throughout the Berkeley Hills and is distributed to customers through underground pipelines. EBMUD was created in 1923, and the age and extent of its system makes it particularly vulnerable to damage in earthquakes. EBMUD has studied the impacts of earthquake shaking, liquefaction, landslides and fault rupture on most of its infrastructure.

Following a major seismic event:

- Earthquake-induced landslides in the Berkeley hills could impact water lines, reducing water available for firefighting
- If fault rupture occurs, water lines within the fault rupture planning zone could be broken
- Liquefaction in the western part of the city could impact water service

In the HayWired earthquake scenario, EBMUD's 4,162 miles of pipe suffer about 1,800 breaks and 3,900 leaks during the earthquake sequence. EBMUD crews will likely begin working to repair the system immediately after an event. The average EBMUD customer would be without water for 6 weeks, some for as many as 6 months.[23]

Depending on the severity of earth movement, water and sewer lines may break, and the safety of the drinking water supply may be compromised. In addition, without power, sewer lift pumps will fail, leading to major sewage overflows. For this reason, the City's Environmental Health

and Public Health Divisions may issue precautionary drinking water advisories, either in collaboration with water utilities or independently. These advisories may be in place until the drinking water system is confirmed safe.[24]

Sanitary Sewer System: Earthquake Exposure and Vulnerability

The City's sanitary sewer system is made up of pipelines with large diameter (six inches to 120 inches). Some of the large diameter pipes provide temporary storage when the EBMUD wastewater interceptor[25] system cannot accept flows. The amount of storage time provided by these large diameter pipes depends on the inflow rate and the ability of downstream segments to accommodate flow. Failure of the EBMUD interceptor system or the City's sanitary sewer system could cause sewage to back up beyond the Berkeley sanitary sewer system's storage capacity. When the volume of effluent is larger than the sanitary sewer system's storage capacity, it will overflow through manhole covers onto city streets and into the storm drain system and creeks that flow to the Bay.

The table below outlines the total length of Berkeley's sanitary sewer system, as well as the length and percentage of the system that lies within the hazard areas depicted on Maps 3,4, and 7.

Table 7. Sanitary Sewer System

Infrastructure Element	Total Length	Length in Hazard Areas		
		Earthquake-Induced Landslide Planning Zone	Fault Rupture Planning Zone	Very High, High, and Moderate Liquefaction Susceptibility Zone
Sanitary sewer	260 miles	50 miles (19%)	29 miles (11%)	101 miles (39%)

The Berkeley hills have a high landslide risk, which could particularly impact the sanitary sewer system.

If fault rupture occurs, it could critically damage portions of the sanitary sewer system that are within the Fault Rupture Planning Zone.

The liquefaction hazard is more acute on the west side of the city. Liquefaction-caused earth movements will affect underground infrastructure, including a high proportion of the sanitary sewer system. Liquefied areas may move laterally, breaking Berkeley's underground sanitary sewer pipelines. Liquefied areas could also compromise EBMUD's wastewater interceptor line, adjacent to Interstate 80. Damage to either system would interrupt the systems' ability to convey sewage.

Storm Drain System: Earthquake Exposure and Vulnerability

Areas of the city's storm drainage system are known to be extremely weak and at risk of collapse. 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. The weaknesses of this system are described in more detail in Section B.8, which addresses floods.

The table below outlines the total length of Berkeley's storm drain system, as well as the length and percentage of the system that lies within the hazard areas depicted on Maps 3,4, and 7.

Table 8. Storm Drain System

Infrastructure Element	Total Length	Length in Hazard Areas		
		Earthquake-Induced Landslide Planning Zone	Fault Rupture Planning Zone	Very High, High, and Moderate Liquefaction Susceptibility Zone
Storm Drains	94 miles	13 miles (14%)	8 miles (9%)	45 miles (48%)

Earthquake-caused ground failure could change the horizontal alignment of pipes so that storm drains would not function.

The Berkeley hills have a high landslide risk, which could block or damage storm drains.

If it occurs, fault rupture could damage portions of the storm drainage system within the Fault Rupture Planning Zone.

The liquefaction hazard is more acute on the west side of the city. Liquefied areas may move laterally, breaking underground storm pipelines and affecting other underground infrastructure and creeks.

Electricity and Natural Gas Systems: Earthquake Exposure and Vulnerability

Electricity

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.

Electrical switches and transformers in the distribution system can be damaged, as can equipment at substations and transmission lines, possibly leading to system wide loss of these utilities. Grid-tied photovoltaic (solar) panels are reliant on the electric grid being functional unless they are designed with smart inverters and battery back-up storage so that they can island from the grid.

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

Underground systems are particularly prone to damage from ground failure in earthquakes and landslides. Natural gas line rupture is one of the chief causes of post-earthquake fires, as

discussed in Section B.5.b.vi Fire Following Earthquake.

Additionally, rupture compromises this lifeline unless redundant connections unaffected by the earthquake are available. Underground damage is harder to detect and repair, and the length of service losses may be greater than for aboveground systems.

This plan is focused on natural hazards and their impacts. This plan addresses gas pipeline rupture as a secondary hazard to earthquake liquefaction, earthquake-induced landslides and surface fault rupture.

The term “gas pipeline” includes:

- Transmission pipelines, which carry natural gas across long distances, usually to and from compressors or to a distribution center or storage facility. Transmission lines are large steel pipes (10" to 42" in diameter) that are federally-regulated. They carry unodorized gas at a pressure of approximately 60-900 psi.

- Distribution pipelines (“gas mains”), which are the middle step between high-pressure transmission lines and low-pressure service lines. Distribution pipelines are small- to medium-sized pipes (.25" to 24" in diameter) that are federally-regulated and carry odorized gas at intermediate pressure levels, from 2 to 60 psi.

- Service pipelines, which connect to meters to deliver natural gas to individual customers. These narrow pipes are usually less than 2” in diameter, and carry odorized gas at low pressures, such as 6 psi.

Like electricity infrastructure, service and distribution pipelines exist throughout Berkeley. In the HayWired Scenario, service and distribution pipelines will be exposed to severe and violent shaking, as well as to liquefaction concentrated in the western part of Berkeley, earthquake-induced landslides and fault rupture in the Berkeley hills. Rupture of service and distribution lines can ignite and fuel fires. Additionally, natural gas leaks within buildings can cause carbon monoxide poisoning.

Not only do ruptures have the potential to cause fires, but they also have 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.[2]

In addition to service and distribution lines, transmission pipelines are also vulnerable to ground failure in a major earthquake. Map 12 uses blue lines to identify PG&E’s natural gas transmission lines. Significant portions of PG&E natural gas transmission lines lie in areas of Berkeley that are more susceptible to liquefaction (see Map 7). In an earthquake, these soils need to be shaken hard and long enough in order to trigger liquefaction. If liquefaction does occur, pipelines located in liquefiable soils can tear apart.

The natural gas transmission line runs the length of Berkeley (north-south direction) under

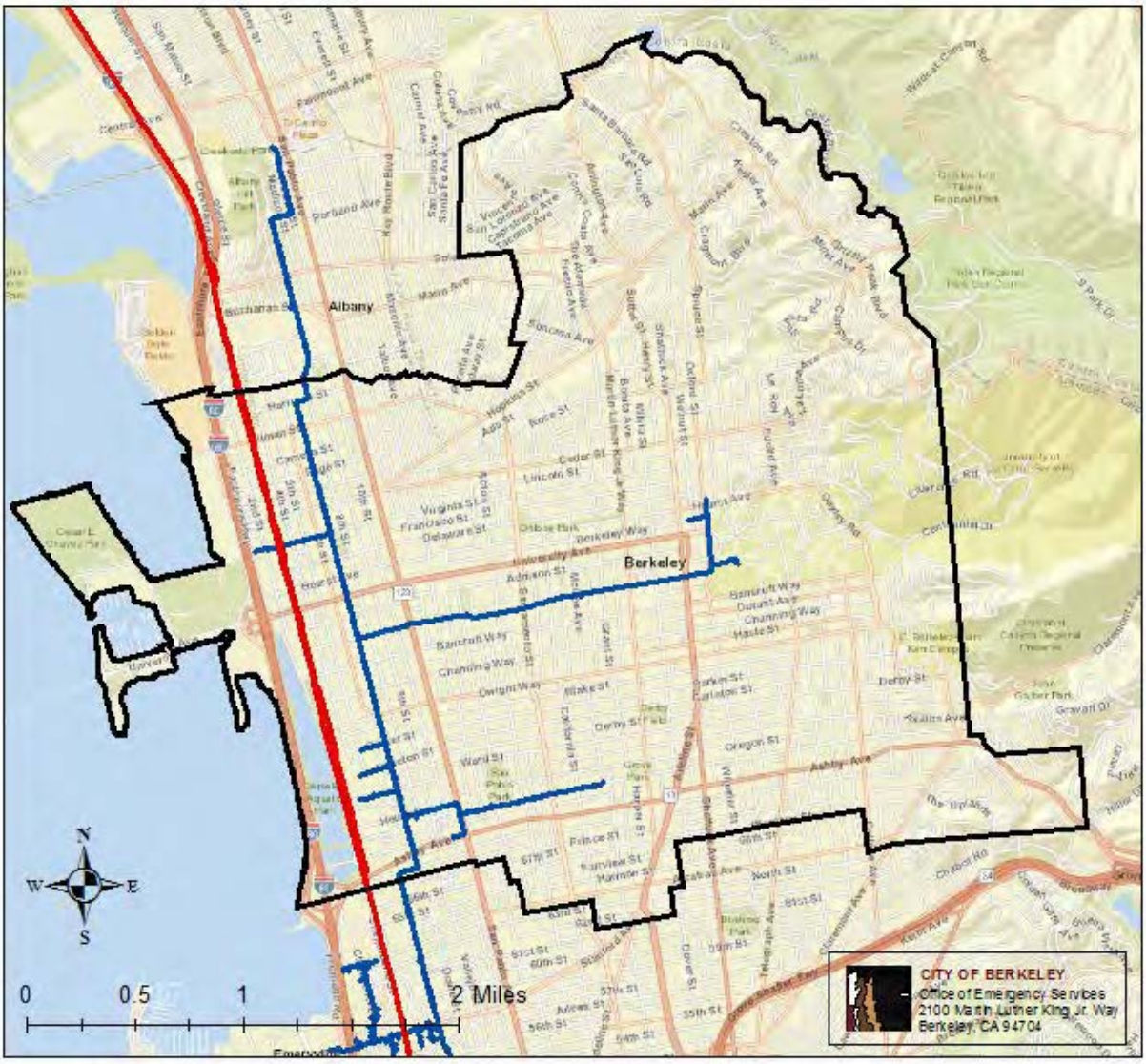
[2] Methane Emissions (EPA, 2018) https://www.epa.gov/ghgemissions/overview-greenhouse-gases#methane

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 12. ***Gas Transmission Pipelines and Jet Fuel Line***



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

Notable Mitigation Activities

One potential solution to mitigate some of the negative impacts of the use of natural gas is to encourage buildings to switch from natural gas to electricity for water heating and space heating/cooling in buildings. The electrification of buildings helps reduce greenhouse gas emissions, especially if the electricity is powered by solar or by carbon-free energy provided by East Bay Clean Energy. The Office of Energy & Sustainable Development is currently exploring options for all-electric buildings, which would potentially no longer need to be connected to the natural gas power grid. This would significantly reduce risk for the fire, health, and climate impacts associated with widespread existing leakages in the system as well as damage to the pipelines from a natural disaster. The electrification of buildings, when coupled with on-site solar and back-up storage batteries, could also provide clean energy back-up power to buildings in the event of a power outage. OESD is currently working to address financial, regulatory, and technical barriers to this clean energy solution, while also exploring the energy assurance aspects of potential solutions.

Key Partner: Pacific Gas and Electric Company (PG&E)[26]

Pacific Gas and Electric (PG&E) provides electricity and natural gas to 15 million people in northern and central California. They have a staff of 20,000 prepared to respond to restore electrical service after disasters and storms. They also have a well-established priority system for restoring power to emergency services before other community needs. PG&E recognizes that large earthquakes may damage key facilities and that electric power might be lost for limited periods of time. The potential for a loss of power means that emergency and critical uses should have dedicated emergency power sources.

Natural gas is subject to damage and disruption in areas with soil failure, for example landslide and liquefaction. Broken lines can create fires if ignited until the fuel supply is exhausted. The repair of damaged underground lines will take time. Following the Loma Prieta earthquake it took about 30 days to repair damaged lines in the San Francisco Marina.

Key Partner's Notable Mitigation Activities

PG&E has assessed the seismic vulnerability of many elements of its system and has taken steps to improve its functionality after an earthquake, such as replacing bushings on high voltage lines, anchoring substation equipment and replacing old gas lines with more flexible alternatives.

As a consequence of the San Bruno rupture, the National Transportation Safety Board (NTSB) has issued a number of recommendations to State and federal administrations and institutions to improve the safety of pipeline networks as well as to upgrade the integrity management program and emergency response system[27].

As a result, PG&E has proposed $2.2 billion in pipeline upgrades through 2014 and outlined a Pipeline Safety Enhancement Plan to modernize its gas transmissions operations over the next several years. As part of this plan and in direct response to the recommendations issued by the

NTSB, PG&E has begun improving its network by automating shutoff valves, with more automatic shutoff valves planned for Berkeley; updating its emergency response plan to reflect industry best practices; and implementing data management systems intended to ensure its pipeline records are traceable, verifiable and complete.

Additionally, PG&E has created a First Responders Safety website, which provides secure access to maps and information about natural gas transmission lines, natural gas storage facilities, and shut-off valves. The City's Information Technology department has incorporated this information into its GIS maps. Berkeley first responders have attended PG&E's First Responder Workshops to learn more about components of natural gas and electric utility infrastructure, as well as how to respond to natural gas hazards and avoid dangers presented by migrating natural gas and secondary ignition sources.

Aviation Fuel Pipeline

Map 12 shows in red lines 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. Per Map 7, soils in this area are potentially susceptible to liquefaction. Like with the PG&E natural gas transmission lines, rupture of these aviation fuel lines during an earthquake could spark and feed a dangerous fire.

Key Partner: Kinder Morgan, Inc.[28]
Two aviation and multipurpose pipelines run along the railroad tracks from Richmond to the Oakland Airport, through western Berkeley. The pipes are made of high-pressure welded steel, installed primarily in the 1960s, although a few segments were installed in the 1950s. The company has not conducted a study of the impacts of an earthquake on the Hayward fault. This type of pipeline, however, is known to have performed well, due to its ductile nature, in earthquakes elsewhere in the world. Kinder Morgan, Inc. has focused on developing procedures to respond immediately after a disaster to shut down the pipeline. Each pipeline has automatic, remote control and other manual valves along its length and the flow can be shut down within minutes. Kinder Morgan, Inc. reported that after the 1989 Loma Prieta earthquake, these pipelines were shut down and monitored for leaks, breaks and changes in pressure. No damage was found.

Hazardous Materials Management

The shaking and ground failure that can accompany earthquakes could cause hazardous materials release. The City carefully tracks and regulates hazardous materials in both public and private structures through its Toxics Management Division. There are 513 facilities in the city that store more than 55 gallons, 200 cu ft or 500 lbs accumulated hazardous materials and hazardous waste.[29] The majority of these sites are automobile-related facilities (e.g., facilities with motor oil), and medical facilities. To minimize the risk of release during an earthquake, the City requires engineering studies for facilities having extremely hazardous substances. These studies are discussed in more detail in Section B.12 *Hazardous Materials Release*.

Transportation System Earthquake Vulnerabilities

The table below shows key transportation system infrastructure in Berkeley, along with the agencies responsible for the systems.

Table 9. Key Berkeley Transportation Systems

Owner/Manager	Infrastructure
City of Berkeley	• Roads, curbs, paths and sidewalks • Traffic lights on poles, and above and below ground conduits supplied from the PG&E system • Traffic circles and islands • Sutter Street Solano Avenue tunnel • I-80 Pedestrian Bridge • University Avenue interchange approach structure and railroad crossing
Caltrans	• US Interstates 80 and 580 and freeway access structures at Ashby, University and Gilman streets in Berkeley, and at Powell and Buchanan streets in Emeryville and Albany owned by the State Department of Transportation • Tunnel Road/Ashby (State Route 13), and San Pablo Avenue (State Route 123)
Bay Area Rapid Transit District	• BART system, consisting of four miles of underground rails and three stations, at Adeline/Ashby, Center Street, and North Berkeley
Union Pacific	• Train tracks
Amtrak	• University Avenue passenger stop

Map 13 below shows the location of major transportation infrastructure. Designated Emergency Access and Evacuation Routes [30] are indicated with purple lines. The Union Pacific railroad is indicated with a black hatched line along Berkeley's western shoreline. Interstate 80 and California State Highways 13 and 123 are indicated in light blue, running along Berkeley's western shoreline, southern end, and north to south in Berkeley's west, respectively. The Bay Area Rapid Transit (BART) tracks are indicated with blue lines, with station icons for the system's three Berkeley stations and the El Cerrito Plaza station in the City of El Cerrito provided for context. The Solano Tunnel, which provides a key north-south connection to vehicles in the eastern portion of the City, is indicated with a thick black line.

Map 13. ***Transportation Infrastructure in Berkeley***

Sources: Berkeley Planning Department, BART, and ESRI, 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
- Highways
- Railroad
- BART Stations
- BART
- Solano Tunnel
- Major streets
- Emergency Access and Evacuation Routes

The table below calculates the exposure of City-owned transportation infrastructure to earthquake these hazards.

Table 10. Curbs, Streets and the Solano Tunnel

Infrastructure Element	Total Length	Length in Hazard Areas		
		Earthquake-Induced Landslide Planning Zone	Fault Rupture Planning Zone	Very High, High, and Moderate Liquefaction Susceptibility Zone
Curbs	354 miles	56 miles (16%)	42 miles (12%)	177 miles (50%)
Streets	258 miles	43 miles (17%)	26 miles (10%)	117 miles (45%)
Solano Tunnel	0.09 miles	0 miles (0%)	0 miles (0%)	0 miles (0%)

Map 13 and Table 10 together identify key areas of exposure within Berkeley's transportation infrastructure.

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 by liquefaction-caused earth movements in a major earthquake. This movement will also affect aboveground infrastructure (streets, curbs and sidewalks.) Transportation infrastructure west of Interstate 80 is especially vulnerable to liquefaction. Per Map 8, in the HayWired scenario earthquake, over 40 percent of this area is expected to liquefy.

Transportation infrastructure in the area could be severely damaged. Additionally, emergency services vehicles may not be able to access the area, at least until the University Avenue overpass is inspected for damage.

Half of all City streets are have a moderate or greater exposure to liquefaction. Curbs serve as water barriers to property when it rains, curbs function as part of the drainage system. If curbs are impacted by ground failure from an earthquake, they lose their ability to function in this way.

To the city'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.

The Solano Tunnel is an important connection in the north-south direction. It is not located in a seismic hazard zone. However, it is situated in the direct proximity of the Fault Rupture Planning Zone, as well as the Earthquake-Induced Landslide Planning Zone. Should one of these hazards occur, access to Solano Tunnel could be limited or even impossible.

Key Transportation Partners

Partner-run transportation systems have varying levels of exposure to seismic hazards.

Per Map 13, Interstate 80 is susceptible to earthquake-induced liquefaction. Additionally, the HayWired Scenario Liquefaction Map (Map 8) shows that in a 7.0 magnitude earthquake on the Hayward fault, 40% or more of the ground underneath Berkeley portions of Interstate 80 is predicted to liquefy. This is a major thoroughfare for Berkeley and the Bay Area overall.

Caltrans[31]
Caltrans is responsible for constructing and maintaining the statewide highway system. The 1989 Loma Prieta earthquake caused significant damage to Caltrans structures, such as bridges, overpasses and on-ramps. As a result, Caltrans launched a comprehensive review of earthquake safety on highways throughout the state. A program to retrofit all vulnerable structures was started and the two overpass structures in Berkeley, at Ashby and University Avenues, have already been strengthened. These retrofits were designed to prevent collapse in a major earthquake, but will not guarantee that these structures can be used after an earthquake. Depending on damage levels, demolition may be required. Caltrans also strengthened the City-owned approach ramps to the overpass on University Avenue to the same standards. Caltrans emergency response teams are trained to inspect their facilities and manage some elements of traffic flow after a major earthquake.

The City owns a portion of a structure at University Avenue that provides access to the state-owned interchange structure connecting to Interstate 80. The City portion of this structure extends over the railroad tracks and west to ground level. Caltrans owns the eastern portion. Caltrans retrofitted both the state-owned and City-owned structures in recent years to high standards of safety.

Bay Area Rapid Transit District (BART)[32]
The Bay Area Rapid Transit District (BART) provides an important public transportation link between Berkeley, San Francisco, and other Bay Area locations to 360,000 riders daily. 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, and these tunnels are generally considered low risk by BART engineers.

According to Map 13, within Berkeley, the BART system is not exposed to ground failure from earthquakes. However, Map 2 shows that BART infrastructure in Berkeley will be subject to severe shaking in a 7.0 magnitude Hayward fault earthquake.

Key Partner's Notable Mitigation Activities

In 2002 BART completed a study of the earthquake vulnerability of the entire system, analyzing multiple earthquakes, predicting damage, and assessing cost-effectiveness of retrofits. Upgrades to the system are being funded by $980 million in General Obligation Bonds, authorized by voters in Alameda, Contra Costa, and San Francisco counties, supplemented with an additional $240 million from other sources. Since 2008, retrofit has been completed on many elevated tracks, stations, parking structures, and rail yards. Work to upgrade the Transbay Tube seismic joints was completed in 2010. BART is continuing to secure the Transbay Tube to a higher level of strength against future large earthquakes. The current effort is expected to be completed in 2014. Evaluations of several other areas of the Tube are ongoing and further retrofits may be constructed in the future. At this time, those retrofits are expected to be completed in approximately 2018.

As part of the vulnerability study, BART determined that the Berkeley Hills Tunnel which crosses the Hayward fault may be damaged in an earthquake on that fault, cutting a key commuting link. Initial evaluations determined that retrofit or replacement of this tunnel were not viable options. BART continues to study the feasibility of adequately strengthening the tunnel but as yet there is not a retrofit solution that can appropriately achieve this goal. Therefore there are no current plans to perform retrofit construction on the tunnel. BART will however be prepared with materials and crews to respond quickly to any damage that may occur in an earthquake.

BART's investment in earthquake retrofit is strengthened by its earthquake early warning system, which can help prevent train derailments in the system by slowing or stopping trains upon notification of an earthquake. Currently, BART has a system in place, which is activated when an earthquake larger than magnitude 4 or 5 is experienced within the BART system. BART is working with UC Berkeley and others to implement a statewide earthquake early warning system. This system would issue notification to operators such as BART upon detection of P-waves.[33] Upon notification, BART would automatically slow or stop trains within the system. The length of advance warning depends on how far away the earthquake originates.

Communications System Earthquake Vulnerabilities

The table below shows key communications system infrastructure in Berkeley, along with the companies responsible for the systems.

Table 11. Key Berkeley Communications Systems

Owner/Manager	Infrastructure
AT&T	• Land line telephone distribution system that shares poles with PG&E in some locations and is located underground in other locations
Comcast and other companies	• Cable systems that share poles with PG&E in some locations and are located underground in other locations
Verizon, Sprint PCS, Nextel and other companies	• Cellular telephone antennae distributed throughout the city

Communications infrastructure is spread throughout Berkeley, and thus is exposed to all earthquake ground failure hazards.

Telephone and cable communications systems are almost entirely aboveground in Berkeley. Earthquake shaking can topple or break utility poles, and falling trees or collapsing structures can damage utility lines.

Additionally, Berkeley's underground utilities include communications conduits. Underground systems are particularly vulnerable to damage from ground failure in earthquakes. Displacement on the Hayward fault could rupture these systems, compromising these lifelines unless redundant connections unaffected by the earthquake are available. Ground movement due to liquefaction in the west and landslides in the east will also severely impact these systems. Liquefied areas may move laterally, breaking underground cables and damaging communication lines. Landslides can damage underground and aboveground communications infrastructure during earthquakes, or in separate slides that can occur for weeks or months following an event.

Underground damage is harder to detect and repair and the length of service losses may be greater than for aboveground systems.

Key Communications Partners

AT&T[34]
AT&T provides and maintains telephone service to Berkeley residents, along with internet access, Uverse Television Service, mobile telephone service, and other business services. The telephone wires, conduits, coaxial cables and fiber optic lines have been tested and designed to be highly resistant to earthquake shaking, and easy to reroute should problems occur. For example, slack is provided in underground cables to permit earth movement without damage. All

AT&T facilities have batteries that can run for four hours without electrical service, and many diesel generators are available to supplement the batteries if needed. Minimal water is required to keep the electrical equipment from overheating.

AT&T expects some telephone outages, including mobile phone service, after a major earthquake, and service restoration would take hours to days, depending on location and the situation. A major earthquake could impact service in a 50 square mile radius. The central office in Berkeley, with major equipment, has been seismically strengthened, but it is possible that neighboring buildings that have structural deficiencies could collapse into this building and cause damage. If the central office building was completely destroyed, portable equipment and trailers could quickly reestablish service. AT&T is prepared to set up additional phone lines open to the public at a central location if major service losses occur.

The AT&T Network Disaster Recovery (NDR) team has managers, engineers, and technicians who receive special training in physical recovery of AT&T's network. Members participate in several recovery exercises each year to test, refine, and strengthen AT&T's business continuity and disaster response services in order to minimize network downtime.

AT&T's Network Disaster Recovery organization is responsible for the rapid recovery of service at AT&T sites following a catastrophic event.

In the case of an event or disaster the NDR has three primary goals:

1. Route noninvolved telecommunications traffic around an affected area

2. Give the affected area communications access to the rest of the world

3. Recover communications service to a normal condition as quickly as possible through restoration and repair

AT&T won Frost & Sullivan's 2010 Product Leader Leadership of the Year Award for Business Continuity and Disaster Recovery Services in North America.

Verizon Wireless[35]
Verizon Wireless serves its individual, government and business customers with voice and/or data services via Verizon's wireless cellular network.

Verizon has designed and built its network with day-to-day reliability and disaster resilience in mind. Since inception, all Verizon Wireless facilities in California have been built to the most stringent California building codes. Verizon also follows an internal Network Equipment Building System standard. Since 2004, Verizon has hardened its network by moving two of its Bay Area switching facilities to newly-constructed facilities. These facilities meet or surpass all then-current earthquake standards; they also provide additional redundancy with respect to capacity for battery back-up, generators, fuel and HVAC. The facilities also have increased security through design and alarming capabilities. All major transport facilities (i.e., the links between switching facilities, network hubs, the internet, etc.) are fully redundant either through

SONET Ring architecture or diverse path routing.

Verizon Wireless has worked with the City to place all 13 of its Berkeley cell site facilities. In the Verizon Wireless Northern California network, about two-thirds of all sites have permanent generators. This represents an approximately 250 percent since increase since 2004. In Berkeley in particular, cell site facilities have relatively few generators, with only 2 of the 13 sites so equipped.

In a disaster, Verizon's basic service mission does not change. However, it is understood that the network may be damaged from the impacts of a disaster, such as an earthquake, and that the demand on the network will simultaneously rise. In this case, the mission of Verizon Wireless will be to:

1. Restore and/or enhance the network as quickly as possible, to the greatest extent possible.

2. Assist with local communities' wireless communications needs to the greatest extent possible to enhance public safety and relief or rescue efforts.

Verizon's local network group trains and drills for disaster events, and local personnel have aided recovery efforts for other disasters outside the area, such as Hurricanes Katrina and Sandy. In the event of a disaster, Verizon makes the resources of the entire company available locally.

Comcast[36]
Comcast provides the following services to the Berkeley community:

- Voice (wireline telephone service)

- Video (television)

- Data (high-speed Internet, Wi-Fi hotspots, cellular backhaul services)

- Home security/home automation

Comcast's distribution telephony network depends on other communications providers. If supporting providers' networks are operational, Comcast will maintain connectivity to all its customers. If an individual network fails, Comcast will lose its connection to the customers using that particular network.

To protect its infrastructure in earthquakes and other disasters, Comcast has hardened all its sites. Additionally, all sites are connected via redundant fiber networks to maintain service to greater service areas. Major metro fiber routes are backed up by redundant routes and failover technologies.

After a catastrophic earthquake, due to facility redundancy of backbone/regional networks, Comcast expects that transport of major traffic should continue. However, local serving areas are more likely to experience gaps in service due to lessened redundancy between headend

facilities[37] and customer homes.

In the event of a power outage, Comcast will use battery backup to maintain service for up to eight hours. Comcast monitors its power supplies, and in the event of the backup batteries being depleted, generators are in place to maintain service.

Comcast's ability to recover from facility damage after an earthquake will be determined by its ability to access headend locations, as well as to refuel generators if commercial power is lost. Customers may experience a total loss of video service, and total loss or severe network congestion of voice and data services. Comcast also provides cellular backhaul services[38] for Verizon Wireless. Impacts to Comcast's infrastructure could potentially impact Verizon's service to its customers.

B.5.c.v *Critical Response Facilities*

In addition to the infrastructure mentioned above, a key network of facilities supports disaster response activities. This network includes facilities owned by the City, as well as others owned by the City's key partners. Map 14 shows the locations of these facilities. Because these facilities serve the whole Berkeley community on a day-to-day basis, they are positioned throughout the City.

Recognizing that these facilities will need to be as usable as possible following a catastrophic earthquake, the City has put major effort into ensuring seismic stability of these buildings:

- The Public Safety Building was built in 2000 to essential services standards. This facility houses the Police Department Headquarters and 9-1-1 Communication Center, the Fire Department Headquarters, and the City's primary Emergency Operations Center.

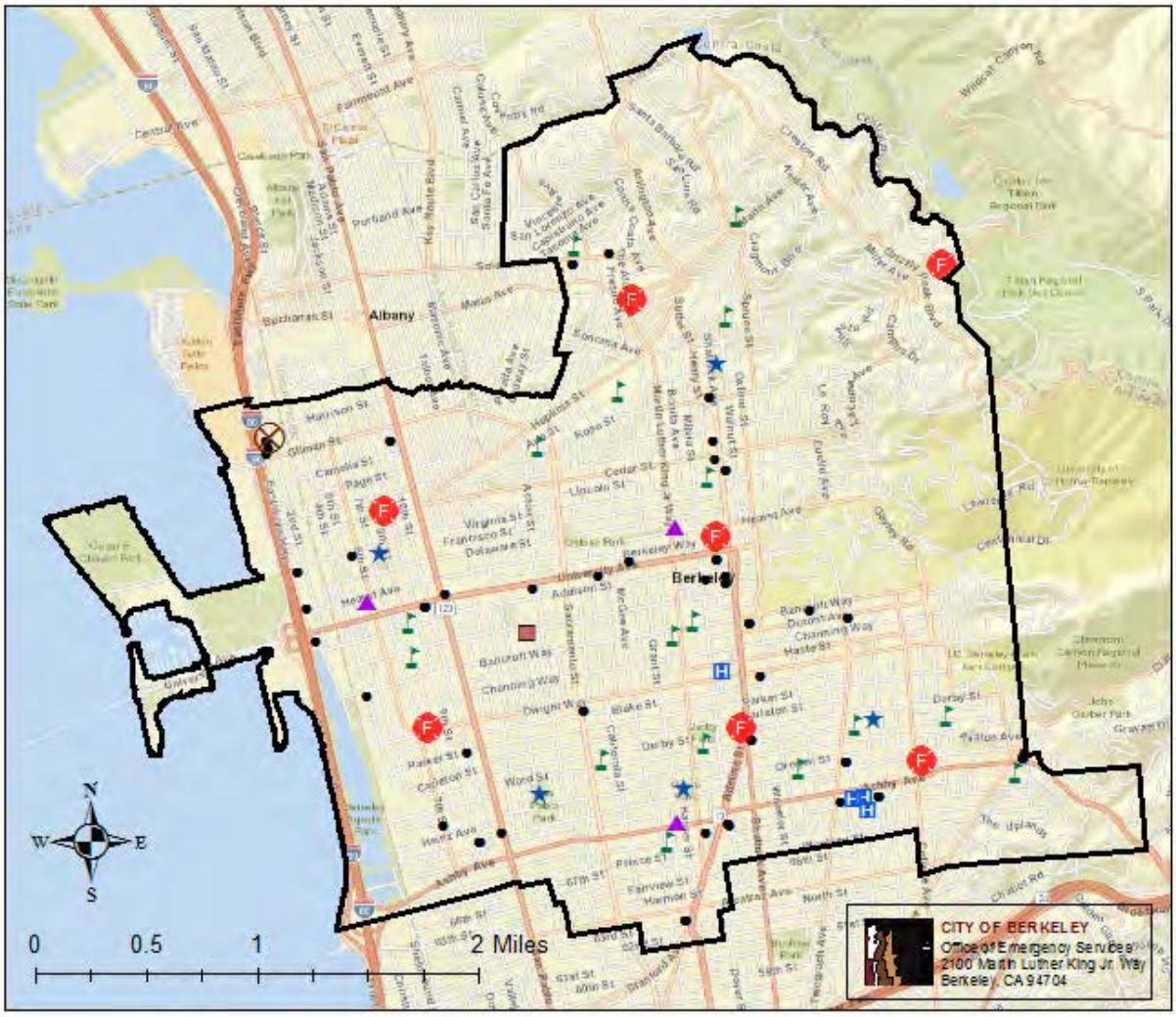
- The City's seven fire stations have all been retrofitted or built to essential services standards.

- City libraries serve as community gathering points both prior to and following disasters. The City's Main Library, which underwent a complete retrofit in 2002, is planned for use as a disaster volunteer reception center. In 2009, the Branch Library Improvement program began work to renovate the City's four branch libraries for seismic safety. Over the next five years Claremont and North branches were remodeled and expanded while South/Tool Lending Library and West branches were demolished and rebuilt. The program was completed in December 2013.

- 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.

- City recreation centers and senior centers are considered potential disaster shelter sites. The James Kenney Recreation Center was retrofitted in 2017. Funding (including FEMA mitigation grant funding) has been secured for a retrofit of the North Berkeley Senior Center.

Map 14. ***City of Berkeley Critical Facilities***



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- City of Berkeley
- Fire Stations
- Recreation Centers
- Senior Centers
- Schools
- Corporation Yard
- Transfer Station
- Hospitals
- Telecom Antenna

Key Critical Response Facility Partner: Hospitals

Hospitals are not operated or owned by City government, but they are critical to disaster response: Following an earthquake, hospitals must be able to care for not only their existing patients, but also a surge of new patients who are injured in the earthquake.

In 1973 as a direct result of the devastation caused by the 1971 San Fernando earthquake (65 deaths and a hospital collapse), the State Legislature passed the Alfred E. Alquist Seismic Safety Act. The Act requires every hospital in California with acute care patient facilities to be built to higher standards than other buildings so they can be reoccupied after major earthquakes. Eleven years later, following the 1994 Northridge earthquake, Senate Bill 1953 expanded the scope of the 1973 Act, requiring:

- By 2002, all critical non-structural components in surgery and emergency medical rooms be retrofitted;

- By 2013, all hospital buildings built before 1973 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) be seismically evaluated and retrofitted, if needed, so they are reasonably capable of providing services to the public after disasters.

The Office of Statewide Health Planning and Development develops and regulates seismic performance standards for hospitals.

Alta Bates Summit Medical Center[39]
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.[40] 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.[41] Four buildings at the Herrick Campus are considered to be a significant risk to life safety.[42] 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 as of 2013.

UC Berkeley University Health Services

University Health Services (UHS), located at the Tang Center, is a fully-accredited ambulatory health facility serving the students, faculty and staff of the University of California, Berkeley.

UHS provides medical care, including urgent care, primary care, occupational health and specialty services, supported by a pharmacy, laboratory, physical therapy, immunization/travel services, a medical records department, radiology services and advice nurse access. UHS also offers counseling, social services and psychiatric care to support students' academic success.

UHS' disaster response role depends on the needs at the time of the event. In a localized emergency, UHS may provide for members of the campus by addressing mental health needs, distributing vaccinations, assisting with relocation, or by providing other support services. In a catastrophic earthquake, UHS will use available resources to triage and care for campus persons, but will require additional resources to care for large numbers of people who may present. By providing care on campus, UHS will help to reduce demand on local emergency rooms from people who do not need tertiary care.

UHS coordinates its disaster readiness activities with both the City of Berkeley's Public Health Division and the Alameda County Public Health Department. Relationships between these entities have been built over many years, establishing the understandings and relationships that will support effective disaster response.

In 1993, the Tang Center was constructed to an essential facilities standard, due to both its health-related mission and its then-designation as a backup Emergency Operations Center for the campus.

To secure access to electronic health records, UHS moved its clinical management system to a secure hardened facility with redundant power and network connectivity. Backups of all data reside both locally in the Data Center and at the San Diego Super Computing Center (SDSCC).

UHS has located shipping containers in close proximity to the building to store medical supplies to support basic triage immediately following a major earthquake.

In coordination with the Office of Emergency Management, and local entities, UHS participates in planning and drills for various emergency scenarios, including loss of water and power.

Key Critical Response Facility Partner: Public Schools

Public schools are not operated or owned by City government, but they are critical to disaster response: they may be used for temporary sheltering of people displaced from their homes following an earthquake. Schools also support disaster recovery, providing a welcome return to normal routines for children, and childcare so that parents can rejoin the workforce.

Unlike laws and regulations for privately-owned buildings, there is a statewide approach to retrofitting and upgrade of existing schools, which must meet special earthquake design standards. The Division of the State Architect is the review agency for the design and construction of public K-12 school facilities in California. The Field Act, originally passed in 1933, 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.

Up until June 30, 2006, community colleges had to comply with the Field Act. In 2006, Assembly Bill 127 was passed, giving community colleges the option of choosing to design and construct under local building codes or under the Field Act.[43]

Only some charter school buildings are subject to Field Act provisions. Many school and building officials are unclear about the rules that apply when the Field Act does not.[44]

Berkeley Unified School District[45]
The Berkeley Unified School District, a special local government district, manages primary and secondary education and educational facilities, including all public schools in the city. City government provides police and fire services to the District, but has limited authority over these structures.

In 1989, shortly after the Loma Prieta earthquake, the District hired engineers to evaluate the structural safety of the buildings. Engineers found significant problems at many schools. The District's Board took swift action. Within a year, the District closed a number of schools, took precautionary measures at ones that remained open, and developed a plan of action to correct safety problems within the District as a whole.

Local voters have approved several bond measures to renovate and modernize city schools. In June 1992, local voters approved a bond measure to raise taxes to provide $158 million to renovate and modernize the city's schools. In November 2000, voters approved another supplemental bond measure for the safety program totaling an additional $116.5 million. In the years since voters approved the original tax measure, all of the schools identified by the engineers have been seismically strengthened or demolished and replaced.

Notable Mitigation Activities
As of 2013, all District pre-K, K-12, and adult educational facilities, requiring retrofit under the Field Act and subsequently adopted State safety laws have been retrofitted. Additionally, with the exception of plant operations, all administrative spaces have been retrofitted and the transportation facility was built in strict accordance with the seismic building code.

In November 2010, Berkeley voters approved Measure I, funding improvements to school safety and facilities. Seismic work funded by the measure includes:

- Demolition of the Old Gymnasium at Berkeley High School.
- Replacement of the unreinforced masonry building at the BUSD corporation yard that functions as its maintenance facility. Due to cost estimates proving to be much higher than the original projections, this project remains on the unfunded list and has been delayed.

In 2012, the District moved its administrative offices out of the seismically-unsafe Old City Hall and into a newly-renovated building on Bonar and University.

In addition, as the building code becomes more stringent, Berkeley continues to improve the seismic safety of its schools. For example, Berkeley plans to do a voluntary upgrade of the Berkeley Community Theater located at Berkeley High School as well as the Multi-Purpose Room building at Rosa Parks Elementary School over the next two years.

Berkeley City College[46]
Berkeley City College is a community college serving about 6,297 students in downtown Berkeley. The college, funded by two local measures, is a state-of-the-art facility meeting the latest seismic and fire safety codes. The building's primary Emergency Operations Center (EOC) is located in the Auditorium, Room 021. Its secondary EOC is located in Room 431. The EOC will be connected to the Alameda County Sheriff and the Peralta Community College district headquarters through short-wave radio.

UC Berkeley Campus
UC Berkeley is a major institution separate from the City but located at its core. 42,000 students, 2,200 faculty and over 11,000 staff work or study on campus. The Hayward fault runs through the eastern half of the UC Berkeley campus, and beginning in the early 1970's, the University began earthquake vulnerability studies and retrofit projects, championed by senior University officials. In the early part of 1997, the campus reassessed the condition of its buildings and began an effort to comprehensively address its seismic risk. The SAFER Program (Seismic Action Plan for Facilities Enhancement and Renewal) was launched through Chancellor Robert Berdahl and Vice Provost Nicholas Jewell. A 1997 structural survey of existing campus buildings revealed that about 27 percent of the building space could perform poorly in a major local or regional earthquake.[47] These findings led to SAFER effectively becoming a physical renewal plan for UC Berkeley's built environment. Since 1997, $500 million worth of seismic improvements have been made to campus buildings and, as of early 2006, work has been completed or started on 72 percent of the square footage identified as needing seismic improvement.[48] The seismic improvement work completed at UC Berkeley has reduced by half the life safety risks for students, faculty, and staff and has cut the risks of potential earthquake-caused economic losses by 25 percent.[49] Planners and executive staff also devoted attention to a wide range of disaster preparedness efforts, ranging from emergency preparedness to facilities and lifeline planning, along with a robust financing strategy.[50]

The City and the University have independent disaster planning programs. However, their risks are inextricably intertwined. A significant portion of UC Berkeley students, faculty and staff live in the city and rely on Berkeley's private industries, housing, and infrastructure. The city's condition after a disaster directly impacts the ability of the University students, faculty and staff to continue their work. Likewise, the city depends on the jobs, commerce, and income created by the University. This means that the viability of University labs, research and other facilities after a disaster has a large influence on the current way of life. The University depends on the City's fire, search and rescue, and hazardous materials emergency services for the campus. Therefore, the risk of fire and catastrophic building collapses on campus directly impacts the capacity of the City's emergency responders. It is in the mutual interest of both the City and the University to coordinate disaster readiness efforts.

Berkeley Lab[51]

Berkeley Lab is a member of the national laboratory system supported by the U.S. Department of Energy through its Office of Science. It is managed by the University of California (UC) and is charged with conducting unclassified research across a wide range of scientific disciplines such as genomics, physical biosciences, life sciences, fundamental physics, accelerator physics and engineering, energy conservation technology, and materials science. The Laboratory's research is conducted in close collaboration with many UC campuses, especially UC Berkeley, UC San Francisco, and UC Davis.

Berkeley Lab employees 5,200 scientists, engineers, support staff and hosts 20,000 guests and users from around the world each year.

Berkeley Lab is located northeast of the City of Berkeley and UC Berkeley campus, on the hill slopes in the East Bay in the Tilden Regional Park area. Parts of the Lab are located on the Hayward fault line, which can result in and significant building damage and earthquake-induced landslides.

The Lab's emergency management function is administered through the Berkeley Lab Emergency Management Program. The mission of the Lab's Emergency Management Program is to build a safe and secure foundation for scientific discovery by preparing for, mitigating, responding to, and recovering from potential hazards caused by natural, technological, and human-caused emergencies.

Berkeley Lab continuously reviews and updates buildings with regard to seismic requirements in accordance with the California Building Code. Several buildings have been retrofitted over the last two decades, with new buildings meeting or exceeding existing code requirements.

Berkeley Businesses

Businesses are vital to the economy of the city and provide jobs to city residents. Ensuring that businesses and employers can return to normal function quickly will in turn ensure that the city recovers quickly from a disaster.

Table 12. Top 25 Berkeley Employers, by Number of Employees[52]

Employers	
Alta Bates Medical Center	Lawrence Berkeley Laboratory
Ansys, Inc.	Lifelong Medical Care
Bayer Healthcare LLC	Meyer Sound
Backroads Active Travel	MSCI Inc.
Berkeley Bowl Produce	OC Jones & Sons
Berkeley Clement Inc.	Recreational Equipment Inc.
Berkeley City College	Siemens Corporation
Berkeley Marina Doubletree	Target
Berkeley Repertory Theatre	University of California, Berkeley
Berkeley Unified School District	US Postal Service
City of Berkeley	Whole Foods Market California Inc.
Genji Pacific	YMCA of the Central Bay Area
Kaiser Permanente	

B.5.d Earthquake 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.

However, 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.[53] In 2014, these loss estimates were combined with impact descriptions from newer HAZUS scenarios for a larger earthquake.[54] 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 scenarios earthquake on the Hayward fault epicentered 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 scenario descriptions create a broad picture of the impact to Berkeley and the Bay Area overall from a catastrophic earthquake.

These HAZUS analyses predict:

Deaths and injuries:

- 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.

- HayWired suggests that across the Bay Area, 800 deaths and 16,000 nonfatal injuries could occur from shaking alone.[55]

Fire following earthquake:

- In the first day following the earthquake[56], fires could ignite in six to twelve[57] 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 $32 to $64 million[58] of damage to structures in Berkeley.

- In counties nearest the fault rupture, the HayWired mainshock could cause about 450 large fires, burning building floor area equivalent to that of more than 52,000 single-family dwellings. Such fires would kill hundreds of people and cause property (building and content) losses approaching $30 billion.[59]

- For the HayWired scenario, an estimated 500,000 to 1 million people will need shelter as a result of fire following earthquake.

- Other potential economic impacts from fire following earthquake in the HayWired scenario include the loss of perhaps $1 billion in local tax revenues.

Debris:

- 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. “Traditional” household waste volumes will also increase due to large amounts of spoiled food resulting from power outages and other debris from residential cleaning. Equipment beyond the current capacity of the region’s private waste management companies will be needed to clear debris. Transportation routes will need to be cleared and restored to move debris out of damaged areas. Before heading to landfill or recycling areas, debris must be sorted at separate facilities. A key challenge will be the disposal of large amounts of contaminated, electronic, and hazardous materials waste. Landfill space is scattered throughout the region.

Buildings:

- Over $2 billion[60] 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.

- Regionally, HayWired suggests that building damage could total $43.3 billion in 2016 dollars, with an additional $17.0 billion in 2016 dollars from damage to contents and commercial inventories.

Displacement:

- From 3,000 to 12,000 households will be displaced from their homes after the quake. About 200 more families will be forced to leave their homes due to fire damage. This represents up to a quarter of households in the city. 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.
- Haywired estimates that in Alameda County, 51,975 households would be displaced and 38,430 people will seek short-term shelter.

- 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.

Infrastructure

Sanitary Sewer System
Interceptors (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.

Water System
EBMUD serves Alameda County and has strengthened its water treatment plants and major aqueducts. Of particular concern, however, are underground pipes, which distribute water from larger aqueducts to customers.

In the HayWired scenario, 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.[61]

These impacts can be reduced if current efforts to replace old, brittle pipe are completed before the next large bay-region earthquake occurs, because such pipe is more susceptible to earthquake damage.

Additionally, EBMUD's Claremont Tunnel has been seismically retrofitted and is not likely to be vulnerable to landslide. It may incur fault offset of up to 7.5 feet immediately but this effect has been incorporated into the mitigation design.[62]

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. For the HayWired scenario, Pacific Gas and Electric Company (PG&E) was unable to offer a public estimate of the time required to restore power throughout the San Francisco Bay area after the HayWired scenario mainshock.

The majority of electrical power in the region is transmitted by Pacific Gas & Electric Company (PG&E). Most of PG&E's electrical substations in the Bay Area were built in the 1900s and 1920s. Although mitigation efforts have been made, significant damage to these buildings is expected. Underground cables that cross liquefiable and weak soils are vulnerable. Immediately after the earthquake, PG&E is likely to initiate power shedding to balance the grid, followed by a progressive blackout of the Bay Area to prevent cascading power failure.

Damaged sections in the transmission and distribution system will need to be repaired or

bypassed. Before electrical circuits are energized, inspections for gas leaks in impacted areas will be necessary. Under the normal circumstances, it takes 2 to 3 days to restore a transmission system. Impeded accessibility as well as workforce shortages will, at the minimum, double restoration times.

Natural Gas
PG&E is the provider of natural gas in the Bay Area. Across the Bay Area, ground failure is expected to damage the network of pipes beneath city streets. Hundreds of breaks in mains, valves, and service connections will occur. Broken gas mains could fuel street fires. Structural fires will occur as a result of broken service connections.

HayWired 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.

Restoration of service across the Bay Area could take as long as two months for customers because individual connections will need to be inspected and appliances re-lighted. Most gas shutoffs are expected to be initiated by cautious customers.

Hazardous Materials Management
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 accidents following an earthquake.

Transportation

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.

The Caldecott Tunnel provides the central link between Contra Costa and Alameda, carries Highway 24, as well as main electrical and gas, transmission lines beneath the roadway. Adjacent, separate tunnels are used for BART and water pipelines. The Claremont Tunnel (EBMUD) has been retrofitted. The BART tunnel is vulnerable to closure due to landslide. If the utilities or mass transit below the roads are damaged, Highway 24 will be closed for months for reconstruction.

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. Additional ferries and bus lines could be established within a week to provide substitutes for BART.

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. As yet, retrofit or replacement of this tunnel is not a viable option and BART has instead developed plans to quickly return this section to service. Depending on the amount of damage sustained, the line could return to partial service within weeks of an earthquake with full replacement potentially taking several years to complete. This will cause inconvenience to many Berkeley residents and may change employment patterns. Temporary transport options, such as buses and increased use of individual cars, are likely to be more polluting than BART. In general, the traffic on all Berkeley roads and highways will probably increase for at least two years following the earthquake. Since 2008, retrofits have been completed on many elevated tracks, stations, parking structures and rail yards. At this time, all retrofits are expected to be completed by approximately 2018.

Communications
HayWired predicts that communications systems, particularly telephone networks, will sustain some damage but perhaps not enough to reduce functionality following the mainshock. However, congestion will reduce functionality to a great degree, for several hours or more.[63]

An overload of post-earthquake calls in the region will make phoning difficult. Carriers will block the calls coming into the region to relieve circuit overloading. Outbound calls, as well as text messaging, are likely to be available.[64] The region's telecommunications companies will prioritize calls to allow emergency responders to communicate by phone.

Customers located in areas subject to severe ground shaking and high probability of ground failure may lose land-based connections to the telephone system. Access for repairs in those areas will be a major problem.

The cellular phone system relies on the integrity of antennas that are mostly located on building tops. Cell phone calls typically connect to the same landline systems that will be hampered by the expected overload of calls.

UC Berkeley
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. 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.

Businesses
Additional losses to income will likely occur due to Berkeley business closures, estimated at $288 million.[65]

Regionally, HayWired predicts $12.3 billion (in 2016 dollars) in building damage-related income losses (for example, relocation costs and lost rent), and total direct economic loss as $82.6 billion in 2016 dollars.

Rebuilding
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 up-ended 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.

An event similar to this scenario is likely to occur in the next few decades. Earthquakes causing significantly more or less damage are also possible.

B.6 *Wildland-Urban Interface Fire*

There are two primary types of wildfires: "wildland" fire and "wildland-urban interface" (WUI) fire. WUI fires occur where the natural landscape and urban-built environment meet or intermix. There may be a distinct boundary between the built and natural areas, or development or infrastructure may be intermixed in the natural area. WUI fires primarily cause damage to the natural and built environment, as well as injury and death of people and animals.

B.6.a Historical Wildland-Urban Interface Fires

Catastrophic fires, including the 2018 Camp Fire in Butte County and the October 2017 North Bay Fires demonstrate the wildland-urban interface fire hazard that is present and growing in California. Berkeley itself has significant WUI fire history, most recently in the October 20, 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 was reignited and whipped into firestorm proportions by 20-30 mph winds, gusting to 60 mph, and spread within minutes 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. Sixty-two single-family homes[66] were destroyed in Berkeley. Ten thousand people were evacuated from the hills areas. Most of the 25 people killed in the blaze were trying to evacuate when they were killed. FEMA estimated the damage at $1.5 billion in 1991 (approximately $2.8 billion in 2018 dollars[67]).

The 1991 firestorm also caused $3 million of damage to Berkeley's public infrastructure[68]. The 2,000-degree fire affected utility systems, including power, gas, telephone and water. Ten key water tanks were drained at the peak of the fire as a result of unprecedented demand from firefighting units, fire prevention measures by homeowners (e.g. wetting roofs with garden hoses), and broken water service connections in burned homes. Early in the fire, burning power lines and melting underground services resulted in a loss of power, which affected water system pumping plants. A total of eight pumping plants, which refilled the water tanks being used by fire fighters, lost power by the first afternoon. Although these were restored by evening, the capacity of the water system pumps was far less than the amount of water used by firefighters and spilled by broken connections.

Total damages in the city of Berkeley, including loss of private structures, loss and damage of public infrastructure, and the cost of City services, are estimated at $61 million.[69]

The day of the 1991 fire, the Bay Area experienced high temperatures of 80-90 degrees, and unusually hot, dry winds blowing from the east, rather than the normal, moisture- laden western winds from the ocean. This type of wind, referred to as Foehn or Diablo winds, occurred 21 days in 2018. These winds, combined with the high temperature, low humidity, and built-up dry fuel load create Red Flag conditions. The number of Red Flag Warnings issued for the East Bay Hills by the National Weather Service has increased from three in 2012 to nine in 2018. These conditions were present for the 1991 Tunnel Fire. The firefighters were helped when on the second day, the winds shifted to the west and cooler temperatures and fog rolled in.

Historically, major fires have occurred in the wildland-urban interface under virtually the same

critical fire conditions. The table below identifies significant WUI fires in Berkeley history.

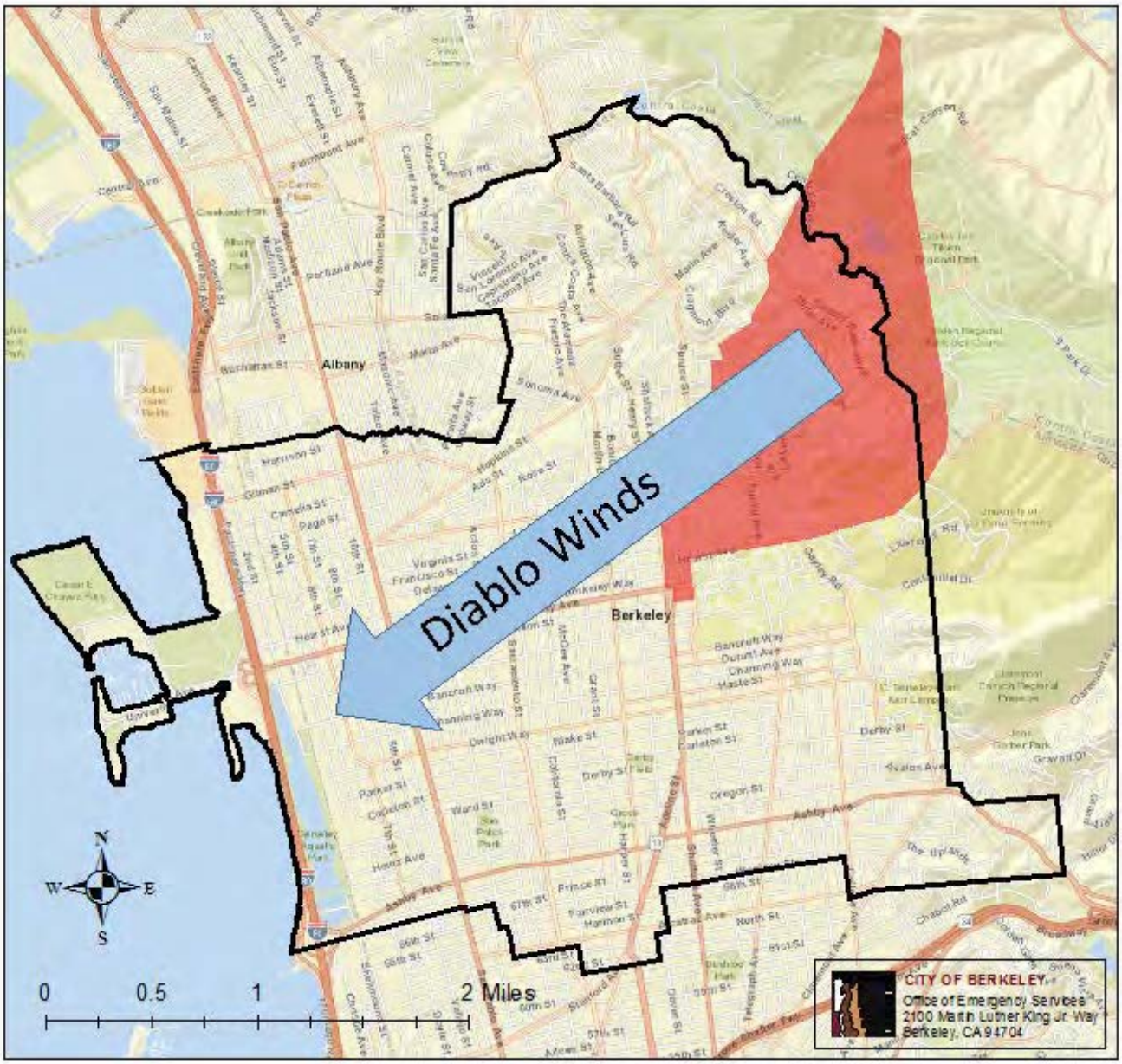
Table 13. History of Major Wildland-Urban Interface Fires in the Oakland/Berkeley Area[70]

September 17, 1923	Berkeley Fire	568 structures
September 22, 1970	Fish Canyon Fire (Oakland)	39 structures
December 14, 1980	Wildcat Canyon Fire (Berkeley)	5 structures
October 20, 1991	Tunnel Fire (Oakland/ Berkeley)	3,354 dwellings; 25 lives lost

The Berkeley Fire of 1923 began in the open lands of Wildcat Canyon to the northeast and, swept by a hot September Diablo wind, penetrated residential north Berkeley and destroyed nearly 600 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. 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. Historical analysis of newspaper reports after the fire indicates that significant acreage was burned in both Strawberry and Claremont Canyons. Because there were few, if any structures in these areas, the full scope of the fire has been underreported in subsequent years. 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[71].

Map 15 depicts in red the area burned by the 1923 fire. It also overlays the Diablo wind pattern to demonstrate how the fire could have spread into the Berkeley flatlands, had it not been for the change in wind direction.

Map 15. ***Area burned by 1923 Berkeley Fire***



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

1923 Burn Area

B.6.b Wildland-Urban Interface Fire Hazard

The City of Berkeley faces an ongoing threat from a very likely wildland fire along its hillsides, where wildland and residential areas intermix. Wildland-urban interface (WUI) fires can be sparked by both human activity and natural causes. Once ignited, these fires can be difficult to contain when they occur during extreme fire weather conditions. A WUI fire can move with breathtaking speed, expanding to one square mile in under an hour, and consuming hundreds of structures in an hour.

Hot, dry, windy weather often coincides with WUI fires. WUI fire spread is affected by wind speed and direction, fuel and topography. Dry, dense vegetation feeds fires, including some residential landscaping. Wooden homes also serve as fuel for fire. Tall trees, present throughout Berkeley, can harbor canopy fires at the treetops that contribute to fire spread and are particularly difficult to fight. Fire spreads uphill quickly.

Fires burn buildings and threaten infrastructure. The intense heat associated with a firestorm can deteriorate concrete and asphalt pavement, curbs, sidewalks, and drainage structures. Other infrastructure that burns includes aboveground wiring for electricity, telephone and cable, and poles for lights and street signals.

In addition to impacts on the natural and built environment, fire has impacts to public health. Fires can result injuries and death from burns and smoke inhalation. Air pollution from fires can cause eye and respiratory illnesses, and can exacerbate asthma, allergies, chronic obstructive pulmonary disease, and other cardiovascular diseases. The City of Berkeley Occupational Health, Public Health, and Environmental Health Divisions coordinate air quality messages for staff and community through the Public Information Officer in the City Manager's Office.

Secondary Hazards: Landslide and Flooding

WUI fires can increase an area's risk of landslide and flooding. 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. When winter rains come, this leads 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,[72] [73] making it a secondary hazard that must be mitigated immediately after a fire.

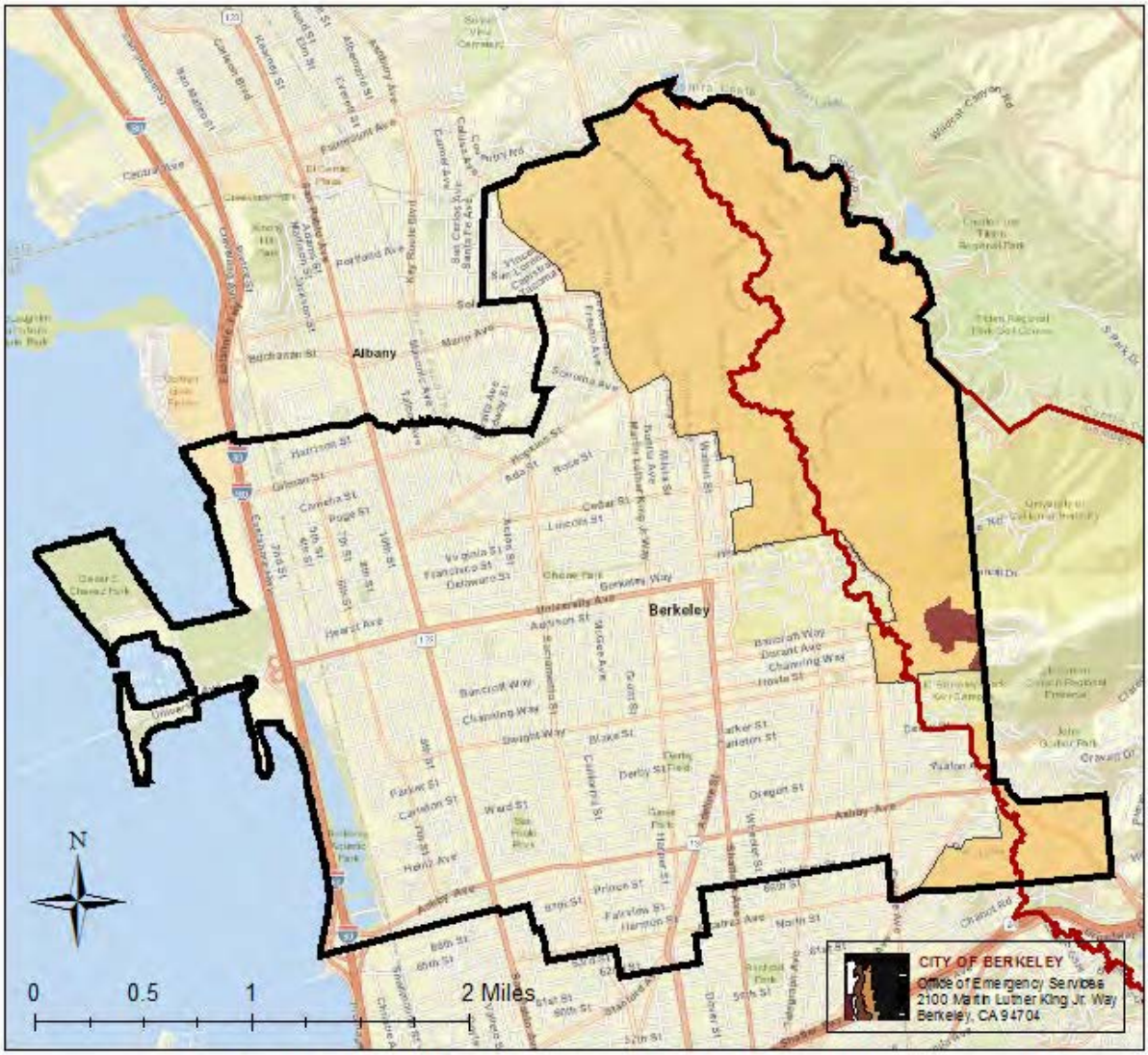
B.6.c Exposure and Vulnerability

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, Berkeley Lab, the East Bay Regional Park District, the City of Oakland or Contra Costa County. The WUI fire risk facing Berkeley's wildland-urban interface area is compounded by the area's mountainous topography, its limited water supply, its minimal access and egress routes, and its location, overlaid upon the Hayward Fault. These factors have all contributed to the area's significant WUI fire history. Given the right wind conditions, a fire in one of these areas could quickly enter and encroach itself in Berkeley.

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. Currently, the Berkeley Fire Department currently has divided the city into Fire Zones 1, 2, and 3, designated in order of ascending fire risk. These zones are shown in Map 16.

Fire Zone 3 is the Panoramic Hill area specifically; Fire Zone 2 covers the remainder of the city's eastern hills; Fire Zone 1 covers the rest of the City west of the hills. Fire Zones 2 and 3 currently include about 8,300 properties. 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.

Map 16. ***California Department of Forestry and City of Berkeley Hazardous Fire Zones***



Sources: Fire Zones 1, 2, and 3 as of 01/2013 Berkeley Ordinance NO. 7,157-N.S., and California Department of Forestry.

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

CA Dept of Forestry, Very High Fire Severity Zone

Berkeley Fire Zones

Hazardous Fire Zone 1

Hazardous Fire Zone 2

Hazardous Fire Zone 3

While much of the concern for fire is placed on the hills, Berkeley's flatlands are at risk as well. The flatlands are densely covered with old wooden buildings that have narrow side yards and dense vegetation. Most of these houses are old and not built with modern, fire-resistant materials. They have a high risk of damage in an earthquake, which could spark multiple ignitions, for example, by damaging gas/electric lines.

Panoramic Hill Area

The Panoramic Hill area (labeled as the "Hazadous Fire Zone 3" Fire Zone on Map 16) has the greatest WUI fire vulnerability.

It is a wildland-urban interface area located on a hill above Memorial Stadium, between Strawberry Canyon to the north and Claremont Canyon Nature Preserve to the south. The ample vegetation in both canyons adds to the neighborhood's WUI fire risk. Many of the homes in this area have wood shake and shingle roofs and are surrounded by brush-type vegetation. Panoramic Hill also 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.

The neighborhood lies in both Berkeley and Oakland. There are about 280 dwelling units on Panoramic Hill, including 215 dwelling units in the Berkeley part of the neighborhood. There are approximately 520 residents in the area, including close to 100 in Oakland. The area is surrounded by the Berkeley Lab, the University of California, Berkeley (Clark Kerr campus) and the East Bay Regional Park District.

The Hill's limited water supply, access/egress routes, and its exposure to fault rupture further exacerbate the area's WUI fire risk above that of Fire Zone 2.

Water Supply Limitations

Water supply to the Panoramic area is limited to one undersized water main. As of December 2018, work is in progress to improve water supply. If the existing main is damaged by an earthquake or landslide, any area beyond the point of the break will be without water service. This is different from other areas in the hills and flatlands, where the "gridded" structure of the water system allows for more redundancy in the event of a water main break. In Panoramic Hill, an earthquake could spark a fire, which could be fueled by damaged gas lines. Damage to the area's one water main from an earthquake or resulting landslide could limit residents' and professionals' ability to suppress the fire.

This sequence of events could devastate the neighborhood and grow into a firestorm, threatening other parts of the city and neighboring jurisdictions.

Access and Egress

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.

History demonstrates that endangered residents in the path of a major fire will attempt to leave the area via private vehicles crammed with personal belongings. When there is another major hill area fire or an earthquake, emergency access and egress on the substandard road will be highly constrained. People trying to leave a dangerous condition will conflict with emergency personnel trying to address it or trying to reach others who need help to leave. Further, an earthquake-induced landslide impacting Panoramic Way could also block any vehicles from entering or leaving the area.

Exposure to Fault Rupture

Further intensifying the neighborhood's vulnerability, the Hayward Fault runs under Panoramic Way, just before it crosses the parking lot and bisects the Memorial Stadium. In a Hayward Fault earthquake, the Panoramic Hill area will likely be isolated from the City's emergency services, all of which lie on the other side of the fault to the West (with the exception of Fire Station 7, which lies north of the UC Berkeley campus).

Notable Mitigation Activities

The City, working together with key partners, is using a comprehensive strategy to aggressively mitigate Berkeley's WUI fire hazard. These approaches include prevention through development regulations; natural resource protection through vegetation management; improvement of access and egress routes; and infrastructure maintenance and improvements to support first responders' efforts to reduce fire spread.

Prevention

The City enforces several programs to reduce Berkeley's fire hazard, especially the WUI fire hazard in the hills. These include strict building and fire code provisions, as well as more restrictive local amendments[74] for new and renovated construction, and vegetation control inspections in high-risk properties.

Panoramic Hill Area Development Regulations

Following the 1970 Fish Canyon Fire, the Planning Department established the Berkeley portion of the area as an ES-R (Environmental Safety-Residential) zone. This action limited the use of land and the size and occupancy of residential structures in the area.

The ES-R regulations are the most stringent residential standards in the Berkeley Zoning code.

The City has continued to adopt strict standards that curtail development on Panoramic Hill, so that as few additional people as possible are placed at risk until the area's underlying infrastructure issues are addressed. In 2008, City Council adopted a moratorium on development on the hill. In May 2010, the Council repealed the moratorium, passing an ordinance that blocks establishment of any residential units on the Hill. The restriction remains in effect until Council adopts a Specific Plan for the area's land use. The Specific Plan must include:

- Proposals for water, wastewater and storm water systems
- Proposals for a circulation system adequate to accommodate projected traffic, and to provide for emergency access to the area
- An action plan and finance measures necessary to carry out the Specific Plan.

Because the neighborhood resides in both Berkeley and Oakland, in 2006, the Alameda County Local Agency Formation Commission (LAFCo) expanded Berkeley's Sphere of Influence to include the Oakland part of Panoramic Hill. LAFCo acted to do so despite opposition letters from the City Manager of the City of Berkeley and City Administrator from City of Oakland. LAFCo's action means that the City of Berkeley is now officially charged with planning for all of Panoramic Hill, including those areas currently in Oakland. While Berkeley must consider the entire Hill in its planning documents, it only gains zoning authority if those portions of the Hill in Oakland are annexed to the City of Berkeley – a long and complicated process requiring agreement of both Cities.

Since it is highly unlikely that there will be City funds available to undertake the planning and then the design and construction necessary to address the area's infrastructure deficiencies in the foreseeable future, existing land and homeowners in Berkeley and Oakland will likely need to collaborate to provide the necessary funding for a Specific Plan. Grant funding may also be available to undertake some of the necessary planning, design, and construction.

Natural Resource Protection

The Hazardous Fire Area Inspection Program is in place for a subset of properties within Fire Zones 2 and 3. Each year, Fire Department personnel inspect over 1,400 parcels in Fire Zones 2 and 3. Additionally, personnel conduct complaint-driven inspections in all three of the City's Fire Zones.

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. The Program serves properties in the hills from June through September each year. Since 2014, over 100 tons of vegetation was collected and recycled, on average, each year.[75]
- A fire fuel abatement program on public land. This Program was maintained 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, pathways and landscaped medians.[76]

- 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.[77]

- Additionally, 30,000 tons of residential and commercial plant debris and commercial food waste[78] is collected each year through weekly curbside collection and converted to compost.

- The City of Berkeley's Zero Waste Division has expanded staffing to include a full-time Recycling Program Manager, and is working to hire additional field representatives to help educate the community about its vegetation management programs. Additionally, the Division is performing a Feasibility Study to reimagine the City's Solid Waste and Recycling Transfer Station to achieve its goal of Zero Waste. This reenvisoned facility will help to support outreach staff in their efforts to promote vegetation management programs.

Access and Egress

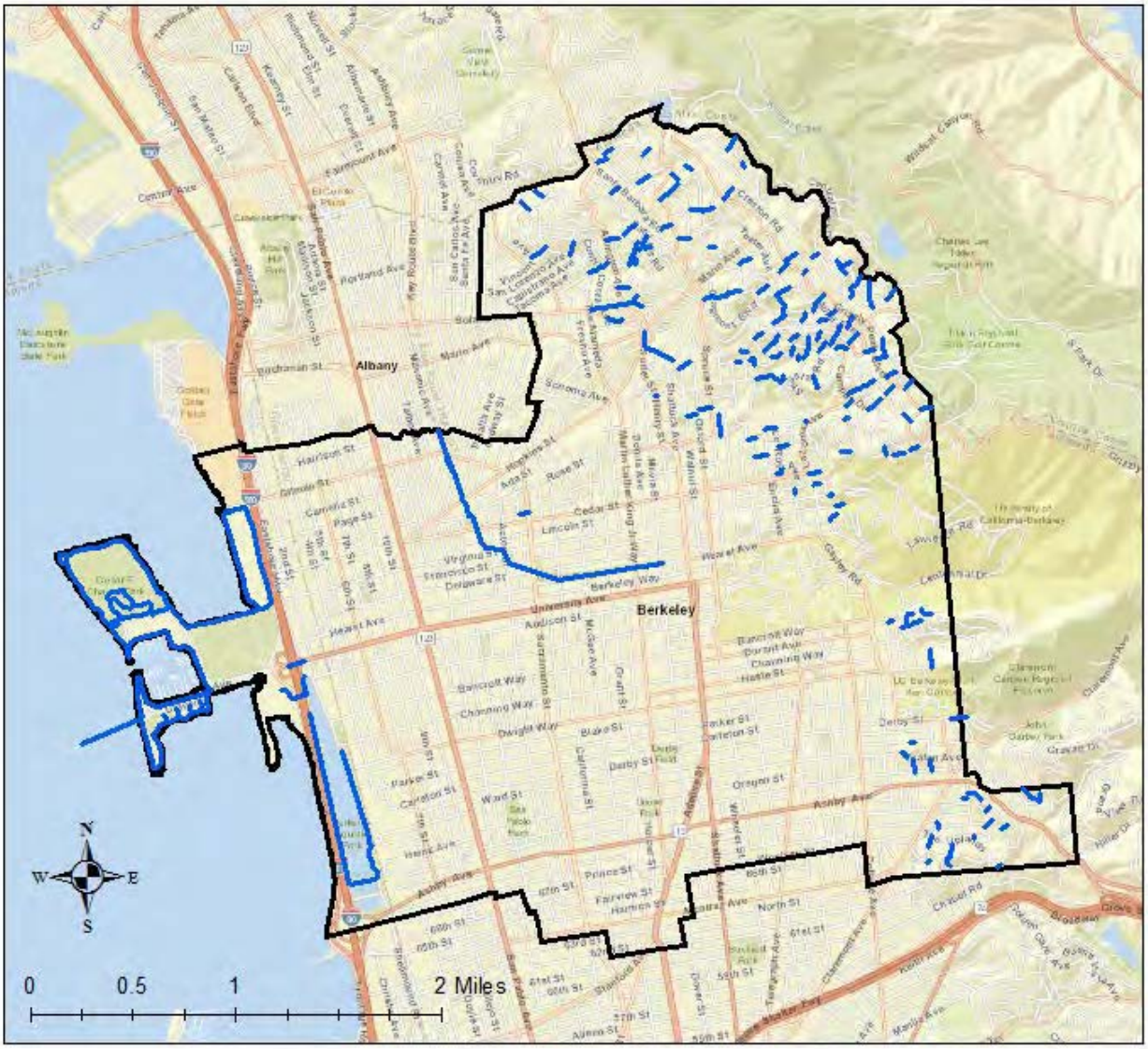
Key Partner: Berkeley Path Wanderers Association

Berkeley Path Wanderers Association (BPWA) is an all-volunteer nonprofit organization concerned with Berkeley paths. In the city's many steep neighborhoods with winding roads, these paths take the shortest, most direct routes, mimicking city block grids that do not exist. In addition to producing a community recreation asset, these pathways can assist evacuation and firefighting efforts in the hills.

Since 1997, BPWA has built and maintained rustic paths using wood ties secured to the ground with rebar, replaced wooden ties and rebar when necessary, cleared overgrown vegetation, and conducted monthly weeding. The group also cleans and clears historic cement paths. BPWA has also contributed funds for installation of handrails. The City's Department of Public Works performs more heavy maintenance, such as cement work and hand rail installation and replacement.

Map 17 shows pedestrian paths in the City of Berkeley using blue lines. As indicated on the map, there are many small paths in the Berkeley hills that can help with fire evacuation and firefighting efforts.

Map 17. ***Pedestrian Pathways in Berkeley***



Source: Berkeley Path Wanderers Map, 8th Edition.
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
Berkeley Paths

BPWA has improved 34 paths in the hills north of the UC Berkeley campus. Most of the paths offer more expeditious evacuation routes than the surrounding city streets. The table below shows some of the BPWA paths that significantly reduce pedestrian evacuation distances.

Table 14. Noteworthy BPWA Paths

Path Name	Distance	Distance without Path
Acacia Walk	0.1 miles	0.4 miles
Atlas Path	<0.07 miles	0.2 miles
Bret Harte Path	< 0.1 miles	0.2 miles
Glendale Path	0.2 miles	0.6 miles
John Muir Path	< 0.1 miles	0.3 miles
Northgate Path	< 0.1 miles	0.4 miles
Upper Covert Path	< 0.1 miles	0.5 miles
Wilson Walk	< 0.03 miles	0.4 miles
Yosemite Steps	0.1 miles	0.4 miles
Dwight Way Path	Links Dwight Way and Clark Kerr Fire Trail	

In July of 2018, BPWA conducted a survey of all the paths, noting the condition and needed repairs of each path. BPWA plans to continue conducting full path surveys every five years.

In addition to maintaining paths, the group raises awareness of the paths for use as both escape routes for residents and as access routes for emergency personnel. BPWA performs outreach through a published map, their newsletter, free public meetings, and free guided walks.

In fall of 2018, the BPWA hosted walks with three Berkeley neighborhoods to practice using evacuation routes out of the Berkeley hills. These routes included key paths, and served to better familiarize community members with evacuation routes they may need to use in a disaster that blocks roadways.

Notable Mitigation Activities

In the spring of 2015 the City performed repair work on Bret Harte Path. Work included the removal and replacement of damaged concrete stairs, removal and replacement of damaged concrete walkway, and the installation of handrails.

In the spring and summer of 2016 the City developed the previously undeveloped John Muir Path.

The BPWA does not maintain paths on UC Berkeley land, but is exploring ways to work with UC Berkeley to improve pedestrian transitions between UC and adjacent neighborhoods. For example, in the winter of 2017 the Berkeley Path Wanderer's Association (BPWA) installed approximately thirty 4'-wide wooden stairs at the bottom steep section of Dwight Way Path. This path is located at the top of Dwight Way (a City street) and merges onto the Clark Kerr Fire Trail on UC Berkeley property.

The City-BPWA partnership will continue into the future:

- The City is currently working on the future development of the currently undeveloped Devon Lane.
- The City has entered into an agreement with EBMUD to realign and upgrade Arden Path. The current upper portion of the path is on EBMUD property rather than City property and will be realigned onto City property. The path will also receive a new staircase over a step section of the path. EBMUD is scheduled complete this work in late 2019.
- City forces are currently working to install a handrail along the lower portion of Park Path. Work is scheduled to be complete in 2019.

Improving Firefighting Readiness

Early suppression efforts prevent many WUI fires from growing out of control. Since the 1991 fire, the City has continued to build firefighting infrastructure to enable firefighters to reduce fire spread.

In 2006, the City constructed a new fire station on Shasta Road, just north of the UC Berkeley campus in the hills. This station, in addition to being in the wildland-urban interface, is the only City fire station east of the Hayward fault.

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. This capacity was based on calculations of water volumes required to fight the fire front presented in the 1991 blaze, assuming that some capacity will be available from EBMUD sources, in light of system upgrades.

Since the 1991 fire, the Berkeley Fire Department has been also working to strengthen its wildland firefighting skills and to prevent conflagrations. Firefighters remain in a constant state of readiness to respond to a wind-driven WUI fire in the hills, which could transition into a fast-moving urban firestorm in the flatlands. Additionally, the City has built cooperative relationships with neighboring fire departments to put out vegetation fires before they grow into multi-jurisdictional problems. Mutual response agreements among the City and its neighboring jurisdictions have increased the fire resources that respond to the reporting jurisdiction.

This cooperation has been assisted through formal efforts, such as the inter-jurisdictional Hills Emergency Forum (HEF), started after the 1991 fire. HEF exists to coordinate the collection, assessment and sharing of information on East Bay Hills fire hazards, and to provide a forum for building interagency consensus on the development of fire safety standards and codes, incident response and management protocols, public education programs, multi-jurisdictional training, and fuel reduction strategies.

Key Partner: UC Berkeley

UC Berkeley campus lands include approximately 800 acres of wildland in the East Bay hills that border on residential neighborhoods in Berkeley and Oakland. The combination of an accumulation of dense nonnative vegetation and increased urbanization has created a wildland-urban interface (WUI) condition posing an extreme threat to lives and property. From 1923 to 1991, 14 major fires have occurred in this area, including the 1991 Tunnel Fire that destroyed more than 3,354 dwellings and claimed 25 lives.

UC Berkeley depends on the City for fire services, but does not fall under City fire preparedness ordinances. The University has an established Campus Fire Mitigation Committee to develop and oversee a program to manage the WUI fire hazard. The goal is to manage vegetation to ensure that the vulnerable areas are WUI fire-defensible by improving accessibility for fire crews, creating and maintaining escape routes, and lessening the rate of fire spread and/or reducing the potential for embers to ignite adjacent neighborhood. The University has made repeated efforts since 1974-75 to eliminate the vast groves of eucalyptus trees on its property. Earlier efforts were unsuccessful, as the felled trees regrew from their cut stumps. UC efforts since 2001 have emphasized the use of herbicides to kill the eucalyptus trees after felling, along with an integrated management approach to prevent the millions of viable eucalyptus seeds from germinating. The University's goal is to convert its eucalyptus- and pine-forested areas to oak/bay woodland, scrubland, grassland or other floral communities historically found in the East Bay hills. In 2006, UC Berkeley opened the Center for Fire Research and Outreach to encourage and facilitate collaboration on fire-related research questions and provide a central point for wildfire information.[79]

Key Partner: Berkeley Lab[80]
With regard to wildland fire and wildland-urban interface (WUI), the Berkeley lab is in a vulnerable position. The lab borders a potential wildland fire area in the Tilden Regional Park area and borders a highly populated urban area in the City of Berkeley. This can cause challenges with timely evacuations, thus the laboratory has developed an invacuation process for shelter-in-place during wildland fires if necessary. The goal will be to evacuate the laboratory, however, this may not be the safest thing for employees after an earthquake or prior to a wildland fire. The lab has a trained and qualified Emergency Response Organization (ERO) to make critical decisions regarding protective actions and the safety of lab employees.

B.6.d Wildland-Urban Interface Fire Risk and Loss Estimates

The 1923 fire was the worst 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 recent 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 structures of Berkeley using the City's Geographic Information System, we find that, today, over 3,000 structures are located in the footprint of the 1923 fire. These structures include single-family homes, multi-family residences (many of which house UC Berkeley students), and 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.[81] Destruction of contents in all of the homes and businesses burned would add hundreds of millions of dollars[82] to fire losses. 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 could be devastating. Thousands of families could be homeless following such an event, losing all of their possessions. Many more could need short-term shelter while the fire was burning. 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 northeast Berkeley could be completely changed.

SECTION II: HAZARDS OF CONCERN

Rain-induced landslides, flooding, tsunami and climate change are hazards of concern for Berkeley, because of their potential to severely impact specific areas of the city. Section C of this plan identifies mitigation actions to reduce the impact of each of these hazards.

Climate change is addressed in further detail in Berkeley's Climate Action Plan.

B.7 *Rainfall-Triggered Landslide*

Seismically-triggered landslides are discussed in detail in B.5.b.iv.

B.7.a Historical Rainfall-Triggered Landslides

The most significant recent landslide in Berkeley occurred in January 2017. In January 2017, the overall rainfall in California was on pace to be the wettest season in over 100 years on record. Rain created saturated soil conditions in parts of Berkeley and throughout the State. The slide occurred on an undeveloped lot in the North Berkeley hills and threatened to close the street lying in the path of the slide. Repairs to the hillside were completed in late 2018. No one was hurt.

Berkeley's most significant recent landslide occurred in North Berkeley during the winter of 1997-98, when soil became oversaturated from heavy rains brought by the El Nino weather system. One home was significantly damaged and had to be demolished. Two additional homes were yellow-tagged, meaning they were of questionable safety, but residents were able to reoccupy these homes after the hillside was stabilized. No one was hurt.

Other recent landslide experiences are limited to minor slides blocking roads, such as the collapse of the Euclid Road retaining wall in 1996.

B.7.b Rainfall-Triggered Landslide Hazard

Landslides are natural geologic phenomena that range from slow moving, deep-seated slumps to rapid, shallow debris flows. Landslide risk can be exacerbated by development. Grading for roads, home construction and landscaping 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.

Landslides are most frequently triggered in periods of high rainfall, and are likely to continue occurring in Berkeley. The hazard is greater in steeply-sloped areas, although slides may occur on slopes of 15 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 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 5) 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.c Exposure and Vulnerability

Berkeley faces a moderate landslide hazard. There are a number of deep-seated landslides that continuously move, with the rate of movement affected by rainfall and groundwater conditions. These active landslides are shown in red on Map 5. 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. In addition, there are many more deep-seated landslides that are not currently moving, but have moved in historic time or in recent geologic time. The more significant of these are shown in yellow on Map 5. These "dormant" landslides could be reactivated by changing surface or subsurface conditions.

Areas of the community situated on historic or recent deep-seated landslides are most vulnerable to landslide hazards. Vulnerabilities in these areas include hundreds of homes, roads, sidewalks, underground utilities (water, sewer lines, storm drains, natural gas lines, conduits) and aboveground utilities (electricity, telecommunications, cable).

For debris flows, hazard areas are typically at the base of steep hillsides, near the mouths of steep hillside drainages, and in or around the mouths of canyons that drain steep terrain[83]. In Berkeley, several collector streets that are critical for emergency access and evacuation are located in areas susceptible to landslides.

Key Mitigation Activities

Regardless of triggering mechanism, landslide hazard mitigation techniques are the same. Landslide hazard can be reduced through grading, soil strengthening, geotechnical engineering components, drainage, control of runoff, and landscape methods. In new development, the City regulates the issuance of permits and inspects new development activities. However, most Berkeley hillside development predates current best practices and codes and therefore remains vulnerable to the threat of landslides. The City maintains major retaining structures in the right-of-way that help to control landslide risk in key areas.

B.7.d Rainfall-Triggered Landslide Risk and Loss Estimates

There are few generally-accepted methods to estimate damage from landslides caused by rain. However, many of Berkeley's hillside homes are located in areas that could slide under the right circumstances. According to a USGS report[84], approximately 6,000 structures are located in areas at moderate to high risk of landslides.

B.8 *Floods*

B.8.a Historical Floods

Berkeley's most recent widespread flooding occurred in 2004 throughout the City 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, causing 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.8.b Flood Hazard

Berkeley faces a minor flood hazard, primarily from local creek flooding and storm drain overflow.

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[85], and open channel segments of the creeks are often segmented by shorter culverts that enable streets and development.

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 overtops the banks and floods into properties and streets.

Creek flooding in Berkeley generally originates on private 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. Flooding from storm drainage infrastructure can happen independently of creek flooding. Causes for such flooding are generally rainfall events that exceed the capacity of the storm drainage facilities, blockages, or storm drainage damage that reduces the capacity of the storm drainage infrastructure.

<u>Capacity</u>
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[86]. Using this 10-year design storm standard is considered the most cost-effective design practice,[87] and provides guidance for computing flows and for sizing storm drainage infrastructure.

<u>Age</u>
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. Berkeley's Watershed Management Plan (see *Notable Mitigation Activities)* recommends an inspection program to identify infrastructure that has deteriorated to a condition of being in danger of collapse or deteriorated reducing hydraulic flow capacity.

Flooding Factors

Factors that induce flooding in Berkeley include:

- Winter storms with heavy rainfall: Heavy rainfall increases urban runoff and flows to creeks and the City's storm drainage infrastructure.

- Blockages: Blockages can happen in creeks and in the City's storm drainage infrastructure. The City increases maintenance efforts of its infrastructure ahead of and during significant rainfall events. Residents are responsible for maintaining their creeks and infrastructure within their property.

- Bay tides: Runoff from Berkeley goes directly to the Bay. Higher tide and sea level rise reduce creek and storm drainage flow capacity in the western portions of the City.

- Power outage: An unknown number of property owners rely on electric sump pumps to keep their homes buildings free from water during the rainy season. Any protracted power outage during the rainy season could disable these pumps and lead to water damage in many structures.

- Climate change and its effects: Climate change is linked to increasing the intensity and severity of rainfall events and to sea-level rise. The effects of heavy rainfall and sea-level rise are discussed above. (See Section B10: Climate Change.)

Public Health Impacts[88]
Urban runoff typically contains contaminants that can threaten public health. These include bacteria, toxins, petroleum products, etc. Watersheds in the City are not a source of municipal potable water.[89] Flood waters represent of potential source of contamination to improvements that are at risk of flooding. Local gardens face a similar 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.[90]

B.8.c Exposure and Vulnerability

Flooding exposure in Berkeley generally results from creek flooding and storm drain overflow.

Creek Flooding Exposure - 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. 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.

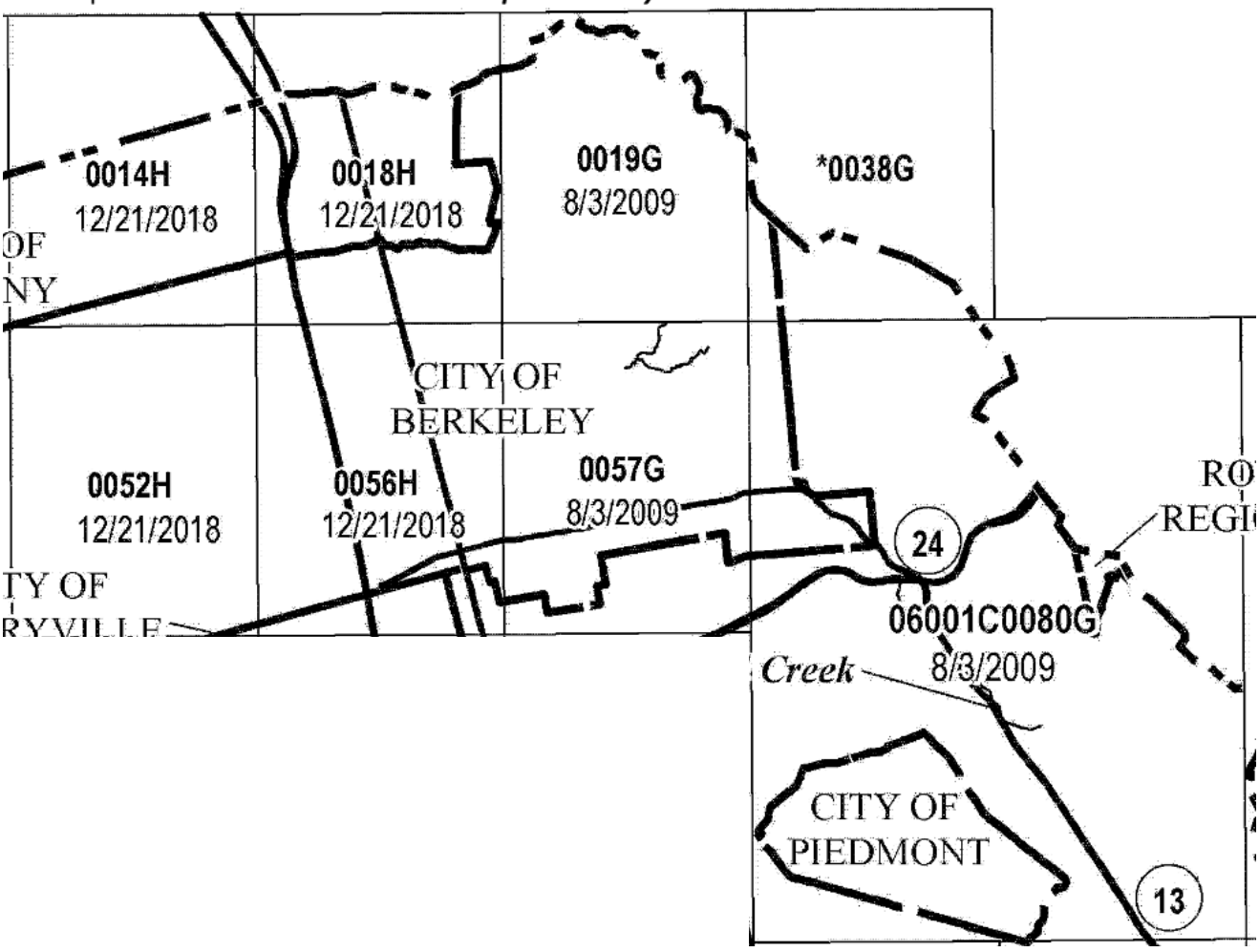
The City last updated Berkeley Municipal Code (BMC) Chapter 17.12: *Flood Zone Development Ordinance* in September 2009 to maintain Berkeley's continued compliance with FEMA National Flood Insurance Program requirements. The Ordinance regulates all publicly- and privately-owned land within the areas 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.

Analysis: Flood Insurance Rate Maps

Map 18 shows the FEMA Flood Insurance Rate Map panels that apply to the City of Berkeley. The map panels present areas of special flood hazard in Berkeley are identified by the FEMA "Flood Insurance Study, Alameda County, California and Incorporated Areas," dated August 3, 2009 and revisions effective December 21, 2018.[91] The study presents flood zone boundaries and any known flood depths or elevations for the one-percent annual chance flood and the 0.2-percent annual chance flood.

Map 18. ***Flood Insurance Rate Map – Berkeley Index***



Each panel displays a number and the date that the associated Flood Insurance Study was last updated by FEMA. These panels, when available, are presented one by one in the following pages.

The pages that follow present the map panels from the index above ordered left to right, top row to bottom row:

Panel Number	Update Date	Notes
0014H	12/21/2018	
0018H	12/21/2018	
0019G	08/03/2009	
0038G	09/30/2015	Not presented because FEMA did not print panel
0052H	12/21/2018	
0056H	12/21/2018	
0057G	08/03/2009	
0080G	08/03/2009	

Maps highlight areas of flood hazard using the following structure[92]:

- Areas highlighted in blue (2018 maps) or blue polka dots (2009 maps) represent Special Flood Hazard Areas subject to inundation by the 1% annual chance flood, meaning that they have a one percent probability of flooding in a given year.
- Areas highlighted in brown (2018 maps) or black polka dots (2009 maps) represent areas of 0.2% annual chance flood hazards, meaning that they have a 0.2% probability of flooding in a given year.

Maps show that flood depths from creek flow in Berkeley are not great.

2004 Flood Analysis

A 2004 analysis explored Berkeley's flood exposure and vulnerabilities to a one percent annual chance flood occurred in Berkeley. This analysis predicted that:

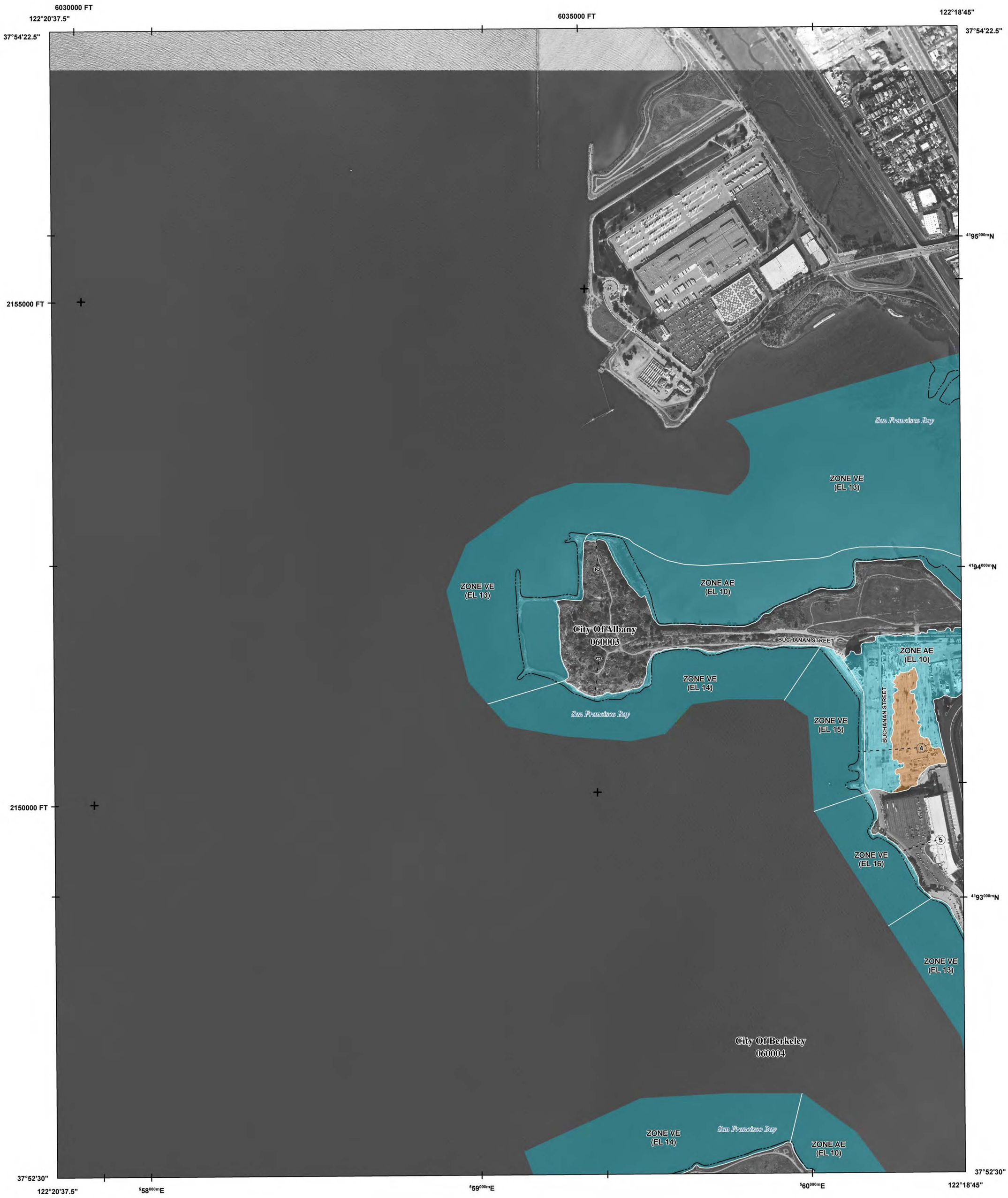
- The maximum flood depth would be two feet deep, mostly near creek channels.
- Approximately 675 structures would be impacted to various degrees:
    - The majority would be inundated by one foot or less of water.
    - Approximately 200 structures could flood with up to two feet of water.

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.

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.

Repetitive Loss Properties

Berkeley does not have any Repetitive Loss Properties as defined by the National Flood Insurance Program.[93]



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was derived from Coastal California LiDAR and Digital Imagery dated 2011. USDA NAIP 2012 imagery is used in areas not covered by the Coastal California imagery.

SCALE

N

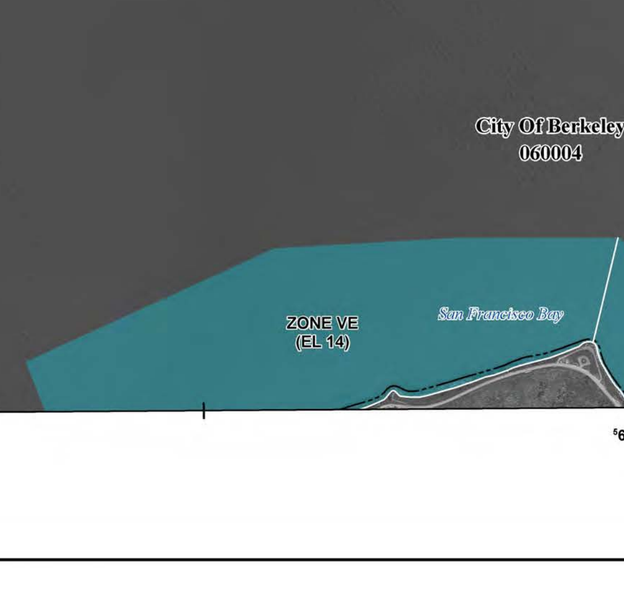
Map Projection:
Universal Transverse Mercator Zone 10N; North American Datum 1983;
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 250 500 750 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



*PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

ALAMEDA COUNTY, CALIFORNIA
and Incorporated Areas

PANEL 14 OF 725

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBANY, CITY OF	060003	0014	H
BERKELEY, CITY OF	060004	0014	H

VERSION NUMBER
2.3.2.0

MAP NUMBER
06001C0014H

MAP REVISED
DECEMBER 21, 2018

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A,V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was derived from Coastal California LiDAR and Digital Imagery dated 2011. USDA NAIP 2012 imagery is used in areas not covered by the Coastal California imagery.

SCALE

N

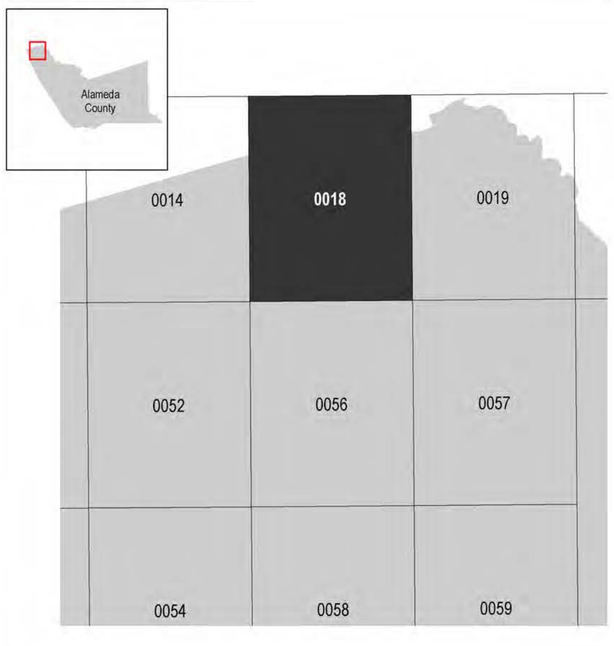
Map Projection:
Universal Transverse Mercator Zone 10N; North American Datum 1983; Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 250 500 750 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

ALAMEDA COUNTY, CALIFORNIA
and Incorporated Areas

PANEL 18 OF 725

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBANY, CITY OF	060003	0018	H
BERKELEY, CITY OF	060004	0018	H

VERSION NUMBER
2.3.2.0

MAP NUMBER
06001C0018H

MAP REVISED
DECEMBER 21, 2018

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 10. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

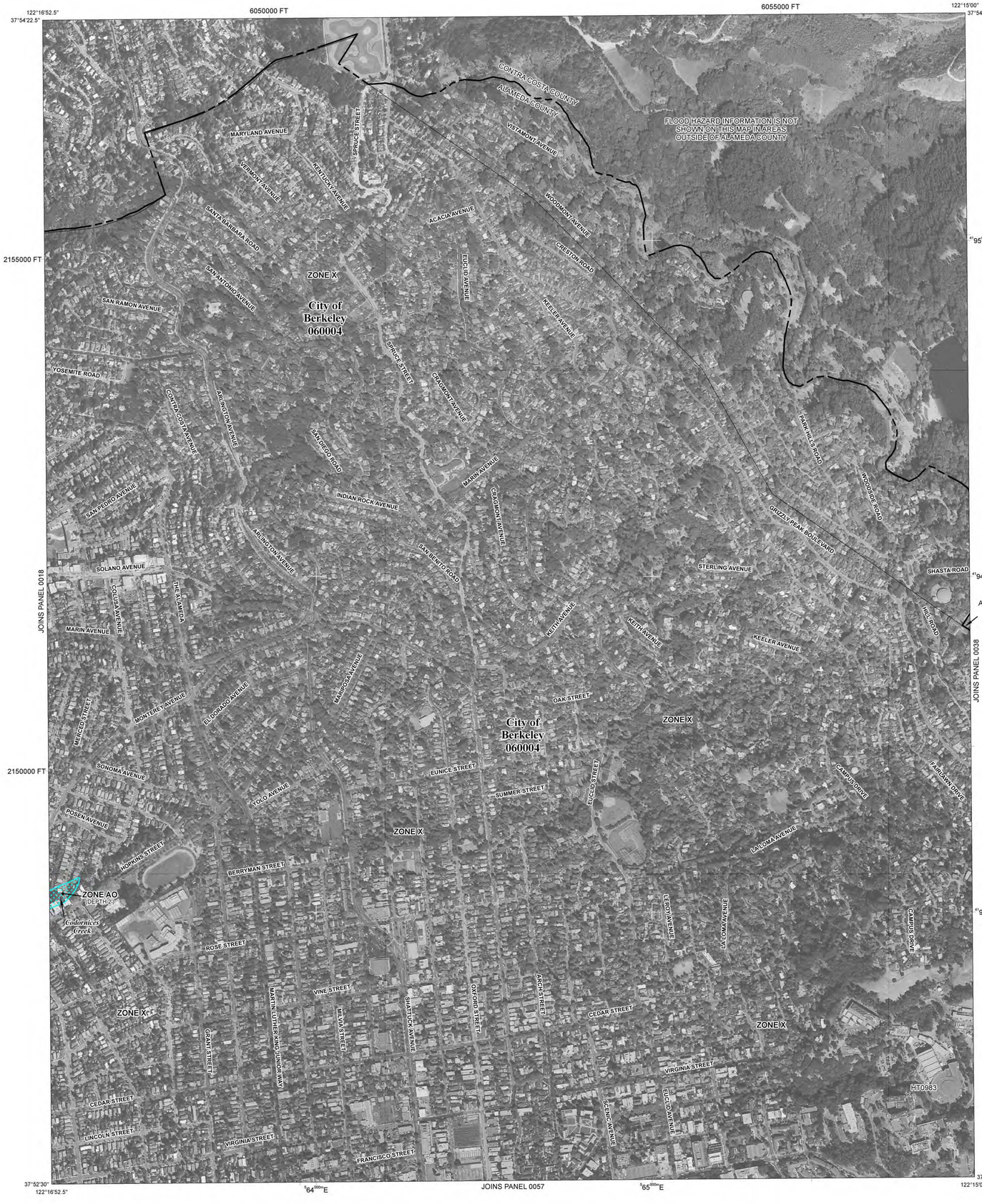
Base map information shown on this FIRM was derived from multiple sources. Within the City of Livermore, base map information was derived from digital orthophotos provided by the City of Livermore Engineering Department. This information was produced at scales of 1:1,200 and 1:2,400 with 1-foot pixel resolution from photography dated May 7, 2001. Within the City of San Leandro, base map information was derived from digital orthophotos provided by the City of San Leandro Information Services Department. This information was produced at a scale of 1:2,400 with 1-foot pixel resolution from photography dated April 19, 2003. Additional information was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1991 or later.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL. 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 — 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
2476000mN	1000-meter Universal Transverse Mercator grid values, zone 10N
600000 FT	5000-foot grid ticks: California State Plane coordinate system, zone III (FIPSZONE 0403), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
August 3, 2009

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0019G

FIRM

FLOOD INSURANCE RATE MAP

ALAMEDA COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 19 OF 725
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

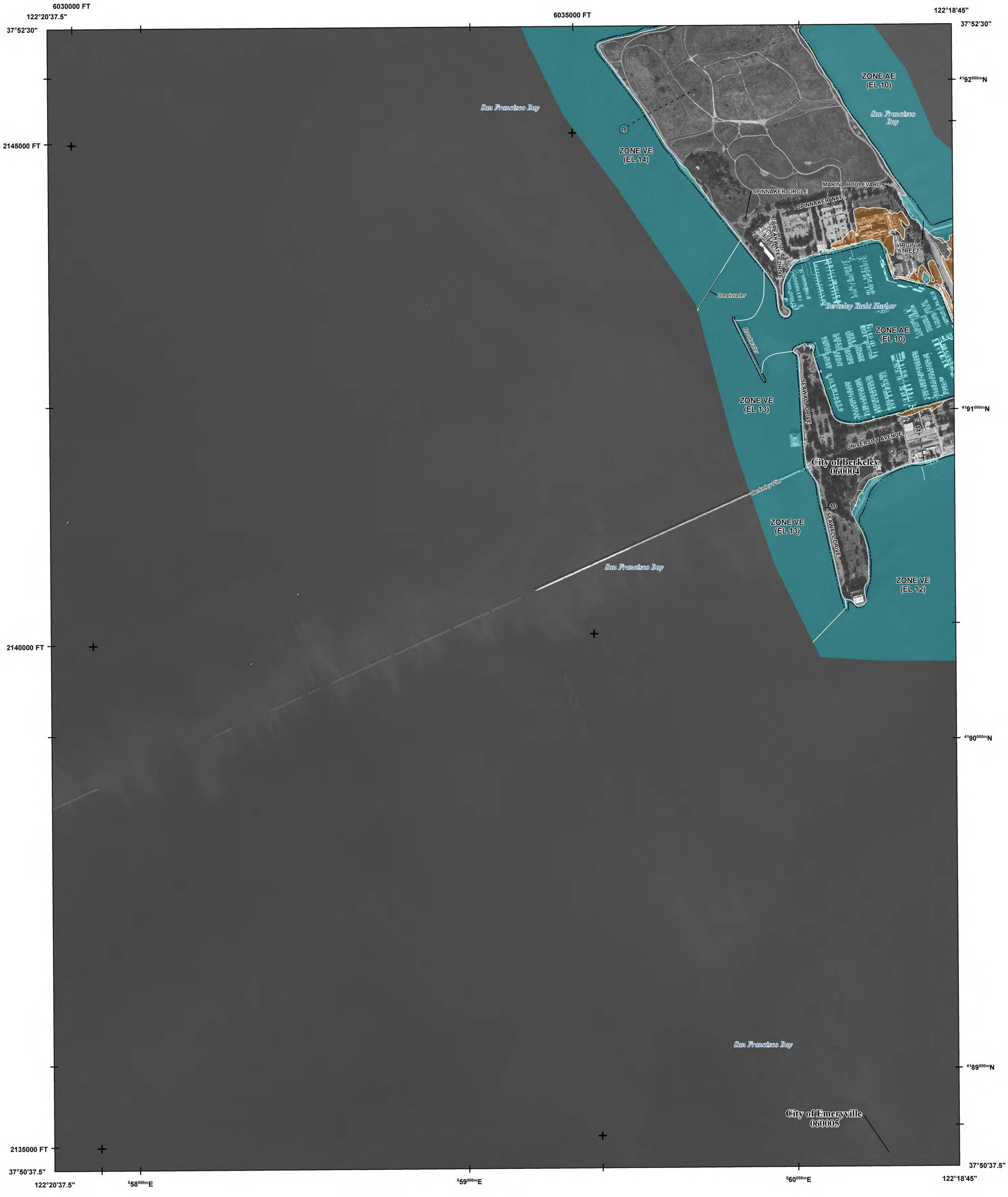
COMMUNITY	NUMBER	PANEL	SUFFIX
BERKELEY, CITY OF	060004	0019	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06001C0019G

EFFECTIVE DATE
AUGUST 3, 2009

Federal Emergency Management Agency



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A,V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- E 18.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 — Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

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For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was derived from Coastal California LiDAR and Digital Imagery dated 2011. USDA NAIP 2012 imagery is used in areas not covered by the Coastal California imagery.

SCALE

N

Map Projection:
Universal Transverse Mercator Zone 10N; North American Datum 1983; Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 250 500 750 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR

*PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

ALAMEDA COUNTY, CALIFORNIA
and Incorporated Areas

PANEL 52 OF 725

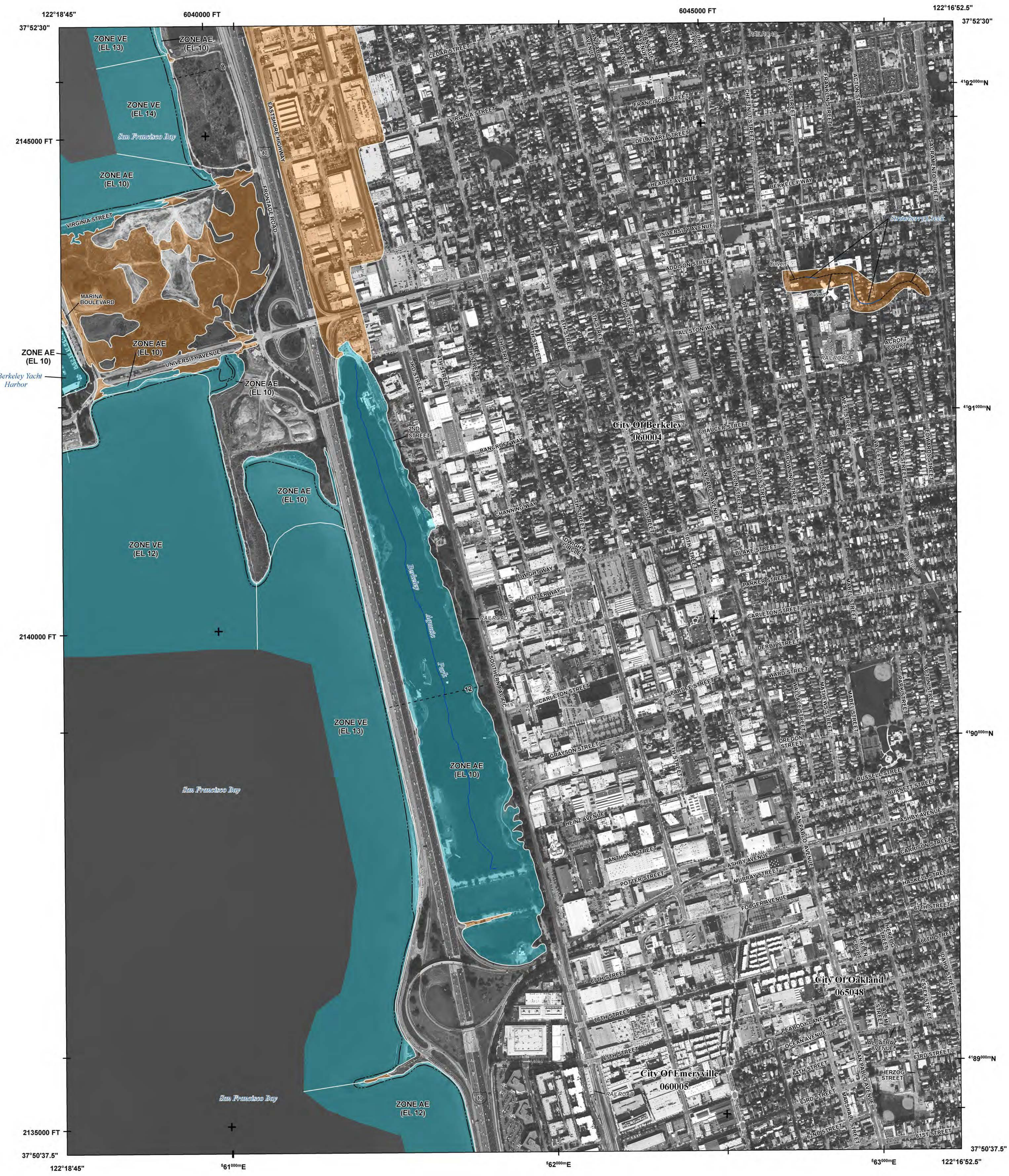
Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
BERKELEY, CITY OF	060004	0052	H
EMERYVILLE, CITY OF	060005	0052	H

VERSION NUMBER
2.3.2.0

MAP NUMBER
06001C0052H

MAP REVISED
DECEMBER 21, 2018



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A,V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

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Base map information shown on this FIRM was derived from Coastal California LiDAR and Digital Imagery dated 2011. USDA NAIP 2012 imagery is used in areas not covered by the Coastal California imagery.

SCALE

N

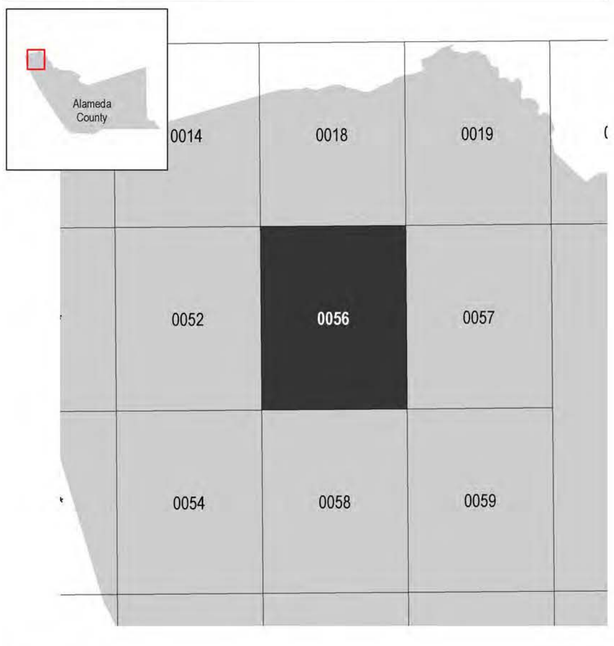
Map Projection:
Universal Transverse Mercator Zone 10N; North American Datum 1983; Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 250 500 750 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

ALAMEDA COUNTY, CALIFORNIA
and Incorporated Areas

PANEL 56 OF 725

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
BERKELEY, CITY OF	060004	0056	H
EMERYVILLE, CITY OF	060005	0056	H
OAKLAND, CITY OF	065048	0056	H

VERSION NUMBER
2.3.2.0

MAP NUMBER
06001C0056H

MAP REVISED
DECEMBER 21, 2018

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 10. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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NGS Information Services
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Silver Spring, Maryland 20910-3282
(301) 713-3242

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LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 — 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
4276000mN	1000-meter Universal Transverse Mercator grid values, zone 10N
600000 FT	5000-foot grid ticks: California State Plane coordinate system, zone III (FIPSZONE 0403), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
August 3, 2009

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0057G

FIRM

FLOOD INSURANCE RATE MAP

ALAMEDA COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 57 OF 725

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BERKELEY, CITY OF	060004	0057	G
OAKLAND, CITY OF	065048	0057	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 06001C0057G

EFFECTIVE DATE AUGUST 3, 2009

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 10. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

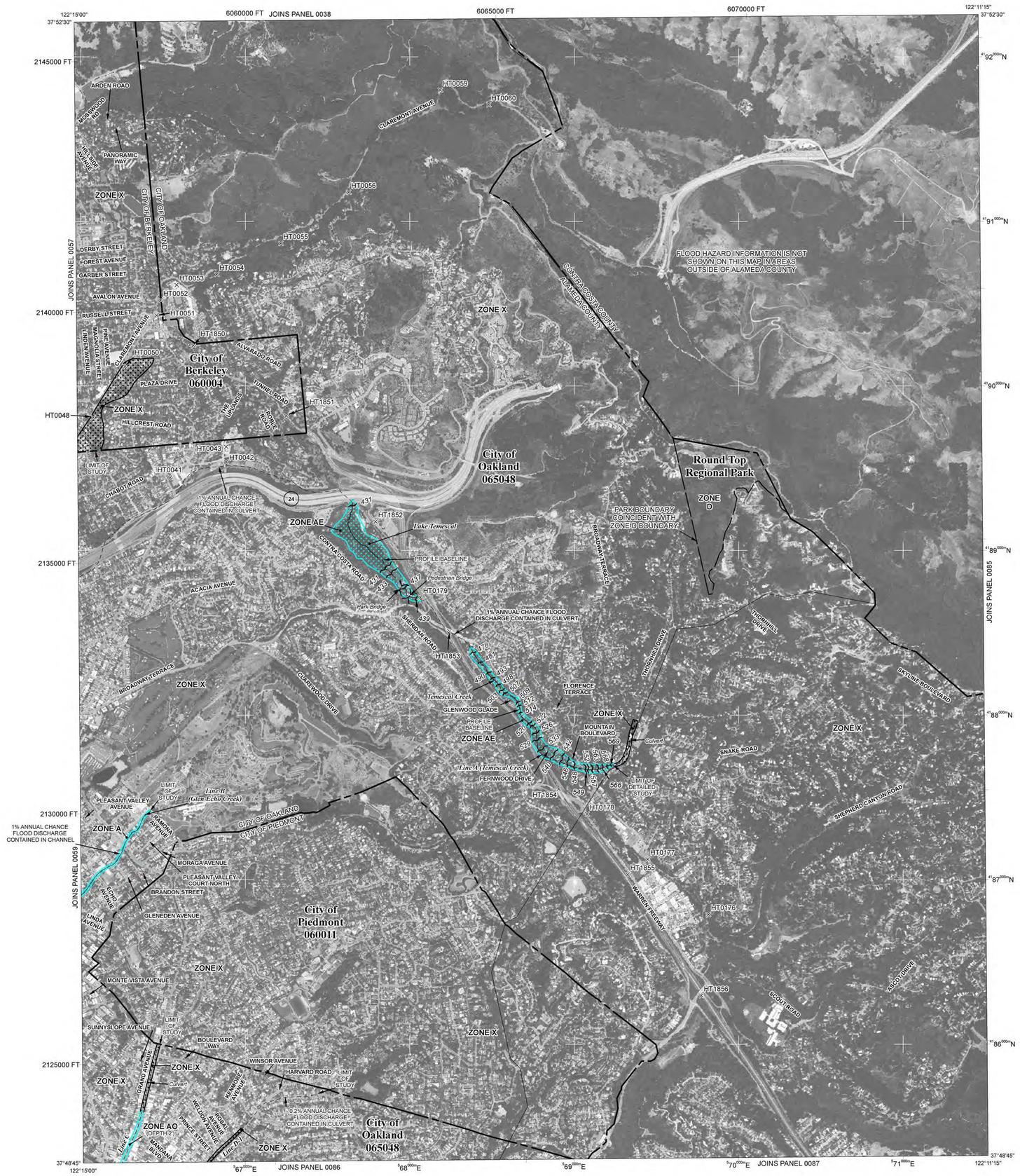
Base map information shown on this FIRM was derived from multiple sources. Within the City of Livermore, base map information was derived from digital orthophotos provided by the City of Livermore Engineering Department. This information was produced at scales of 1:1,200 and 1:2,400 with 1-foot pixel resolution from photography dated May 7, 2001. Within the City of San Leandro, base map information was derived from digital orthophotos provided by the City of San Leandro Information Services Department. This information was produced at a scale of 1:2,400 with 1-foot pixel resolution from photography dated April 19, 2003. Additional information was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1991 or later.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- (A)—(A) Cross section line
- (23)—(23) Transect line
- 87°07'45", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4276000mN 1000-meter Universal Transverse Mercator grid values, zone 10N
- 600000 FT 5000-foot grid ticks: California State Plane coordinate system, zone III (FIPSZONE 0403), Lambert Conformal Conic projection
- DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
- ●M1.5 River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
August 3, 2009

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0080G

FIRM
FLOOD INSURANCE RATE MAP

ALAMEDA COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 80 OF 725
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BERKELEY, CITY OF	060004	0080	G
OAKLAND, CITY OF	065048	0080	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06001C0080G

EFFECTIVE DATE
AUGUST 3, 2009

Federal Emergency Management Agency

Storm Drain Overflow Exposure

In 2011, the Engineering Division of the City's Public Works Department developed the Watershed Management Plan (WMP). The WMP examined two of the watersheds in the City, represented in Map 27. The Potter and Codornices Watersheds were selected because they represent the full range of the urban drainage spectrum in Berkeley.[94] The modeling identified locations of predicted overflows. See Watershed Resources - City of Berkeley, CA for information on the WMP.

Map 26. ***Berkeley Area Watersheds***

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

Watershed

Potter Watershed

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. Localized flooding can be expected in varying degrees at several locations including:

- San Pablo Avenue between Ward and Murray
- California Street between Woolsey and Harmon
- Woolsey Street between California and Adeline
- Woolsey Street at Dana
- Ashby Avenue between California and King
- Martin Luther King, Jr. Way between Russell and Woolsey
- Parker Street between Seventh and Fourth
- Fulton Street at Derby
- Ellsworth Street between Blake and Parker
- Telegraph Avenue between Ashby and Woolsey
- Telegraph Avenue at Stuart
- College Avenue at Dwight

Many of these locations were confirmed as chronic nuisance flooding sites by Public Works Maintenance staff and correspond well with City experiences during the storms of February 25, 2004 and the El Nino events of the 2005-06 rainy season.

Additionally, tidal effects from the Bay 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.

Codornices Watershed

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. Localized flooding can be expected in varying degrees at several locations including:

- Second Street, Creek corridor to Gilman

- Railroad tracks, Creek corridor to Gilman and to Albany
- Gilman Street between Sixth and Second
- Codornices Creek at Sixth, at most street crossings west of San Pablo, at Glen
- Ninth Street between Harrison and Creek Corridor
- Monterey Ave between Posen and Hopkins
- Hopkins Street at Carlotta
- The Alameda between Napa and Yolo
- Sonoma Ave between Fresno and Hopkins
- Spruce Street, Eunice to Creek corridor
- Euclid Ave, Cragmont to Codornices Park
- Various locations on LaLoma, Glendale, Campus Drive, Queens, Shasta Road

The City plans to develop hydraulic models of the remaining eight watersheds within Berkeley.

Watershed Management Plan

In October 2012, Council adopted the Watershed Management Plan (WMP). The mission of the WMP is to promote a healthier balance between the urban environment and the natural ecosystem, including the San Francisco Bay. One of the WMP's four goals is to reduce urban flooding, with associated objectives as follows:

- Maintain and operate appropriately sized storm drain pipe infrastructure.
- Reduce peak runoff volumes and velocities.
- Keep storm water inlets free of obstructions.
- Collect/analyze data to better understand issues and plan accordingly.

To this end, the WMP recommends analysis and rehabilitation of existing storm drain pipes, along with landscape-based retrofits within the public right-of-way or open space areas. Studies have indicated that when these landscape-based retrofits are combined with other traditional approaches, a number of WMP goals can be met for a capital cost similar to merely upsizing storm drain pipes to convey flow.

Until 2018, no funding was identified to implement the Watershed Management Plan. Voting property owners approved the 2018 Clean Stormwater Fee, which Council adopted through

Resolution No. 68,483-N.S. on June 12, 2018. Revenues collected through this fee will provide a stable funding source to move Watershed Management Plan activities forward.

B.8.d Flood Risk and Loss Estimates

A 2004 analysis explored Berkeley's flood exposure and vulnerabilities to a one percent annual chance flood occurred in Berkeley.

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. 2004 Flood Loss Analysis

	Three Feet Flood Waters			One Foot Flood Waters			*Totals (2004)*	*Totals (2018)*[95]
	Value	% Damage	Damage	Value	% Damage	Damage		
Structures	$70 mill	27%	$19 mill	$250 mill	14%	$35 mill	$54 mill	$72 mill
Contents[96]	$35 mill	40%	$14 mill	$250 mill	21%	$53 mill	$67 mill	$90 mill
Totals (2004)	$105 mill		$33 mill	$500 mill		$88 mill	**$121 mill**	**$162 mill**

The estimated losses to properties in Berkeley from a one percent annual chance flood total $162 million in 2018 dollars. Approximately $72 million is damage to the building structures, including walls, finishes, etc. $90 million is losses to contents, including damage to furniture in homes and equipment and inventory in commercial and industrial properties.

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 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. Some of these losses could be avoided if property owners were able to protect 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. Remediation

activities like sandbagging require property owners to have adequate warning time and manpower.

Due to the small watersheds and paved, urban environment, floodwaters in Berkeley 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.

It is possible that key underpasses and roads accessing Interstate 80 could be inaccessible during high floodwaters. This could cause significant traffic problems regionally.

B.9 *Tsunami*

B.9.a Historical Tsunamis

The most recent tsunami to impact 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[97]. The tsunami surge entered the Berkeley marina, causing $158,000 of damage to docks and boats.

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 Great 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.

B.9.b Tsunami Hazard

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.

The 2013 Science Application for Risk Reduction (SAFRR) Tsunami Scenario[98] outlines multiple mechanisms of tsunami damage, which are described below:

- Buildings affected by tsunamis can be damaged by either the inflow or outflow of water, which can affect building finishes, carpets, carpets, electrical wiring, computers and other contents. Tsunamis may deposit soil or other water-borne debris in or around buildings. Tsunamis can erode soil around the building, especially at corners. In more severe cases, the pressure of the moving water can damage a building's structural components, and can even displace the entire building. Additionally, buoyancy can lift and move a building off its foundation.
- Tsunami damage to coastal infrastructure can release complex debris, crude oil, various fuel types and other petroleum products, cargo, and diverse other pollutants into nearby coastal marine environments and onshore in the inundation zone.
- Fires often occur within the inundation zone of a tsunami. Ignitions can occur when spilled liquid fuels mingle with waterborne debris, which can spark when jostled.
- Tsunamis can damage roads though erosion ("scour") of the land beneath the

roadway, especially if the roadway is on a levee or embankment.

- Tsunamis can damage railroad embankments and tracks, which can be submerged, washed out-of-line, or washed out completely. Rolling stock can be overturned or derailed.
- Deaths are possible if individuals choose not to evacuate hazardous areas, do not understand tsunami warnings, or are unable to evacuate for various reasons. Injuries and illness can result from contact with tsunami surges, such as drowning and/or trauma from being struck by debris in the tsunami flow. Post-tsunami, mold can develop in inundated houses, buildings, and debris piles. Secondary infections can result from injuries or from living conditions following the disasters, such as an increase in pneumonia from water aspiration, as well as cellulitis from exposure of breaks in the skin to contaminated water.
- Physical damages, debris, and contamination can have short- and longer-term impacts on the environment and the health of coastal marine and terrestrial ecosystems. Marine habitats in intertidal zones, marshes, sloughs, and lagoons can be damaged by erosion or sedimentation, and can receive an influx of debris, metal and organic contaminants, and sewage-related pathogens. Debris and re- exposed contaminated sediments could pose chronic toxicity threats to ecosystems.

B.9.c Exposure and Vulnerability

Given the known history of tsunamis within the San Francisco Bay, tsunamis are considered to be possible, but the severity of their impacts on Berkeley cannot be determined at this time.[99] In December 2010, the California Emergency Management Agency released the first ever tsunami inundation map within the San Francisco Bay, shown in Map 27. This map is based on current sea levels and land elevation. This map shows in blue hatched lines the area of potential tsunami inundation in Berkeley. It does not reflect the inundation area from any singular tsunami. Rather, it depicts the worst-case scenario run-up heights from all potential tsunami sources across the Pacific Rim. 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. According to Map 27, 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 the western edge of Interstate 80. At Virginia Street, the edge of the zone crosses Interstate 80 and stretches as far east as Second Street. The edge of the zone runs south along Second Street and the eastern edge of Aquatic Park to Ashby/CA-13. In this area, the edge of the zone extends further east to Fifth Street and Hollis.

According to Map 27, 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, and Aquatic Park.

Sea-level rise associated with climate change will increase the zone of potential inundation, but the future boundaries of the zone are not yet clear.

Map 27. ***Berkeley Tsunami Inundation***

Source: Initial tsunami modeling was performed by the University of Southern California (USC) Tsunami Research Center funded through the California Emergency Management Agency (CalEMA) by the National Tsunami Hazard Mitigation Program. 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

Tsunami Inundation Area

Tsunami Evacuation Playbooks

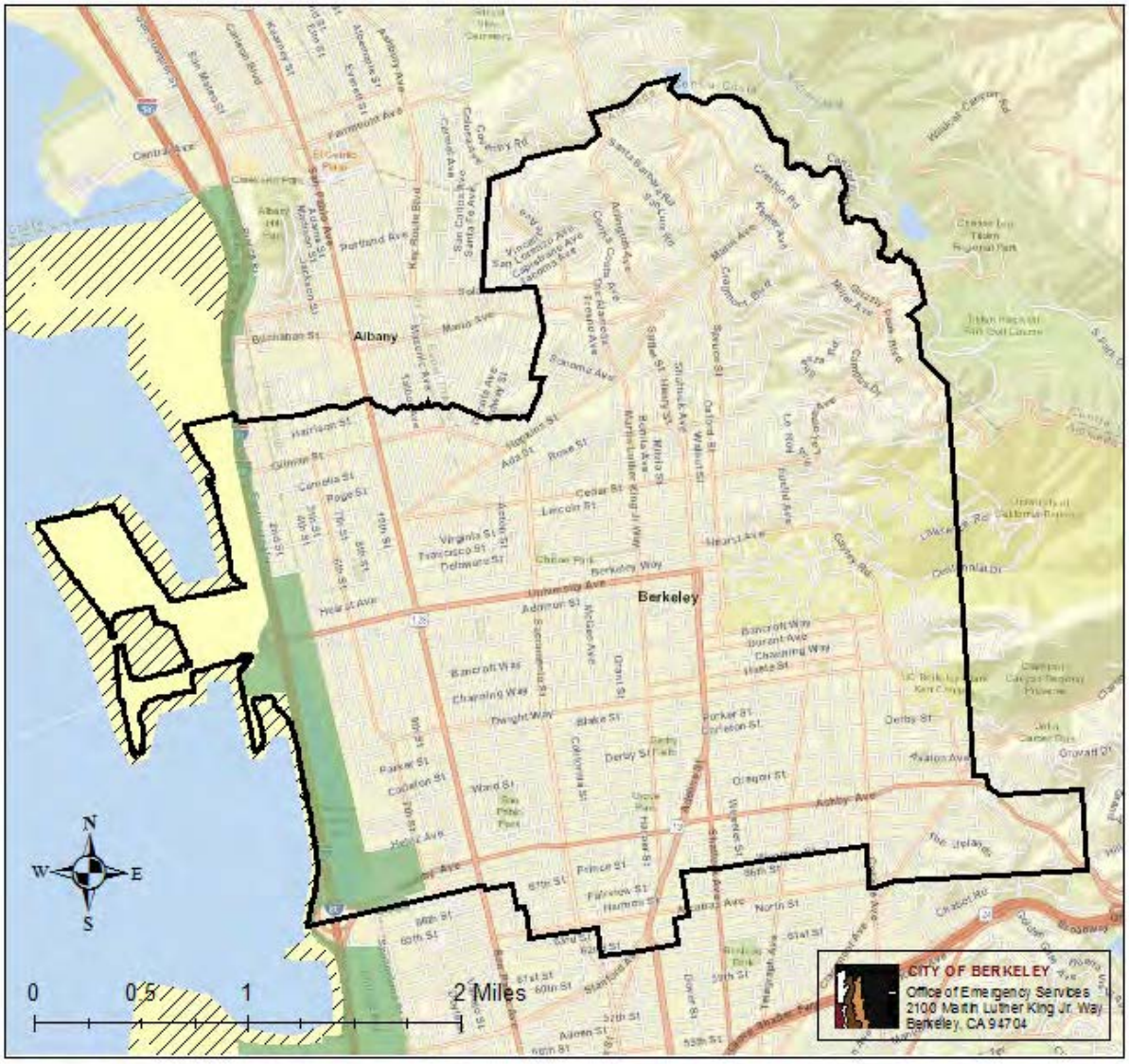
In 2018, the California Geological Survey, the California Governor's Office of Emergency Services, and the National Ocean and Atmospheric Administration (NOAA) released the California Tsunami Evacuation Playbook for the City of Berkeley.

Tsunami Evacuation Playbooks reflect more refined and detailed planning, in which forecasted tsunami amplitudes, storm surge, and tidal information can help guide what areas might be inundated. This information helps NOAA to better predict inundation areas based on the specific tidal and storm conditions when the tsunami is predicted to arrive in Berkeley. Local emergency managers can use this information to better target evacuation areas.

Map 28 presents these Playbook zones, with expanding areas of evacuation:

- Phase 1 is not presented as it includes beaches, harbor docks and boats, and piers.
- Phase 2 is presented in yellow and black hatched lines and adds small areas of land south of University Avenue and west of the West Frontage Road.
- Phase 3 is presented in solid yellow and 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 Evacuation Zone is presented in dark green and is based on areas presented on Map 27. The Maximum Evacuation Zone includes the Dona Spring Animal Shelter, portions of Interstate 80 and the frontage roads beside it, Aquatic Park, and the Police Department Traffic Substation.

Map 28. ***Tsunami Evacuation Zones***



Source: California Geological Survey, California Governor's Office of Emergency Services, and National Oceanic and Atmospheric Administration, California Tsunami Evacuation Playbook No.2018-Alam-02. 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
Phase 2 Tsunami Evacuation Zone
Phase 3 Tsunami Evacuation Zone
Maximum Phase Tsunami Evacuation Zone

USGS Exposure Study[100]
A USGS study of community exposure to tsunami hazards in California found that in Berkeley:

- Approximately 47 residents (23 households) live in the tsunami inundation zone.
    - Eight of the residents are over 65 and one is under five. Elderly and young residents as well as those in group homes may have a particular challenge evacuating from tsunamis.
    - Seven of the households are non-institutionalized group quarters, 20 households are owner-occupied, and 3 are rented.

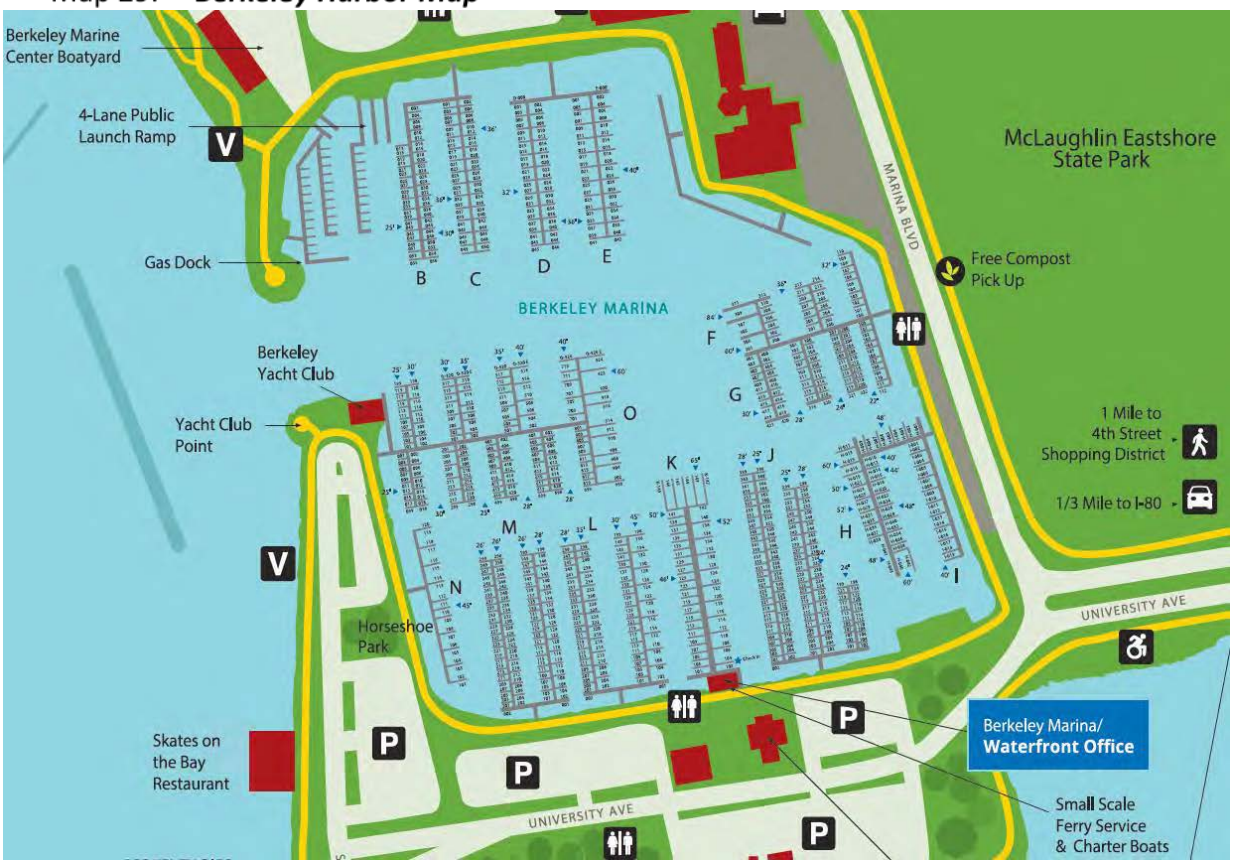
The study also found that:

- 77 businesses and 4 government offices with 1,664 employees are located in the tsunami inundation zone.
    - 80% of these businesses are estimated to have high visitor potential, including the DoubleTree hotel. Visitors may not be aware of what to do in case of a tsunami warning.

While this study examined the Berkeley Marina, its information on residents at the Marina and surrounding park area is not as detailed or accurate as City of Berkeley data. For example, figures do not include the 100 live aboard households, as well as 13 houseboats, at the Marina, for a total of 113 households. At least three children under 5 live on boats. In addition, these figures do not account for boaters who stay on board their vessels regularly up to 12 nights per month, but do not "live" aboard.

Berkeley Marina
Of primary concern to the City is the Marina, which is primarily used for recreational purposes, educational and environmental programming, industrial, non-profit, and commercial operations.

Map 29. ***Berkeley Harbor Map***



Infrastructure Vulnerabilities

Existing docks are more than 40 years old and 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 many finger docks and piling 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 models[101] have identified a moderate tsunami vulnerability in the Gas Dock, Docks B-K, and Dock O. Docks D and E as being the area's most vulnerable to modeled tsunami events, with a moderate level of vulnerability to all events. The next most vulnerable area is 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.

Additional Vulnerabilities

The area includes a 378-room hotel, with many ground floor rooms; 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. Despite the area's low density, the area's

populations, roadways, and businesses will be vulnerable to a tsunami:

- Marina residents: The Berkeley Marina has 1,000 boat slips. Approximately 200 residents live onboard boats in these slips. An additional estimated 13 live on board houseboats, and regulations permit all slip holders to spend 12 nights per month on their boats.

- Marina businesses and visitors: A number of Marina restaurants, such as Skates on the Bay, often have large numbers of customers. The DoubleTree Hotel has 378 rooms, and regularly hosts events with 500-600 attendees, potentially making it the City's most densely-populated location with tsunami exposure.

- Roadways: Inundation maps show overtopping of parking areas and inundation of 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. It is unlikely that the overpass itself would be inundated due to its height and its limited extent beyond Second Street. However, if water extends to Second Street, the access ramps on either end of the overpass would be covered, making the overpass impassable.

Evacuation Challenges

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 overcrossing[102]

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 driving option out of the Marina.

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: all of the above listed routes lie within the tsunami inundation zone.

B.9.d Tsunami Risk and Loss Estimates

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 27, which is intended to display worst-case scenario run-up heights from all potential tsunami sources across the Pacific Rim.

The 2013 SAFRR tsunami scenario[103] 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 one-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.

City of Berkeley Assets

The most significant financial losses to the City of Berkeley in the event of a tsunami would be inundation of the following structures:

- City Animal Shelter[104]
- Marina Boat Docks
- Berkeley Yacht Club
- Shorebird Nature Center
- Marina Corporation Yard
- Marina Administration Building

Other City- and privately-owned facilities of significant value 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.

Further research is needed to fully assess Berkeley's tsunami hazard, including the following:

- Definition of Berkeley's different areas of inundation for different tsunami scenarios;
- Vulnerabilities of each evacuation route to tsunami inundation;
- 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.

SECTION III: MANMADE HAZARDS OF CONCERN

The focus of this mitigation plan is on natural hazards as emphasized in the Disaster Mitigation Act of 2000 (DMA 2000).[105] While climate change is known to be manmade, it is described because its impacts are likely to exacerbate the natural hazards of concern identified in the plan. Extreme heat events are projected to increase exponentially in the next century as climate change continues. The 2019 LHMP specifically addresses the hazard of extreme heat events. Hazardous materials release is addressed in this mitigation plan as a potential impact from a natural hazard. Terrorism is identified as a hazard of concern but is not analyzed in-depth.

B.10 *Climate Change*

Human activities have created a large quantities of greenhouse (GHG) emissions that have been and continue to be released into the atmosphere. The majority of the emissions come from burning fossil fuels. Other activities, such as deforestation and solid waste disposal, also play a role. Greenhouse gas (GHG) emissions, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), Ozone (O_3) and water vapor, trap heat in the atmosphere and prevent the planet from cooling down at night[106]. This is known as the greenhouse effect. While it is a natural phenomenon, it is accelerated by a dangerous buildup of GHG emissions in the atmosphere resulting in climate change.

Earth's average temperature has increased by over 1° F during the past century, and average temperatures in California increased 1.7°F since 1985.[107] Because global greenhouse gas (GHG) emissions will likely continue to increase, scientists predict that average global surface temperatures will rise 2.5° to 10° F by the end of the century.[108] For the Bay Area, scientists estimate that average temperatures will increase about 3 - 6° F by century's end, compared to the average temperature during the historical period 1961 - 1990.[109]

This section identifies the main climate change impacts that Berkeley is currently experiencing, or is projected to experience in the future. This section also describes how climate change exacerbates natural hazards of concern identified in this plan. Where possible, the information provided here is specific to Berkeley, the Bay Area, and/or the state of California. For each climate impact, the associated historical events, hazard description, exposure and vulnerability analysis, and risk and loss estimates are presented, as available.

A discussion of many of the local climate impacts, and recommendations for mitigating those impacts, are also included in the Berkeley Climate Action Plan (CAP). The CAP was adopted by the Berkeley City Council in 2009, and is designed to guide community-wide efforts to achieve deep and sustained reductions in global warming emissions, and to help the community prepare for the impacts of the changing climate. Additional information on the CAP and its implementation is included at the end of this section. Ongoing updates on the CAP are available at www.CityofBerkeley.info/climate.

3.8.1 Direct and Secondary Climate Change Impacts

Climate change is a global issue with local effects. Like regions across the globe, the San Francisco Bay Area is experiencing increasing impacts of the changing climate, including increased temperatures and sea level rise. Extreme heat events and heavy rains are exacerbated by high winds, sparking wildfires and increasing damage from flooding. These impacts affect the natural environment, but they also affect our infrastructure, local and regional economies, food security, and the health and safety of the people in our community, while disproportionately impacting people of color and the poor.[110] The impacts of climate change also exacerbate the natural hazards of concern in this plan, including extreme heat events, flooding[111], wildland-urban interface fire,[112] and landslides.[113]

The next section focuses on the direct and indirect impacts from climate change.

Extreme Heat

Extreme heat events will increase in the Bay Area due to climate change in intensity, length, and frequency. By the end of the century, Bay Area residents may average six heat waves annually, which will average a length of ten days[114]. Extreme heat threatens critical infrastructure, air quality, and public health. The urban heat island effect, where built surfaces absorb and retain heat causing higher nighttime temperatures, can exacerbate those health risks. See Section B11 *Extreme Heat* for further details.

Precipitation and Drought

As GHG emissions continue to increase, more of the precipitation will fall as rain instead of snow in the mountains, and the snow that does fall will melt earlier.[115] This has significant implications for the Sierra Nevada spring snowpack. The water distribution system for the state, including Berkeley and many other parts of the Bay Area, depends on the snowpack for water during the dry spring and summer months. Rising temperatures and the change of precipitation from rain to snow could reduce the snowpack by as much as 70 to 90 percent by century's end.[116] A shrinking snowpack poses significant challenges for water managers and for all communities that depend on this vital water source. The loss of snowpack also poses challenges for hydropower generation, which contributes significantly to California's energy. Hydropower is an emissions-free source of energy, and currently plays a considerable role in the quest to reduce emissions from fossil fuel power generation.

Climate change is also likely to increase the severity and frequency of drought. Temperature increases and reduction in snowpack are the "two most direct effects of climate change that will result in a drier state with fewer natural water resources than historically have been available."[117] Drought not only affects local water supply for urban, agricultural, and environmental uses, but can also increase wildfire hazard, and may be correlated with high heat conditions.[118]

California experienced a prolonged drought from 2012-2016. Record-setting temperatures induced by global warming may have amplified the drought.[119] The drought resulted in well-documented agricultural, physical (e.g. groundwater depletion-related subsidence), environmental (tree death) and wildlife impacts (e.g. fish mortality)[120]. To mitigate water supply impacts, surface and groundwater supplies were used, and water use restrictions were implemented at state and local levels.

Sea Level Rise

Warmer temperatures associated with climate change are causing global sea levels to rise through two processes:

1. 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.

2. In a process termed "thermal expansion," warmer temperatures cause ocean water to expand, increasing the ocean's volume.

Sea level rise has multiple cascading impacts. When sea levels rise:

- Beaches and shoreline habitats become permanently inundated. These changes are expected to substantially alter the Bay ecosystem, reducing wetlands, affecting water quality, and adversely affecting wildlife.[121]
- Groundwater table and stream water levels rise, increasing areas subject to flooding.
- Storm surges rise, increasing risks in areas previously not susceptible to flooding.
- Coastal erosion increases, expanding areas susceptible to flooding and inundation[122].
- 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.

Sea level rise is an ongoing challenge for communities surrounding the San Francisco Bay. It is estimated that the San Francisco Bay has already risen approximately eight inches since 1900.[123]

Carbon Emissions Scenarios and 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. Recent studies have suggested that the Antarctic ice sheets are melting at rates much faster than previously reported. The Intergovernmental Panel on Climate Change has identified four scenarios, known as Representative Concentration Pathways (RCPs) that reflect different greenhouse gas concentrations of the atmosphere. They range from RCP 2.6, which represents not only stopping all current emissions but also significant carbon sequestration (a negative carbon output), to RCP 8.5, which 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. Below is a table of median probability projections of sea level rise for the state and the Bay Area under different climate scenarios in year 2100.[124]

Table 16. Sea Level Rise Projections in year 2100

Source	**Projected Carbon Emissions Scenarios**		
	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)[125]	N/A	2.4 ft	4.5 ft
Bay Area Projections (Ocean Protection Council)[126]	1.6 ft	N/A	2.5 ft

Sea Level Rise Exposure and Vulnerability
An interactive, Bay Area-specific map called the Bay Shoreline Flood Explorer (available at https://explorer.adaptingtorisingtides.org/explorer) was produced by Adapting to Rising Tides (ART) purely based on topography.

These maps do not take into account riverline flooding, wave hazards, groundwater, erosion and subsidence, marsh vegetation, and salt ponds and wetlands, which would require further hydrological modeling and mapping analysis to understand how they would affect inundation and flooding areas.[127]

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 Marina is the most vulnerable, as sea level rise will permanently inundate commercial and recreational areas.

Map 30. ***Berkeley Shoreline Areas Prone to Permanent Inundation due to 2-ft of Sea Level Rise by year 2100 (Very likely scenario)***

This map shows that with two feet of sea level rise, which is considered very likely by 2100, the edge of Berkeley shoreline will experience shallow inundation, with small sections of the northern and southern edges of McLaughlin Eastshore State Shoreline experiencing inundation further in. Deeper permanent inundation can be expected along edge of Berkeley Marina.

Map 31. ***Berkeley Shoreline Areas Prone to Permanent Inundation due to 4-ft of Sea Level Rise by year 2100 (Likely scenario)***

This map shows that with four feet of sea level rise, which is considered likely by 2100, all edges of Berkeley will experience inundation, with further inward expansion in the inundation areas of McLaughlin Eastshore State Shoreline. Additionally, with four feet of sea level rise, portions of Tom Bates Regional Sports complex will experience shallow inundation.

Map 32. ***Berkeley Shoreline Areas Prone to Permanent Inundation due to 5.5-ft of Sea Level Rise by year 2100 (Not as likely scenario)***

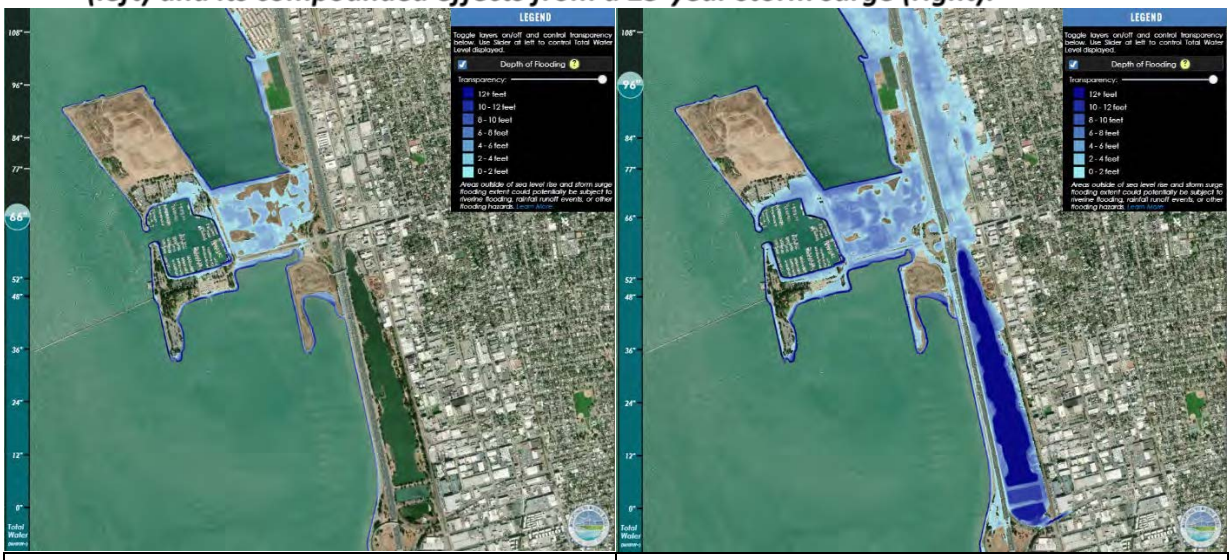
This map shows that with 5.5 feet of sea level rise, which is considered not as likely by 2100, the shoreline of the entire Berkeley Marina peninsula will experience deep inundation, and the majority of the McLaughlin Eastshore State Seashore will be inundated with varying depths of water, along with similar portion of Tom Bates Regional Sports Complex as with four feet of sea level rise (as presented on the previous map).

Sea Level Rise and Severe Storms

It is important to note that the maps above only present permanent inundation from sea level rise alone. Sea level rise causes permanent inundation that increases the areas of temporary flood exposure during severe storms and high tides.

Map 33 below considers a combined scenario of increased carbon emissions (per Table 16) resulting in 5.5 feet of sea level rise, combined with a 25-year design storm. Under these circumstances water could inundate Interstate 80 and potentially as far east as Fifth Street in Berkeley.

Map 33. ***Comparison maps of Berkeley Shoreline with modeled 5.5 feet of sea level rise (left) and its compounded effects from a 25-year storm surge (right).***



5.5 ft SLR *Inundation in majority of McLaughlin Eastshore State Shoreline*	*5.5 ft SLR + 25-yr storm surge* *Inundation of McLaughlin Eastshore State Shoreline, flooding of Aquatic Park, Interstate 80, and parts of Northwest Berkeley reaching Fourth St.*

As sea levels rise, storms could cause key underpasses and roads accessing Highway 80 to flood more often or be permanently inundated, impacting transportation on this major regional artery, including Ashby Avenue (State Highway 13). Other nearby infrastructure that is vulnerable to inundation includes Berkeley's stormwater and sanitary sewer pipes, the Oakland International Airport, and the East Bay Municipal Utility District's wastewater treatment plant, located just east of the Bay Bridge.

Consideration of storm surge and other compounding effects 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 will need to be considered in long-term planning along the City's coast.

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 functionality of California's natural gas distribution system[128]. 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.

More comprehensive vulnerability assessments are necessary to clearly define the structures and infrastructure that will be affected with particular levels of sea level rise, and identify ways to address these issues.

Land subsidence increases the areas that are exposed to sea level rise. 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.[129] In the Bay Area, this includes developed areas that sit on top soft compressible bay mud[130]. Land subsidence can expand areas susceptible to sea level rise as these areas sink while sea levels are rising to meet them[131].

Food-, Water-, and Vector-Borne Diseases[132]

Climate change may also accelerate the incidence and geographic distribution of diseases that are transmitted through food, water, and animals such as deer, birds, mice, and insects. Increases in air temperature and change in precipitation and humidity levels may expand the territory of many species, including pests. In California, three vector-borne diseases of particular concern are: West Nile virus, human hanta virus, and Lyme disease. Salmonella and other bacteria-related food illnesses also grow more rapidly in warm environments, causing gastrointestinal distress and, in severe cases, death. Flood events may also cause contamination from toxic materials stored in flood zones, and can also lead to the growth of harmful molds.[133] These molds can trigger allergies and asthma attacks in physically vulnerable populations, including children under the age of 5, health-impaired adults, and the elderly.[134]

3.8.2 Climate Change Impacts to Natural Hazards of Concern

Climate change is expected to exacerbate the natural hazards of concern identified in this plan. The ways that climate change affects Berkeley's natural hazards of concern are described below.

Earthquake (Section B5)

Sea level rise will cause the groundwater table and stream water levels to rise, increasing the areas subject to liquefaction risks in the event of an earthquake.[135]

Wildland-Urban Interface Fires (Section B6)

Climate change will bring higher temperatures and increased risk of drought, which will likely lengthen the fire season in our region.[136] The incidences of large wildfires in California could more than double by the end of the century.[137] Due to Berkeley's biophysical setting, climate, and other jurisdictional characteristics, scientists project little change to fire risk in Berkeley specifically.[138] However, Berkeley is still at risk due to the increased vulnerability of surrounding jurisdictions to wildland fire. A wildland fire that ignites outside of Berkeley's borders could spread into Berkeley.

Further complicating matters, wildfires are a large contributor of greenhouse gases that will lead to further climate change impacts.

Landslides (Sections B7)

Increases in the intensity and frequency of extreme storms will cause more frequent landslides in the Berkeley hills.

Severe Storms and Floods (Section B8)

The effects of climate change will increase the frequency and severity of extreme storm and precipitation events[139]. As climate change impacts continue to intensify, rainfall events for California are expected to exhibit higher amounts of precipitation over shorter time periods coupled with longer dry spells.

Climate change will increase the frequency of flood events, and will expand the areas of Berkeley that are exposed to flooding. A confluence of factors contributes to these changes:

- More precipitation over a shorter period of time each year; [140]
- Frequent and more hazardous storms, combined with sea level rise and high tides, can lead to more frequent and amplified storm surge events;
- Freshwater outfalls in Berkeley go directly to the Bay, and are influenced by tidal effects. As the sea level rises, it will require less rain to cause upstream flooding.
- Under drought conditions, soil moisture decreases and makes natural areas that typically absorb water less permeable; this can contribute to flooding.

These factors will likely cause more frequent and extensive flooding events long before sea level rise leads to permanent inundation of the shoreline.[141] Further analysis is necessary to truly understand Berkeley's flooding exposure and vulnerability under the combined impacts of severe storms, storm surge, and sea level rise. This analysis could also impact flood insurance and development, and infrastructure safeguarding and building for the future.[142]

Tsunami (Section B9)

Rising sea levels will increase Berkeley's exposure to tsunami inundation, making more people and property vulnerable to tsunami impacts.

Notable Climate Change Mitigation and Adaptation Activities

The Berkeley Climate Action Plan (CAP) provides policy and project recommendations to advance community-wide efforts to reduce, or mitigate, global warming emissions and to prepare for and adapt to the climate change impacts identified above. The severity of climate change impacts are entirely dependent on the amount of emissions we continue to emit in the near future. Just as the challenges to adaptation and mitigation are often interrelated, the solutions

overlap and provide multiple benefits.

CAP recommendations are implemented through City departments and community stakeholders. Outlined below are examples of specific CAP recommendations related to both mitigating global warming emissions and adapting to climate change impacts, and some explanation of how each of the identified recommendations is being implemented.[143]

Water Efficiency and Recycling

The CAP recommends proactive efforts to mitigate vulnerabilities of the regional water supply to climate change, including the following:

In preparation for the impacts of climate change on the region's water resources, partner with local, regional, and State agencies to encourage water conservation and efficiency and expand and diversify the water supply (see CAP, Adapting to a Changing Climate, Goal 1, Policy B).

Water efficiency and reuse reduces global warming emissions and helps the community prepare for potential future water resource constraints. The City is advancing water efficiency and water recycling efforts in several ways. In 2010 the City developed a voluntary *Guide to Conserving Water through Rainwater Harvesting and Graywater Reuse for Outdoor Use*. The purpose of the guide is to give homeowners the information they need to install effective, safe, and legal rainwater and/or graywater irrigation systems. Rainwater and graywater systems can help residents save water (and money) by reducing demand for potable water. The City coordinates with regional agencies such as StopWaste to provide education and training on new State water requirements: the Water Efficiency Landscape Ordinance (WELO), reinforcing landscape irrigation and water conservation best practices for new and existing landscapes, and SB704, requiring low-flow plumbing fixtures at time of sale. Additionally, the City conducts regular water audits of its buildings and infrastructure. Since the drought began in 2012, several City buildings and parks have received the WaterSmart Certification from East Bay Municipal Utility District.

Mitigating Vulnerabilities to Flooding and Coastal Erosion

The CAP recommends proactive efforts to prepare for potential flooding associated with climate change impacts, including:

In preparation for rising sea levels and more severe storms, partner with local, regional, and State agencies to reduce the property damage associated with flooding and coastal erosion (see CAP, Adapting to a Changing Climate, Goal 1, Policy C).

West Berkeley is particularly low-lying and vulnerable to sea level rise, as well as potentially increased flooding from severe storms. For all City-owned development projects, the City reviews and works to mitigate any risk from coastal flooding. The City needs to 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.

The City's urban forestry program mitigates global warming emissions through a process called carbon sequestration. The program also mitigates the impacts of climate change, such as flooding

and extreme heat events. For example, one of the benefits of the City's ongoing urban forestry program is stormwater management. Trees absorb rainwater, reducing runoff and delaying peak flows. Tree roots also draw and hold water in the soil, helping the soil retain moisture and helping keep nearby plants hydrated. Berkeley's urban forest also helps to mitigate the impacts of extreme heat events by shading buildings and paved and dark-colored surfaces, such as roads and parking lots that absorb and store heat. (See Section B11 *Extreme Heat* for more details.)

Another strategy designed to assist with stormwater management is installation of green roofs. A green roof, also known as a "living roof" or "vegetated roof," is a planted rooftop garden that offers an attractive and energy-saving alternative to a conventional rooftop. One of the many benefits of green roofs is that they help filter and retain rainwater onsite and alleviate stormwater management needs throughout the City. As part of the City's education and outreach efforts, the City developed a Permit Guide to Living Roofs, which is designed to assist residents and businesses to understand the benefits and permitting requirements associated with installing a green roof.

As part of an effort to increase green infrastructure in Berkeley, the City has installed bioswales to curb water runoff in several locations around Berkeley. Bioswales use a stepped grade and native plants to redirect water away from flowing directly downhill, into an earthen swale which catches the water, which allows the water to slowly penetrate into the soil over a longer period of time. This helps replenish the groundwater, and provides water for summertime use by trees. By reducing this direct runoff into stormwater drains, bioswales also help reduce flooding from storm drain overflow, as well as the amount of debris washed into storm sewers, keeping organic matter and trash out of the Bay. Along with these great benefits, increasing vegetation in the City helps address issues related to the urban heat island effect and water management as these are impacted by climate change.

Electrification and Energy Efficiency

As a climate mitigation and adaptation strategy, the City is promoting electrification as a method to reach the community's ambitious climate goals. State and local policy is working toward 100% carbon-free electricity, achieved through programs like East Bay Community Energy (EBCE), a community-governed, local power supplier, or through rooftop solar. As electricity reaches this goal, the remainder of our emissions will come from transportation (gasoline and diesel) and natural gas in buildings. Transitioning natural gas uses in buildings to electricity provides many co-benefits that address climate adaptation as well as reducing emissions, such as better health and safety for populations inside and outside buildings (as the natural gas system is susceptible to leaking methane), especially after a disaster which could cause breakage in the natural gas delivery system. Reducing our reliance on natural gas will reduce air quality issues during extreme heat events, our vulnerability to fire following earthquake, and vulnerability to pipeline infrastructure damage from flooding and inundation. This transition is complex and will require strategic investments. City staff is working to address technical and regulatory barriers, educate contractors and the community, and implement strategic investment to ensure clean, equitable, and reliable electricity for the entire Berkeley community.

A transition to clean electricity will require reducing our overall energy demands. This includes encouraging non-polluting modes of transportation, such as walking, biking, and public transit, while transitioning remaining cars to electricity. In buildings, this means continued work on

energy efficiency. Beginning in 2015, the Office of Energy & Sustainable Development has been implementing the Building Energy Saving Ordinance (BESO), requiring buildings to complete energy efficiency opportunity assessments. The ordinance offers opportunity to incorporate electrification, battery storage, and building cooling capacity to address the natural hazards that are and will be felt throughout the community as climate change progresses.

In order to ensure accountability and progress on its emissions reduction and climate adaptation efforts, the City regularly reports on the status and outcomes of CAP implementation (see www.CityofBerkeley.info/climate). Effectively monitoring and reporting progress and working to engage the community in advancing CAP-related actions is fundamental to achieving the CAP goals. Actions outlined in this plan are designed to be consistent with CAP goals.

B.11 *Extreme Heat Events*

B.11.a Historical extreme heat events

In August 2017, the Bay Area experienced record-setting high temperatures.[144] A Berkeley weather station on the University of California, Berkeley campus near Hearst and Euclid avenues reported a temperature of 108.5°F.[145] The National Weather Service issued an excessive heat warning that lasted five days for the Bay Area, and during this time there were six heat-related deaths in nearby San Francisco and San Mateo Counties.

Additionally 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 2006 was in 1972, which lasted two days.[146]

B.11.b Extreme Heat Hazard

According to Cal-Adapt, California's database of climate information, multiple factors contribute to the extreme heat hazard:

1. 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 F.
2. 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.
3. Heat wave: When there are five or more days of extreme heat.
4. Extreme heat during unexpected times of year: When extreme heat occurs outside of historically hotter months.
5. Duration of heat wave: Longer heat waves have proportionally more negative impacts than shorter heat waves.

Projections indicate that the number of extreme heat days, warm nights, and heat waves will increase exponentially in the next century. In addition to this increased frequency and duration, heat waves are also expected to also occur in months not typically associated with extreme heat.

<u>Urban Heat Island Effect</u>

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 as well.

The UHI effect can also worsen air quality (particularly ground-level ozone) in urban environments.[147] The UHI effect increases heat-related illnesses and fatalities, particularly after two to three days of extreme heat.[148]

Vegetation helps mitigate the UHI effect through evaporative cooling, making urban tree cover, parks, and green roofs essential 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, with co-benefits such as improving air quality and providing needed shade (for buildings and people) during heat events.

Secondary Hazards

Public health impacts
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.[149]

Fire
While hot temperatures do not necessarily start fires, they can decrease moisture in vegetation, increasing its flammability and the length and severity of the fire season.[150] Warming temperatures combined with increased development in the wildland-urban interface are projected to increase fire risk in most of the Bay Area.

Damage to critical facilities and infrastructure
Extreme heat can 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 that can overwhelm the power grid, causing power outages when people need their cooling devices the most.

High temperatures also damage critical infrastructure, such as 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.[151] 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.[152]

As extreme heat becomes more frequent and severe, Berkeley buildings will need to add cooling capacity. This effort will need to be done 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[153] in energy efficient buildings) with both heating and cooling capabilities. The California Energy

Commission and City staff are working to promote this technology and to optimize usage to take advantage of California's abundant solar energy, even after the sun goes down and even during high-usage events without overwhelming the grid.

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.

Worsened 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 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.[154] 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, and the elderly, infants, and children are particularly susceptible to experiencing these impacts.[155]

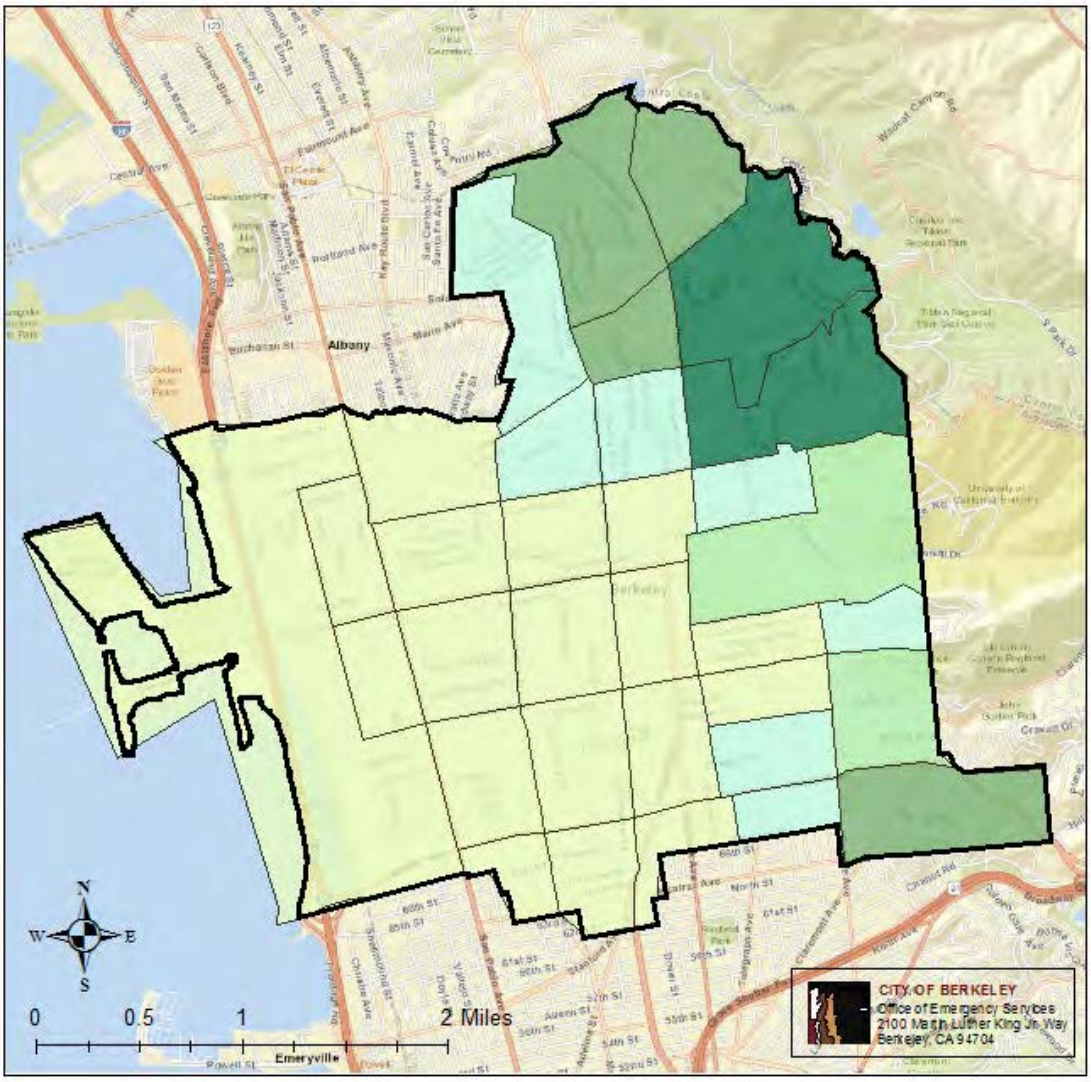
B.11.c Exposure and Vulnerability

There are social, infrastructure and environmental factors that contribute to the Berkeley community's exposure and vulnerability to heat wave. These factors are explored further below.

Trees
A dense tree canopy can result in fewer heat related emergencies.[156] Urban tree canopy directly reduces surface and air temperatures through shading and absorption, directly combating the urban heat island effect. In addition, 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.

In Berkeley, census tracts have between 4% and 48% tree coverage. As of November 2018, Cal Adapt predicts that this coverage will decrease over time. Map 34 shows the current percentage of tree coverage for each census tract 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 least, meaning that these buildings and communities will likely not benefit from reduced temperatures provided by urban tree cover.

Map 34. ***Percentage of tree coverage in City of Berkeley***



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

City of Berkeley

Tree Coverage

- 41% to 50%
- 31% to 40%
- 21% to 30%
- 11% to 20%
- Less than 10%

Notable Mitigation Activity: City Tree Programs[157]

The City of Berkeley's municipal forest is maintained by the Urban Forestry Unit of the Parks Division, which is part of the Parks, Recreation, and Waterfront Department. There are approximately 38,000 street, park, and median trees that comprise the municipal forest in Berkeley.

The City's Urban Forestry Unit plants trees on the public right-of-way, in City parks, and on City-owned property. The public right-of-way includes the planting strip between the curb and the sidewalk, and street medians.

Residents can submit a tree planting application to have the City plant a tree, or to purchase and plant a tree at their own expense. Based on Tree Planting Location Standards, the City will designate the species and location of any tree that is planted on the public right-of-way, regardless of who purchases and/or plants it.

The Urban Forestry Unit is actively engaged in diversifying the urban forest population. Various species have been planted to determine their viability as a street or park tree. Climate change, the potential for temperature increase, and drought are additional considerations that are also changing the tree species selection process.

Social Factors

People with disabilities, chronic diseases, the elderly, and children under five are the most at risk to heat-related illnesses.[158] 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.[159] People working outdoors and homeless populations are also vulnerable.

Across California, the highest risk of heat-related illness occurs in the typically cooler regions found in coastal areas like Berkeley. Some of this vulnerability is because these communities are relatively unaccustomed to extreme heat. As a result, they are less acclimatized or potentially less aware of preventative behavior.[160]

Infrastructure

Having access to an air conditioner, or a building with ventilation, can make a huge difference to individuals during periods of extreme heat. Berkeley has public buildings that are equipped to provide relief from extreme heat and can serve as cooling centers during extreme heat events. Map 35 shows the location of these buildings. There are only a few of them, mostly libraries and community centers, and they are clustered in a few neighborhoods.

Map 35. ***Location of Cooling Centers in City of Berkeley***

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

Cooling Centers

B.11.d Extreme Heat Event Risk and Loss Estimates

Based on climate models from Cal-Adapt, the average number of extreme heat days in Berkeley is projected to increase by more than 10 days by the end of the century. Table 17 shows how this number will gradually increase between now and 2099.

Table 17. Predicted average number of extreme heat days in Berkeley by year[161]

2011-2030	2021-2040	2031-2050	2041-2060	2051-2070	2061-2080	2071-2090	2081-2099
5	6	7	8	10	12	15	18

Source: https://cal-adapt.org/tools/extreme-heat/
Note: In Berkeley, an extreme heat day is when daily maximum temperature is above 88.3 degrees F.

Social and Infrastructure Impacts

The specific impacts of future heat waves are difficult to predict, but may include illness, injury, death, and damage to critical infrastructure. According to California Climate Change Center, by mid-century, extreme heat in urban centers could cause two to three times more heat-related deaths than occur today.[162]

B.12 *Hazardous Materials Release*

Because this plan is concerned with natural disasters, hazardous materials release is considered primarily as a secondary impact of the hazards presented in Sections B5 to B11. This section will identify how the natural hazards discussed in the plan can trigger the release of hazardous materials, as well as the potential impacts of those hazardous materials releases.

B.12.a Historical Hazardous Materials Releases

Berkeley has not recently experienced significant hazardous materials releases secondary to a natural disaster. 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.[163] 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.[164] 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.b Hazardous Materials Release Hazard

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.

B.12.c Exposure and Vulnerability

Hazardous Materials Sites

There are 513 facilities[165] within Berkeley that are regulated by TMD.[166] 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 513 facilities in Berkeley are Level 3 automotive- or medically- related facilities with limited quantities of hazardous materials and hazardous waste.

Fifteen Hazard Level 1 facilities hold sufficiently large quantities of toxic chemicals to pose a high risk to the community.[167] TMD works directly with each of these sites to make sure they meet stringent safety requirements. Facilities in Table 18 are at the highest risk level.

Table 18. Berkeley industrial sites with large quantities of extremely hazardous substances

Site	Location
Alta Bates Summit Medical Center	2450 Ashby Avenue
Atlas Welding Supply, Inc.	1224 Sixth Street
Bayer Healthcare LLC	800 Dwight Way
Davlin Coatings	700 Allston Way
DSM Biomedical, Inc.	829 Heinz Avenue
Electro Coatings, Inc.	893 Carleton Street
Enthalpy Analytical LLC	2323 Fifth Street
Henkel Corporation	742 Grayson Street
Howlett Machine Works	746 Folger Avenue
Lawrence Berkeley National Lab	1 Cyclotron Road
Precision Technical Coatings, Inc.	800 Grayson Street
Ravago Chemical Distribution	2424 Fourth Street
The Polymer Technology Group	2810 Seventh Street
TPMG Regional Lab (Kaiser)	1725 Eastshore Highway
UC Berkeley – Main Campus	200 California Hall MC

Hazardous Materials Sources Outside of Berkeley

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 Transportation

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 (see Map 12 *Gas Transmission Lines and Jet Fuel Line*)

Transportation accidents have occurred with trucks carrying dangerous materials. These accidents will undoubtedly occur in the future.[168] 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.

Links to Berkeley's Hazards of Concern

Map 36 identifies the locations of Hazard Level 1 Industrial Sites, along with key hazardous materials transportation routes. Level 1 industrial sites are identified as square red, blue, white, and yellow icons on the map. Hazardous materials transportation routes are identified by purple lines.

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.

While business owners are required to secure and isolate hazardous chemicals, this may not prevent spills from causing fires or health hazards after an earthquake.

Flooding could cause hazardous materials release. The City requires some hazardous materials to be surrounded by berms to contain any spills. The Berkeley Municipal Code[169] requires development in flood-prone areas to be protected against flood damage at the time of initial construction.

Map 36. ***Level 1 Hazardous Materials Facilities and Transportation Systems***

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

Level 1 Hazardous Materials Facilities

Hazardous Materials Transportation Route

Notable Mitigation Activities

The State of California requires engineering studies for facilities exceeding threshold quantities of extremely hazardous substances (EHS).[170] EHS regulations may also require mechanical and structural improvements to the respective facilities. Implementing State laws over the past twenty years has resulted in the decline of the number of EHS- regulated facilities in Berkeley by over 90 percent.

The City's Toxics Management Division regulates use and management of non- radioactive[171] hazardous materials at UC Berkeley and Berkeley Lab.[172] Both of these sites provide lists of the substances used in campus research to the TMD, which makes the information available to the Berkeley Fire Department in accordance with California Health and Safety Code. The TMD also makes these chemical types and volumes publicly available as part of its Community Right-to-Know program; however, locations of these chemicals are not disclosed to the public.

Key Hazardous Materials Partners

University of California at Berkeley

Hazardous materials are dispersed throughout many laboratories on the UC Berkeley campus, which has comprehensive programs to secure hazardous materials during and after disasters. The UC Berkeley campus relies on the City for fire and search and rescue services.

Berkeley Lab[173]
There are hazardous materials at the Berkeley Lab, which consist of radiological materials, biological agents and toxins, and chemicals. The Emergency Management Program analyzes these materials to determine those that are a threat to workers and the public to ensure protective actions are predetermined and administrative and engineering controls are identified and implemented.

Although additional planning and response efforts are in place for hazardous material releases, response to earthquakes and WUI fires can be complicated with the presence of hazardous materials.

Bayer Corporation[174]
Bayer's headquarters for biotechnology manufacturing is located in Berkeley and employs over 1,000 workers. Bayer has been proactive in managing its disaster risk, focusing on both reducing risks to buildings and equipment and preparing for a robust emergency response. The entire site has been assessed for earthquake risk; buildings and other structures have been retrofitted on a risk-basis. All production-related buildings have been structurally strengthened to at least 1.5 times code requirements, all other structures meet or exceed earthquake standards, including the ammonia-based refrigeration facility. New buildings have been designed to exceed code requirements.

Bayer also trains its own emergency response team each year with the following capabilities:

- Industrial Firefighting

- Hazardous Materials Response (including 'level A' response)
- Advanced first aid
- Confined space rescue, including non-entry rescue

Bayer has a type-1 fire engine to bolster City's fire suppression capabilities. Bayer conducts at least annual joint training sessions with the Berkeley Fire Department, which allows the two groups to understand the capabilities of each other's organizations. Bayer has created plans and entered into contracts with vendors in order to mitigate the damage associated with earthquakes or other disasters. Internal and community-based communications plans are being updated to assure timely communications in the event of a range of emergencies.

B.12.d Hazardous Materials Release Risk and Loss Estimates

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 *Terrorism*

The City considers terrorism to be a hazard of concern. However, because this plan is concerned with natural disasters, an in-depth analysis of terrorism is not included, and mitigation actions for terrorism will not be identified.

It is not possible to estimate the probability of a terrorist attack. Experts prioritize terrorism readiness efforts by identifying critical sites and assessing these sites' vulnerability to terrorist attack. Critical sites include those that are essential to the functioning of the City, that contain critical assets, or which would cause significant impacts if attacked (e.g., a chlorine gas release). Vulnerability of these sites is determined subjectively by considering factors such as visibility (e.g., does the public know this facility exists in this location?), accessibility (e.g., is it easy for the public to access this site?) and occupancy (e.g., is there a potential for mass casualties at this site?)

City officials are currently working with State and regional groups to prevent and prepare for terrorist attacks. This effort involves the City's Police, Fire, Public Works, Public Health, and Toxics Management groups. The City also participates in the federal BioWatch program, designed to allow early detection of release of bioterrorism agents in the city.

The City's emergency response teams actively train to detect Pre-Incident indicators for all types of terrorist events including, but not limited to, bomb scenarios, hostage situations, infrastructure damage and a multitude of other terror-associated threats. Since any terrorist event has the potential to significantly impact the city and the region, City emergency response teams regularly conduct training with emergency response teams from neighboring jurisdictions to ensure seamless integration of resources and personnel should such a need arise.

Buildings and other structures constructed to resist earthquakes and fires usually have qualities that also limit damage from blasts and resist fire spread and spread of noxious fumes in the event of a terrorist attack.

Endnotes

[1] Human action directly influences the probability that climate change will occur. Climate change is referenced as a natural hazard here because of its potential to exacerbate natural hazards described in this plan.

[2] Documentation is on file at the Berkeley Planning Department

[3] Public Law 106-390

[4] Johnson, L. and Mahin, S. California Seismic Safety Commission Pacific Earthquake Engineering Research Center (PEER). 2016. The Mw 6.0 South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California. http://peer.berkeley.edu/publications/peer_reports/reports_2016/CSSC1603-PEER201604_FINAL_7.20.16.pdf

[5] Detweiler, Shane and Wein, A., 2018, The HayWired Earthquake Scenario – Earthquake Hazards: U.S. Geological Survey Scientific Investigations Report 2017-5013-A-H, p.3.
[6] Detweiler, Shane and Wein, A., 2018, The HayWired Earthquake Scenario – Earthquake Hazards: U.S. Geological Survey Scientific Investigations Report 2017-5013-A-H, p.4.

[7] Southern California Earthquake Center. *A Comparison of the February 28, 2001, Nisqually, Washington, and January 17, 1994, Northridge, California Earthquakes*. http://www.scec.org/news/01news/feature010313.html

[8] Information adapted from the United States Geological Survey: http://earthquake.usgs.gov/learn/topics/mag_vs_int.php

[9] https://wim.usgs.gov/geonarrative/safrr/haywired_vol1/
[10] The State of California is required by two Acts of the State Legislature to establish and map three Seismic Hazard Planning Zones, depicting areas within the state with the potential to experience these types of ground failure.

Seismic Hazard Planning Zones, also known as Zones of Required Investigation, are regulatory maps that depict areas identified as having a high potential for earthquake- triggered ground failure caused by fault rupture, landsliding or soil liquefaction. These maps are used to guide land use planning and construction permitting for projects that fall within the area. Applicants for permits who are in one of the zones are required to have site-specific geotechnical investigations and use engineering measures to mitigate the hazard.

Seismic Hazard Planning Zones do not show effects of a particular earthquake scenario, but rather, consideration of all future earthquakes affecting the area. They are used to support land use decisions by identifying areas where future earthquake- induced ground failure is more likely to occur, and to determine whether approval of more in-depth site-specific hazard investigation and mitigation may be required for certain projects during the construction permitting process.

[11] Charles Real, California Geological Survey

[12] Yasuhara K., Komine H., Murakami S., Chen G., Mitani Y. (2010) Effects of climate change on geo-disasters in coastal zones. Journal of Global Environmental Engineering, JSCE 15, 15–

23.

[13] ATC 52-1. 2010. San Francisco Department of Building Inspection, Community Action Plan for Seismic Safety (CAPSS) Project. *Here Today Here Tomorrow: The Road to Earthquake Resilience in San Francisco.* http://www.sfgsa.org/modules/showdocument.aspx?documentid=9753.

[14] Johnson, L. and Mahin, S. California Seismic Safety Commission Pacific Earthquake Engineering Research Center (PEER). 2016. The Mw 6.0 South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California. http://peer.berkeley.edu/publications/peer_reports/reports_2016/CSSC1603-PEER201604_FINAL_7.20.16.pdf

[15] http://www.sfmuseum.org/conflag/underwriters.html

[16] City of Berkeley Budget Book FY2012-2013,Community Profile Data

[17] 2010 American Community Survey.

[18] The City has adopted Standard Plan Set A for wood frame homes of two stories or less that provides typical details and other guidance. This plan set simplifies the design of cripple wall retrofits for many homes in Berkeley.

[19] To create the City's inventory of non-ductile concrete and rigid wall-flexible diaphragm buildings, staff did extensive research, including examining local Sanborn maps, Google Map images, building permit data obtained from Accela, real estate data from RealQuest, housing unit data from the Rent Stabilization Board, and City of Berkeley records such property cards, microfiche data, files from prior field surveys, and zoning data. Sanborn maps, which were originally created for assessing fire insurance liability, provide the approximate size, shape and construction material of each building within the city that existed at the time. The City of Berkeley's Sanborn maps were last updated in the early 1980's, and were therefore useful as a starting point for identifying older buildings constructed of concrete or reinforced masonry that may be vulnerable in a seismic event.

After identifying concrete buildings on the Sanborn maps, staff investigated each building's current status. Buildings confirmed to still be in existence were researched for construction material and year built, as well as for any permit history indicating whether alterations and/or seismic retrofits might have occurred. Information was also gathered for each building's use classification, APN, alternate addresses, square footage, number of stories and residential units, historic registry list data, and property ownership information required for conducting outreach.
[20] During a sidewalk survey in November 2017, contracted EERI engineers visually assessed over 250 buildings to validate the City's inventory of seismically vulnerable buildings and identify common structural deficiencies. Additionally, two teams of experienced structural engineers were hired to help develop engineering guidelines and establish minimum standards for retrofits of non-ductile concrete and other rigid wall-flexible diaphragm buildings supported by FEMA-funded Retrofit Grants, in an effort to improve their performance during an earthquake.

[21] To help identify soft story buildings with 3-4 residential units or commercial uses, staff utilized a Rental Housing Safety Program database and field survey sheets of nonresidential

buildings from the original Soft Story inventory conducted in the 1990s. Staff undertook a "virtual" survey of each building using Google maps aerial and street view imagery to identify potential Soft Story buildings, and then verified the unit count and building configuration for each property by consulting City and county property records.

[22] Information provided by Steven Frew, Elizabeth Bialek, Jose Rios, and Mike Ambrose, EBMUD.

[23] Detweiler, Shane and Wein, A., 2018, The HayWired Earthquake Scenario – Engineering Implications: U.S. Geological Survey Scientific Investigations Report 2017-5013-I-Q, p.6.

[24] Information provided by Manuel Ramirez, City Environmental Health Division Manager, and Dr. Janet Berreman, City Health Officer, as of November 2012

[25] Interceptors are sewer pipes, as large as 10 feet in diameter, which form the backbone of the wastewater transport system.

[26] Information provided by Stuart Nishenko, Senior Seismologist, and PG&E

[27] National Transportation Safety Board, 2011. *Pipeline Accident Report: Pacific Gas and Electric Company Natural Gas Transmission Pipeline Rupture and Fire San Bruno, California, September 9, 2010,* Washington D.C.

[28] Information provided by Nicole Stewart, Area Manager Brisbane Terminal & Richmond Station of the Kinder Morgan, Inc., as of December 2018.

[29] Karl Busche, City Toxics Management Division, August 2018.

[30] Evacuation routes are designated in the City's General Plan, Transportation Element policy T-28: Emergency Access.

[31] Information provided by Craig Whitman, Office of Earthquake Engineers, Steve Prey, Energy Conservation Program Coordinator, and Robert Braga (January 2012), Branch Chief Maintenance Services/Emergency Management: Planning & Training, all at Caltrans.

[32] BART information provided by Tracy Johnson, Seismic Engineering Manager, BART, June 2013. BART earthquake early warning system information provided by John McPartland, BART Board of Directors.

[33] P-waves are non-destructive, earthquake-generated waves. They travel faster than secondary waves (S-waves), which create the strong shaking responsible for structural damage in earthquakes.

[34] Information provided by Rochelle Pollard Account Manager for AT&T, in March 2018.

[35] Information provided by Ken Fattlar, Director of Network Operations for Verizon Wireless in Northern California, in April 2013.

[36] Bryan Byrd, Comcast, Director, Communications, June 2013

[37] A "headend" is a master facility for receiving television signals for processing and distribution over a cable television system.

[38] In a hierarchical telecommunications network, the "backhaul" portion of the network comprises the intermediate links between the core network, or backbone network and the small sub-networks at the "edge" of the entire hierarchical network.

[39] Carl Scheuerman, Director of Regulatory Affairs, Sutter Health Facility Planning & Development, personal communication February 23, 2012

[40] 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.

[41] 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.

[42] 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.

[43] California Seismic Safety Commission. *The Field Act and Public School Construction: A 2007 Perspective.* February 2007.

[44] California Seismic Safety Commission. *Seismic Safety in California's Schools: Findings and Recommendations on Seismic Safety Policies and Requirements for Public, Private, and Charter Schools.* December 2004.

[45] John Calise, Executive Director of Facilities, Berkeley Unified School District

[46] Shirley Slaughter, Berkeley City College Business Officer and Safety Committee Co-Chair, December 2018.

[47] Camerio, Mary. "The Economic Benefits of a Disaster Resistant University: Earthquake Loss Estimation for UC Berkeley." April 12 2000, Institute of Urban Design and Regional Development.

[48] See http://www.berkeley.edu/administration/facilities/safer/index.html for more information on UC Berkeley's SAFER program.

[49] www.berkeley.edu/administration/facilities/safer/

[50] Office of the Vice Provost and the Disaster Resistant University Steering Committee. Strategic Plan for Loss Reduction and Risk Management: University of California, Berkeley. Working Paper 2000-03. University of California, Berkeley, July 2000.

[51] Information provided by Dr. Tonya Petty, Emergency Manager and Continuity Manager, Lawrence Berkeley National Laboratory, as of October 2018.

[52] City of Berkeley, Office of Economic Development, Economic Dashboard, September 2018.

[53] 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.

[54] 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.

[55] Detweiler, Shane and Wein, A., 2018, The HayWired Earthquake Scenario – Engineering Implications: U.S. Geological Survey Scientific Investigations Report 2017-5013-I-Q, p.1.

[56] 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.

Risk, S. P. A. "Enhancements in HAZUS-MH Fire Following Earthquake, Task 3: Updated Ignition Equation pp. 74pp. *SPA Risk LLC, Berkeley CA. Principal Investigator C.Scawthorn. Prepared for PBS&J and the National Institute of Building Sciences, San Francisco* (2009).

[57] Estimation derived from Ch. 10, particularly Eqn. 10-1, of HAZUS Earthquake Tech Manual MR 4: FEMA, 2003. Multi-hazard Loss Estimation Methodology, Earthquake Model, HAZUS-MH MR4 Technical Manual. Developed by: Department of Homeland Security, Federal Emergency Management Agency, Mitigation Division, Under a contract with: National Institute of Building Sciences Washington, D.C., p. 712.

[58] In 2004, estimate was $20 million damage from 5 estimated fires. This plan estimates 6-12 fires. If $4 million/ignition assumed, $24 million - $48 million damage is estimated in 2004 dollars. This figure was then updated for 2018 to $32 million - $64 million using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[59] Detweiler, Shane and Wein, A., 2018, The HayWired Earthquake Scenario – Engineering Implications: U.S. Geological Survey Scientific Investigations Report 2017-5013-I-Q, p.2.

[60] 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.

[61] Detweiler, Shane and Wein, A., 2018, The HayWired Earthquake Scenario – Engineering Implications: U.S. Geological Survey Scientific Investigations Report 2017-5013-I-Q, p.6.

[62] Information provided by Bill Cain (ret.), EBMUD

[63] Detweiler, Shane and Wein, A., 2018, The HayWired Earthquake Scenario – Engineering Implications: U.S. Geological Survey Scientific Investigations Report 2017-5013-I-Q, p.390.

[64] Per Rochelle Pollard, Account Manager for AT&T, in March 2018.For Prioritization and Preemption of the Berkeley first responders, the cornerstone of the AT&T Mobile solution is FirstNet.

First Priority™ & Preemption Capability

First Priority™, which means first responders connect first – they don't have to compete with

non-emergency users for a connection. Delivery of priority and preemption capabilities, an exclusive public safety core, application ecosystem, deployables and mission critical services – all required by the government contract

Highly reliable and extensive coverage

- A contractual commitment to build a network designed to meet a 99.99% end-to-end service availability objective – a standard unmatched by any other large-scale LTE network in the world today.
- A commitment to grow coverage to rural, tribal and
- U.S. territories specifically for public safety
- Public safety Band 14 deployment to 95% of America's population
- Deployables dedicated exclusively for public safety
  - for planned activities and disaster recovery
- Local control of users and applications and the ability to give others priority access to the network
- A network backbone that supports integration with Next Generation 9-1-1 and Smart Cities public safety applications – ensuring emergency work/call flows are available to public safety.
- Preemption will make sure first responders have the bandwidth they need by detouring others off the network. This works like vehicle traffic being routed off the highway to make room for emergency personnel.

Unprecedented level of network security

- Building a physically separate dedicated core with end-to-end encryption
- Single-sign-on and federated identity, providing ease of use and integration between the network, applications and public safety databases
- A robust and highly secure device ecosystem – with a broad portfolio of devices enabled for multiple bands, including Band 14
- Dedicated security operations center to monitor the network (24/7/365) and mitigate threats

Critical interoperability

- Building a dedicated, interoperable network, and ecosystem
- Building a dedicated public safety application store with certified, public-safety relevant, highly secure and interoperable applications

[65] In 2004, estimate was $215 million. Updated for 2018 using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[66] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[67] Updated for 2018 using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[68] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[69] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[70] United States Fire Administration. *The East Bay Hills Fire, Oakland-Berkeley, California (October 19-22, 1991): Report 60 of the Major Fires Investigation Project.*

[71] City of Berkeley. *Fire Hazard Mitigation Plan*. February 25, 1992.

[72] California Department of Public Health. 2008. Public Health Climate Change Adaptation Strategy for California. http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf

[73] Pacific Institute. (2010). A Review of Social and Economic Factors that Increase Vulnerability to Climate Change Impacts in California.

[74] 2010 CBC Chapter 7A: Materials and Construction Methods for Exterior Wildfire Exposure, and 2010 CRC Section R327: Materials and Construction Methods for Exterior Wildfire Exposure

[75] Per Dan Gallagher, Senior Forestry Supervisor, City of Berkeley: The Fire Fuel Chipper Program collected green waste vegetation in the following amounts in the following years:

- 2005: 264.35 tons
- 2006: 237.59 tons
- 2007: 189.06 tons
- 2008: 175.16 tons
- 2009: 167.17 tons
- 2010: 161.31 tons
- 2011: 187.24 tons
- 2012: 155.94 tons
- 2013: 141.27 tons
- 2014: 119.72 tons
- 2015: 130.26 tons
- 2016: 430 cubic yards of wood chips and 34.28 tons of loose vegetation

[76] Information provided by Susan Ferrera, Superintendent of Parks, City of Berkeley, as of November 2018

[77] Information provided by Greg Apa, Solid Waste and Recycling Manager of Zero Waste Division, City of Berkeley, as of September 2018

[78] Information provided by Greg Apa, Solid Waste and Recycling Manager of Zero Waste Division, City of Berkeley, as of September 2018

[79] http://firecenter.berkeley.edu/

[80] Information provided by Dr. Tonya Petty, Emergency Manager and Continuity Manager, Lawrence Berkeley National Laboratory, as of October 2018.

[81] Total square footage of buildings in burn area is 9,386,281 square feet.

[82] In 2004, estimate was $500 million.

[83] Ellen et al. “Map showing principal debris-flow source areas in Alameda County, California.” USGS Open-File Report 97-745 E.

[84] Pike et al. “Map and map database of susceptibility to slope failure by sliding and earth flow in the Oakland area, California.” USGS MF-2385.

[85] In Berkeley, culverted creeks are below ground and within a pipe or box-shaped conduit in a creek bed.

[86] 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.

[87] The City uses a 10-year design storm as representation of a rainfall event that reflects local conditions.

[88] California Adaptation Planning Guide, July 2012.

[89] There are no wastewater treatment facilities located in Berkeley. The East Bay Municipal Utility District (EBMUD) operates multiple potable water reservoirs within the City limits. EBMUD is responsible for protecting their facilities and ensuring their proper function.

[90] California Adaptation Planning Guide, July 2012.

[91] Revisions effective December 21, 2018 present the results of revised coastal hazard analysis and resulting flood elevations and flood depths. These revisions result in reissued Flood Insurance Rate Map, Panel numbers 14, 18, 52, 54, and 56.

[92] The FIRM map was created by the Federal Emergency Management Agency (FEMA) for the National Flood Insurance Program. Data current as of 2009, with revisions effective December 18, 2018.

[93] 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.

[94] 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.

[95] In 2018, loss estimates quoted in the narrative were updated using Consumer Price Index Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl.

[96] 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.

[97] Wilson, R., Ewing, L., Dengler, L., Boldt, E., Evans,T., Miller, K., Nicolini, T., and Ritchie,

A. Effects of the February 27, 2010 Chilean Tsunami on the Harbors, Ports, and the Maritime Community in California With Comparison to Preliminary Evaluation of March 11, 2011 Tsunami. Proceedings from ASCE Coasts, Oceans, Ports, and Rivers Institute Conference, Alaska, June 2011.

[98] The SAFRR Tsunami Modeling Working Group, 2013, Modeling for the SAFRR Tsunami Scenario—Generation, propagation, inundation, and currents in ports and harbors, chap. D 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, 136 p., http://pubs.usgs.gov/of/2013/1170/d/.

[99] A team of scientists from California Geological Survey, US Geological Survey and the California Office of Emergency Services are in the process of developing a methodology for estimating tsunami hazard to the west coast. In 2013 they expect to begin two pilot studies to test the methodology in Crescent City and Huntington Beach. Following validation of the pilot studies, probabilities for the rest of the state will be developed.

[100] Wood, N., Ratliff, J., and Peters, J., 2013, Community exposure to tsunami hazards in California: U.S. Geological Survey Scientific Investigations Report 2012-5222, 49p.

[101] California Geological Survey, University of Southern California, California State Lands Commission, California Governor's Office of Emergency Services: February 2018 DRAFT Harbor Improvement Report (HIR) No. 2018-Alam-01

[102] Overcrossing provides non-automobile access between the residential and business districts on the east side of I-80 and the Berkeley waterfront, Bay Trail and Eastshore State Park (Addison St and Bolivar Drive) to the west of the freeway (West Frontage Road and University Avenue).

[103] The SAFRR Tsunami Modeling Working Group, 2013, Modeling for the SAFRR Tsunami Scenario—Generation, propagation, inundation, and currents in ports and harbors, chap. D 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, 136 p., http://pubs.usgs.gov/of/2013/1170/d/.

[104] The Dona Spring animal shelter, opened in 2012, is built above the 100-year flood plain but is still in the tsunami inundation zone

[105] Public Law 106-390

[106] Diurnal asymmetry to the observed global warming (Royal Meteorological Society, 2016) https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.4688

[107] Our Changing Climate 2012 (California Climate Change Center, 2012) http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf

[108] How Climate is Changing (NASA, Updated December 6, 2018) https://climate.nasa.gov/effects/

[109] San Francisco Bay Area 2017 Risk Profile (ABAG, 2017)

[110] Morello-Frosch, R; Pastor, M; Sadd, J; Shonkoff, S. The Climate Gap: Inequalities in How Climate Change Hurts Americans & How to Close the Gap. May 2009.

[111] Our Changing Climate 2012 (California Climate Change Center, 2012) http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdfhttp://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf

[112] McKenzie, D.; Heinsch, F.A.; Heilman, W.E. 2011. Wildland Fire and Climate Change. (January 17, 2011). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. http://www.fs.fed.us/ccrc/topics/wildland-fire.shtml
[113] Our Changing Climate 2012 (California Climate Change Center, 2012).
[114] San Francisco Bay Area 2017 Risk Profile (ABAG, 2017, p58-59) http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/RiskProfile_4_26_2017_optimized.pdf
[115] Our Changing Climate 2012 (California Climate Change Center, 2012).
[116] Our Changing Climate 2012 (California Climate Change Center, 2012).
[117] San Francisco Bay Area 2017 Risk Profile (ABAG, 2017, p53)
[118] Ibid.
[119] Causes and Predictability of the 2011-14 California Drought (NOAA, 2014) https://cpo.noaa.gov/Meet-the-Divisions/Earth-System-Science-and-Modeling/MAPP/MAPP-Task-Forces/Drought/Drought-Task-Force-I/Causes-and-Predictability-of-the-2011-2014-California-Drought
[120] 2012-2016 California Drought: Historical Perspective (USGS, Updated 2018) https://ca.water.usgs.gov/california-drought/california-drought-comparisons.html
[121] San Francisco Bay Conservation and Development Commission, 2011, p. 5
[122] 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/
[123] 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
[124] 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
[125] 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
[126] 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.
[127] Adapting to Rising Tides (ART) Bay Shoreline Flood Explorer https://explorer.adaptingtorisingtides.org/explorer
[128] 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
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[130] http://www.adaptingtorisingtides.org/wp-content/uploads/2018/07/BATA-ART-SLR-Analysis-and-Mapping-Report-Final-20170908.pdf
[131] 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/
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[133] 2017 Clean Air Plan (BAAQMD, 2017, Chapter 3, pg 10) http://www.baaqmd.gov/~/media/files/planning-and-research/plans/2017-clean-air-plan/attachment-a_-proposed-final-cap-vol-1-pdf.pdf?la=en
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[135] San Francisco Bay Area 2017 Risk Profile (ABAG, 2017) http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/RiskProfile_4_26_2017_optimized.pdf
[136] McKenzie, D.; Heinsch, F.A.; Heilman, W.E. 2011. Wildland Fire and Climate Change. (January 17, 2011). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. http://www.fs.fed.us/ccrc/topics/wildland-fire.shtml.
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[138] Alameda County Climate Change and Health Profile Report (California Department of Public Health, 2017). https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHPRs/CHPR001Alameda_County2-23-17.pdf
[139] 2017 Clean Air Plan (BAAQMD, 2017, p.3/6) http://www.baaqmd.gov/~/media/files/planning-and-research/plans/2017-clean-air-plan/attachment-a_-proposed-final-cap-vol-1-pdf.pdf?la=en
[140] San Francisco Bay Area 2017 Risk Profile (ABAG, 2017, p58-59) http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/RiskProfile_4_26_2017_optimized.pdf
[141] Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on the Shoreline. October 6, 2011. San Francisco Bay Conservation and Development Commission
[142] http://www.flseagrant.org/coastalplanning/sea level-rise-and-climate-change-to-be-considered-in-flood-mapping/
[143] Recommendations related to mitigating climate change impacts are contained in Climate Action Plan Chapter 5 (p. 101).
[144] California Statewide Heat Wave September 2017 (Climate Signals Beta, Updated July 20, 2018) http://www.climatesignals.org/headlines/events/california-statewide-heat-wave-september-2017
[145] https://www.kqed.org/news/11614957/what-you-need-to-know-about-bay-areas-heat-wave
[146] https://www.sfgate.com/news/article/THAT-WAS-THE-WAVE-THAT-WAS-Bay-Area-s-string-of-2492288.php
[147] Excessive Heat Events Guidebook (EPA, 2006, Updated Appendix A 2016) https://www.epa.gov/sites/production/files/2016-03/documents/eheguide_final.pdf
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[149] California Adaptation Planning Guide, July 2012.
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[154] Rising Temperatures, Worsening Ozone Pollution, Union of Concerned Scientists (2011), p7 https://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/climate-change-and-ozone-pollution.pdf
[155] Rising Temperatures, Worsening Ozone Pollution, Union of Concerned Scientists (2011), p12.
[156] https://www.sciencedirect.com/science/article/pii/S161886671630348X
[157] https://www.cityofberkeley.info/urban_forestry_information/
[158] San Francisco Bay Area 2017 Risk Profile (ABAG, 2017) http://resilience.abag.ca.gov/wp-content/documents/mitigation_adaptation/RiskProfile_4_26_2017_optimized.pdf
[159] 2017 Clean Air Plan (BAAQMD, 2017, Chapter 3, pg 11).
[160] 2017 Clean Air Plan (BAAQMD, 2017, Chapter 3, pg 9).
[162] San Francisco Bay Area 2017 Risk Profile (ABAG, 2017).

[163] Both of these accident sites no longer store anhydrous ammonia.

[164] UC Berkeley and Berkeley Lab have since evaluated their storm water systems as potential hazardous materials conduits to the creeks.

[165] Of the 513 facilities indicated, 481 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 Karl Busche, City Toxics Management Division, August 2018).

[166] 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.

[167] City Toxics Management Division, as of July 2018.

[168] 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.

[169] Berkeley Municipal Code Section 17.12.030.C.2 requires uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction. This requirement applies to future businesses but does address existing facilities. BMC 17.12.030 does not recognize areas exposed to sea-level rise in the flood exposure area.

[170] Per Nabil Al-Hadithy (March 2018), the engineering study is a Risk Management Plan, which includes safety information, process hazard analysis/hazard review, operating procedures, training, maintenance, compliance audits and incident investigations, along with documents and records showing that the facility is implementing the program.
Scenarios for release including earthquake, operator error and fire are studied and corrections are made. The technical severity of these studies depends on the quantity and type of hazardous substances at the facility.

[171] The City has limited regulatory authority over radioactive material use and management. Radioactive materials are managed by the federal Department of Energy and Nuclear Regulatory Commission.

[172] Per Karl Busche, Toxics Management Division, City of Berkeley: Per the State's Unified Hazardous Waste and Hazardous Materials Management Regulatory Program, the City's Toxics Management Division is the agency responsible for administering six of the State's hazardous materials and waste programs for Berkeley. The City of Berkeley regulates both UC Berkley and Berkeley Lab for the following six State programs:

1. Hazardous Materials Release Response Plans and Inventories (HMBP) Program, Health and Safety Code, Division 20, Chapter 6.95, Article 1, with supplemental regulations in California Code of Regulations Title 19, Sections 2620-2732.

2. California Accidental Release Prevention (CalARP) Program, Health and Safety Code, Division 20, Chapter 6.95, Article 2, with supplemental regulations in California Code of Regulations, Title 19, Sections 2735-2785.

3. Underground Storage Tank (UST) Program, Health and Safety Code, Division 20, Chapter 6.7, with accompanying regulations in the California Code of Regulations, Title 23.

4. Aboveground Petroleum Storage Act Requirement for Spill Prevention, Control and Countermeasure (SPCC) Plans, Health and Safety Code, Division 20, Chapter 6.67, Section 25270-25270.13.

5. Hazardous Waste Generator and Onsite Hazardous Waste Treatment (tiered permitting) Programs, Health and Safety Code, Division 20, Chapter 6.5, with accompanying regulations in the California Code of Regulations, Title 22.

6. California Fire Code: Hazardous Materials Management Plans (HMMP) and Hazardous Materials Inventory Statements, California Code of Regulations, Title 27, Division 2, Chapter 4.5.

The Toxics Management Division also enforces City codes regarding hazardous materials and waste. These codes are often more stringent than CUPA codes.

[173] Information provided by Dr. Tonya Petty, Emergency Manager and Continuity Manager, Lawrence Berkeley National Lab, as of October 2018.

[174] Information provided by Jeffrey Bowman, CHMM Senior Manager - Health, Safety, Environment, and Security

C. Mitigation Strategy

Berkeley aims to be a disaster-resilient community that can survive, recover from, and thrive after a disaster while maintaining its unique character and way of life. 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.

Elements C.3-C.6 of this plan outline 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: Hazard Analysis. It 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-C.2 of this plan.

C.1 *Authorities, Policies, Programs, and Resources*

This section identifies the regulatory authorities, policies, programs and funding structures that support the Berkeley community's hazard mitigation efforts, as well as the City's ability to expand on and improve these programs. This section addresses these topics at the City level and addresses State and federal requirements related to hazard mitigation, describing how Berkeley complies with these requirements.

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 services.

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 March 2016, the City Council modified the

Demolition Ordinance to account for the loss of affordable housing that can occur with building demolition. That ordinance established the City's authority to set and collect a fee for each dwelling unit demolished in a building constructed prior to June 1980. It also allows for projects to provide one for one replacement units in lieu of fee payment as long as the units are restricted in perpetuity at a below market rate.

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.

Preserving Historic Character

The City has a strong value for 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.

Public Works Divisions and staffing allocations (measured in Full Time Equivalent (FTE) positions) are as follows:

- Office of the Director (6 FTE)
- Operations (98 FTE)
- Engineering (34 FTE)
- Zero Waste (90 FTE)

- Transportation (15.6 FTE)
- Administrative & Fiscal Services (16 FTE)

Significant objectives expected to be accomplished by the department during FY 2020 include the seismic retrofit of the North Berkeley Senior Center, the complete remodel of the City's Mental Health Clinic, implementing computerized maintenance management system for Operation's activities, and procuring a global positioning system for tracking the City's fleet. The Zero Waste Division has begun the feasibility process to replace the existing Transfer Station Facility. In addition the City plans to submit the Debris Management Plan to FEMA for approval.

Four publicly-staffed commissions provide community oversight over Public Works activities:

- Commission on Disability
- Public Works Commission
- Transportation Commission
- Zero Waste Commission

C.1.c. 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 3.5 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 provides community oversight over emergency management activities. The 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.d. 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 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.

Sales tax is 9.75 cents on every dollar. Of that, the State gets 7 cents, Alameda County gets 1.75 cents, and the City gets a penny. Berkeley's sales tax revenue has decreased during the economic

downturn, but is expected to remain steady going forward because of the City's efforts to retain its diverse retail mix.

The change in property transfer tax is an example of the impact of the economy on City budgets. 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.e. 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 2018 & FY 2019 budget was adopted by the Berkeley City Council at their June 27, 2017 meeting. The City's budget follows the fiscal year - beginning on July 1st and ending on June 30th.

The City's General Fund budget is approximately $184.2 million. The balance of the City's budget is made up of special funds ($277.4 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:

- Focusing on the long-term fiscal health of the City by adopting a two-year budget and conducting multi-year planning;
- Building a prudent reserve;
- Developing long-term strategies to reduce unfunded liabilities;
- Controlling labor costs while minimizing layoffs;

- Allocating one-time revenue for one-time expenses;
- Requiring enterprise and grant funds to balance and new programs to pay for themselves; and
- Any new expenditure requires either additional revenue or expenditure reductions.

The City also used the "fix it first" approach in developing the budget, through which current capital improvements are funded before funding new projects.

C.1.f. 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 2017, work was completed on the James Kenney Recreation Center and the Center Street Garage. The James Kenney Community Center Seismic Retrofit project was made possible by a Pre-Disaster Mitigation Program grant for $727,499 and involved seismic strengthening of the Recreation and Gym Building, as well as fire protection sprinklers throughout the building, and necessary ADA upgrades throughout. The replacement of the Center Street Garage was one of the City's high priority downtown projects. The preexisting 5-story structure did not meet current seismic standards and retrofit was determined to be infeasible.

Additionally, since 2004 the City has strengthened or rebuilt all seven of the City's fire stations, the historic Ratcliff Building (which houses the Public Works Department Operations Center), the Civic Center (which houses many key government functions), the Public Safety Building, a new animal shelter, and all libraries. The City is currently 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.g. 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[i] 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. The initial wood-frame SWOF inventory included 321 buildings. The inventory has since increased to 332 buildings, containing 3,665 units.

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 table below describes the status of the 332 soft story buildings subject to mandatory retrofit as of December 2018.

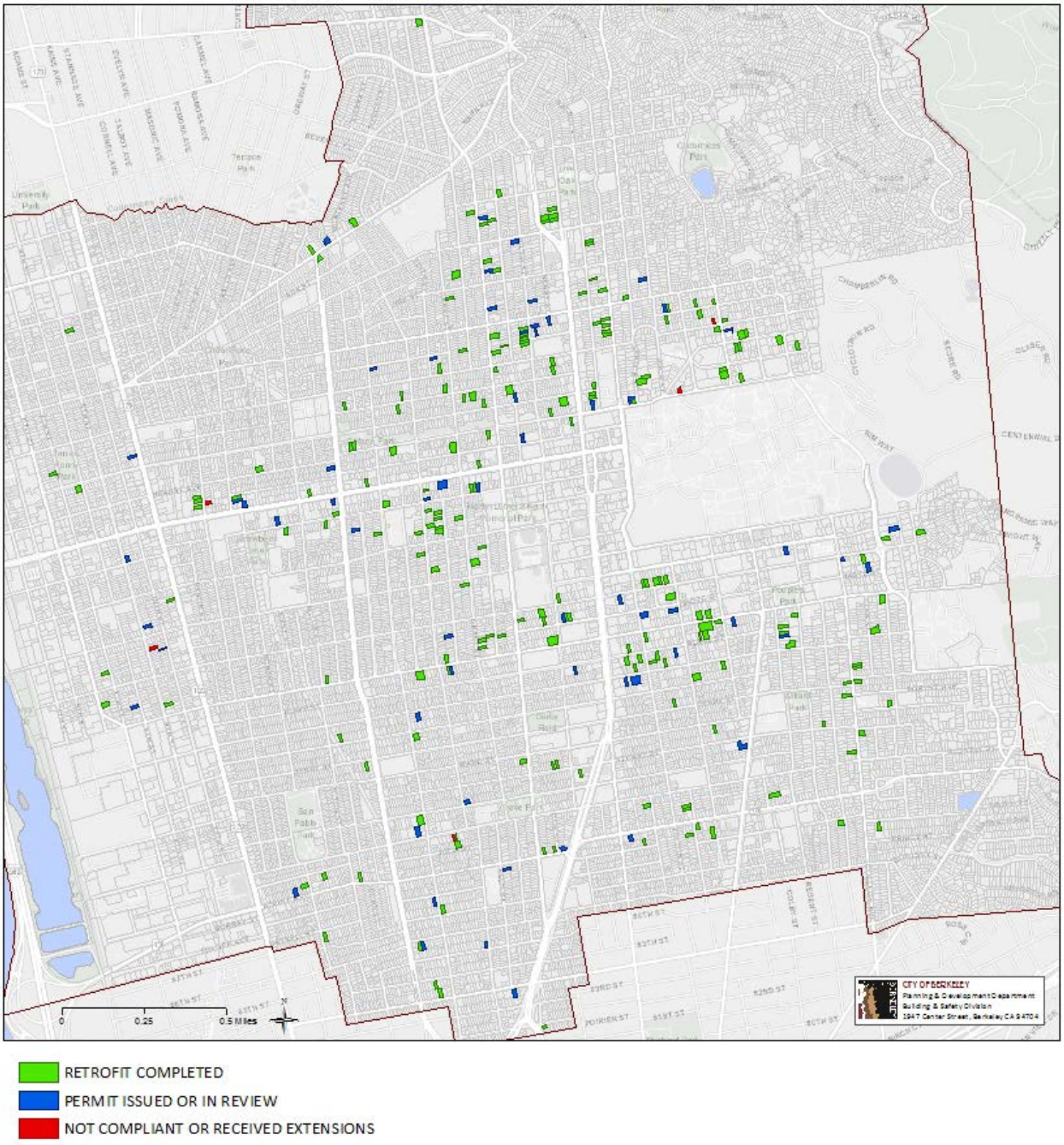
Table 1. Berkeley Soft-Story Building Status as of December 2018

Number of buildings	**Percent***	**Status**
204	61	Retrofit Complete
34	10	Permit
30	9	Applied for Permit
6	2	Not Compliant or Received Extension
58	17	Removed from Inventory for Other Reasons
332	*100%*	*Total buildings identified as soft-story*

*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 December 2018. Green symbols depict parcels with retrofit buildings, blue indicates parcels containing one or more buildings with permits issued or currently under review, and red shows parcels with extensions filed or buildings out of compliance.

Map 1. Status of Soft Story Buildings Subject to Mandatory Retrofit (December 2018)



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 with inadequate reinforcement (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.

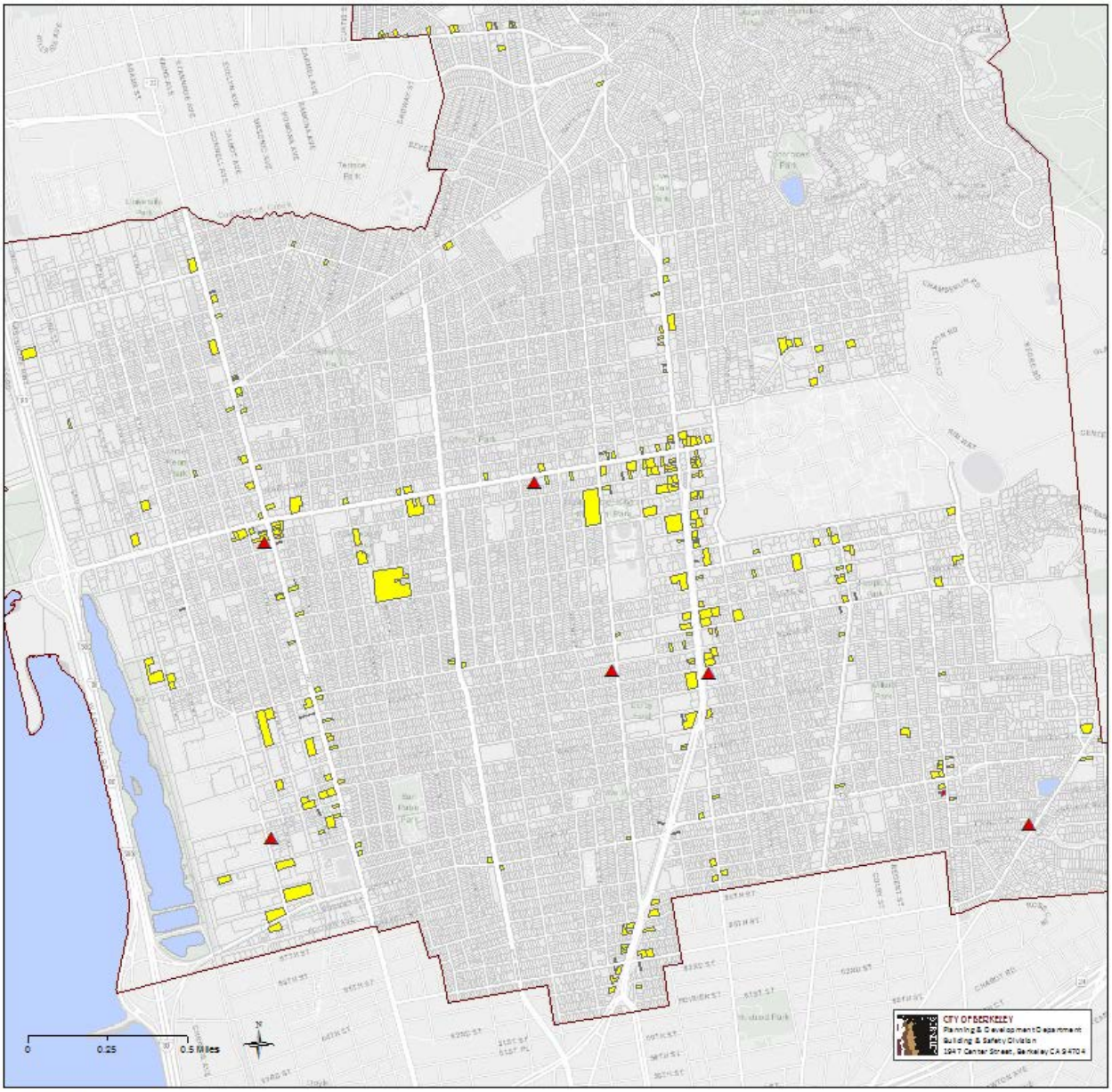
Although unreinforced masonry buildings are no longer constructed today, existing URM buildings can be retrofitted to reduce risks caused by earthquake activity. If these buildings are not retrofitted and suffer major damage in an earthquake, the costs of repair after the earthquake could be prohibitively 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 August 2018, six buildings are still required to retrofit in order to avoid further penalties. Five of the six building owners have applied for retrofit permits.

Map 10 shows the unreinforced masonry (URM) inventory as of June 2018. 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 2. Berkeley Parcels with Unreinforced Masonry Building Types (June 2018)



COMPLIANT WITH URM ORDINANCE

▲ NOT COMPLIANT WITH URM ORDINANCE (INCLUDING THOSE IN PERMIT REVIEW PROCESS)

C.1.a Financial Incentives

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). In the first round of the Retrofit Grants program, the City offered grants of up to $25,000 to owners of soft story buildings with five or more units, and unreinforced masonry buildings. During the first round of the grant program, owners of 48 buildings containing over 400 housing units applied for grants, amounting to over $1 million in federal funding.

The Building and Safety Division launched the second round of grant funding in May 2018, offering design and construction grants to owners of other seismically vulnerable buildings: rigid wall - flexible diaphragm buildings (RWFD) with walls made of concrete or masonry and wood or steel roofs, non-ductile concrete buildings (NDC), and soft story buildings with 3-4 residential units and non-residential uses, which are not covered under the mandatory soft story retrofit program. In the second round of the grant program, as of August 2018, owners of 66 buildings applied for an additional $1.3 million in FEMA funding. These buildings contain almost 300 housing units in addition to a variety of retail, commercial, and educational occupancies.

In the spring of 2018, City staff conducted outreach to promote the second round of grant funding and assist owners with the application process. Information packets, including applications, fact sheets about relevant building types and grant program details were mailed to property owners of nearly 1,000 potentially vulnerable buildings. The application deadline for the second phase of the Retrofits Grants Program was June 25, 2018.

Although single-family homes and duplexes were not eligible for this program, other programs 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 to be applied to earthquake upgrades on homes. The process begins once the homeowner makes seismic safety improvements. 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 $12 million to homeowners through this program.

Table 2. Transfer Tax Rebate Program

Fiscal Year	Property Transfer Rebates	Total Funds Issued
2003	382	$1,133,047
2004	467	$ 1,539,738
2005	385	$ 1,459,510
2006	262	$ 1,168,654
2007	144	$ 611,433
2008	152	$ 681,002
2009	138	$ 533,061
2010	150	$ 592,539
2011	157	$ 593,974
2012	166	$ 623,502
2013	159	$ 766746
2014	164	$ 798,370
2015	138	$ 773,697
2016	147	$ 859,831
2017	55	$ 423,586
2018[1]	31	$ 165,010
Total (FY 2003-2018)	3,097	$12,723,700

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.

[1] As of September 2018. Taxpayers may still claim seismic-related refunds for properties purchased in FY 2018.

The program supplements other programs to subsidize or finance seismic improvements in Berkeley homes; these programs can be used in combination or separately.

Property Assessed Clean Energy (PACE)
Additionally, the PACE program provides financing for seismic improvements, and allows owners to pay back costs over time on their property tax bills with no upfront costs.

C.1.b 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 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.

Since the initial phase of the project, the grant program has expanded to include Soft Story buildings with 3-4 residential units, and some mixed-use or nonresidential Soft Story buildings that are not mandated to retrofit.

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 non-ductile concrete buildings, 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.[ii] 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[iii], and a "virtual survey" to identify potential soft story buildings.[iv]

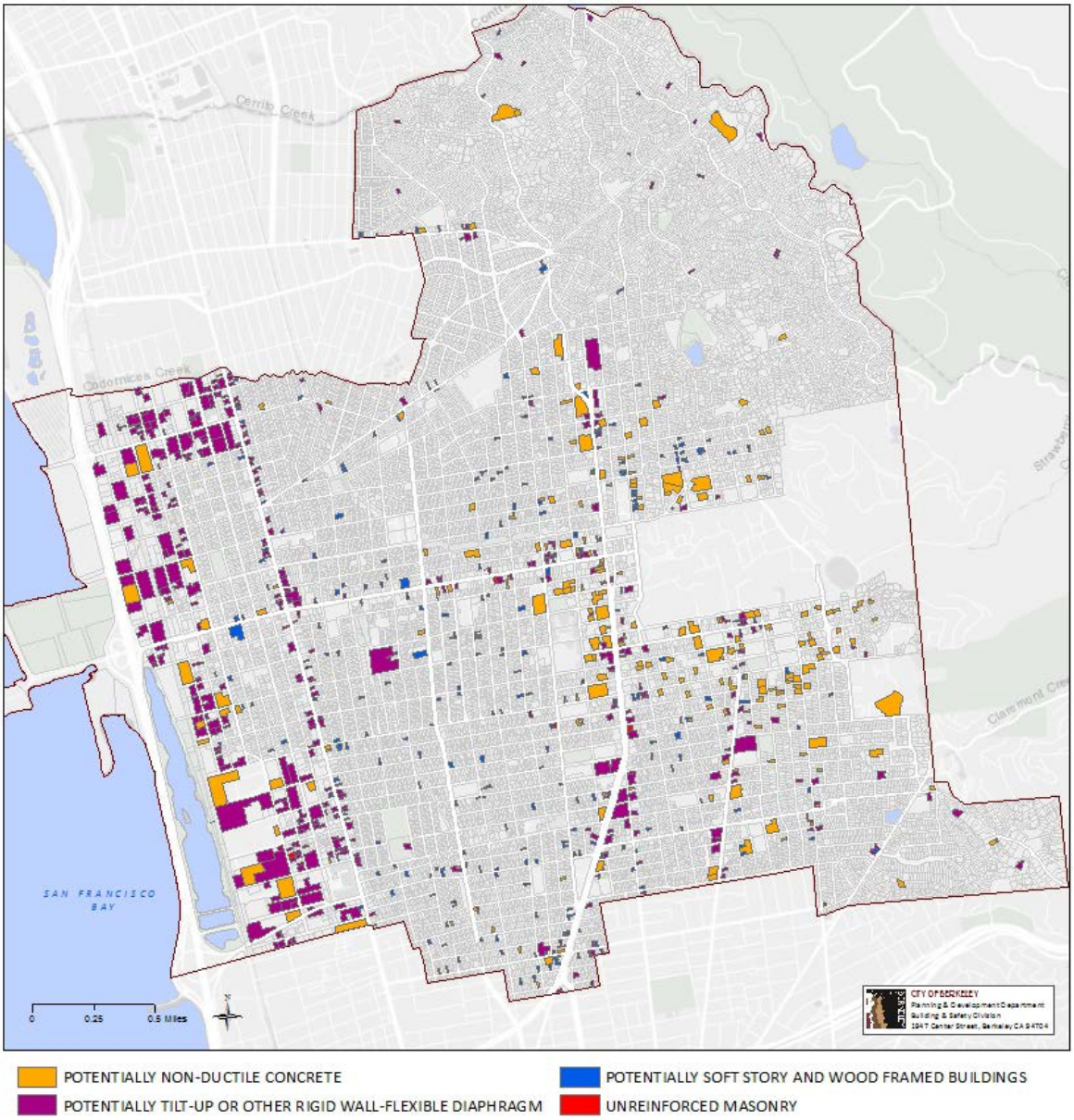
Updated Inventory of Seismically Vulnerable Buildings (2018)

As of June 2018, the City identified 1,047 potentially seismically vulnerable buildings that did not already appear on the soft story or URM inventories. The updated inventory includes 230 potentially non-ductile buildings and nearly 550 buildings that may be rigid wall-flexible diaphragm, including tilt-ups. The City has also added to the inventory approximately 240 soft story buildings not subject to mandatory retrofit under Chapter 19.39 of the Berkeley Municipal Code.

Map 11 shows Berkeley's updated Inventory of Seismically Vulnerable buildings, as of June 2018. Soft story 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 are eligible for the Cal OES/FEMA Grant Program.

Map 3. Updated Inventory of Potentially Seismically Vulnerable Buildings (June 2018)



C.1.h. 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; improvement of access and egress routes; and infrastructure maintenance and improvements to support first responders' efforts to reduce fire spread.

Hazardous Fire Area Zones

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. 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 and have the strictest fire prevention standards for issues such as building materials for new structures. The City also enforces vegetation management measures in these areas.

Fire Inspections

The Berkeley Fire Department annually inspects designated high fire risk zones for hazards such as excess vegetation. The Fire Department inspects over 1,400 parcels in Fire Zones 2 and 3, in addition to complaint-driven inspections throughout the City. Residents must clear combustible brush and vegetation adjacent to building property lines and roadsides. Tree branches must be cleared from any chimney, stovepipe or overhang over a building. All leaves, needles, and dead vegetation must be swept from roofs. This program is done in cooperation with the East Bay Regional Park District, which has programs to limit combustible material in the wildland-urban interface zone on its property.

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. The Program serves properties in the hills from June through September each year. Since 2014, over 100 tons of vegetation was collected and recycled, on average, each year.[v]
- A fire fuel abatement program on public land. This Program was maintained 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, pathways and landscaped medians.[vi]
- 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.[vii]
- Additionally, 30,000 tons of residential and commercial plant debris and commercial food waste[viii] is collected each year through weekly curbside collection and converted to compost.
- The City of Berkeley's Zero Waste Division has expanded staffing to include a full-time Recycling Program Manager, and is working to hire additional field representatives to help educate the community about its vegetation management programs. Additionally, the Division is performing a Feasibility Study to reimagine the City's Solid Waste and Recycling Transfer

Station to achieve its goal of Zero Waste. This re-envisioned facility will help to support outreach staff in their efforts to promote vegetation management programs.

C.1.i. Community Readiness

Community Emergency Response Team (CERT) Program

CERT classes are offered free through the Fire Department to all Berkeley residents and those who work in Berkeley. Trained volunteers can help douse small fires, conduct light search and rescue, help with first aid, and communicate with City emergency responders. Neighborhoods have organized response teams and conducted drills with City emergency responders.

Neighborhood Caches

The Disaster Cache Program incentivizes community-building for disaster readiness. To date, the City has awarded caches of disaster response equipment to neighborhoods, congregations, and UC Berkeley Panhellenic groups that have undertaken disaster readiness activities.

Community Oversight

The Disaster and Fire Safety Commission closely monitors the City's disaster readiness efforts. Members are safety advocates appointed by the Mayor and City Council.

C.1.j. 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 3. State Mitigation Requirement and Berkeley Implementation

Statewide Requirements	Berkeley Implementation
Mandatory Building Code. The State requires all communities to enforce the 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.	Berkeley enforces the State building code with additional local provisions for seismic and fire safety. The City has adopted the 2016 California Building Code and 2016 California Residential Code. Berkeley's application of WUI fire standards exceeds current State requirements.

Essential Services Buildings. State law requires that new essential services buildings, such as police, fire, and emergency operation and communications centers, meet a higher safety standard than other buildings. The standards include backup utilities and design and construction checks by inspectors following State guidelines.	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.
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.	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 2019 update continues to use the General Plan as a strategic guide.
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 of hazards on development and the resulting consequences for the environment. On occasion, certain emergency safety projects are exempted from the CEQA process.	The City of Berkeley complies with State CEQA requirements.
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.	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 Hazard Analysis of this mitigation plan replicates these maps. Because of the well- defined surface expression of this fault, it is reasonable to expect ground surface rupture in this area during future earthquakes.
Seismic Hazards Maps. The California Geologic Survey mapped seismic zones where earthquake-induced landslides and liquefaction are likely. The State requires	Seismically-induced landslide risk maps are available in the Hazard Analysis of this plan. The City enforces State requirements by requiring site-specific investigations and feasible mitigation measures.

site-specific investigations for new building in these zones.	
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).	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.
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.	There is one acute care hospital in Berkeley, Alta Bates, owned and operated by the Sutter Health Corporation. The corporation is planning compliance renovations for the site.
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.	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.
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.	The City of Berkeley complies with this State law.
Emergency Response Plans. In the wake of the 1991 Tunnel Fire, the State requires that all jurisdictions practice the Standardized Emergency Management System (SEMS), a	The City complies with all State requirements.

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.

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.

Current Flood Insurance Rate Maps are presented in this Plan's Hazard Analysis (Element B.8.c *Exposure and Vulnerability* to review maps in detail.)

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.

C.3 *Disaster Mitigation Goals and Objectives*

Berkeley will focus on three goals to reduce and avoid long-term vulnerabilities to the hazards identified in Element B: *Hazard Analysis*:

1. The City will evaluate and strengthen all City-owned properties and infrastructure, particularly those needed for critical services, to ensure that the community can be served adequately after a disaster.
2. The City will establish and maintain incentive programs and standards to encourage local residents and businesses to upgrade the hazard resistance of their own properties.
3. The City will actively engage other local and regional groups to collaboratively work towards mitigation actions that help maintain Berkeley's way of life and its ability to be fully functional after a disaster event.

Five objectives guide the mitigation strategy:

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. Preserve Berkeley's unique character and values from being compromised by hazardous 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.

C.4 *Overview of Actions*

This plan identifies and analyzes 27 mitigation actions to reduce the impacts from hazards described in Element B: *Hazard Analysis.* This suite of actions addresses every natural hazard posing a threat to Berkeley, with an emphasis on new and existing buildings and infrastructure.

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 2014 mitigation plan, as well as Berkeley's progress on these actions since 2014. This Team then revised these actions, created new actions, and established priorities to guide Berkley's mitigation strategy for the next five years. At a meeting in December 2018, staff presented proposed 2019 actions to Institutional Community Partners, who offered feedback and identified opportunities for collaboration to further strengthen these actions. Staff revised actions and incorporated them into the 2019 First Draft Plan, which went through further public review. Additional detail on the process used to identify 2019 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) and each action addresses.

Table 4. High-Priority Actions in mitigation strategy

Name	Action	Hazards
Building Assessment	Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Strengthen and Replace City Buildings	Strengthen or replace City buildings in the identified prioritized order as funding is available.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Buildings	Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.	Earthquake Wildland-Urban Interface Fire Landslide Floods
Retrofit Grants	Implementation of the Retrofit Grants Program which helps Berkeley building owners increase safety and mitigate the risk of damage caused by earthquakes	Earthquake
Soft Story	Continued Implementation of the Soft Story Retrofit Program, which mandates seismic retrofit of soft story buildings with 5+ residential units.	Earthquake

Name	Action	Hazards
Unreinforced Masonry (URM)	Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.	Earthquake
Concrete Retrofit Ordinance Research	Monitor passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices.	Earthquake
Gas Safety	Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.	Earthquake Wildland-Urban Interface Fire Landslide Tsunami
Fire Code	Reduce fire risk in existing development through fire code updates and enforcement.	Wildland-Urban Interface Fire
Vegetation Management	Reduce fire risk in existing development through vegetation management.	Wildland-Urban Interface Fire Climate Change
Hills Pedestrian Evacuation	Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.	Earthquake Wildland-Urban Interface Fire
Hills Roadways and Parking	Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.	Earthquake Wildland-Urban Interface Fire
Undergrounding	Coordinate with PG&E for the construction of undergrounding in the Berkeley Hills within approved Underground Utility Districts (UUDs).	Earthquake Wildland-Urban Interface Fire
EBMUD	Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.	Earthquake Wildland-Urban Interface Fire
Extreme Heat	Reduce Berkeley's vulnerability to extreme heat events and associated hazards.	Climate Change Extreme Heat

Name	Action	Hazards
Hazardous Materials	Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami
Air Quality	Define clean air standards for buildings during poor air quality events and use those standards to assess facilities for the Berkeley community.	Wildland-Urban Interface Fire Extreme Heat
National Flood Insurance Program (NFIP)	Maintain City participation in the National Flood Insurance Program.	Floods
Hazard Information	Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Partnerships	Coordinate with and encourage mitigation actions of key City partners.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat

Table 5. Medium-Priority Actions in mitigation strategy

Name	Action	Hazards
Severe Storms	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 Climate Change
Energy Assurance	Implement energy assurance strategies at critical City facilities.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Climate Change Integration	Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.	Climate Change Extreme Heat
Sea Level Rise	Mitigate the impacts of sea level rise in Berkeley.	Climate Change
Water Security	Collaborate with partners to increase the security of Berkeley's water supply from climate change impacts.	Climate Change

Table 6. Low-Priority Actions in mitigation strategy

Name	Action	Hazards
Tsunami	Mitigate Berkeley's tsunami hazard.	Tsunami
Streamline Rebuild	Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami

C.5 *Details of Actions*

The 2019 LHMP Mitigation Strategy is detailed below. First, the document describes the process used to prioritize the actions. Next, the document overviews the constituent parts of each action, including responsibility, potential funding sources, and expected timeframes. Third, each action is presented in detail.

C.5.a Action Prioritization

The City incorporated eight key factors into the prioritization strategy used for 2019 mitigation actions. These criteria are described below and summarized in the table that follows.

Key Factors

1. Support of goals and objectives

Actions that support multiple goals and objectives are prioritized.

2. 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.

3. Funding availability

Actions with secured funding are prioritized.

4. Hazards addressed

Actions addressing the Plan's hazards of greatest concern (earthquake and wildland-urban interface fire) are prioritized.

5. Public and political support

Actions with public and political support are prioritized.

6. Adverse environmental impact

Actions with low environmental impact are prioritized.

7. Environmental benefit

Actions that provide an environmental benefit are prioritized.

8. 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 7. 2019 Action Prioritization Structure

Factors	Priority		
	High	**Medium**	**Low**
1. Support of goals and objectives	Supports multiple goals and objectives	Supports goals and objectives	Will mitigate the risk of a hazard
2. Cost/benefit relationship[2]	Benefits exceed cost	Has benefits that exceed costs	Benefits do not exceed the costs or are difficult to quantify
3. Funding availability[3]	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
4. Hazards addressed	Addresses hazards of greatest concern	May not address hazards of greatest concern	Addresses hazards identified in Hazard Analysis
5. Public and political support	Has public and political support	Has public and political support	May not have public and political support
6. Adverse environmental impact	No environmental impact	Low environmental impact	May not have a low environmental impact
7. Environmental benefit	Environmental benefit	No environmental benefit	No environmental benefit
8. 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)

[2] Actions that address other hazards, but for which benefits exceed costs, may also be considered high priority.
[3] Medium priority projects will become high priority projects once funding is secured.

C.5.b Details of Actions

Mitigation actions identified by the Berkeley community are presented in the following pages. Actions are presented per their high, medium- or low-priority designation.

The following information is provided for each action:

- *Action Title*: Short title to identify the action
- *Action*: Proposed action
- *Proposed Activities*: Specific projects or efforts that support the action
- *Related Natural Hazard(s)*: Lists hazards whose impacts would be mitigated by the action
- *Associated LHMP Objective(s)*: Mitigation objectives that the action supports
- *Related Policies from the General Plan or Climate Action Plan*: General Plan or Climate Action Plan policies that the action supports
- *Lead Organization(s) and Staff Lead(s)*: City departments and divisions, along with particular City staff positions, which will be responsible for implementing and administering the action
- *Priority*: High, Medium or Low priority assigned to the action using criteria outlined in Appendix E: *Prioritization Structure*
- *Timeline*: Outlines expected timeframes for completion of the action
- *Additional Resources Required*: Identifies if funding is not yet available to complete the action
- *Potential Funding Sources*: Identifies potential funding sources to complete the action. Includes all sources that could possibly fund any element of the action, including staff time, contracted work, equipment purchase, etc. **Note: Funding allocations are made through the City-wide budget process. Listing a specific potential funding source <u>does not</u> commit resources to the action.**
- *Activity Type(s)*: If the action could be eligible for federal mitigation grant funding, identifies federally-defined activity type for grant purposes

C.5.b.i High-Priority Actions

2019 **Building Assessment**	**Continue appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.**
Proposed Activities	a) Continue analysis of structures supporting critical emergency response and recovery functions, and make recommendations for structural and nonstructural improvements. b) 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. c) Continue to integrate unsafe structures into a prioritized program for retrofit or replacement.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Associated LHMP Objective(s)	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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-10, Action B General Plan Policy S-20, Actions G and H General Plan Policy UD-7, Actions A and B General Plan Policy UD-12, Actions A and C

Lead Organization(s) and Staff Lead(s)	Public Works Department: Facilities Division Staff Lead: Supervising Civil Engineer (for facilities)
Priority	High
Timeline	Ongoing
Additional Resources Required	Resources have been identified to perform some of this work; however, additional resources could allow for more facilities and structures to be analyzed in the coming five years.
Potential Funding Sources	General Fund T1 Bond

2019 **Strengthen and Replace City Buildings**	**Strengthen or replace City buildings in the identified prioritized order as funding is available.**
Proposed Activities	a) Retrofit North Berkeley Senior Center b) West Berkeley Service Center c) Old City Hall d) Veterans Memorial Building e) Live Oak Community Center f) Seek funding to seismically strengthen or replace additional City buildings in a prioritized order.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat

Associated LHMP Objective(s)	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. Preserve Berkeley's unique character and values from being compromised by hazardous events.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-20, Action H General Plan Policy UD-12, Actions A and C
Lead Organization(s) and Staff Lead(s)	Public Works Department – Engineering Division Staff Lead: Supervising Civil Engineer (for facilities) Parks, Recreation and Waterfront Department Staff Lead: Department Director
Priority	High
Timeline	North Berkeley Senior Center: Completion in 2010 Other projects: Funding-dependent Live Oak Community Center: Start construction in 2019 (funding-dependent) Frances Albrier Community Center: Funding-dependent Seek funding: Ongoing
Additional Resources Required	North Berkeley Senior Center: No additional resources required West Berkeley Service Center: To be determined Old City Hall retrofit: To be determined Veterans Memorial Building retrofit: To be determined Live Oak Community Center: Additional resources required Frances Albrier Community Center: Additional resources required Seek funding: No additional resources required

Potential Funding Sources	Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP) General Fund T1 Bond Other City-Issued Bonds
Activity Type(s) (Federal Mitigation Grant Funding only)	Mitigation: Structural Retrofitting of existing buildings Mitigation: Nonstructural retrofitting of existing buildings and facilities

2019 **Buildings**	**Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.**
Proposed Activities	a) 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. b) 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.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods
Associated LHMP Objective(s)	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. C. Preserve Berkeley's unique character and values from being compromised by hazardous 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.

Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-15, Action A General Plan Policy S-20, Actions D and E General Plan Policy UD-7, Actions A and B General Plan Policy UD-12, Actions A and C
Lead Organization and Staff Lead	Planning and Development Department – Building and Safety Division (Building Code and Retrofit Guidance) Staff lead: Building Official Planning and Development Department – Office of Energy and Sustainable Development (Earthquake Brace and Bolt Program) Staff lead: Sustainability Planner Finance Department – Revenue Collection Division (Transfer Tax Rebate Program) Staff lead: Revenue Collection Manager
Priority	High
Timeline	Enactment of 2019 Building Code: January 1, 2020 Technical assistance: Ongoing
Additional Resources Required	No additional resources required

2019 **Retrofit Grants**	**Implementation of the Retrofit Grants Program which helps Berkeley building owners increase safety and mitigate the risk of damage caused by earthquakes**
Proposed Activities	a) Assist participating property owners with the grant process, including dissemination of program rules and guidelines. b) 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*
Related Natural Hazard(s)	Earthquake
Associated LHMP Objective(s)	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. C. Preserve Berkeley's unique character and values from being compromised by hazardous 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-20, Actions D General Plan Policy S-15, Action A General Plan Policy-17, Action A
Lead Organization(s) and Staff Lead(s)	Planning and Development Department: Building & Safety Division Staff Lead: Program and Administration Manager
Priority	High
Timeline	April 1, 2019: Building Permit deadline for Retrofit Grants applicants August 1, 2019: Deadline for obtaining building permit or permit with a status "ready for issuance" Complete construction within nine (9) months of receiving notification of FEMA approval If a second grant is secured, an additional three-year timeline will be established for that grant.
Additional Resources Required	The Planning and Development Department is seeking additional Hazard Mitigation Grant funding from Cal OES / FEMA.
Potential Funding Sources	Hazard Mitigation Grant Program (HMGP)

Activity Type(s) (Federal Mitigation Grant Funding only)	Mitigation: Structural Seismic Retrofitting of existing buildings

2019 **Soft Story**	**Continued Implementation of the Soft Story Retrofit Program, which mandates seismic retrofit of soft story buildings with 5+ residential units.**
Proposed Activities	a) Continue to inform impacted property owners of the requirement to seismically retrofit their building b) 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.
Related Natural Hazard(s)	Earthquake
Associated LHMP Objective(s)	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. C. Preserve Berkeley's unique character and values from being compromised by hazardous 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.

Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-20, Actions B, C, D, E, and F General Plan Policy S-15, Action A
Lead Organization and Staff Lead	Planning and Development Department – Building and Safety Division Staff Lead: Program and Administration Manager
Priority	High
Timeline	January 2017: Deadline for soft-story building owners to submit a permit application for retrofit January 2019 OR two years after permit application: Deadline for soft-story retrofit completion
Additional Resources Required	No additional resources required
Potential Funding Sources	Permit Service Center Enterprise Fund
Activity Type(s) (Federal Mitigation Grant Funding only)	Not eligible for federal mitigation grant funding

2019 **URM**	**Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.**
Proposed Activities	a) 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. b) Apply available legal remedies, including but not limited to citations, to owners who fail to comply with the URM ordinance.
Related Natural Hazard(s)	Earthquake
Associated LHMP Objective(s)	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. 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-20, Action A
Lead Organization and Staff Lead	Planning and Development Department - Building and Safety Division Staff Lead: Program and Administration Manager
Priority	High
Timeline	Complete all remaining URM retrofits/demolitions by January 2020
Additional Resources Required	No additional resources required
Potential Funding Sources	Permit Service Center Enterprise Fund Hazard Mitigation Grant Program (HMGP)

2019 **Concrete Retrofit Ordinance Research**	**Monitor passage and implementation of mandatory seismic retrofit ordinances for concrete buildings in other jurisdictions to assess best practices.**
Proposed Activities	a) Monitor mandatory seismic retrofit ordinances for concrete buildings passed by other municipalities for effectiveness and best practices b) Communicate and collaborate with other cities and Structural Engineers Association of California (SEAOC) regarding implementation challenges and successes
Related Natural Hazard(s)	Earthquake
Associated LHMP Objective(s)	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.

	C. Preserve Berkeley's unique character and values from being compromised by hazardous 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-10, Action C
Lead Organization(s) and Staff Lead(s)	Planning and Development Department: Building & Safety Division Staff Lead: Program and Administration Manager
Priority	High
Timeline	Monitor effectiveness of mandatory seismic retrofit ordinances for concrete buildings: Ongoing Outreach to other municipalities regarding best practices: Ongoing
Additional Resources Required	No additional resources required

2019 **Gas Safety**	**Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.**
Proposed Activities	a) 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. b) 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.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide

	Tsunami
Associated LHMP Objective(s)	B. 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. 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-12, Action C
Lead Organization(s) and Staff Lead(s)	Fire Department – Office of Emergency Services Staff Lead: Emergency Services Coordinator (Shutoff Valve Program) Planning Department – Office of Energy and Sustainable Development (Electrification) Staff Lead: Climate Action Program Coordinator (Electrification)
Priority	High
Timeline	Ongoing
Additional Resources Required	Shutoff Valve Program: No additional resources required Promoting electrification: Additional funding required for implementation
Potential Funding Sources	General Fund Measure GG Special Revenue Fund Ratepayer funds from PG&E or East Bay Community Energy Grants from Energy Foundation, Urban Sustainability Directors Network, California Energy Commission, California Air Resources Board, Bay Area Air Quality

	Management District, U.S. Department of Energy

2019 **Fire Code**	**Reduce fire risk in existing development through fire code updates and enforcement.**
Proposed Activities	a) 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. b) Evaluate Fire Prevention Division staffing necessary to adequately perform and enforce required inspections for both Annual and HFA inspections. c) Consider expansion of the number of properties to be included in the Hazardous Fire Area inspection program. d) Maintain Fire Department efforts to reduce fire risk through inspections: a. Annual building inspections in all Fire Zones b. Hazardous Fire Area inspections c. Multi-unit-residential building inspections in all Fire Zones e) Create a standard for written vegetation management plans for major construction projects in Fire Zones 2 and 3. f) Evaluate inspection procedures and adjust inspection cycle annually based on changing climatic conditions. g) Develop and enforce Fire Code requirement for fire fuel clearance on public roadways.
Related Natural Hazard(s)	Wildland-Urban Interface Fire
Associated LHMP Objective(s)	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, heat waves, and their secondary impacts. C. Preserve Berkeley's unique character and values from being compromised by hazardous events.
Related Policies	General Plan Policy S-21: Fire Preventative Design

from the General Plan or Climate Action Plan	Standards, Action A General Plan Policy S-23: Property Maintenance, Action B General Plan Policy UD-7, Actions A and B General Plan Policy UD-12, Actions A and C Climate Action Plan – Adaptation, Goal 1D, Action 3
Lead Organization(s) and Staff Lead(s)	Fire Department – Division of Fire Prevention Staff Lead: Fire Marshal
Priority	High
Timeline	Fire Code Adoption: May and November 2019, and November 2022 Staffing evaluation: Ongoing HFA expansion research: February 2019 Inspections: Ongoing/Funding-dependent Vegetation Management Standard: Funding-dependent Inspection system evaluation: Funding-dependent Roadway clearance: Conceptual Plan in 2020, Implement Pilot with Community Education in 2021, Plan Enforcement in 2022
Additional Resources Required	Inspections: Additional staffing required Vegetation Management Standard: Additional staffing required Inspection system evaluation: Additional staffing required Roadway clearance code: Additional staffing required
Potential Funding Sources	Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP) General Fund New City tax
Activity Type(s) (Federal Mitigation Grant Funding only)	Mitigation: Hazardous Fuels Reduction

2019 **Vegetation Management**	**Reduce fire risk in existing development through vegetation management.**
Proposed Activities	a) Maintain Fire Fuel Chipper Program b) Maintain Fire Fuel Abatement Program on Public Land c) Maintain Fire Fuel Debris Bin Program d) Maintain Weekly Curbside Plant Debris Collection e) Pursue external funding to increase education and awareness of vegetation management standards for fire fuel reduction f) 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. g) Pursue external funding to perform vegetation management on public and private property h) Develop and enforce Fire Code requirement for fire fuel clearance on public roadways (see Fire Code action for details)
Related Natural Hazard(s)	Wildland-Urban Interface Fire Climate Change
Associated LHMP Objective(s)	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, heat waves, and their secondary impacts. 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-23, Action A
Lead Organization(s) and Staff Lead(s)	Department of Parks Recreation and Waterfront – Parks Division Fire Fuel Chipper Program Staff Lead: Senior Landscape Gardener (Senior Forestry Supervisor)

	Fire Fuel Abatement Program on Public Land Staff Lead: Senior Landscape Supervisor Fire Fuel Debris Bin Program and Weekly Curbside Plant Debris Collection: Department of Public Works – Zero Waste Division Staff Lead: Solid Waste and Recycling Manager Fire Department Staff Lead: Captain of Professional Standards Division (Pursue funding for education and vegetation management) Fire Chief (Fire Fuel Reduction Zones)
Priority	High
Timeline	Ongoing
Additional Resources Required	Fire Fuel Chipper Program: Additional resources required, amount to be determined Fire Fuel Abatement Program on Public Land: No additional resources required Vegetation management activities on public/private lands: Additional resources required, amount to be determined Fire fuel reduction zones: Additional resources required, amount to be determined
Potential Funding Sources	City General Fund Refuse Fee Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP) Assistance to Firefighters Grant California Climate Investments Fire Prevention Grant Program
Activity Type(s) (Federal Mitigation Grant Funding only)	Mitigation: Hazardous Fuels Reduction

2019 **Hills Pedestrian Evacuation**	**Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.**

Proposed Activities	a) 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. b) Maintain signage for public pathways to identify safe and accessible pedestrian evacuation routes from the hill areas. c) Update City maps of all emergency access and evacuation routes to include pedestrian pathways. d) Publicize up-to-date maps of all emergency access and evacuation routes.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire
Associated LHMP Objective(s)	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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-1 Response Planning, Action B General Plan Policy S-22 Fire Fighting Infrastructure, Action A General Plan Policy T-28 Emergency Access, Actions B and C
Lead Organization(s) and Staff Lead(s)	Department of Public Works (Maintenance) Paths: Engineering Division – Assistant Public Works Engineer Signage: Transportation Division – City Traffic Engineer Department of Information Technology (Mapping) GIS Division GIS Coordinator Fire Department (Outreach) Office of Emergency Services - Emergency Services Coordinator
Priority	High
Timeline	Ongoing

Additional Resources Required	No additional resources required (additional funding could facilitate additional activities)

2019 **Hills Roadways and Parking**	**Improve responder access and community evacuation in Fire Zones 2 and 3 through roadway maintenance and appropriate parking restrictions.**
Proposed Activities	a) Maintain and improve roadways in Fire Zones 2 and 3. b) Maintain community-driven process to identify and consider areas for parking restrictions and red curbing. c) Explore options for comprehensive parking restrictions in Fire Zones 2 and 3 during Red Flag and/or Extreme Fire Weather conditions. d) Develop and enforce Fire Code requirement for fire fuel clearance on public roadways (see Fire Code action for details)
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire
Associated LHMP Objective(s)	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. 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-16, Action A General Plan Policy T-25, Action A General Plan Policy T-28, Action D General Plan Policy S-22, Action A
Lead Organization(s) and	Roadway maintenance Public Works Department: Engineering Division

Staff Lead(s)	Staff Lead: Supervising Civil Engineer Community-driven parking restrictions Public Works Department: Transportation Division Staff Lead: Supervising Traffic Engineer Fire weather parking restrictions Fire Department: Office of Emergency Services Staff Lead: Assistant Chief Fire Department: Fire Prevention Division Staff Lead: Fire Marshal
Priority	High
Timeline	Roadway maintenance: Ongoing Community-driven parking restrictions: Ongoing Fire weather parking restrictions: Conceptual Plan in 2020, Implement Pilot with Community Education in 2021, Plan Enforcement in 2022
Additional Resources Required	No additional resources required

2019 Undergrounding	**Coordinate with PG&E for the construction of undergrounding in the Berkeley Hills within approved Underground Utility Districts (UUDs).**
Proposed Activities	a) 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.) b) Construction of undergrounding of overhead utility wires within UUD No. 35A (Vistamont Ave., Rochdale Way, and Rosemont Ave from Woodmont Ave. to Vistamont Ave.) c) Construction of undergrounding of overhead utility wires on Bayview Place
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire

Associated LHMP Objective(s)	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. Preserve Berkeley's unique character and values from being compromised by hazardous events.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy T-28, Action E General Plan Policy S-1, Actions B and C General Plan Policy S-12, Action B General Plan Policy S-22, Action A General Plan Policy UD-8, Action A
Lead Organization(s) and Staff Lead(s)	Public Works Department- Engineering Staff Lead: City Engineer
Priority	High
Timeline	UUD No. 48 Hold Community Meeting for Lighting Selection: November 2018 Secure Easements for Above Ground Structures: November 2018 - March 2019 Advertise for Bids: February 2019 Construction Contract Award: Late Spring 2019 Construction Start: Summer 2019 UUD No. 35A On hold UUD Bayview Place On hold
Additional Resources Required	Funding for UUD No.48: General Fund for staff time, consultant services, lighting, and payment for easements if it is required Assessed fees for lighting Rule 20A Funds for construction

	Funding for UUD 35A: General Fund Remaining Rule 20A Funds Funding for UUD Bayview Place: Property Owner Funds (20B) General Fund for consultant services
Potential Funding Sources	Funding for UUD No.48: General Fund Rule 20A Funds Funding for UUD 35A: General Fund Rule 20A Funds Funding for UUD Bayview Place: Property Owner Funds
Activity Type(s) (Federal Mitigation Grant Funding only)	Federal mitigation grant funding is not anticipated

2019 **EBMUD**	**Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.**
Proposed Activities	a) 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. b) Explore project approaches with EBMUD to expedite replacement of problem pipelines in Berkeley neighborhoods exposed to wildland-urban interface fire and seismic ground failure. c) 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.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire

Associated LHMP Objective(s)	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. 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-12: Utility and Transportation Systems, Action A
Lead Organization(s) and Staff Lead(s)	Department of Public Works – Engineering Division Staff Lead: City Engineer
Priority	High
Timeline	Ongoing
Additional Resources Required	No additional resources required

2019 **Extreme Heat**	**Reduce Berkeley's vulnerability to extreme heat events and associated hazards.**
Proposed Activities	a) 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. b) 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. c) 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. d) Encourage cooling technologies 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.
Related Natural Hazard(s)	Climate Change Extreme Heat
Associated LHMP Objective(s)	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. 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.
Related Policies from the General Plan or Climate Action Plan	Climate Action Plan - Adaptation Goal 1, Policies A and D General Plan Policy EM-29: Street and Park Trees
Lead Organization(s) and Staff Lead(s)	Planning Department – Office of Energy and Sustainable Development (Monitor Impacts, Energy Efficiency Ordinances, Cooling Technologies) Staff Lead: Climate Action Program Coordinator Department of Parks, Recreation and Waterfront – Parks Division (Tree Planting) Staff Lead: Parks Superintendent
Priority	High
Timeline	Ongoing
Additional Resources Required	Scientific monitoring, energy efficiency ordinances, cooling technologies: Additional funding required for implementation

	Tree planting: Dependent on State of California Environmental Enhancement Mitigation Program Grant
Potential Funding Sources	City General Fund
	Tree planting grants
	City Parks Tax Fund 450
	Ratepayer funds from PG&E or East Bay Community Energy
	Grants from Energy Foundation, Urban Sustainability Directors Network, California Energy Commission, California Air Resources Board, Bay Area Air Quality Management District, U.S. Department of Energy

2019 **Hazardous Materials**	**Mitigate hazardous materials release in Berkeley through inspection and enforcement programs.**
Proposed Activities	a) Implement Hazardous Materials Release Response Plans and Inventories (HMRRP) Program b) Implement California Accidental Release Prevention (CalARP) Program c) Implement Underground Storage Tank (UST) Program d) Implement Aboveground Petroleum Storage Act Requirement for Spill Prevention e) Implement Hazardous Waste Generator and Onsite Hazardous Waste Treatment Programs f) Implement Hazardous Materials Management Plans (HMMP) and Hazardous Materials Inventory Statements per California Fire Code g) Enforce California Fire Code for Hazardous Materials Compliance (See Fire Code Action)
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami

Associated LHMP Objective(s)	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. 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy EM-12, Action A General Plan Policy EM-13, Action A General Plan Policy EM-14, Actions A and B
Lead Organization(s) and Staff Lead(s)	Planning: Toxics Division (all programs except Fire Code enforcement) Staff Lead: Hazardous Materials Manager Fire Department: Fire Prevention Division (Fire Code) Staff Lead: Fire Marshal
Priority	High
Timeline	Ongoing
Additional Resources Required	No additional resources required

2019 **Air Quality**	**Define clean air standards for buildings during poor air quality events and use those standards to assess facilities for the Berkeley community.**
Proposed Activities	a) Participate in regional efforts to define standards and tools to predict buildings' ability to deliver clean air to occupants during poor air quality events. b) Apply standards and tools to assess City facilities' ability to provide clean air to occupants during poor air quality events. c) Coordinate with willing Berkeley partners to apply standards and tools to partner facilities. d) Use findings to develop a list of potential clean air facilities (City-run and partner-run) to the community.

Related Natural Hazard(s)	Wildland-Urban Interface Fire Extreme Heat
Associated LHMP Objective(s)	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. 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-20
Lead Organization(s) and Staff Lead(s)	Standards Development: Department of Health, Housing and Community Services: Public Health and Environmental Health Divisions Staff Leads: Health Officer/Environmental Health Division Manager Standards Implementation at City Facilities: Department of Public Works: Staff Lead: Facilities Division – Supervising Civil Engineer Staff Lead: Building Maintenance Supervisor Partner Coordination and Community Outreach: Fire Department: Office of Emergency Services Staff Lead: Chief of Special Operations
Priority	High
Timeline	To be determined
Additional Resources Required	To be determined

2019 **NFIP**	**Maintain City participation in the National Flood Insurance Program.**
Proposed Activities	a) Continue to use the most current FEMA information defining flood areas. b) Continue to incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards.
Related Natural Hazard(s)	Floods
Associated LHMP Objective(s)	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. 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-28 Flood Insurance, Actions B and C
Lead Organization(s) and Staff Lead(s)	Public Works Department: Engineering Division (NFIP application to City projects; Program Management) Staff Leads: Manager of Engineering, Director of Public Works Planning Department (application to private projects): Land Use Planning Division (determines if new project is subject to NFIP regulations) Staff Lead: Land Use Manager Building and Safety Division (coordinates to ensure that projects are compliant with Flood Zone Development Ordinance)

	Staff Lead: Senior Plan Check Engineer
Priority	High
Timeline	Ongoing
Additional Resources Required	No additional resources required

2019 **Hazard Information**	**Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.**
Proposed Activities	a) Track changes in hazard risk using the best-available information and tools. b) Collect and share up-to-date hazard maps identifying areas subject to heightened risk from hazards. c) Publicize financial and technical assistance resources for risk reduction.
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Associated LHMP Objective(s)	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 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-13: Hazards Identification, Action A General Plan Policy S-19: Risk Analysis, Action A General Plan Policy UD-12, Actions A and C Climate Action Plan: Adaptation Action A
Lead Organization(s) and Staff Lead(s)	Fire Department – Office of Emergency Services Lead Staff: Emergency Services Coordinator Office of Energy and Sustainable Development (Climate Change Hazards) Lead Staff: Climate Action Program Coordinator
Priority	High
Timeline	Ongoing
Additional Resources Required	No additional resources required
Potential Funding Sources	General Fund Measure GG Special Revenue Fund

2019 Partnerships	**Coordinate with and encourage mitigation actions of key City partners.**
Proposed Activities	a) Coordinate with and encourage mitigation actions of: • Institutions serving the Berkeley community • Berkeley organizations and nonprofits • Other partners whose actions affect the Berkeley community

Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat
Associated LHMP Objective(s)	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. Preserve Berkeley's unique character and values from being compromised by hazardous 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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-5 The City's Role in Leadership and Coordination, Actions A and B General Plan Policy UD-7, Actions A and B General Plan Policy UD-12, Actions A and C General Plan Policy S-12 Utility and Transportation Systems, Action A
Lead Organization(s) and Staff Lead(s)	Fire Department: Office of Emergency Services Staff Lead: Assistant Chief of Special Operations
Priority	High
Timeline	Ongoing

Additional Resources Required	To be determined
Potential Funding Sources	General Fund Measure GG Special Revenue Fund

C.5.b.ii Medium-Priority Actions

2019 **Severe Storms**	**Reduce Berkeley's vulnerability to severe storms and associated hazards through proactive research and planning, zoning regulations, and improvements to stormwater drainage facilities.**
Proposed Activities	a) Use development standards to ensure that new development does not contribute to an increase in flood potential. b) Complete the Watershed Management Plan to recommend improvements to problem areas in individual watersheds, and 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. c) Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio-filtration systems.
Related Natural Hazard(s)	Landslide Floods Climate Change
Associated LHMP Objective(s)	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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-26, Actions B and C General Plan Policy S-27 New Development Climate Action Plan - Adaptation Goal 1, Policy C
Lead Organization and Staff Lead	Planning Department – Land Use Planning Division (Development Standards) Staff Lead: Land Use Manager Public Works Department – Engineering Division Staff Lead: Supervising Civil Engineer (Watershed Management Plan and Public Improvements)
Priority	Medium

Timeline	Ongoing
Additional Resources Required	Development Standards: To be determined Watershed Management Plan/Stormwater Master Plan: To be determined Public Improvements Design: To be determined
Potential Funding Sources	City General Fund Permit Service Center Enterprise Fund Measure M Bond Funds Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP)
Activity Type(s)	Mitigation: Infrastructure Retrofit

2019 **Energy Assurance**	**Implement energy assurance strategies at critical City facilities.**
Proposed Activities	a) Identify potential actions to mitigate energy assurance vulnerabilities at critical City facilities during planning/conceptual design. b) 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).
Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami Climate Change Extreme Heat

Associated LHMP Objective(s)	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.
Related Policies from the General Plan or Climate Action Plan	General Plan - Disaster Preparedness and Safety Element: Objective 1 General Plan Policy S-8: Continuity of Operations Climate Action Plan – Chapter 4, Goal 5: Increase Energy Efficiency and Renewable Energy Use in Public Buildings – Policies 5a and 5b
Lead Organization(s) and Staff Lead(s)	Department of Public Works – Facilities Division (Identify actions) Staff Lead: Supervising Civil Engineer (for facilities) Planning Department – Office of Energy and Sustainable Development (Clean Energy Opportunities) Staff Lead: Climate Action Program Manager
Priority	Medium
Timeline	Ongoing
Additional Resources Required	Additional resources to analyze specific energy assurance options for individual projects.
Potential Funding Sources	General Fund T1 Bond Measure GG Special Revenue Fund Ratepayer funds from PG&E or East Bay Community Energy Grants from Energy Foundation, Urban Sustainability Directors Network, California Energy Commission, California Air Resources Board, Bay Area Air Quality Management District, U.S. Department of Energy

2019 **Climate Change Integration**	**Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.**
Proposed Activities	a) Determine staffing needs to monitor research and oversee integration of climate change adaptation into City operations and services b) Develop and implement a process to integrate adaptation planning into City operations. Activities include: a. Train City staff on the basic science and impacts of climate change and on climate adaptation strategies b. Develop policy and programs to address potential climate impacts in municipal capital and land use planning
Related Natural Hazard(s)	Climate Change Extreme Heat
Associated LHMP Objective(s)	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.
Related Policies from the General Plan or Climate Action Plan	• Climate Action Plan – Adaptation, Goal 1A • Climate Action Plan – Community Outreach and Empowerment, Goal 1A • Climate Action Plan – Implementation, Monitoring and Reporting, Goals 2, 3 and 4
Lead Organization(s) and Staff Lead(s)	Planning Department – Office of Energy and Sustainable Development Staff Lead: Climate Action Program Manager
Priority	Medium
Timeline	Determine staffing needs: 3-4 years Staff Training: Ongoing Address climate impacts in municipal planning processes: 1-2 years
Additional	To be determined

Resources Required	
Potential Funding Sources	General Fund Permit Service Center Enterprise Fund

2019 **Sea Level Rise**	**Mitigate the impacts of sea level rise in Berkeley.**
Proposed Activities	a) Monitor and participate in regional and State-level research on projected sea-level rise in Berkeley and the region. b) 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.
Related Natural Hazard(s)	Climate Change
Associated LHMP Objective(s)	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.
Related Policies from the General Plan or Climate Action Plan	Climate Action Plan, Adaptation Policies A and C General Plan Goal 6: Make Berkeley a disaster-resistant community that can survive, recover from, and thrive after a disaster – Utilize Disaster-Resistant Land Use Planning General Plan Policy S-27: New Development General Plan Policy S-14: Land Use Regulation, Action E
Lead Organization(s) and Staff Lead(s)	Planning Department – Office of Energy and Sustainable Development (Monitor Research/Integrate Considerations) Staff Lead: Climate Action Program Manager Planning Department – Land Use Planning Division (Development Regulations) Staff Lead: Division Director
Priority	Medium
Timeline	Research: Ongoing

	Policy Development: 2 years
Additional Resources Required	Research: Additional staff capacity or funding needed for further analysis. Policy Development: Additional staff capacity to develop regulations and standards.
Potential Funding Sources	General Fund Permit Service Center Enterprise Fund Adapting to Rising Tides, San Francisco Bay Conservation & Development Commission, National Oceanic & Atmospheric Administration, Urban Sustainability Director's Network, or Resource Legacy Fund

2019 **Water Security**	**Collaborate with partners to increase the security of Berkeley's water supply from climate change impacts.**
Proposed Activities	a) Partner with East Bay Municipal Utility District (EBMUD) to provide and market incentives for residents, businesses and institutions to conserve water. b) 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. c) Encourage water efficiency and conservation in existing buildings, such as incorporating water assessments into existing policies or creating a compliance program for SB407.
Related Natural Hazard(s)	Climate Change
Associated LHMP Objective(s)	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. 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.
Related Policies from the General Plan or Climate Action Plan	Climate Action Plan - Adaptation Goal 1, Policy B General Plan Policy EM-25: Groundwater General Plan Policy EM-26: Water Conservation General Plan Policy EM-31: Landscaping
Lead Organization(s) and Staff Lead(s)	Planning Department – Office of Energy and Sustainable Development Staff Lead: Climate Action Program Coordinator (Water Recycling/Incentives) Staff Lead: Sustainability Planner (Landscaping Techniques) Staff Lead: Climate Action Program Coordinator (Water Efficiency and Conservation)
Priority	Medium
Timeline	Encourage water efficiency in existing policies: 2-3 years
Additional Resources Required	Additional staff capacity.
Potential Funding Sources	General Fund Permit Service Center Enterprise Fund

C.5.b.iii Low-Priority Actions

2019 **Tsunami**	**Mitigate Berkeley's tsunami hazard.**
Proposed Activities	a) Fund and replace damaged finger docks. b) Secure funding for replacement of D and E docks; begin the permitting process once funding is secure c) Begin the permitting process for piling replacement. d) Repair University Avenue, Marina Boulevard, and Spinnaker Way in order to mitigate tsunami vulnerabilities. e) 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.
Related Natural Hazard(s)	Tsunami
Associated LHMP Objective(s)	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.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy S-19: Risk Analysis, Action A
Lead Organization(s) and Staff Lead(s)	All activities: Parks, Recreation and Waterfront Department – Marina Division Staff Lead: Waterfront Manager, Alexandra Endress, and Waterfront Supervisor, Stephen Bogner. Cal OES/CGS/FEMA collaboration: Fire Department – Office of Emergency Services Staff Lead: Emergency Services Coordinator
Priority	Low

Timeline	Activities a) - d): funding-contingent Activity e) To be determined
Additional Resources Required	a) Finger Dock Replacement: estimated $100k-$500k b) D and E Dock Replacement: estimated $4-7 million c) Piling replacement: estimated $50k for permitting only d) Roadway repair: estimated $4-6 million e) No additional resources required
Potential Funding Sources	Pre-Disaster Mitigation Grant Program (PDM) Hazard Mitigation Grant Program (HMGP) General Fund City-Issued Bonds
Activity Type(s) (Federal Mitigation Grant Funding only)	Mitigation: Infrastructure Retrofit

2019 **Streamline Rebuild**	**Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.**

Proposed Activities	a) 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.
	b) Consider different treatment for buildings in high-risk areas, such as:
	  a. Imposing higher standards of building construction for rebuilding
	  b. Excluding buildings in these areas from the amendment
	c) 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.
	d) Define the process for the City to accept and file this documentation.
	e) Outreach to property owners about this documentation process.

Related Natural Hazard(s)	Earthquake Wildland-Urban Interface Fire Landslide Floods Tsunami
Associated LHMP Objective(s)	C. 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 focus to mitigation efforts.
Related Policies from the General Plan or Climate Action Plan	General Plan Policy LU-26: Neighborhood Commercial Areas General Plan Policy LU-27: Avenue Commercial Areas General Plan S-9: Pre-Event Planning, Action B General Plan policy UD-7, Action C
Lead Organization(s) and Staff Lead(s)	Planning Department – Land Use Planning Division Staff Lead: Division Manager
Priority	Low
Timeline	2 years
Additional Resources Required	Staff with capacity to focus on this effort
Potential Funding Sources	General Fund

C.6 *Mitigation Plan Integration*

As with prior LHMP updates, this Plan will be well-integrated into the City's existing and future plans and planning mechanisms.

C.6.a General Plan

Upon its adoption by the Berkeley City Council, the 2019 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 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.

C.6.b City of Berkeley Strategic Plan

On January 16, 2018, the City Council adopted the City of Berkeley 2018-2019 Strategic Plan. Many actions outlined in this Mitigation Strategy come from the Strategic Plan. For upcoming fiscal years, the City's Office of Emergency Services will be responsible for working with Department leaders to further incorporate actions from this Mitigation Strategy into the Strategic Plan. 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.

C.6.c 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 2019 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.

C.6.d Climate Action Plan

The 2014 and 2019 updates to the LHMP support concepts outlined in the Berkeley Climate Action Plan, which was written 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.

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. The City of Berkeley uses the Climate Action Plan to present activities to mitigate climate change itself, and the LHMP to present climate adaptation actions. In this way both plans reflect and support one

another. The Mitigation Strategy of the LHMP identifies for each action the related policies from the Climate Action Plan.

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[i] The City has adopted Standard Plan Set A for wood frame homes of two stories or less that provides typical details and other guidance. This plan set simplifies the design of cripple wall retrofits for many homes in Berkeley.

[ii] To create the City's inventory of non-ductile concrete and rigid wall-flexible diaphragm buildings, staff did extensive research, including examining local Sanborn maps, Google Map images, building permit data obtained from Accela, real estate data from RealQuest, housing unit data from the Rent Stabilization Board, and City of Berkeley records such property cards, microfiche data, files from prior field surveys, and zoning data. Sanborn maps, which were originally created for assessing fire insurance liability, provide the approximate size, shape and construction material of each building within the city that existed at the time. The City of Berkeley's Sanborn maps were last updated in the early 1980's, and were therefore useful as a starting point for identifying older buildings constructed of concrete or reinforced masonry that may be vulnerable in a seismic event.

After identifying concrete buildings on the Sanborn maps, staff investigated each building's current status. Buildings confirmed to still be in existence were researched for construction material and year built, as well as for any permit history indicating whether alterations and/or seismic retrofits might have occurred. Information was also gathered for each building's use classification, APN, alternate addresses, square footage, number of stories and residential units, historic registry list data, and property ownership information required for conducting outreach.

[iii] During a sidewalk survey in November 2017, contracted EERI engineers visually assessed over 250 buildings to validate the City's inventory of seismically vulnerable buildings and identify common structural deficiencies. Additionally, two teams of experienced structural engineers were hired to help develop engineering guidelines and establish minimum standards for retrofits of non-ductile concrete and other rigid wall-flexible diaphragm buildings supported by FEMA-funded Retrofit Grants, in an effort to improve their performance during an earthquake.

[iv] To help identify soft story buildings with 3-4 residential units or commercial uses, staff utilized a Rental Housing Safety Program database and field survey sheets of nonresidential buildings from the original Soft Story inventory conducted in the 1990s. Staff undertook a "virtual" survey of each building using Google maps aerial and street view imagery to identify potential Soft Story buildings, and then verified the unit count and building configuration for each property by consulting City and county property records.

[v] Per Dan Gallagher, Senior Forestry Supervisor, City of Berkeley: The Fire Fuel Chipper Program collected green waste vegetation in the following amounts in the following years:

2005: 264.35 tons

2006: 237.59 tons

2007: 189.06 tons

2008: 175.16 tons

2009: 167.17 tons

2010: 161.31 tons

2011: 187.24 tons

2012: 155.94 tons

2013: 141.27 tons

2014: 119.72 tons

2015: 130.26 tons

2016: 430 cubic yards of wood chips and 34.28 tons of loose vegetation

[vi] Information provided by Susan Ferrera, Superintendent of Parks, City of Berkeley, as of November 2018

[vii] Information provided by Greg Apa, Solid Waste and Recycling Manager of Zero Waste Division, City of Berkeley, as of September 2018

[viii] Information provided by Greg Apa, Solid Waste and Recycling Manager of Zero Waste Division, City of Berkeley, as of September 2018

D. Plan Review, Evaluation, and Implementation

D.1 *Community Profile and Trends*

The people and structures of Berkeley are continually changing. This section examines changes that have occurred in hazard-prone areas and increased or decreased the vulnerability of Berkeley since 2014. First, this section discusses changes to the group of people who make up the Berkeley community, and how their characteristics will influence the population's hazard vulnerability, necessary approaches to mitigation and response. Next, changes in development are discussed, including description of recent and potential development throughout Berkeley. Next, the effects of this development of population and structures on Berkeley's vulnerability to natural hazards are discussed. Last, key City policies and goals that affect development are outlined.

D.1.a Community

According to the 2010 Census, the number of people living in Berkeley grew by almost 10,000 people in the last decade, to 112,580. As Berkeley's population of Berkeley has grown, the number of jobs in the city has increased from about 50,000 in 1970 to approximately 64,500[1] today. Additionally, UC Berkeley's Long Range Development Plan projects that as a result of growth in both education and research, by 2020 the total campus headcount during the regular academic year may increase to 51,260 – a 12% increase over 2001-2002 levels. These population increases means that more Berkeley residents and visitors will be exposed to the area's hazards.

Berkeley has a mobile population including many people moving to Berkeley from out of the area, meaning that community disaster awareness activities need to be ongoing to penetrate the population. This figure also reflects community members moving within Berkeley, meaning that community-building activities must be constant as residents join new neighborhoods.
Much of Berkeley's mobility is due to its large college student population, with about 30 percent of city residents (34,000 enrolled in college or graduate school according to the 2016 American Community Survey).
Students represent a significant portion of Berkeley's rental market and support a variety of local merchants. Large losses in rental units after an earthquake could force students to move to other nearby cities, which would profoundly affect Berkeley's character and economics. The University of California, Berkeley faces significant earthquake risks, and a closure of this campus for any length of time would greatly impact the city overall.
Over one quarter (28 percent according to the 2016 American Community Survey) of Berkeley residents use a language other than English at home. It is critical for the city to make sure that emergency responders are prepared to communicate with limited- English speakers. This includes communicating emergency and evacuation warnings as well as mitigation strategies.

[1] https://www.labormarketinfo.edd.ca.gov/data/labor-force-and-unemployment-for-cities-and-census-areas.html#CCD

D.1.b Recent and Potential Development

Berkeley is a densely-populated city with well-established land use patterns. Many private homes have been expanded and renovated, but few new lots have been developed due to Berkeley's already built-up state.

Nonetheless, development activity is ongoing. Since 2014, Berkeley has seen a significant increase in housing units. Typically, this development represents densification of commercial areas, rather than development of new sites. Before the global recession of 2009, the City issued discretionary permits for many high-occupancy mixed-use commercial/residential structures in commercial corridors on Shattuck, San Pablo and University Avenues. In the years that followed, these projects were not pursued. Now in 2018, many projects are once again moving forward. Zoning changes from the City's Downtown Area Plan have encouraged upgrades to and replacement of vulnerable buildings in the downtown area. The plan also allows for construction of three 180-foot-tall buildings and four 120-foot-high building in the downtown core.

As reported in the October 31, 2017 Housing Pipeline Report,

- 910 units have been built since 2014 across 11 projects that are now occupied.
- 525 units are under construction, or with secured building permits, in nine projects.
- About 1,400 units, in 20 projects, have been submitted and are pending review.
- About 1,134 units have been approved since 1999 but are without building permits.

The University of California, Berkeley has expanded its facilities both on and off the campus. UC Berkeley's 2020 Long Range Development Plan projects space demands for campus academic and support programs may grow by up to 18%, or 2,200,000 GSF, over 2005 levels. This includes classrooms, libraries, research facilities and student services centers. These estimates of future space needs are both future growth and compensation for existing shortages.

D.1.c 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. However, Because of Berkeley's built-out nature, new development tends not to add new geographic areas of hazard exposure. All of Berkeley is exposed to earthquake shaking. While commercial corridors are becoming denser, density in the eastern hills, which are exposed to wildland-urban interface fire and landslides, is stable. The city's western edge will be exposed to sea-level rise from climate change. 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.

New development generally 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, and elevation above flood levels. Replacing or significantly renovating older structures significantly increases the Berkeley community's protection from natural hazards. For example, pursuant to the Seismic Hazards Mapping Act codified in the Public Resources Code as Division 2, Chapter 7.8 and Guidelines for Evaluations and Mitigating Seismic Hazards in California (Special Publication 117), much of the new construction in the City's west must have site-specific geological and geotechnical investigations, due to the area's mapped potential liquefaction hazard. These investigations result

in recommendations for design professionals to design new or rehabilitated buildings for human occupancy to mitigate the potential effects of liquefaction caused by earthquakes to a level that does not cause the collapse of the buildings. This means that a new or rehabilitated building will be equipped to better withstand potential liquefaction impacts than an old building.

D.2 *Progress in Mitigation Efforts: Status of 2014 Actions*

This Plan was last adopted on December 16, 2014. Since that date, Berkeley has made steady progress on implementing 2014 plan actions and supporting activities. This section describes Berkeley's progress on the actions and activities identified in the 2014 plan. It also identifies where some 2014 actions and activities have been incorporated into this new plan.

In the following pages, Berkeley's progress on each 2014 mitigation activity is described using a detailed narrative. Progress on each activity is summarized in Table 2 using the categories presented below.

Table 1. Progress Categories

Category	Description	2019 Inclusion
Completed	Activity has been completed as written.	No
Completed with Modifications	Over the course of completing this action, the City modified the activity to better meet the associated objective.	No
In progress	Progress has been made since 2014, but the activity has not been fully completed.	Yes
Deferred	Progress has not been made since 2014, but the activity is still relevant.	Yes
Deleted	Progress has not been made since 2014, and the activity is no longer relevant.	No

In Progress or *Deferred* activities have been incorporated into the 2019 plan's mitigation strategy. Table 2 shows where in the 2019 strategy the 2014 *In Progress* or *Deferred* activities have been incorporated. Following the table, progress on 2014 actions is presented in detail based on the order presented in the table.

Table 2. 2014 Actions and Activity Status Summary

2014 Actions/Priority	2014 Activity							
	a	b	c	d	e	f	g	h
High Priority Actions								
Building Assessment	In progress	Deferred	In progress	Completed with modifications				
Strengthen and Replace City Buildings	Deleted	Completed	In progress					
Soft-Story	Completed	Completed	In progress	Completed with modifications	In progress	In progress	In progress	In progress
URM	In progress	In progress	In progress					
Buildings	In progress	In progress						
Fire Code	Completed	Deferred	Completed with modifications	Deferred				
Vegetation Management	In progress	In progress	In progress	In progress	Deferred			
Hazard Information	In Progress	In Progress	Completed with modifications	In progress				
Partnerships	Completed with modifications	In progress						
EBMUD	In progress	In progress	In progress					
Hills Evacuation	In progress	In progress	Completed	In progress				
Climate Change Integration	In progress	Completed/In progress						
Medium Priority Actions								

2014 Actions/Priority	2014 Activity							
	a	b	c	d	e	f	g	h
Energy Assurance	Completed/in progress	In progress						
Gas Safety	Completed with modifications	Completed						
Stormwater System	Deferred	Completed						
Tsunami	Completed	In progress						
Extreme Heat	In progress	In progress	In progress					
Severe Storms	Completed	In progress/ Deferred/ Completed						
Water Security	Deleted	Completed	Completed with modifications	In progress	In progress			
NFIP	In progress	In progress						
Streamline Rebuild	Deferred	Deferred	Deferred	Deferred				
Low Priority Actions								
Sea-Level Rise	In progress	In progress						
HazMat Floods	Deleted	Deleted	Deleted					

D.2.a 2014 High-Priority Actions

2014 Building Assessment	**Perform appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures.**
Proposed Activities	a) First, complete analysis of structures supporting critical emergency response and recovery functions, and make recommendations for structural and nonstructural improvements. b) 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. c) Integrate unsafe structures into a prioritized program for retrofit or replacement. d) Develop emergency guidelines for buildings with structural deficiencies.
Lead Organization and Staff Lead	Public Works Department: Facilities Division Staff Lead: Facility Maintenance Superintendent
Priority	High
Timeline	Analysis of critical structures: December 2013 Analysis of remaining structures: Funding-dependent Emergency guideline development: Ongoing as identified
Progress on Action Between 2014-2019	**a) First, complete analysis of structures supporting critical emergency response and recovery functions, and make recommendations for structural and nonstructural improvements.** **In Progress** In 2015, a contractor (Kitchell) completed the Facilities Condition Assessments Report. The report provided a comprehensive review of the maintenance and repair needs of 28 City-owned capital facilities. The assessed facilities included those supporting critical emergency response and recovery functions, such as community shelters. Elements studied included life safety and fire/life safety protection systems. The report did not specifically assess seismic vulnerabilities, however, identified vulnerabilities in substandard buildings could be exacerbated by seismic events. Seismic upgrades are performed for buildings as they undergo major maintenance and repair indicated in the Kitchell Report.

	b) 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. **Deferred** As additional funding becomes available, the City will pursue further analysis of remaining structures not included in the 2015 Kitchell Report. Analysis is prioritized at the direction of Public Works staff based on known structural or general building deficiencies, as well as code requirements. **c) Integrate unsafe structures into a prioritized program for retrofit or replacement.** **In Progress (Ongoing)** The Kitchell Report established a list of maintenance and repair priorities among assessed facilities and analyzed cost implications based on facility life-cycle cost analysis or construction cost estimates, prepared for each facility. The City uses the Kitchell report as a first step in prioritizing capital projects; from there a project will go through a thorough public process for prioritization. **d) Develop emergency guidelines for buildings with structural deficiencies.** **Completed with Modifications** City Safety Officers in the Human Resources Department regularly update the Emergency Action Plan Manual, which addresses evacuation procedures and provides guidelines for response to various emergencies including earthquake and fire.

2014 Strengthen and Replace City Buildings	**Strengthen or replace City buildings in the identified prioritized order as funding is available.**
Proposed Activities	a) Seismically strengthen 2180 Milvia Civic Center b) Replace the Center Street Garage c) Seek funding to seismically strengthen or replace additional City buildings in a prioritized order
Lead Organization and Staff Lead	Public Works Department – Engineering Division Staff Lead: Supervising Civil Engineer
Priority	High
Timeline	2180 Milvia Civic Center retrofit by 2019

	Center Street Garage replacement by 2019 Funding identification: Ongoing
Progress on Action Between 2014-2019	**a) Seismically strengthen 2180 Milvia Civic Center Deleted** 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). This action refers to bringing the Civic Center building to Essential Services Standards. The City is focusing efforts on retrofit of hazardous buildings. **b) Replace the Center Street Garage Completed** Construction on the new Center Street Garage began in 2016. The garage is scheduled to reopen in October 2019. The new garage will meet current standards for seismic safety. **c) Seek funding to seismically strengthen or replace additional City buildings in a prioritized order In Progress** Construction of the new Center Street Garage is being funded by a combination of 2016 Parking Revenue Bond Funds ($28.3 million) and the Off Street Parking Fund (Fund 835) ($8.2 million). The City has sought out and received funding to strengthen/replace City buildings through the City of Berkeley Infrastructure and Public Facilities Bond Measure T1, which was approved by the voters in fall of 2016. Additionally, the City has received grants to seismically strengthen or replace additional facilities: • The James Kenney Retrofit ($3,050,512 total) was supported by grants from FEMA's Pre-Disaster Mitigation Program ($727,499), as well as a Department of Housing and Community Development grant of $1,036,700. • In 2016 the City was awarded a FEMA Pre-Disaster Mitigation Program Grant of $1.875 million for retrofit of North Berkeley Senior Center. Work on this project is expected to begin in February 2019. The City will continue to seek out funding for remaining projects.

2014 Soft-Story	**Implement Phase Two of the Soft-Story Retrofit Program, mandating retrofit of soft-story residences.**
Proposed Activities	a) Develop and publish Framework Guidelines calibrating, delineating and detailing technical requirements to be used for building retrofits. b) Inform impacted property owners of the requirement to retrofit their building c) Designated project manager will: • Prepare handouts and correspondence • Respond to inquiries from owners, tenants, engineers, contractors and realtors about the mandatory program, compliance procedures and requirements d) Investigate and adopt financial, procedural, and land use incentives to facilitate retrofit. • The Rent Board will review requests for pass-through of capital improvement expenses for seismic retrofits. They will determine on a case-by-case basis if rent increases to tenants can be approved. • Explore establishment of a loan program to assist landlords who cannot access financing to retrofit their buildings. e) Review plan submittals for soft-story seismic retrofits f) Issue permits and perform field inspections g) Remove retrofitted buildings from the Soft-Story Inventory h) Review appeals to accommodate unique circumstances preventing owners from meeting program requirements; consider time extensions, etc.
Lead Organization and Staff Lead	Planning and Development Department – Building and Safety Division Staff Lead: Program and Administration Manager
Priority	High
Timeline	January 2017: Deadline for soft-story owners to submit a permit application for retrofit January 2019: Final deadline for soft-story retrofit completion (2 years after permit application)
Progress on Action Between 2014-2019	**a) Develop and publish Framework Guidelines calibrating, delineating and detailing technical requirements to be used for building retrofits. Completed** Framework Guidelines were published in 2014.

b) Inform impacted property owners of the requirement to retrofit their building

Completed

Following passage of mandatory retrofit requirements in November 2013, the City mailed impacted property owners a notice informing them of the requirement to retrofit their buildings.

c) Designated project manager will:

- **Prepare handouts and correspondence**
- **Respond to inquiries from owners, tenants, engineers, contractors and realtors about the mandatory program, compliance procedures and requirements**

In Progress

Description: Owners were notified of the requirement to retrofit their buildings and sent handouts and correspondence. Staff continues to enforce the ordinance and provide information about compliance. When properties are sold, staff work with new owners to assist them with completing retrofits.

d) Investigate and adopt financial, procedural, and land use incentives to facilitate retrofit.

- **The Rent Board will review requests for pass-through of capital improvement expenses for seismic retrofits. They will determine on a case-by-case basis if rent increases to tenants can be approved.**
- **Explore establishment of a loan program to assist landlords who cannot access financing to retrofit their buildings.**

Completed with Modifications

Description: The Rent Board revised its capital pass-through requirements to allow pass-throughs in certain cases of seismic retrofit costs for mandatory retrofits for owners who own fewer than 12 residential units in Berkeley.

The City of Berkeley opted into the Property Assessed Clean Energy (PACE) program that provides financing for seismic retrofits.

The City obtained a Hazard Mitigation grant from FEMA and established a retrofit grant program, offering grants of up to $25,000 for mandatory soft story retrofits.

e) Review plan submittals for soft-story seismic retrofits

In Progress

	Description: The City is continuing to review plan submittals for soft story retrofits as building owners apply for permits. **f) Issue permits and perform field inspections** **In Progress** **g)** Description: The City is continuing to issue permits and perform inspections for the remaining required retrofits. As of November 2018, of the 331 buildings on the inventory of potentially hazardous Soft Story buildings, 72 owners still need to retrofit. Of those, 66 have either obtained permits or submitted permit applications, and 6 building owners have not yet applied for permits.**Remove retrofitted buildings from the Soft-Story Inventory** **In Progress** Description: As retrofits are completed, buildings are removed from the Soft Story Inventory. Since 2014, 95 buildings have been removed from the inventory and ten buildings have been added. **h) Review appeals to accommodate unique circumstances preventing owners from meeting program requirements; consider time extensions, etc.** **In Progress** Owners who have submitted applications for a use permit to make changes to their property at the same time as completing a seismic retrofit have been granted extensions. Where properties have changed hands, new owners have also received additional time.

2014 URM	**Complete the ongoing program to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings.**
Proposed Activities	a) Begin by working 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. b) Apply available legal remedies, including but not limited to citations, to owners who fail to comply with the URM ordinance. c) Maintain program notification to building occupants and owners.
Lead Organization and Staff Lead	Planning Department - Building and Safety Division Staff Lead: Program and Administration Manager
Priority	High

Timeline	Engage all remaining URM building owners by January 2015 Complete all remaining URM retrofits/demolitions by January 2019
Progress on Action Between 2014-2019	a) **Begin by working 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** Description: Of 587 buildings placed on the URM inventory, 20 buildings remained on the inventory in 2014. Since 2014, 15 have complied and been removed. One additional URM building was identified and added to the inventory. There are currently six URM buildings that need to be retrofitted. All owners have received multiple communications from the City including citation penalties. Five of the six building owners have applied for permits. b) **Apply available legal remedies, including but not limited to citations, to owners who fail to comply with the URM ordinance.** **In Progress** Description: The Building and Safety Division continues to cite the remaining owners of unreinforced masonry buildings. In addition, staff established a Retrofit Grants program and has worked to incentivize retrofits with financial assistance. c) **Maintain program notification to building occupants and owners.** **In Progress** Description: Owners are required to post signs in the main entrance of the building indicating their building is on the URM inventory and constitutes a severe threat to life safety in the event of an earthquake of moderate to high magnitude. Additionally, the City maintains and regularly updates its List of Unreinforced Masonry Buildings that still need to be retrofitted, available for public review on the City website.

2014 Buildings	**Reduce hazard vulnerabilities for non-City-owned buildings throughout Berkeley.**

Proposed Activities	a) 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. b) Explain requirements and provide guidance to owners of potentially hazardous structures to facilitate retrofit.
Lead Organization and Staff Lead	Planning Department – Building and Safety Division Staff lead: Building Official
Priority	High
Timeline	Enactment of 2013 Building Code: January 1, 2014 Enactment of 2016 Building Code: January 1, 2017 Technical assistance: Ongoing
Progress on Action Between 2014-2019	**a) 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.** **In Progress** Description: Each three-year code cycle, the Building and Safety Division adopts local technical amendments and updated standards addressing local fire and seismic hazards. **b) Explain requirements and provide guidance to owners of potentially hazardous structures to facilitate retrofit.** **In Progress** The City has identified additional categories of potentially hazardous buildings including rigid wall - flexible diaphragm buildings, non-ductile concrete buildings and soft-story buildings with three or four residential units or commercial uses that are not subject to mandatory retrofit requirements. The City published technical guidelines regarding retrofits of these building types and eligible building owners were invited to apply for a FEMA-funded retrofit grant. The City also participated in the Earthquake Brace + Bolt program, a grant program administered by the California Earthquake Authority, providing grants of up to $3,000 for seismic retrofits of buildings with 1-4 dwelling units.

2014 Fire Code	**Reduce fire risk in existing development through fire code updates and enforcement.**
Proposed Activities	a) Periodically update and adopt the Berkeley Fire Code with local amendments to incorporate the latest knowledge and design standards to protect people and property against known risks in both structural and non-structural building and site components. b) Maintain Fire Department efforts to reduce fire risk through inspections: • Annual inspections in all Fire Zones • Hazardous Fire Area inspections • Multi-unit-residential building inspections in all Fire Zones c) Create a standard for written vegetation management plans for major construction projects in Fire Zones 2 and 3. d) Evaluate inspection procedures and adjust inspection cycle annually based on changing climatic conditions.
Lead Organization and Staff Lead	Fire Department – Division of Fire Prevention Staff Lead: Deputy Fire Chief (Fire Marshal)
Priority	High
Timeline	Fire Code Adoption: Complete by January 2014 and January 2017 Inspections: Ongoing Vegetation Management Standard: 1-2 years Inspection system evaluation: Ongoing
Progress on Action Between 2014-2019	**a) Periodically update and adopt the Berkeley Fire Code with local amendments to incorporate the latest knowledge and design standards to protect people and property against known risks in both structural and non-structural building and site components.** **Completed (Ongoing)** The City of Berkeley updated the Berkeley Fire Code on November 29, 2016 (Ordinance No. 7,518-N.S) **b) Maintain Fire Department efforts to reduce fire risk through inspections:** • **Annual inspections in all Fire Zones** **Deferred** The Fire Department was not able to complete all annual inspections in 2014 - 2018 due to lack of staff. The Fire Department has improved its efficiency and as of 2018 completed approximately 90% of required inspections.

While Fire Prevention Division staffing has not increased, Berkeley's population has grown and the city has seen a substantial increase in new construction and associated density. These additional services demand more staffing that has not yet been appropriated in the budget.

- **Hazardous Fire Area inspections**

Completed with modifications (Ongoing)
From 2014-2016, Fire Department personnel completed required inspections in the Hazardous Fire Area (HFA). In 2017 and 2018, the Fire Prevention Division added over 300 properties to the HFA Program. This was an approximate increase of 30% without additional staffing allocations.
In 2017, the Fire Department completed inspections of all HFA properties and found violations in approximately half of the 300+ newly-added properties. These violations were subsequently abated.
The Fire Department will complete all HFA Program inspections in 2018.
The Fire Department is undergoing a thorough review of this program and will possibly further increase the number of properties to be included in the HFA Program if additional staffing is provided.

- **Multi-unit-residential building inspections in all Fire Zones**

Deferred
See item (a) above.

c) Create a standard for written vegetation management plans for major construction projects in Fire Zones 2 and 3.
Deferred
The Fire Prevention Division was unable to complete this activity due to lack of staffing resources. However, the City has adopted the State-mandated regulations, California Building Code Chapter 7A, which requires ignition-resistant exterior construction.

d) Evaluate inspection procedures and adjust inspection cycle annually based on changing climatic conditions.
Deferred

	The Fire Prevention Division was unable to carry out this activity due to lack of staffing resources.

2014 Vegetation Management	**Reduce fire risk in existing development through vegetation management.**
Proposed Activities	a) Maintain Fire Fuel Chipper Program b) Maintain Fire Fuel Abatement Program on Public Land c) Maintain Fire Fuel Debris Bin Program d) Maintain Weekly Curbside Plant Debris Collection e) Pursue external funding to increase education and awareness of vegetation management standards for fire fuel reduction
Lead Organization and Staff Lead	Department of Parks Recreation and Waterfront – Parks Division Fire Fuel Chipper Program Staff Lead: Senior Forestry Supervisor Fire Fuel Abatement Program on Public Land Staff Lead: Senior Landscape Supervisor Department of Public Works – Zero Waste Division (Fire Fuel Debris Bin Program and Weekly Curbside Plant Debris Collection) Staff Lead: Zero Waste Manager Fire Department – Division of Support Services (Funding for education) Staff Lead: Deputy Fire Chief (Fire Marshal)
Priority	High
Timeline	Ongoing
Progress on Action Between 2014-2019	**a) Maintain Fire Fuel Chipper Program** **In Progress (Ongoing)** The City maintained this yard waste collection program, which reduced fire fuels on private properties. The Program serves properties in the hills from June through September each year. Since 2014, over 100 tons of vegetation was collected and recycled, on average, each year.

	b) Maintain Fire Fuel Abatement Program on Public Land **In Progress/Ongoing** This Program was maintained 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, pathways and landscaped medians. **c) Maintain Fire Fuel Debris Bin Program** **In Progress (Ongoing)** 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. **d) Maintain Weekly Curbside Plant Debris Collection** **In Progress (Ongoing)** 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. **e) Pursue external funding to increase education and awareness of vegetation management standards for fire fuel reduction** **Deferred** The Fire Prevention Division was unable to carry out this activity due to lack of staffing resources. In September 2018, the Fire Department established the Professional Standards Division, which will support the Department in seeking out external funding to perform these activities.

2014 Hazard Information	**Collect, analyze and share information with the Berkeley community about Berkeley hazards and associated risk reduction techniques.**
Proposed Activities	a) Track changes in hazard risk using the best-available information and tools. b) Collect and share up-to-date hazard maps identifying areas subject to heightened risk from hazards. c) Partner with the Association of Bay Area Governments to incorporate Berkeley's vulnerabilities onto regionally-managed hazard maps.

	d) Publicize financial and technical assistance resources for risk reduction.
Lead Organization and Staff Lead	Fire Department – Office of Emergency Services Lead Staff: Emergency Services Coordinator Office of Energy and Sustainable Development (Climate Change Hazards) Lead Staff: Climate Action Coordinator
Priority	High
Timeline	Ongoing
Progress on Action Between 2014-2019	**a) Track changes in hazard risk using the best-available information and tools.** **In Progress (Ongoing)** Earthquake: The City of Berkeley is a HayWired Coalition Partner, having provided input in development of the USGS's HayWired Earthquake Scenario. USGS scientists presented findings to staff at two meetings in 2017. HayWired findings have been integrated into this 2019 Local Hazard Mitigation Plan. Additionally, emergency managers have used the HayWired scenario as a basis for staff emergency response exercises. Tsunami: The Office of Emergency Services adopted the *California Maritime Tsunami Response Playbook* and the *California Tsunami Evacuation Playbook*. These Playbooks address appropriate response actions for different tsunami scenarios, considering Berkeley's specific geography. These documents were produced by the California Geological Survey, National Oceanic and Atmospheric Administration, and California Office of Emergency Services. City staff met with representatives from these organizations in 2018 to discuss implementation of these products in Berkeley. These tools enable Berkeley to have scaled responses to different expected tsunami flood levels. Climate Science: The Office of Energy & Sustainable Development (OESD) continues to track the latest science, information and tools related to climate change impacts, including but not limited to sea-level rise and extreme heat. Some of this new research is incorporated into the 2019 LHMP Update. **b) Collect and share up-to-date hazard maps identifying areas subject to heightened risk from hazards.** **In Progress (Ongoing)**

The 2019 Local Hazard Mitigation Plan incorporates up-to-date hazard maps. Additionally, the Office of Emergency Services has created web pages with hazard maps for earthquake, seismic-induced landslide, wildfire, and tsunami.
Hazard maps have been incorporated into community outreach presentations, including the 1-hour Disaster Preparedness presentation and the 3-hour Community Emergency Response Team Disaster Preparedness Course.

OESD continues to track and share any new information that can inform hazard maps.

c) Partner with the Association of Bay Area Governments to incorporate Berkeley's vulnerabilities onto regionally-managed hazard maps.
Completed with Modifications
ABAG's website provides hazard maps for earthquake, flooding, wildfire, and landslide.
Berkeley vulnerabilities are presented in this 2019 Local Hazard Mitigation Plan update.

d) Publicize financial and technical assistance resources for risk reduction.
In progress
The Building & Safety Division has developed a comprehensive website for Seismic Safety Information and Programs, which links to resources for the following:

Funding for Seismic Retrofits:
- Transfer Tax Reductions for Qualifying Seismic Work
- Retrofit Grants for Seismically Vulnerable Buildings
- Earthquake Brace + Bolt
- PACE Financing for Seismic Retrofits

Berkeley's Mandatory Seismic Retrofit Programs
- Soft Story Program
- Unreinforced Masonry Program

Earthquake and Disaster Preparedness
- Building Occupancy Resumption Program (BORP)
- Community Emergency Response Team (CERT) Training

	The City has hosted multiple community workshops for these and other programs. OESD continues to promote Property Assessed Clean Energy (PACE) financing. More information at: https://www.cityofberkeley.info/PACE/

2014 Partnerships	**Ensure that the City provides leadership and coordinate with the private sector, public institutions, and other public bodies in disaster mitigation.**
Proposed Activities	a) Support and encourage efforts undertaken by key lifeline providers to plan for and finance seismic retrofit and other disaster-resistance measures, including: • Utility providers • Transportation agencies • Communication providers • Healthcare facilities b) Coordinate with and encourage mitigation actions of: • Institutions serving the Berkeley community • Berkeley organizations and nonprofits • Other partners whose actions affect the Berkeley community
Lead Organization and Staff Lead	City Manager's Office (Advocacy) Staff Lead: Deputy City Manager Fire Department – Office of Emergency Services (Coordination) Staff Lead: Office of Emergency Services Captain
Priority	High
Timeline	Ongoing
Progress on Action Between 2014-2019	**a) Support and encourage efforts undertaken by key lifeline providers to plan for and finance seismic retrofit and other disaster-resistance measures, including:** • **Utility providers** • **Transportation agencies** • **Communication providers** • **Healthcare facilities** **Completed with Modifications** City staff coordinate regularly on disaster planning and preparedness activities with emergency management staff from partner agencies. Support and encouragement as written in this action is primarily undertaken by elected officials.

	b) Coordinate with and encourage mitigation actions of: • **Institutions serving the Berkeley community** • **Berkeley organizations and nonprofits** • **Other partners whose actions affect the Berkeley community** **In Progress (Ongoing)** In 2018, the City of Berkeley Office of Emergency Services provided key support to Easy Does It, an agency serving community members with access and functional needs. Easy Does It successfully applied for a $30,000 grant from the Christopher and Dana Reeve Foundation to provide in-home non-structural mitigation services to people with spinal cord injuries. Through the Community Resilience Center Program and the Apartment Resilience Center Program, City staff maintain connections with organizations serving vulnerable populations in Berkeley. The City regularly shares information about upcoming mitigation opportunities with participating organizations.

2014 EBMUD	**Work with EBMUD to ensure an adequate water supply during emergencies and disaster recovery.**
Proposed Activities	a) Coordinate with EBMUD regarding plans to install a new 48-inch pipeline parallel to the existing north-south water main in 2015-2016. b) Explore project approaches with EBMUD to expedite replacement of problem pipelines in Berkeley neighborhoods exposed to wildland-urban interface fire and seismic ground failure. c) Coordinate with EBMUD to ensure that pipeline replacement projects and upgrades are coordinated with the City's five-year street paving program.
Lead Organization and Staff Lead	Department of Public Works – Engineering Division Staff Lead: City Engineer
Priority	High
Timeline	Ongoing
Progress on Action Between 2014-2019	**a) Coordinate with EBMUD regarding plans to install a new 48-inch pipeline parallel to the existing north-south water main in 2015-2016.** **In Progress** EBMUD has settled on a pipeline alignment, running north-south on Ellsworth Street between Bancroft Way and Stuart Street, then east-west on Stuart Street between Ellsworth Street and Benvenue

	Avenue. EBMUD produced 65% drawings for City review and comments. EBMUD's project timeline is for construction in 2019-2020 timeframe. **b) Explore project approaches with EBMUD to expedite replacement of problem pipelines in Berkeley neighborhoods exposed to wildland-urban interface fire and seismic ground failure.** **In Progress (Ongoing)** The City and EBMUD meet on a quarterly basis to exchange information on projects to allow timely coordination and minimize conflicts between City, EBMUD, and private projects within Berkeley. In 2018, EBMUD completed an extensive pipeline replacement project in the Panoramic Hill area, which is exposed to both wildland-urban interface fire hazards and seismic hazards. They have also prepared to construct a Pumping Plant Project on Panoramic Hill in late 2019 and 2020. c) **Coordinate with EBMUD to ensure that pipeline replacement projects and upgrades are coordinated with the City's five-year street paving program.** **In Progress (Ongoing)** In quarterly meetings the coordination of EBMUD projects with City stormwater projects, sanitary sewer projects, traffic management projects, paving projects, 5-year paving program, and known significant private projects is discussed. An example of this is coordinating the sequencing of the construction of the Panoramic Pumping Plant with the City's Panoramic Street Rehabilitation Project in an effort to minimize impacts to the residents and provide the residents with high quality paved streets in their neighborhood.

2014 Hills Evacuation	**Manage and promote pedestrian evacuation routes in Fire Zones 2 and 3.**
Proposed Activities	a) Ensure that all public pathways and associated signage are maintained to identify and provide safe and

	accessible pedestrian evacuation routes from the hill areas. b) Update City maps of all emergency access and evacuation routes to include pedestrian pathways. c) Coordinate with UC Berkeley and Berkeley Lab to ensure that evacuation route options account for paths on UC and Berkeley Lab property. d) Publicize up-to-date maps of all emergency access and evacuation routes.
Lead Organization and Staff Lead	Department of Public Works – Engineering Division (Maintenance) Public Works Staff Lead: Associate Civil Engineer Information Technology GIS Division (Mapping) IT Staff Lead: GIS Coordinator Fire Department Office of Emergency Services (Outreach) Fire-OES Staff Lead: Emergency Services Coordinator
Priority	High
Timeline	Maintenance: Ongoing Mapping: 1 year to include pathways in public maps, then ongoing updates Publicizing Maps: Ongoing
Progress on Action Between 2014-2019	**a) Ensure that all public pathways and associated signage are maintained to identify and provide safe and accessible pedestrian evacuation routes from the hill areas.** **In Progress (Ongoing)** In spring 2015 the City performed repair work on Bret Harte Path; work included the removal and replacement of damaged concrete stairs, removal and replacement of damaged concrete walkway, and the installation of handrails. In spring/summer 2016 the City developed the previously undeveloped John Muir Path. In winter 2017 the Berkeley Path Wanderers Association (BPWA) installed approximately thirty 4'-wide wooden stairs at the bottom steep section of Dwight Way Path. When the City develops a previously undeveloped path, a "street" sign is installed at either end with the path's name. Path name signs are maintained in the same manner as street name signs. Specifically if a sign is brought to the City's attention as needing replacement due to deterioration, damage, or theft, it is added to the work list and replaced as funding and competing priorities permit.

b) Update City maps of all emergency access and evacuation routes to include pedestrian pathways.
In Progress
City staff are coordinating with the Berkeley Path Wanderers to include pedestrian pathways on City Emergency Access and Evacuation Network maps.

c) Coordinate with UC Berkeley and Berkeley Lab to ensure that evacuation route options account for paths on UC and Berkeley Lab property.
Completed
Because the location and anticipated spread of a wildfire are by nature unpredictable, the City coordinates with UC Berkeley and the Lawrence Berkeley National Lab to be ready to consider evacuation route options through both UC Berkeley and LBNL property.

Authority to open or close these campuses rests with the campuses themselves. The City is ready to coordinate with these campuses at both the Field and Emergency Operations Center level should a fire threaten Berkeley community members in or proximal to these locations. The City coordinates regularly with these agencies. In December 2017, City staff supported the LBNL's Evacuation Exercise, including coordination between the City of Berkeley Police Department and the UC Berkeley Police Department (which provides protective services to LBNL.)

Additionally, the City instructs community members to select and practice multiple evacuation routes, considering both car-based and foot-based paths. These evacuation routes may cross into UC Berkeley territory. Because of the sensitive and hazardous materials at the LBNL site, the facility is not open to the community and would be unlikely to be opened during a wildfire evacuation.

d) **Publicize up-to-date maps of all emergency access and evacuation routes.**
In Progress (Ongoing)
The City's Wildfire Evacuation website recommends that community members be ready to evacuate on foot, and links to the Berkeley Path Wanderers (BPWA) website.

	The Office of Emergency Services (OES) produced a Household Wildfire Evacuation Plan flyer. OES uses this flyer in wildfire evacuation community meetings. The flyer is tailored to include a relevant selection from the Berkeley Path Wanderers Map, and instructs the user to highlight multiple car- and foot-based evacuation routes. BPWA regularly communicates path locations to Google, which makes them publicly available online through Google Maps.

2014 Climate Change Integration	**Mitigate climate change impacts by integrating climate change research and adaptation planning into City operations and services.**
Proposed Activities	a) Determine staffing needs to monitor research and oversee integration of climate change adaptation into City operations and services b) Develop and implement a process to integrate adaptation planning into City operations. Activities include: • Integrate climate change adaptation actions into the Citywide Work Plan • Integrate climate change adaptation considerations into templates for staff reports to City Council and City commissions • Train City staff on the basic science and impacts of climate change and on climate adaptation strategies • Develop a staff recognition and award program to encourage staff to integrate climate change considerations into City projects and programs
Lead Organization and Staff Lead	City Manager's Office through Sustainability Working Group (Process Management) Staff Lead: Deputy City Manager Planning Department – Office of Energy and Sustainable Development (Support) Staff Lead: Climate Action Coordinator
Priority	Medium
Timeline	Staffing: 2-3 years Work Plan Integration: 1 year Council/Commission Report Integration: 1 year Funding Mechanisms: 2-3 years Staff Training: 2-3 years
Progress on Action Between 2014-2019	- **Determine staffing needs to monitor research and oversee integration of climate change adaptation into City operations and services**

In Progress
OESD has a current staff of 7 part- and full-time employees, and 3 interns, but additional support is needed in order to achieve Climate Action Plan goals, including the integration of climate change adaptation into City operations and services. Transferred this action to Sustainability Office from the City Manager's Working Group.

- **Develop and implement a process to integrate adaptation planning into City operations. Activities include:**
    - **Integrate climate change adaptation actions into the Citywide Work Plan**
      Completed
      Sustainability was included in the Citywide Work Plan for one budget cycle. Climate adaptation is addressed in the City's Resilience Strategy, and resilience and sustainability are included as long-term goals of the City's Strategic Plan.

    - **Integrate climate change adaptation considerations into templates for staff reports to City Council and City commissions**
      Completed with modifications
      Environmental sustainability was incorporated to all staff reports as part of the City Council template.

    - **Train City staff on the basic science and impacts of climate change and on climate adaptation strategies**
      In Progress
      Sustainability staff will continue to develop training for staff on climate change and climate adaptation strategies. OESD has also applied for funding from the Urban Sustainability Directors Network to create a training for City staff on implementing adaptation practices with an equity lens.

    - **Develop a staff recognition and award program to encourage staff to integrate climate change considerations into City projects and programs**

	Completed with modifications In 2014, the City created the Berkeley Environmental Achievement Awards to recognize employees that showed innovation and creativity, leadership and collaboration, and achievement of a clear environmental benefit in their work. OESD plans to continue to coordinate this annual award program in the future.

D.2.b Medium-Priority Actions

2014 Energy Assurance	**Develop an Energy Assurance Plan for City operations.**
Proposed Activities	a) Develop a plan to assist the City of Berkeley to prepare for, respond to, and recover from disasters that include energy emergencies. • Identify the key City facilities that support emergency operations. • Estimate those facilities' energy supply and demand during emergencies to assess those facilities' vulnerabilities to power loss. • Identify potential actions to mitigate those vulnerabilities (e.g., photovoltaic-supplemented emergency generation, energy efficiency activities, and/or mobile charging stations). b) Integrate energy assurance actions into Citywide planning processes.
Lead Organization and Staff Lead	Fire Department – Office of Emergency Services (Plan Development and Gap Analysis) Staff Lead: Emergency Services Coordinator Planning Department – Office of Energy and Sustainable Development (Energy Profile) Staff Lead: Sustainability Outreach Specialist Department of Public Works – Facilities Division (City Infrastructure) Staff Lead: Facility Maintenance Superintendent
Priority	Medium
Timeline	Plan Development: 1 year Project implementation: To be determined
Progress on Action Between 2014-2019	**a) Develop a plan to assist the City of Berkeley to prepare for, respond to, and recover from disasters that include energy emergencies.** • **Identify the key City facilities that support emergency operations.** **Completed** The City identified 48 City facilities that support emergency operations in an assessment of Municipal Energy Assurance Vulnerabilities. • **Estimate those facilities' energy supply and demand during emergencies to assess those facilities' vulnerabilities to power loss.** **Completed**

The assessment of Municipal Energy Assurance Vulnerabilities included a basic analysis of gas and electric usage at each facility, along with estimated runtimes for any generators positioned at these facilities.

For four of the key City facilities (Center Street Garage, Public Safety Building, 2180 Milvia, and 1947 Center Street) more detailed analysis of energy supply and demand was created through the Berkeley Energy Assurance Transformation (BEAT) project.

- **Identify potential actions to mitigate those vulnerabilities (e.g., photovoltaic-supplemented emergency generation, energy efficiency activities, and/or mobile charging stations).**
  In Progress
  OESD worked on feasibility analysis and design for downtown microgrid (BEAT project). The feasibility study completed as part of the BEAT project investigated the potential for a microgrid to connect critical facilities in downtown Berkeley. The results of the feasibility study now show that solar + storage at singular facilities is more feasible than a microgrid. OESD is now seeking to identify potential financing opportunities to expand this solution beyond downtown.

  OESD will also evaluate solar + storage options at critical facilities.

b) Integrate energy assurance actions into Citywide planning processes.
In Progress (Ongoing)
Energy assurance planning is integrated into Citywide planning processes at the planning/conceptual design phase. For example, with the upcoming retrofit of the North Berkeley Senior Center, staff considered options for increasing energy efficiency and assurance of the facility, including keeping the building solar and generator ready. Solar battery backups were determined to be infeasible due to cost and challenges in placing the batteries on the site. Instead, the North Berkeley Senior

	Center will be constructed with hookups for portable generators.

2014 Gas Safety	**Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption following a disaster.**
Proposed Activities	a) Work with the Public Utilities Commission, utilities, and oil companies to strengthen, relocate, or otherwise safeguard natural gas and other pipelines where they extend through areas of high liquefaction potential, cross potentially active faults, or traverse potential landslide areas, or areas that may settle differentially during an earthquake. b) Establish 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.
Lead Organization and Staff Lead	Fire Department – Office of Emergency Services Staff Lead: Office of Emergency Services Captain (Coordination) Staff Lead: Associate Management Analyst (Shutoff Valve Program)
Priority	Medium
Timeline	Coordination: Ongoing Gas Valve Shutoff Program: July 2014
Progress on Action Between 2014-2019	**a) Work with the Public Utilities Commission, utilities, and oil companies to strengthen, relocate, or otherwise safeguard natural gas and other pipelines where they extend through areas of high liquefaction potential, cross potentially active faults, or traverse potential landslide areas, or areas that may settle differentially during an earthquake.** **Completed with Modifications** City staff regularly coordinate with PG&E and EBMUD on emergency response planning, training, and exercise activities. Additionally, City staff participated in extensive discussions with Berkeley High School Safety Committee regarding opportunities to strengthen or add an automatic or electronic shutoff valves to the transmission pipeline on Allston Way. In June 2018, staff participated in PG&E exercise on the topic.

	b) Establish 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 (Ongoing)** The Automatic Gas Shutoff Valve Program distributes valves to homeowners and renters with building owner approval. In order to qualify, applicants must take two City of Berkeley-offered disaster preparedness trainings. All qualified applicants receive a free shutoff valve, and low-income applicants do not have to pay for the permit. As of 10/15/18, 11 valves have been distributed through the program.

2014 Stormwater System	**Rehabilitate the City's stormwater system to reduce local flooding caused by inadequate storm drainage.**
Proposed Activities	a) Complete the hydraulic analysis of watersheds in the city to predict areas of insufficient capacity. b) Seek funding to perform system capacity and disaster resistance improvements.
Lead Organization and Staff Lead	Public Works Department – Engineering Division Staff Lead: Associate Civil Engineer
Priority	Medium
Timeline	Complete the hydraulic analysis: funding-dependent System improvements: funding-dependent
Progress on Action Between 2014-2019	**a) Complete the hydraulic analysis of watersheds in the city to predict areas of insufficient capacity.** **Deferred** The 2018 Clean Stormwater Fee was put to a vote of property owners in Spring 2018. The property owners approved the fee enabling City Council to adopt Resolution No. 68,483—N.S. on June 12, 2018 enabling the fee to be collected through the County Tax Roll for Fiscal Year 2018-2019. A portion of the revenue generated by the 2018 Clean Stormwater Fee will be used to complete the Watershed Management Plan and produce an overall storm water master plan. **b) Seek funding to perform system capacity and disaster resistance improvements.** **Completed** The 2018 Clean Stormwater Fee provides the City with much needed funding to operate and maintain stormwater

	drainage facilities, reduce pollutant discharges from the City, and improve the financial health of the stormwater program. Some funding will be available for system improvements, but this funding will not be enough to address all of the required improvements. The City continues to look for funding opportunities to supplement City funding sources.

2014 Tsunami	**Define and mitigate Berkeley's tsunami hazard.**
Proposed Activities	a) Collaborate with the California Office of Emergency Services to define Berkeley's different areas of inundation for different tsunami scenarios. b) Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to document and explore potential tsunami hazard mitigation measures for Berkeley's maritime communities.
Lead Organization and Staff Lead	Fire Department – Office of Emergency Services (Scenarios) Staff Lead: Emergency Services Coordinator Parks, Recreation and Waterfront Department – Marina Division (Mitigation Measures) Staff Lead: Waterfront Manager
Priority	Medium
Timeline	Scenarios: 2 years Mitigation Measures: To be determined
Progress on Action Between 2014-2019	**a) Collaborate with the California Office of Emergency Services to define Berkeley's different areas of inundation for different tsunami scenarios.** **Completed** See *Hazard Information* Action above. **b) Collaborate with the California Office of Emergency Services, the California Geological Survey, and the Federal Emergency Management Agency to document and explore potential tsunami hazard mitigation measures for Berkeley's maritime communities.** **In Progress** The City of Berkeley met with the California Office of Emergency Services and the California Geological Survey to review tsunami playbooks. At this meeting

	State representatives provided a DRAFT Harbor Improvement Report for the Berkeley Marina, which mitigation measures that minimize loss of life and damage from future tsunamis. Staff plans to use this guidance to consider potential mitigation measures.

2014 Extreme Heat	**Reduce Berkeley's vulnerability to extreme heat events and associated hazards.**
Proposed Activities	a) 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 into City operations and services. b) Create and maintain shading by sustaining municipal tree planting efforts and continuing to maintain the health of existing trees. c) 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.
Lead Organization and Staff Lead	Planning Department – Office of Energy and Sustainable Development (Monitor Impacts) Staff Lead: Climate Action Coordinator Department of Parks, Recreation and Waterfront – Parks Division (Tree Planting) Staff Lead: Parks Superintendent
Priority	Medium
Timeline	Other Activities: Ongoing
Progress on Action Between 2014-2019	**a) 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 into City operations and services.** **In Progress (Ongoing)** OESD continues to track the latest science and information related to extreme heat events. This includes tracking new reports, such as the San Francisco Bay Area 2017 Risk Profile by the Association of Bay Area Governments, the EPA's 2016 Extreme Heat Guidebook, and the Air District's 2017 Clean Air Plan. **b) Create and maintain shading by sustaining municipal tree planting efforts and continuing to maintain the health of existing trees.** **In Progress (Ongoing/Funding-Dependent)** Since 2014, at least 857 trees have been planted using funding from a State of California Environmental Enhancement Mitigation Program grant. Since July 18, 2014, over 5,743 trees have been pruned.

	c) 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. **In Progress** The City continues implement the Building Energy Saving Ordinance (BESO), which aims to motivate upgrades in existing buildings in Berkeley. The ordinance requires an energy assessment for buildings less than 25,000 sq ft at time of sale. For buildings over 25,000 sq ft, BESO requires an assessment as well as annual energy benchmarking data. OESD is exploring opportunities to integrate building vulnerability to extreme heat events into BESO.

2014 **Severe Storms**	**Reduce Berkeley's vulnerability to severe storms and associated hazards.**
Proposed Activities	a) Support and monitor research on climate change impacts on local rainfall patterns and incidences of severe storms. b) Integrate considerations of severe storms into City operations and services: • Use development review to ensure that new development does not contribute to an increase in flood potential. • Complete the hydraulic analysis of watersheds in the city to predict areas of insufficient capacity. • Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio-filtration systems such as greenscapes. • Continue to encourage use of permeable surfaces and other techniques as appropriate in both greenscape and hardscape areas for retention and infiltration of stormwater. • Continue to encourage the development of green roofs by providing local outreach and guidelines consistent with the Building Code.
Lead Organization and Staff Lead	Planning Department – Office of Energy and Sustainable Development Staff Lead: Climate Action Coordinator (Monitor Research) Staff Lead: Sustainability Outreach Specialist (Green Roof outreach) Planning Department – Land Use Planning Division (Development Review)

	Staff Lead: Division Director Department of Public Works – Engineering Division (Watershed Management Plan, Permeable Surfaces, Public Improvements) Staff Lead: Supervising Civil Engineer
Priority	Medium
Timeline	Ongoing
Progress on Action Between 2014-2019	- **Support and monitor research on climate change impacts on local rainfall patterns and incidences of severe storms.** **Completed** Research has indicated that climate change will not significantly affect total rainfall, but may contribute to a more abbreviated and intense wet season, which has associated impacts. - **Integrate considerations of severe storms into City operations and services:** • **Use development review to ensure that new development does not contribute to an increase in flood potential.** **In Progress/Ongoing** 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 described below are followed. • **Complete the hydraulic analysis of watersheds in the city to predict areas of insufficient capacity.** **Deferred** The City is monitoring developing sea level rise discussions and requirements, and changes in rainfall event intensities. These characteristics will be incorporated in the Watershed Management Plan and other appropriate planning documents, and design standards for the City. • **Design public improvements such as streets, parks and plazas, for retention and infiltration of stormwater by diverting urban runoff to bio-filtration systems such as greenscapes.** **In Progress (Ongoing)**

	Public Works has been using Measure M funds and other City funds to implement green infrastructure retain, treat, and infiltrate stormwater. Since 2014 the City installed bioswales at the intersections of Rose Street/Hopkins Street and at Hearst Avenue/Oxford Street, and a permeable paver bus pad at the intersection of Shattuck Avenue/University Avenue. In addition the City will have the Woolsey LID project under construction in 2019. • **Continue to encourage use of permeable surfaces and other techniques as appropriate in both greenscape and hardscape areas for retention and infiltration of stormwater.** **In Progress (Ongoing)** The City requires green infrastructure on public and private regulated projects through the zoning and building permitting processes. These include bio-swales, permeable paving systems, and controlling peak runoff. The City continues to explore use of permeable surfaces such as permeable concrete and pavers in future projects. Ongoing guides will be available on City's sustainability website. • **Continue to encourage the development of green roofs by providing local outreach and guidelines consistent with the Building Code.** **Completed** The City maintains a webpage that serves as an introductory guide to green roofs including the benefits, types, building factors to consider and permit requirements.

2014 **Water Security**	**Collaborate with local, State, regional and federal partners to increase the security of Berkeley's water supply from climate change impacts.**
Proposed Activities	a) Support efforts by the U.S. Forest Service and its partners to improve water security through restoration of the Headwaters Forest and Mokelumne River.

	b) Encourage water recycling and gray water use through the distribution of outreach materials and local guidelines that are consistent with the Building Code. c) Encourage the use of water conservation technologies and techniques in the design of new buildings and landscapes, such as waterless urinals and cisterns, through the development of local guidelines that are consistent with the Building Code. d) Partner with East Bay Municipal Utility District (EBMUD) to provide and market incentives for residents, businesses and institutions to conserve water. e) Partner with agencies such as EBMUD and StopWaste.org 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.
Lead Organization and Staff Lead	City Manager's Office via Sustainability Working Group (Partner Support) Staff Lead: Deputy City Manager Planning Department – Office of Energy and Sustainable Development Staff Lead: Climate Action Coordinator (Community Awareness) Staff Lead: Sustainability Outreach Specialist (Water Recycling/Incentives) Staff Lead: Sustainability Coordinator (Guidelines and Landscaping)
Priority	Medium
Timeline	Ongoing
Progress on Action Between 2014-2019	**a) Support efforts by the U.S. Forest Service and its partners to improve water security through restoration of the Headwaters Forest and Mokelumne River.** **Deleted** Regularly reached out to US Forest Service to understand actions being taken for water security, but ongoing efforts were not continued due to lack of resources. **b) Encourage water recycling and gray water use through the distribution of outreach materials and local guidelines that are consistent with the Building Code.** **Completed** Information will continue to be available on the City's sustainability website.

	c) Encourage the use of water conservation technologies and techniques in the design of new buildings and landscapes, such as waterless urinals and cisterns, through the development of local guidelines that are consistent with the Building Code. **Completed with modifications** The State Energy Code and Water Efficiency Landscape Ordinance incorporated minimum water requirements before local guidelines were developed. City staff now encourage water conservation technologies and techniques as part of implementation of the new code and encourage enforcement through roundtables. Note: Waterless urinals and cisterns are no longer considered best practice. **d) Partner with East Bay Municipal Utility District (EBMUD) to provide and market incentives for residents, businesses and institutions to conserve water.** **In progress** Although focused on during the recent drought, ongoing efforts remain to continue coordination. City staff continuously refer members of the public to available EBMUD resources, such as free water efficiency technologies or rebate programs. **e) Partner with agencies such as EBMUD and StopWaste.org 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.** **In progress** Water Efficiency Landscape Ordinance (WELO) became effective December 2015 with new requirements that are being implemented. Jurisdictions are required to report annually to the State, and coordination with EBMUD on implementation is ongoing. StopWaste has prepared general materials that can be tailored by each jurisdiction and plans to do additional training on compliance and enforcement, which the City of Berkeley will utilize.

2014 **NFIP**	**Maintain City participation in the National Flood Insurance Program.**

Proposed Activities	a) Continue to update and revise flood maps for the City. b) Continue to incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards.
Lead Organization and Staff Lead	Public Works – Engineering Division Staff Lead: Supervising Civil Engineer
Priority	Medium
Timeline	Ongoing
Progress on Action Between 2014-2019	**a) Continue to update and revise flood maps for the City.** **In Progress (Ongoing)** The most recent map updates took effect December 21, 2018. These maps were updated to include new detailed coastal analyses for the San Francisco Bay shoreline of Alameda County north of the San Mateo Bridge. **b) Continue to incorporate FEMA guidelines and suggested activities into City plans and procedures for managing flood hazards.** **In Progress (Ongoing)** The City performs the suggested actions by keeping the Berkeley Municipal Code Chapter 17.12: Flood Zone Development Ordinance in consistent with FEMA National Flood Insurance Program requirements. Most recently updated in 2009, the Ordinance regulates all publicly- and privately-owned land within the areas of special flood hazard. It establishes the Director of the Public Works Department as the Floodplain Administrator for the City. The Building Official ensures construction standards are addressed for projects in flood zones.

2014 Streamline Rebuild	**Streamline the zoning permitting process to rebuild residential and commercial structures following disasters.**
Proposed Activities	a) Explore a Zoning Amendment to BMC 23C.04.100 that streamlines the Zoning permitting process to allow industrial and commercial buildings, and multiple-family dwellings to rebuild by right following disasters. Consider different treatment for buildings in high-risk areas, such as: • Imposing higher standards of building construction for rebuilding • Excluding buildings in these areas from the amendment

	b) 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. c) Define the process for the City to accept and file this documentation. d) Outreach to property owners about this documentation process.
Lead Organization and Staff Lead	Planning Department – Land Use Planning Division Staff Lead: Division Director
Priority	Medium
Timeline	1 year
Progress on Action Between 2014-2019	**a) Explore a Zoning Amendment to BMC 23C.04.100 that streamlines the Zoning permitting process to allow industrial and commercial buildings, and multiple-family dwellings to rebuild by right following disasters. Consider different treatment for buildings in high-risk areas, such as:** • **Imposing higher standards of building construction for rebuilding** • **Excluding buildings in these areas from the amendment** **Deferred** The Land Use Planning Division begun research to address this proposal. **b) 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.** **Deferred** See (a) above. **c) Define the process for the City to accept and file this documentation.** **Deferred** See (a) above. **d) Outreach to property owners about this documentation process.** **Deferred** See (a) above.

D.2.c Low-Priority Actions

2014 Sea-Level Rise	**Mitigate the impacts of sea-level rise in Berkeley.**
Proposed Activities	a) Monitor and participate in regional and State-level research on projected sea-level rise in Berkeley and the region. b) Develop guidelines, regulations, and development review procedures to protect new and existing public and private developments and infrastructure from floods due to expected sea-level rise.
Lead Organization and Staff Lead	Planning Department – Office of Energy and Sustainable Development (Monitor Research/Integrate Considerations) Staff Lead: Climate Action Coordinator Planning Department – Land Use Planning Division (Development Regulations) Staff Lead: Division Director
Priority	Low
Timeline	To be determined
Progress on Action Between 2014-2019	**a) Monitor and participate in regional and State-level research on projected sea-level rise in Berkeley and the region.** **In Progress (Ongoing)** New research incorporated into the 2019 LHMP Hazard Analysis. This includes the Adapting to Rising Tides Bay Area Sea Level Rise Analysis and Mapping Project completed in 2017 for local mapping, as well as the State of California Sea-Level Rise Guidance document published in 2018. **b) Develop guidelines, regulations, and development review procedures to protect new and existing public and private developments and infrastructure from floods due to expected sea-level rise.** **In Progress (Ongoing)** Ongoing efforts to integrate consideration of climate impacts into capital and land use planning are underway, including research on other cities' similar efforts as well as beginning cross-departmental conversations on what such requirements would entail.

2014 HazMat Floods	**Explore local legislation to require hazardous materials stored in the flood zones to be elevated or otherwise protected from floodwaters.**

Proposed Activities:	a) Conduct cost/benefit evaluation to determine if hazardous materials should be elevated/protected in existing development in flood hazard zones: • Assess potential impacts from hazardous materials release due to flooding • Consult with federal, State and regional partners to identify legislative best practices and lessons learned • Work with Berkeley Building Official to identify engineering solutions and potential permitting requirements for hazardous materials • Identify potential costs to hazardous materials owners b) If cost/benefit evaluation is positive, work with City Manager's Office and City Council to determine and implement path forward. c) If cost/benefit is not positive, consider alternative methods of compliance such relocation or modification of business activities.
Lead Organization and Staff Lead:	Planning Department – Toxics Management Division Staff Lead: Hazardous Materials Specialist II
Priority:	Low
Timeline:	Complete assessment of existing legislation: January 2014 Complete Cost-benefit evaluation for assessment by City Manager's Office: To be determined
Progress on Action Between 2014-2019	**a) Conduct cost/benefit evaluation to determine if hazardous materials should be elevated/protected in existing development in flood hazard zones:** • **Assess potential impacts from hazardous materials release due to flooding** • **Consult with federal, State and regional partners to identify legislative best practices and lessons learned** • **Work with Berkeley Building Official to identify engineering solutions and potential permitting requirements for hazardous materials** • **Identify potential costs to hazardous materials owners** **b) If cost/benefit evaluation is positive, work with City Manager's Office and City Council to determine and implement path forward.** **c) If cost/benefit is not positive, consider alternative methods of compliance such relocation or modification of business activities.**

	Deleted This flooding scenario is unlikely and resources are not identified or likely to become available to perform this work.

D.3 *2019 Changes in Priorities*

While the City's goals and objectives have remained very similar to the 2014 plan, the 2019 LHMP reflects thorough revisions from the 2014 document. Those revisions have resulted in some actions in the 2019 Mitigation Strategy receiving different priority levels than in 2014. The 2019 Hazard Analysis accounts for newly-available science and research and emerging hazards. The associated 2019 mitigation actions account for progress made on mitigation actions since 2014, changes in development in Berkeley, and our new understanding of the hazards we face.

	Fire Safety, Education, Prevention and Community Disaster Preparedness									
	Recommended Action Item	**DSFC Imme-diate Priority**	**Cost Est Low$0-100k Med$101-500k High+$500k**	**Existing Study or "Shovel Ready" Project or Program**	**No Change in Law/Regulation or new MOU needed**	**Possible Private Org or Volunteer Involvement to Support City Effort**	**DFSC Comments**		**Source**	**Staff Feedback**
WILDLAND URBAN INTERFACE - WILDFIRE SAFETY IMPROVEMENTS										
	Evacuation, Fire, and Medical Response									
1	Completion of Evacuation Plan			✔	✔				Hahn et al	Draft Wildfire Evacuation Annex scheduled for completion by end of FY18. Anticpate additions to BMC
2	DFSC/Parks & Rec commissions work with Berkeley Path Wanderers Association - improve safety and marking of paths for evacuees			✔	✔	✔	Follow up with Joint commission subcommittee or workgroup		D&FS Commission	Possible future efforts in concert with Public Works and Path Wanderers: Posting permanent signage to highlight/direct to main evac routes.
3	Publicize Evac Routes and Protocols			✔	✔	✔			Hahn et al	Wildfire evac routes and protocols available on https://www.cityofberkeley.info/wildfireevacuation/ More detailed evac routes/protocols contingent on Wildfire Evacuation Annex.
4	Issue Red Flag Day digital Nixle/AC alerts within city limits when Red Flag Day warning is issued for the East Bay Hills			✔	✔				D&FS Commission	Red Flag Warning vs. High Fire Danger. Berkeley protocol for dangerous days doesn't always align with NWS. AlCo OES is actively working on this too. Red Flag watches/warnings issued by NOAA are broad in scope and are not accurate predictors of fire weather in Berkeley, due to the East Bay's topography, mountains, and weather patterns. I strongly advise against automatically pushing out Red Flag alerts with our warning systems. Berkeley has issued Elevated Fire Danger alerts in the past, when fire personnel have noted that the weather conditions in place pose a threat to our community in particular.
5	Expand outreach efforts for AC Alert resident participation			✔	✔	✔	Use social media, such as NextDoor, to push the messaging out inexpensively via PSA announcement, along with annual disaster preparedness article in Berkeleyside. Use of Posters in Bus Shelters (clear channel works with AC Transit and as a public entity Berkeley should be able to get non-profit rate. Council members encourage use of AC Alert in their communications with their constituants.		Hahn et al	Current Outreach: AC Alert is included in all Berkeley Ready presentations. AC Alert sign up assistance available via phone and at fairs/public events. Consider: recorded message on 1610 AM, outreach through TV station
6	**Consider implementation of siren warning system**	✔	L-M		✔		Being discussed by the commission		Hahn et al	Siren systems are Outdoor Public Warnings Systems (OPWS) Outdoor Public Warning Systems (OPWS) have considerable limitations and would not effectively replace any currently-available alert and warning technologies (AC Alert, 1610 AM, Nixle, Emergency Alert System, Wireless Emergency Alerts, City Website, Twitter.) An OPWS that reached all outdoor areas of Berkeley, is well-maintained, includes an ongoing public education campaign would be a good addition to the suite of Berkeley's notification tools. Specifically, it would help for people outdoors to know that they need to tune into another information source to get more information and instructions. In order to accomplish this, very significant initial/ongoing staffing and funding allocations would be required.
7	Purchase, install, maintain siren warning system			✔	✔		D&FS Commission recommends contribution of GG funds (assuming Council or CM approves recommendation to purchase sirens)		D&FS Commission	See above.
8	Design and Propose a tailored red-curb program to address specific identified conditions on streets impassible by emergency vehicles or present unusual ingress or egress challenges				✔		See Olds recommendations to council 1996 and Fire Commission 1997 recommendations		Hahn et al	
9	**Enforce CVC 22514 for stopping or parking near a fire hydrant, including adding proper signage and/or red paint**	✔	L-M	✔	✔		Traffic Enforcement will partially offset cost through fines		D&FS Commission	Public Works/Police referral
10	Complete installation of blue reflectors marking location of fire hydrants			✔	✔		PW doing blue reflector installations		D&FS Commission	Not relatively low cost - significant staff time for Public Works
11	Have Beat Police Officers ticket hydrant infractions when making rounds in the hills fire zone				✔		See note on item #13 above		D&FS Commission	Police Department referral
12	Adopt parking restrictions on narrow streets in hills fire zone				✔		Follow existing CVC for street parking based on width of streets		D&FS Commission	Not relatively low cost - significant staff time
13	Limit parking one side of street narrower than 26 feet				✔		See note on item #12		Bartlett et al	
14	Restrict parking on Red Flag days, similar to LA Reg Flag restricted parking program						See DFSC recommendation 2/9/16		Bartlett et al	See item #4. Red Flag conditions do not equate with high fire danger for Berkeley. Could consider for High Fire Danger days. LA restricts parking on High Fire Danger days not Red Flag days.
15	Have traffic control personnel randomly canvass hills fire zone to ensure parking compliance				✔		See note on item #13 above		D&FS Commission	Police Department referral
16	Pursue multiple sources of grant funding supporting: fire mitigation incentives and enforcement.; fire safety education; greater use of Nixle and AC Alerts; promoting evacuation routes including pathways.				✔	✔			D&FS Commission	
	Vegetation Management									
17	Work with EBRP to ensure proper vegetation management in Tilden and other regional parks			✔					Hahn et al	
18	Consider protocols for the City to monitor and advocate for inspection and maintenance of PG&E electrical facilities and power lines, tree conditions.								Hahn et al	Public Works referral

	Fire Safety, Education, Prevention and Community Disaster Preparedness									
	Recommended Action Item	**DSFC Imme-diate Priority**	**Cost Est Low$0-100k Med$101-500k High+$500k**	**Existing Study or "Shovel Ready" Project or Program**	**No Change in Law/Regulation or new MOU needed**	**Possible Private Org or Volunteer Involvement to Support City Effort**	**DFSC Comments**		**Source**	**Staff Feedback**
19	Expand programs/practices to reduce fire hazards/fuel loads			✔	✔	✔			Hahn et al	Existing programs: Fire Fuel Chipper Program: PRW - Forestry Fire Fuel Abatement Program on Public Land: PRW - Landscape Fire Fuel Debris Bin Program: PW - Zero Waste
20	Update vegetation standards on city and private property			✔		✔	See Wengraf referral 6/10/14 and DFSC 9/24/14 resolution to support options dated 9/10/14 to Parks & Waterfront Commision		Hahn et al	New brochure and website depicting current standards currently in process 2014 LHMP Action - create a standard for written vegetation management plans for major construction projects in Fire Zones 2 and 3.
21	Create & execute city-wide action and funding plan for vegetation mgmt, starting with highest risk areas. Plan to include wildlife, vegetation and tree replacement								Hahn et al	
22	Consider, propose new/enhanced mechanisms and funding sources for inspections and enforcement of vegetation protocols								Hahn et al	
23	Incentivize and enforce fire safe vegetation management on private properties in the fire zone			✔					Bartlett et al	
24	Review and possible expansion of Fire Fuel Chipper and Debris Bin Program			✔		✔			Hahn et al	PRW referral. See item #19
25	DFSC/Parks & Waterfront commissions review efficacy of Fire Fuel Debris Program			✔		✔	Refer to both commissions to form Joint Subcommittee or workgroup		D&FS Commission	
26	**DFSC/ Parks & Waterfront commissions to recommend improvements in educating the public on firesafe vegetation practices, meeting the needs of participants and encouraging greater participation in program**	✔		✔	✔	✔	See note on item # 25. The Fire Fuel Chipper Vegetation Debris Bin Program is funded by a surcharge paid by property owners in the fire fuel designated areas		D&FS Commission	
27	Disseminate updated vegetation and tree mgmt requirements to property owners, initial outreach in high-risk zones				✔	✔			Hahn et al	See item #20
	Prevention and Compliance									
28	Increase fire prevention staffing			✔	✔				Bartlett et al	
29	Review/Update Fire Safety Ordinances inc BMC12.50-Fire Inspection Program								Hahn et al	
30	Temporarily suspend ADU applications in the Very High Hazard Zone to review public safety issues relevant to risk of WUI fires						Referred to Planning Commission 2/27/18		D&FS Commission	Planning Department - Land Use Planning Referral
31	Amend Section 23D.10 for ADUs to incorporate recommendations from public safety review before issuing AUPs			✔					D&FS Commission	Planning Department - Land Use Planning Referral
32	Require major remodels and all ADU conversions to include indoor sprinklers						Existing requirement?		Bartlett et al	Planning Department - Land Use Planning Referral
33	Review, strengthen coordination and communication with nearby jurisdictions and governmental agencies			✔					Hahn et al	
34	Add disaster preparedness to yearly Rental Housing Safety Program (RHSP) self-check form			✔		✔	See note on item #48 to refer to HAC		Bartlett et al	Current focus of flyer is actual code enforcement violations. Need to update link to OES page already on back of flyer to www.CityofBerkeley.info/Ready
35	Require Rental Housing Safety Program (RHSP) self-check for short term rental properties					✔	See note on item #48 to refer to HAC		Bartlett et al	
	STRENGTHEN OVERALL DISASTER PREPAREDNESS									
36	Consider and recommend improvements to community and volunteer participation in fire and disaster safety initiatives			✔	✔	✔			Hahn et al.	
37	Dedicate city staff time to apply for and administer grants from BAUASI, State of California, and other sources for disaster preparedness improvements. Explore other forms of funding partnerships								Bartlett et al	
	Improve the accountability and equity of disaster programs in the City of Berkeley									
38	New neighborhood disaster cache distributions meet equity criteria			✔		✔	What kind of evaluation has been done on the cache system? How do neighborhoods get prioritized and how are the cache's monitored?		Bartlett et al	
39	Expand CRC program - goal 20 new CRCs			✔	✔	✔			Bartlett et al	Current Goal: 12 by end of fiscal year 17/18
40	Expand apartment building program (ARC) - goal:100 apartment buildings			✔	✔	✔	See note on item #49 below		Bartlett et al	Initializing program- after 1 year pilot, will evaluate effectiveness and determine expansion potential
41	Expand CERT District Coordinators to every fire district; increase support for CERT District Coordinators			✔	✔	✔			Bartlett et al	
42	Explore grant funded partnership with CESC to provide seismic safety related services to low income households					✔			Bartlett et al	CERT coordinated a $5000 grant with CESC from PG&E to pilot fully funding seismic assessments and nonstructural mitigation for low income/seniors in 2017.
43	Provide multi-lingual disaster preparedness services consistent with City communications			✔	✔	✔			Bartlett et al	Rarely receive requests for preparedness in other languages. Currently offer Spanish outreach in LISTOS program

	Fire Safety, Education, Prevention and Community Disaster Preparedness									
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44	Develop and annually report on clear quantitative measures for disaster prep and response programs			✔	✔	✔	Clarification on existing measures and criteria could be helpful		Bartlett et al	OES/Berkeley Ready Performance measures exist and are updated quarterly.
	Yearly Citywide Exercise									
45	OES coordinates annual citywide exercise to include all staff, residents and other disaster program partners			✔	✔	✔			Bartlett et al	Factoring in staff time from OES to develop and all other departments to participate in such an exercise, proposal is not relatively low-cost. Participation by all City staff creates impacts to provision of City services to community (ex: 3-1-1, service counters, etc.) Evacuation drills coordinated through HR-Safety. Consider coordination with ShakeOut effort. For staff, consider initial response drill as follow-up from DSW education and planning.
	School Preparedness									
46	OES/BUSD improve school preparedness					✔	Put on the School Board/Superintendent's priority to-do list?		Bartlett et al	CERT program volunteers have been supporting parent groups to provide training and guidance on school emergency preparedness. Conducted 8 trainings at 3 different schools through 2016-2017 with two additional trainings scheduled in March 2018.
47	OES offer annual 3 hour trainings to BUSD teachers/staff					✔			Bartlett et al	
	Disaster Programs Equity for Renters									
48	Require Apt bldgs. with 3+units to supply residents with 3 days supply of water or develop incentives for disaster supply storage					✔	Recommend integration into housing plan per HAC recommendation 2/1/18		Bartlett et al	ARC Program encourages, but does not require preparedness
49	Expand CRC model to multi-unit apartment bldgs. (ARC) - goal 100 bldgs			✔	✔	✔	Same note as item #48		Bartlett et al	See ARC Program
50	In ARCs, obtain resident input in design of above program in each bldg.			✔	✔	✔	Same note as item #48		Bartlett et al	
51	In ARCs, minimum of 2 residents have access to emergency caches			✔	✔	✔	Same note as item #48		Bartlett et al	
52	Minimum 2 on-site residents have access to utility shut-off values in buildings w/o property manager on-site					✔	Same note as item #48		Bartlett et al	
53	New Ordinance requiring new and existing rental agreements to allow bracing of water heaters and furniture					✔	Same note as item #48		Bartlett et al	
54	Update Demolition ordinance to address loss of rent controlled units post disaster						Same note as item #48		Bartlett et al	
55	Have Rent Board review legal rights and responsibilities of tenants and landlords when bldg, is red-tagged after disaster						Same note as item #48		Bartlett et al	
56	Add disaster preparedness to yearly Rental Housing Safety Program (RHSP) self-check form					✔	Same note on item #48. This item is a duplicate of item #34.		Bartlett et al	Current focus of flyer is actual code enforcement violations. Need to update link to OES page already on back of flyer to www.CityofBerkeley.info/Ready
57	Require Rental Housing Safety Program (RHSP) self-check for short term rental properties			✔		✔	Same note on item #48. This item is a duplicate of item #35.		Bartlett et al	
	Post-Disaster Communications									
58	Launch post-disaster service hub program; goal - every person within walking distance, volunteer staffed				✔	✔			Bartlett et al	
59	Evaluate adoption of FirstNet for first responders. Consider possible cost reduction of future radio purchases.				✔				Bartlett et al	
60	Reinstate DSW designation for volunteer HAM radio operators					✔			Bartlett et al	Current City policy is not to pre-register anyone as a DSW. NALCO volunteers can be registered as City Volunteers.
61	Strengthen 1610AM signal to reach all of Berkeley			✔	✔				Bartlett et al	1610 AM is a Travelers' Information Station licensed by the FCC, so it is limited to a 10 watt transmitter output power, an antenna height no greater than 15 meters (49.2 feet), and a coverage radius of 3 km so that we do not interfere with similar emergency radio stations in surrounding jurisdictions.
	City Staff Training									
62	Provide a yearly disaster training for all city staff, including their role in disaster			✔	✔				Bartlett et al	
	Volunteer Corps									
63	Create a Volunteer Corps program including quantitative measures					✔			Bartlett et al	
64	Designate a dedicated staff coordinator to run program				✔				Bartlett et al	
	Disaster Shelters									
65	Assess and publicize current sheltering capacity			✔	✔				Bartlett et al	Shelter capacity is currently assessed (Shelter Gap Identification Tool). Unclear what publicization is desired. We do not pre-publicize shelter locations.
66	Set 5 year goal to expand sheltering capacity to meet 100% need in 6.7 N. Hayward Fault EQ						Correction: This should have said 6.9 Hayward Fault earthquake, which is a scenario earthquake in the Berkeley Hazard Mitigation plan.		Bartlett et al	SEE DFSC comment re: using 6.9 quake scenario rather than 6.7 Need info on what sheltering need would be for a 6.7 N. Hayward Quake- Doesn't match current scenarios in use.
67	Sheltering plan to include most cost effective ways to meet post-disaster shelter needs						Can an MOU with UC Berkeley be explored to identify possible Mass Care and Shelter facilities?		Bartlett et al	This may focus more on medium to long term housing?

	Fire Safety, Education, Prevention and Community Disaster Preparedness								
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68	**Within 1 year, sign MOU with BUSD re: school bldg, use as sheltering sites**	✔	L				School sites will ultimately need to be reviewed for Seismic and other health & safety parameters.	Bartlett et al	Reasonable goal. Requires collaboration with BUSD. Aligns with current focus of UASI Care and Shelter Workgroup
	Reorganization of Emergency Management								
69	Explore creating new department for emergency management						As part of Berkeley's master plan, can this be explored?	Bartlett et al	
	CERT Training								
70	Partner with other Bay Area cities to share classes and CERT trainings			✔		✔	See CERT Volunteers January, 2017 Long Range Plan	Bartlett et al	Often collaborate - Recent examples, Kensington for radio communications training; San Pablo/Concord/SF/etc on LISTOs spanish training/CERT
71	Consider reducing minimum age of CERT participation				✔	✔		Bartlett et al	Minimal activity but we have included Berkeley High School Fire Science and Emergency Response Teens club in some of our trainings.
72	Partner with UC Berkeley			✔		✔		Bartlett et al	
73	Offer class time and location alternatives			✔	✔	✔	See CERT Volunteers January, 2017 Long Range Plan	Bartlett et al	CRC is aimed at addressing alternative locations. Also we have begun increased number of classes in neighborhoods.
74	Require OES hold a minimum 40 3-hour CERT trainings per year			✔	✔	✔		Bartlett et al	
75	Require at least 6 of trainings in item #73 be held at apartment buildings.					✔	Same note as item #48	Bartlett et al	
76	Require that 6 annual weekend CERT Academy trainings are included in item #73			✔	✔	✔		Bartlett et al	Our last CERT Academy was held in March 2016
	Increase Home Storage of Water								
77	Develop plan to offer low priced 50 gal water containers				✔	✔	Can this be done in partnership with EBMUD?	Bartlett et al	
78	Develop program for rain water catchment in homes and apartments				✔	✔	EBMUD / Environmental agency partnership?	Bartlett et al	
	Support Business Continuity								
79	Create emergency plans for/with local businesses			✔	✔	✔		Bartlett et al	Rachel Rodriguez (Public Health) currently working on small business program.
80	Set OES annual goal- provide one-on-one mentoring for 20+small businesses in emergency and business continuity planning			✔	✔	✔		Bartlett et al	Rachel Rodriguez (Public Health) currently working on small business program.