*Final Plan*

February 21, 2019 | # Hazard Mitigation Plan



epc
emergency planning consultants

CITY OF BRADBURY

**Q&A | ELEMENT A: PLANNING PROCESS | A1c.**

**Q:** Does the plan identify who represented each jurisdiction? (At a minimum, it must identify the jurisdiction represented and the person's position or title and agency within the jurisdiction.) (Requirement §201.6(c)(1))

**A:** See **Credits** below.

# Credits

## Special Thanks

### *Hazard Mitigation Planning Team:*

| *Agency* | *Name* | *Position* | *Department* |
|---|---|---|---|
| | Kevin Kearney (Planning Team Chair) | City Manager | City Manager's Office |
| | Scarlett Santos Leon | Management Analyst | City Manager's Office |
| | Anne Browning McIntosh | City Planner (Contracted) | Planning Department |
| | Julio Donayre (Former Planning Team Chair) | Management Analyst (Former) | City Manager's Office |
| | Ryan Parker | Management Analyst (Former) | City Manager's Office |
| Emergency Planning Consultants | Carolyn J. Harshman | President | Consultant |

## Acknowledgements

### *City of Bradbury*

✓ Richard G. Barakat, Mayor
✓ Richard T. Hale Jr., Mayor Pro-Tem
✓ D. Montgomery Lewis, Council Member
✓ Bruce Lathrop, Council Member
✓ Elizabeth Bruny, Council Member

## Point of Contact

To request information or provide comments regarding this mitigation plan, please contact:

| | |
|---|---|
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| **Telephone Number** | (626) 358-3218 |

## Consulting Services

### *Emergency Planning Consultants*

- ✓ Project Manager: Carolyn J. Harshman, CEM, President
- ✓ Lead Research Assistant: Alex L. Fritzler
- ✓ HAZUS/GIS: Michael McDaniel

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## Mapping

The maps in this plan were provided by the City of Bradbury, County of Los Angeles, Federal Emergency Management Agency (FEMA), or were acquired from public Internet sources. Care was taken in the creation of the maps contained in this Plan, however they are provided "as is". The City of Bradbury cannot accept any responsibility for any errors, omissions or positional accuracy, and therefore, there are no warranties that accompany these products (the maps). Although information from land surveys may have been used in the creation of these products, in no way does this product represent or constitute a land survey. Users are cautioned to field verify information on this product before making any decisions.

## Mandated Content

In an effort to assist the readers and reviewers of this document, the jurisdiction has inserted “markers” emphasizing mandated content as identified in the Disaster Mitigation Act of 2000 (Public Law – 390). Following is a sample marker:

***EXAMPLE***

**Q&A | ELEMENT A: PLANNING PROCESS | A1a.**

**Q** Does the plan document the planning process, including how it was prepared (with a narrative description, meeting minutes, sign-in sheets, or another method)? (Requirement §201.6(c)(1))

**A:**

# Table of Contents

# Part I: PLANNING PROCESS

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | A1b.**

**Q:** Does the plan list the jurisdiction(s) participating in the plan that are seeking approval? (Requirement §201.6(c)(1))

**A:** See **Introduction** below.

# Introduction

The Hazard Mitigation Plan (Mitigation Plan) was prepared in response to Disaster Mitigation Act of 2000 (DMA 2000). DMA 2000 (also known as Public Law 106-390) requires state and local governments to prepare mitigation plans to document their mitigation planning process, and identify hazards, potential losses, mitigation needs, goals, and strategies. This type of planning supplements the City's comprehensive land use planning and emergency management planning programs. This document is a federally mandated update to the City of Bradbury 2007 Natural Hazard Mitigation Plan and ensures continuing eligibility for Hazard Mitigation Grant Program (HMGP) funding.

DMA 2000 was designed to establish a national program for pre-disaster mitigation, streamline disaster relief at the federal and state levels, and control federal disaster assistance costs. Congress believed these requirements would produce the following benefits:

- ✓ Reduce loss of life and property, human suffering, economic disruption, and disaster costs.
- ✓ Prioritize hazard mitigation at the local level with increased emphasis on planning and public involvement, assessing risks, implementing loss reduction measures, and ensuring critical facilities/services survive a disaster.
- ✓ Promote education and economic incentives to form community-based partnerships and leverage non-federal resources to commit to and implement long-term hazard mitigation activities.

The following FEMA definitions are used throughout this plan (Source: FEMA, 2002, *Getting Started, Building Support for Mitigation Planning*, FEMA 386-1):

Hazard Mitigation – "Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards".

Planning – "The act or process of making or carrying out plans; specifically, the establishment of goals, policies, and procedures for a social or economic unit."

## Planning Approach

The four-step planning approach outlined in the FEMA publication, *Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies* (FEMA 386-3) was used to develop this plan:

- ✓ **Develop mitigation goals and objectives -** The risk assessment (hazard characteristics, inventory, and findings), along with municipal policy documents, were utilized to develop mitigation goals and objectives.
- ✓ **Identify and prioritize mitigation actions -** Based on the risk assessment, goals and objectives, existing literature/resources, and input from participating entities, mitigation activities were identified for each hazard. Activities were 1) qualitatively evaluated against the goals and objectives, and other criteria; 2) identified as high, medium, or low priority; and 3) presented in a series of hazard-specific tables.
- ✓ **Prepare implementation strategy -** Generally, high priority activities are recommended for implementation first. However, based on community needs and goals, project costs, and available funding, some medium or low priority activities may be implemented before some high priority items.
- ✓ **Document mitigation planning process -** The mitigation planning process is documented throughout this plan.

## Hazard Land Use Policy in California

Planning for hazards should be an integral element of any City's land use planning program. All California cities and counties have General Plans (also known as Comprehensive Plans) and the implementing ordinances that are required to comply with the statewide land use planning regulations.

The continuing challenge faced by local officials and state government is to keep the network of local plans effective in responding to the changing conditions and needs of California's diverse communities, particularly in light of the very active seismic region in which we live.

Planning for hazards requires a thorough understanding of the various hazards facing the City and region as a whole. Additionally, it's important to take an inventory of the structures and contents of various City holdings. These inventories should include the compendium of hazards facing the City, the built environment at risk, the personal property that may be damaged by hazard events and most of all, the people who live in the shadow of these hazards. Such an analysis is found in this hazard mitigation plan.

## State and Federal Partners in Hazard Mitigation

All mitigation is local and the primary responsibility for development and implementation of risk reduction strategies and policies lies with each local jurisdiction. Local jurisdictions, however, are not alone. Partners and resources exist at the regional, state and federal levels. Numerous California state agencies have a role in hazards and hazard mitigation.

Some of the key agencies include:

- ✓ California Office of Emergency Services (Cal OES) is responsible for disaster mitigation, preparedness, response, recovery, and the administration of federal funds after a major disaster declaration;
- ✓ Southern California Earthquake Center (SCEC) gathers information about earthquakes, integrates information on earthquake phenomena, and communicates this to end-users and the general public to increase earthquake awareness, reduce economic losses, and save lives.

- ✓ California Department of Forestry and Fire Protection (CAL FIRE) is responsible for all aspects of wildland fire protection on private and state properties, and administers forest practices regulations, including landslide mitigation, on non-federal lands.
- ✓ California Division of Mines and Geology (DMG) is responsible for geologic hazard characterization, public education, and the development of partnerships aimed at reducing risk.
- ✓ California Division of Water Resources (DWR) plans, designs, constructs, operates, and maintains the State Water Project; regulates dams; provides flood protection and assists in emergency management. It also educates the public, serves local water needs by providing technical assistance
- ✓ FEMA provides hazard mitigation guidance, resource materials, and educational materials to support implementation of the capitalized DMA 2000.
- ✓ United States Census Bureau (USCB) provides demographic data on the populations affected by natural disasters.
- ✓ United States Department of Agriculture (USDA) provides data on matters pertaining to land management.

## Stakeholders

A Hazard Mitigation Planning Team (Planning Team) consisting of department representatives from City of Bradbury staff worked with Emergency Planning Consultants to create the updated Plan. **The Planning Team served as the primary stakeholders throughout the planning process.**

As required by DMA 2000, the Planning Team shared the plan update with City staff, the community, and external agencies (including utility providers, special districts and adjoining jurisdictions). The staff, public and external agencies served as secondary stakeholders and were provided an opportunity to participate in the plan writing phase of the plan's development. Following distribution of the First Draft Plan to the Planning Team, amendments were incorporated into the Second Draft Plan. Emails were sent to City staff (new City Manager and contracted City Engineer), and external agencies. Both were encouraged to contribute to the plan. To solicit input from the public, the Second Draft Plan was announced and posted on the City's website on June 14, 2017. In addition, on June 14, 2017, an online newsletter was sent to City of Bradbury residents to inform and request feedback and input on the Second Draft Plan.

***The City staff, community, and external agencies served as secondary stakeholders with an opportunity to contribute to the plan during the Plan Writing Phase.***

## Hazard Mitigation Legislation

### *Hazard Mitigation Grant Program*

In 1974, Congress enacted the Robert T. Stafford Disaster Relief and Emergency Act, commonly referred to as the Stafford Act. In 1988, Congress established the Hazard Mitigation Grant Program (HMGP) via Section 404 of the Stafford Act. Regulations regarding HMGP implementation based on the DMA 2000 were initially changed by an Interim Final Rule (44 CFR Part 206, Subpart N) published in the Federal Register on February 26, 2002. A second Interim Final Rule was issued on October 1, 2002.

The HMGP helps states and local governments implement long-term hazard mitigation measures for natural hazards by providing federal funding following a federal disaster declaration. Eligible applicants include state and local agencies, Indian tribes or other tribal organizations, and certain nonprofit organizations.

In California, the HMGP is administered by Cal OES. Examples of typical HMGP projects include:

- ✓ Property acquisition and relocation projects
- ✓ Structural retrofitting to minimize damages from earthquake, flood, high wind, wildfire, or other natural hazards
- ✓ Elevation of flood-prone structures
- ✓ Vegetative management programs, such as:
  - Brush control and maintenance
  - Fuel break lines in shrubbery
  - Fire-resistant vegetation in potential wildland fire areas

**"Floods and hurricanes happen. The hazard itself is not the disaster – it's our habits, it's how we build and live in those areas…that's the disaster."**

**Craig Fugate, FEMA Director**

## *Pre-Disaster Mitigation Program*

The Pre-Disaster Mitigation Program (PDM) was authorized by §203 of the Stafford Act, 42 United States Code, as amended by §102 of the DMA 2000. Funding is provided through the National Pre-Disaster Mitigation Fund to help state and local governments (including tribal governments) implement cost-effective hazard mitigation activities that complement a comprehensive mitigation program.

In Fiscal Year 2009, two types of grants (planning and competitive) were offered under the PDM Program. Planning grants allocate funds to each state for Mitigation Plan development. Competitive grants distribute funds to states, local governments, and federally recognized Indian tribal governments via a competitive application process. FEMA reviews and ranks the submittals based on pre-determined criteria. The minimum eligibility requirements for competitive grants include participation in good standing in the National Flood Insurance Program (NFIP) and a FEMA-approved Mitigation Plan.
(Source: http://www.fema.gov/fima/pdm.shtm)

## *Flood Mitigation Assistance Program*

The Flood Mitigation Assistance (FMA) Program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101). Financial support is provided through the National Flood Insurance Fund to help states and communities implement measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP.

Three types of grants are available under FMA: planning, project, and technical assistance. Planning grants are available to states and communities to prepare Flood Mitigation Plans. NFIP-participating communities with approved Flood Mitigation Plans can apply for project grants to implement measures to reduce flood losses. Technical assistance grants in the amount of 10 percent of the project grant are available to the state for program administration. Communities that receive planning and/or project grants must participate in the NFIP.

**Q&A | ELEMENT C. MITIGATION STRATEGY | C2**

**Q:** Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))

**A:** See **NFIP Participation** below.

## National Flood Insurance Program

Established in 1968, the NFIP provides federally-backed flood insurance to homeowners, renters, and businesses in communities that adopt and enforce floodplain management ordinances to reduce future flood damage. The City of Bradbury adopted a floodplain management ordinance and has Flood Insurance Rate Maps (FIRM) that show floodways, 100-year flood zones, and 500-year flood zones. The City Manager is designated as Floodplain Administrator (reference: BMC § 3550).

### *NFIP Participation*

The City of Bradbury participates in NFIP by providing public information brochures and confirming location of all future development/improvements as pertains to floodways and floodplains. These services are provided by the Planning Department and Engineering Department during land development and building permit review process. According to FEMA, the City of Bradbury is designated a Non-Special Flood Hazard Area (NSFHA). A Non-Special Flood Hazard Area (NSFHA) is an area that is in a moderate- to low-risk flood zone (Zones B, C, X Pre- and Post-FIRM). An NSFHA is not in any immediate danger from flooding caused by overflowing rivers or hard rains.

However, it's important to note that structures within a NSFHA are still at risk. In fact, over 20-percent of all flood insurance claims come from areas outside of mapped high-risk flood zones.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B4**

**Q:** Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

**A:** See **Repetitive Loss Properties** below.

### *Repetitive Loss Properties*

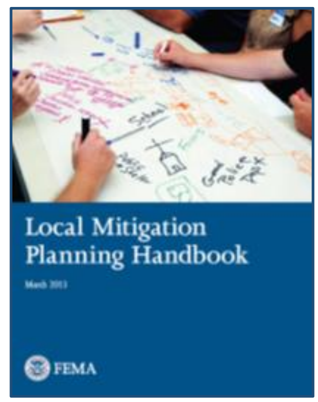
Repetitive Loss Properties (RLPs) are most susceptible to flood damages; therefore, they have been the focus of flood hazard mitigation programs. Unlike a Countywide program, the Floodplain Management Plan (FMP) for repetitive loss properties involves highly diversified property profiles, drainage issues, and property owner's interest. It also requires public involvement processes unique to each RLP area. The objective of an FMP is to provide specific potential mitigation measures and activities to best address the problems and needs of communities with repetitive loss properties. A repetitive loss property is one for which two or more claims of $1,000 or more have been paid by the National Flood Insurance Program (NFIP) within any given ten-year period. According to FEMA resources, there are no Repetitive Loss Properties (RLPs) within the City of Bradbury.

## State and Federal Guidance in Hazard Mitigation

While local jurisdictions have primary responsibility for developing and implementing hazard mitigation strategies, they are not alone. Various state and federal partners and resources can help local agencies with mitigation planning.

The Mitigation Plan was prepared in accordance with the following regulations and guidance documents:

- ✓ DMA 2000 (Public Law 106-390, October 10, 2000)
- ✓ 44 CFR Parts 201 and 206, Mitigation Planning and Hazard Mitigation Grant Program, Interim Final Rule, October 1, 2002
- ✓ 44 CFR Parts 201 and 206, Mitigation Planning and Hazard Mitigation Grant Program, Interim Final Rule, February 26, 2002
- ✓ How-To Guide for Using HAZUS-MH for Risk Assessment, (FEMA 433), February 2004
- ✓ Mitigation Planning "How-to" Series (FEMA 386-1 through 9 available at: http://www.fema.gov/fima/planhowto.shtm)
- ✓ Getting Started: Building Support for Mitigation Planning (FEMA 386-1)
- ✓ Understanding Your Risks: Identifying Hazards and Estimating Losses (FEMA 386-2)
- ✓ Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies (FEMA 386-3)
- ✓ Bringing the Plan to Life: Implementing the Mitigation Plan (FEMA 386-4)
- ✓ Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)
- ✓ Integrating Historic Property and Cultural Resource Considerations into Mitigation Planning (FEMA 386-6)
- ✓ Integrating Manmade Hazards into Mitigation Planning (FEMA 386-7)
- ✓ Multi-Jurisdictional Mitigation Planning (FEMA 386-8)
- ✓ Using the Mitigation Plan to Prepare Successful Mitigation Projects (FEMA 386-9)
- ✓ State and Local Plan Interim Criteria Under the DMA 2000, July 11, 2002, FEMA
- ✓ Mitigation Planning Workshop for Local Governments-Instructor Guide, July 2002, FEMA
- ✓ Report on Costs and Benefits of Natural Hazard Mitigation, Document #294, FEMA
- ✓ LHMP Development Guide – Appendix A - Resource, Document, and Tool List for Local Mitigation Planning, December 2, 2003, Cal OES
- ✓ Local Mitigation Plan Review Guide (FEMA 2011)
- ✓ Local Mitigation Planning Handbook (FEMA 2013)



## How is the Plan Organized?

The structure of the plan enables the reader to use a section of interest to them and allows the City to review and update sections when new data is available. The ease of incorporating new data into the plan will result in a Mitigation Plan that remains current and relevant.

Following is a description of each section of the plan:

### Part I: Planning Process

**Introduction**

Describes the background and purpose of developing a mitigation plan.

**Planning Process**

Describes the mitigation planning process including: stakeholders and integration of existing data and plans.

### Part II: Risk Assessment

**Community Profile**

Summarizes the history, geography, demographics, and socioeconomics of the City.

**Risk Assessment**

This section provides information on hazard identification, vulnerability and risk associated with hazards in the City.

**City-Specific Hazard Analysis**

Describes the hazards posing a significant threat to the City including:

**Earthquake | Wildfire | Flooding | Landslide | Windstorm | Drought**

Each City-Specific Hazard Analysis includes information on previous occurrences, local conditions, hazard assessment, and local impacts.

### Part III: Mitigation Strategies

**Mitigation Strategies**

Documents the goals, community capabilities, and priority setting methods supporting the Plan. Also highlights the Mitigation Actions Matrix: 1) goals met; 2) identification, assignment, timing, and funding of mitigation activities; 3) benefit/cost/priorities; 4) plan implementation method; and 5) activity status.

**Plan Maintenance**

Establishes tools and guidelines for maintaining and implementing the Mitigation Plan.

### Part IV: Appendix

The plan appendices are designed to provide users of the Mitigation Plan with additional information to assist them in understanding the contents of the mitigation plan, and potential resources to assist them with implementation.

**General Hazard Overviews**

Generalized subject matter information discussing the science and background associated with the identified hazards.

**Attachments**

FEMA Letter of Approval, City Council Resolution, City Council Staff Report, Planning Team sign-in sheets, email invitations and recipient information, and notices to the public.

**References**
Bibliographic listing of sources used in the Mitigation Plan.

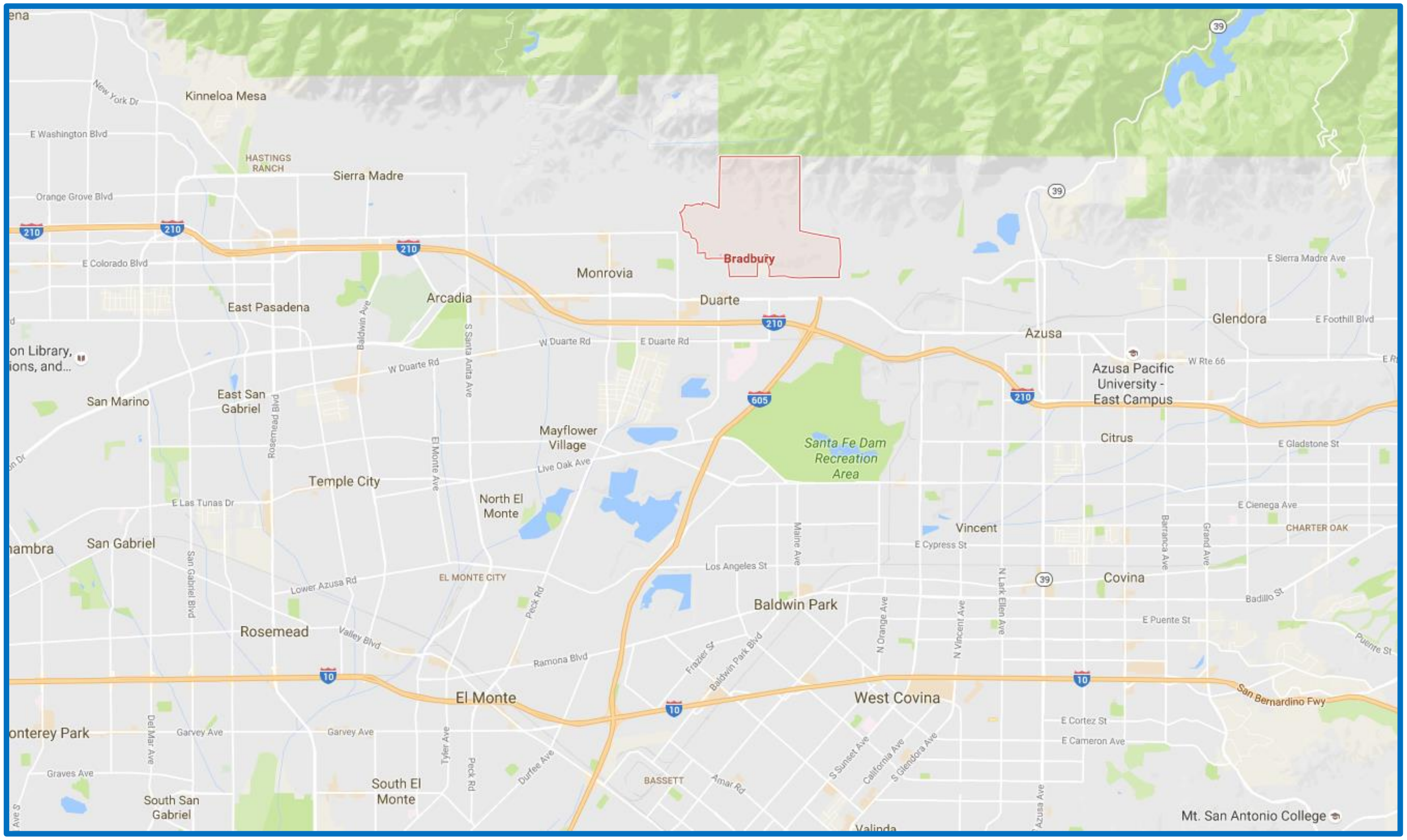
## Plan Adoption and Approval

As per DMA 2000 and supporting Federal regulations, the Mitigation Plan is required to be adopted by the City Council and approved by FEMA. See the **Planning Process Section** for details.

## Who Does the Mitigation Plan Affect?

This plan provides a framework for planning for natural hazards. The resources and background information in the plan are applicable City-wide and to City-owned facilities outside of the City boundaries, and the goals and recommendations provide groundwork for local mitigation plans and partnerships. **Map: City of Bradbury** shows the regional proximity of the City to its adjoining communities.

**Map: City of Bradbury**
**(Source: Google Maps)**



# Planning Process

Throughout the project, the City followed its traditional approach to developing policy documents which included preparation of a First Draft Plan for review by the City's Hazard Mitigation Planning Team. Next, following necessary updates, a Second Draft Plan was shared with the rest of the City staff (new City Manager, contracted City Engineer), the community, and external agencies (special districts and adjoining jurisdictions) during the plan writing phase. Next, comments from the staff, community, and external agencies were incorporated into a Third Draft Plan which was submitted to Cal OES and FEMA along with a request for an "approval pending adoption".

Next, the Planning Team completed mandated amendments to the Plan to reflect input by Cal OES and FEMA during the review phase. The Fourth Draft Plan and agenda were then posted in advance of the City Council public meeting for plan adoption. Comments gathered in advance of the public meeting were incorporated into the City Council Staff Report. Following adoption by the City Council, the Final Draft Plan was re-submitted to FEMA with a request for final approval. This narrative is portrayed below in a timeline:

**Q&A | ELEMENT A: PLANNING PROCESS | A1a.**

**Q:** Does the plan document the planning process, including how it was prepared (with a narrative description, meeting minutes, sign-in sheets, or another method)?

**A:** See **Plan Methodology and Planning Phases Timeline** below.

**Q&A | ELEMENT A: PLANNING PROCESS | A3**

**Q:** Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))

**A:** See **Planning Phases Timeline** below.

**Figure: Planning Phases Timeline**

| PLANNING PHASES TIMELINE | | | | |
|---|---|---|---|---|
| **Plan Writing Phase (First & Second Draft Plan)** | **Plan Review Phase (Third Draft Plan)** | **Plan Adoption Phase (Fourth Draft Plan)** | **Plan Approval Phase (Final Draft & Final Plan)** | **Plan Implementation Phase** |
| • Planning Team input – research, meetings, writing, review of First Draft Plan<br>• Incorporate input from the Planning Team into Second Draft Plan<br>• Invite all City staff, community, and external agencies to contribute to the Second Draft Plan. | • Third Draft Plan incorporating input was sent to Cal OES and FEMA for Approval Pending Adoption<br>• Address any mandated revisions identified by Cal OES and FEMA | • Post notice and Final Draft Plan in advance of City Council public meeting.<br>• Incorporate any comments into City Council Staff Report<br>• Present Final Draft Plan to the City Council<br>• City Council Adopted Plan<br>• Incorporate input from City Council public meeting into Final Draft Plan | • Submit Final Draft Plan to FEMA with request for final approval<br>• Receive FEMA approval<br>• Incorporate FEMA approval into the Final Plan | • Conduct quarterly Planning Team meetings<br>• Integrate mitigation action items into budget, CIP and other funding and strategic documents |

## Plan Methodology

DMA 2000 emphasizes the importance of participatory planning in the development of Mitigation Plans. This Mitigation Plan was written using the best available information from a wide variety of sources.

Throughout the planning process, the City made a concerted effort to gather information from City and County departments, as well as state and federal agencies, the local business community, City of Bradbury residents, and other stakeholders.

On February 19, 2019, staff presented the Mitigation Plan to the City Council for adoption. A copy of City Council Resolution No. 19-03 adopting the Mitigation Plan and FEMA's Letter of Approval dated February 21, 2019 both appear in the **Appendix**.

The rest of this section describes the mitigation planning process including 1) Planning Team involvement, 2) public and external agency involvement; and 3) integration of existing data and plans.

**Q&A | ELEMENT A: PLANNING PROCESS | A1a.**

**Q:** Does the plan document the planning process, including how it was prepared (with a narrative description, meeting minutes, sign-in sheets, or another method)? (Requirement §201.6(c)(1))

**A:** See **Table: Planning Team Involvement and Level of Participation** below.

## Planning Team Involvement

The Planning Team consisted of representatives from City of Bradbury departments related to hazard mitigation processes. The Planning Team served as the primary stakeholders throughout the planning process. The City staff, community, and external agencies served as secondary stakeholders in the planning process. The Planning Team was responsible for the following tasks:

- ✓ Confirming planning goals
- ✓ Prepare timeline for plan update
- ✓ Ensure plan meets DMA 2000 requirements
- ✓ Organize and solicit involvement of public and external agencies
- ✓ Analyze existing data and reports
- ✓ Prepare HAZUS loss projection estimates
- ✓ Participate in Planning Team meetings and City Council public meeting

The Planning Team, with assistance from Emergency Planning Consultants, identified and profiled hazards; determined hazard rankings; estimated potential exposure or losses; evaluated development trends and specific risks; and developed mitigation goals and action items.

**Table: Planning Team Level of Participation**

| Name | Research and Writing of Plan | Planning Team Meeting 5/31/16 | Planning Team Meeting 7/7/2016 | Planning Team Meeting 8/25/2016 | Planning Team Review and Comment on First Draft Plan | Incorporate input from general public, and external agencies of the Second Draft Plan | Submit Third Draft Plan to Cal OES/FEMA for Approval Pending Adoption | Post Final Draft Plan prior to City Council public meeting | Present Final Draft Plan to City Council at Public Meeting for Plan Adoption | Submit City Council Resolution to FEMA for Final Approval | Incorporate FEMA Approval into Final Plan |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Planning Team** | | | | | | | | | | | |
| Julio Donayre, Planning Team Chair (Former) | | X | X | X | X | | | | | | |
| Ryan Parker, Planning Team Chair (Former) | | | | | X | | | | | | |
| Anne Browning McIntosh | | X | | X | X | | | | | | |
| Kevin Kearney, Planning Team Chair | | | | | | | X | X | X | | |
| Scarlett Santos Leon | | | | | | | X | X | X | | |
| **Emergency Planning Consultants** | | | | | | | | | | | |
| Carolyn J. Harshman | X | X | X | X | | X | X | | X | X | X |

### Table: Planning Team Timeline

| | May 2016 | June | July | August | September | October-December | January 2017 | February-May | May | June | July | August | September-December | January 2018 | February-December | January 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Research and Writing of First Draft Plan | X | | X | X | | | | | | | | | | | | |
| Planning Team Meetings | X | | X | X | | | | | | | | | | | | |
| Planning Team Input on First Draft Plan | | | | X | X | X | X | X | | | | | | | | |
| Second Draft Plan incorporated comments from the Planning Team. Solicit input from City staff, community, and external agencies of the Second Draft Plan | | | | | | | | | X | X | | | | | | |
| Third Draft incorporated input from the Second Draft Plan. Submit Third Draft Plan to Cal OES/FEMA for Approval Pending Adoption | | | | | | | | | | | | X | | | | |
| Incorporate mandated amendments into Third Plan | | | | | | | | | | | | | | | X | |
| Notice and post Final Draft Plan prior to City Council meeting | | | | | | | | | | | | | | | X | |
| Present Final Draft Plan to City Council at public meeting for adoption | | | | | | | | | | | | | | | | X |
| Submit Resolution to FEMA for Final Approval | | | | | | | | | | | | | | | | X |
| Incorporate FEMA Approval into Final Plan | | | | | | | | | | | | | | | | X |

**Q&A | ELEMENT A: PLANNING PROCESS | A2a.**

**Q:** Does the plan document an opportunity for 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 to be involved in the planning process? (Requirement §201.6(b)(2))

**A:** See **General Public and External Agency Involvement** below.

**Q&A | ELEMENT A: PLANNING PROCESS | A2b.**

**Q:** Does the plan document an opportunity for 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 to be involved in the planning process? (Requirement §201.6(b)(2))

**A:** See **General Public and External Agency Involvement** below.

## General Public and External Agency Involvement

The Planning Team members provided data and expertise during plan writing phase. This effort was supplemented through the assistance of the City staff, community, and external agencies (special districts and adjoining jurisdictions) during the plan writing phase. The City posted public notices announcing the availability of the Second Draft Plan on its website and other customary posting locations. Copies of the postings are located in the **Appendix**. The postings directed the general public to the City's website where the Second Draft Plan was available for download along with a request to submit input directly to the Chair of the Planning Team.

City staff and external agencies listed below were invited via email and provided with an electronic link to the Second Draft Plan on the City's website. Following is the email distributed along with the invitation to comments.

### Table: Email to External Agency Representatives

Hello,

The City of Bradbury is pleased to release the draft of Bradbury's Hazard Mitigation Plan.

So that you are aware, the Hazard Mitigation Plan provides guidance on mitigating possible disasters, such as earthquakes, wildfire, mudslides, and other major disasters. Disasters can result in loss of life, property and infrastructure. In order to prevent or lessen the loss caused by disasters, the Hazard Mitigation Plan helps communities by assessing vulnerabilities and identifying actions to reduce those risks.

The reason you are receiving this notice is because you have been identified as a stakeholder in the City's emergency response community. Before the plan can be finalized, the City is requesting feedback from external stakeholders. It would be greatly appreciated if you could review the plan and provide feedback that could possibly be incorporated to the final plan.

The plan will remain available on the City website until July 14, 2017.

Please click here to view the plan.

If you have any questions or would like to add feedback please contact me at: Rparker@cityofbradbury.org or 626-358-3218

Best,

Based on feedback received from Cal OES and FEMA, mandated amendments were completed, and a Fourth Draft Plan was created. Customary posting including the City's website was completed in advance of the City Council public meeting. Any comments gathered prior to the City Council meeting were incorporated into the City Council Staff Report.

### Table: Input from City Staff, Community, and External Agencies During Plan Writing Phase

| Name | Position Title | Agency | Input |
|---|---|---|---|
| **City Staff** | | | |
| Bruce Inman | City Manager (Former) | City of Bradbury | Minor grammatical corrections |
| Dave Gilbertson | City Engineer (Contracted) | City of Bradbury | Clarified who serves as Floodplain Administrator |
| **Community** | | | |
| | | | None |
| **External Agencies** | | | |
| Diana Manzano | Coordinator | DMAC Area D | None |
| Jim Enriquez | Chief | LA Fire Dept. | None |
| Alicia Mejia | Assistant to Chief | LA Fire Dept. | None |
| Thomas McNeal | Lieutenant | Sheriffs | None |
| Karen Herrera | Deputy CM | City of Duarte | None |
| Brian Villalobos | Public Safety | City of Duarte | None |
| Allan Mucerino | Superintendent | Duarte Unified | None |
| Janice Kolodinski | Principal | Royal Oaks Elementary | None |

| | | | |
|---|---|---|---|
| Ron Pelham | Division Chief | City of Monrovia | None |
| Jeremy Sanchez | Division Chief | City of Monrovia | None |
| Louie Romero | Representative | Cal Am Water | None |
| Joshua Torres | Representative | Edison Company | None |
| Bob Cruz | Representative | Gas Company | None |

***Other than minor comments gathered from City staff not involved on the Planning Team, no other comments were gathered from the community or external agencies during the plan writing phase.***

**Q&A | ELEMENT C. MITIGATION STRATEGY | C1a.**

**Q:** Does the plan document each jurisdiction's existing authorities, policies, programs and resources? (Requirement §201.6(c)(3))

**A:** See **Capability Assessment – Existing Processes and Programs** below.

## Capability Assessment – Existing Processes and Programs

The City will incorporate mitigation planning as an integral component of daily operations. This will be accomplished by the Planning Team working with their respective departments to integrate mitigation strategies into the planning documents and operational guidelines within the City. In addition to the Capability Assessment below, the Planning Team will strive to identify additional policies, programs, practices, and procedures that could be created or modified to address mitigation activities.

**Table: Capability Assessment - Existing Processes and Programs**

| Resource Type | Resource Name | Ability to Support Mitigation |
|---|---|---|
| Personnel | City Manager's Office | *The City Manager is appointed by the City Council. The City Manager is responsible for advising the Council on the needs of the City, carrying out Council policies, and administering the personnel, financial affairs and the day-to-day functions of the municipal corporation.* |
| Personnel | City Clerk | *The appointed City Clerk is responsible to the electorate for keeping a complete and accurate record of City Council proceedings, maintaining official City records, and conducting municipal elections in accordance with state and federal law. The City Clerk stores and indexes official documents and City records for retrieval, administers Conflict of Interest disclosures and Campaign Disclosures Statements filed under the Political Reform Act, and is the custodian of the seal of the City.* |
| Personnel | City Attorney | *The City Attorney is appointed by the City Council. The City Attorney is the primary legal advisor to the City Council, its Commissions and City staff. Major activities include providing accurate legal advice and direction to ensure that the City's operations conform to all federal, state, and City laws, as well as representing the City in legal proceedings. The City Attorney also* |

| Resource Type | Resource Name | Ability to Support Mitigation |
|---|---|---|
| | | *serves as the City Prosecutor when necessary. These services are provided on a contract basis by an outside legal firm. Requests for City Attorney opinions and advice are funneled through the City Manager.* |
| Personnel | Planning Department | *The City of Bradbury contracts with a City Planner, who oversees all development applications until approved by the Planning Commission and ready for submittal to the Department of Building & Safety. The Planning Department provides direction and leadership in implementing the goals, objectives, and policies of the General Plan as adopted by the City Council. The Department is also responsible for the orderly development of the City and the administration of various land use regulations, including the zoning code, design guidelines and is the staff liaison to the Planning Commission.* |
| Personnel | Department of Building & Safety | *The City of Bradbury's Building Department is responsible for the implementation and enforcement of City and State codes relating to the construction, remodeling, alteration, repair and demolition of buildings and structures located within the City. To ensure that work complies with the various codes, the City requires permits, inspections and approval of the work.* |
| Personnel | Law Enforcement | *Law enforcement services are outsourced to the Los Angeles County Sheriff's Department.* |
| Personnel | Hazard Mitigation Planning Team | *Hazard Mitigation Planning Team is made up of representatives from each of the department assigned mitigation action items in the Hazard Mitigation Plan. In addition to responsibility to prepare each of the 5-year plan updates as required by FEMA, the Planning Team is responsible for implementing, monitoring, and evaluating the plan during its quarterly meetings. The Planning Team plays a pivotal role in writing, implementing, and funding mitigation action items.* |
| Personnel | Fire Services | *Fire related services are outsourced to Los Angeles County Fire Department.* |
| Personnel | Code Enforcement | *The City of Bradbury's Code Enforcement Officer is empowered by the State of California to enforce local, County and State statutes adopted by the City or assigned to them. The City responds to anonymous complaints, neighborhood complaints, complaints via email and telephone complaints, in addition to performing routine patrol to locate violations.* |
| Personnel | Engineering | *The City of Bradbury contracts with RKA Consulting Group for City Engineer services. The City Engineer provides for the design, plan check, construction, and construction inspection of all infrastructure constructed within the public right-of-way and on city-owned property and coordinates National Pollution Discharge Elimination System requirements with Los Angeles County, Regional Water Quality Control Board, residents, developers and City staff.* |
| Plans | Emergency Operations Plan | *Emergency Operations Plan is a reference and guidebook to operations during a major emergency impacting Bradbury. The* |

| Resource Type | Resource Name | Ability to Support Mitigation |
|---|---|---|
| | | *Plan includes a discussion on a wide range of hazards, organization and staffing of the Emergency Operations Center, and connectivity with field responders and external agencies. The Emergency Operations Plan is an excellent source of hazard information for the Hazard Mitigation Plan.* |
| Plans | Hazard Mitigation Plan | *The City's Hazard Mitigation Plan identifies the risks from natural hazards present in the community and includes strategies to reduce these risks. Updates to the Plan are coordinated with the hazard information and mitigation activities identified in the County of Los Angeles HMP as well as the HMP for the State of California in order to ensure a more consistent and unified approach to hazard mitigation.* |
| Plans | General Plan | *General Plan outlines long-term direction for development and policy in Bradbury. There are opportunities to coordinate local hazard mitigation actions with policies governed by the General Plan. Next update to General Plan Safety Element should include integration with the Hazard Mitigation Plan. Also, General Plan is an excellent resource to assist with implementing many of the mitigation action items identified in the Hazard Mitigation Plan.* |
| Plans | Storm Water Ordinance | *The City Engineer is responsible for managing the City's Storm Water Ordinance and to ensure compliance with the NPDES permit issued by the Regional Water Quality Control Board under the authority of the Environmental Protection Agency. This program includes eliminating the source of any illegal dumping or discharge of material or liquids which can end up on the City streets and then in the storm drain system and ultimately in the open ocean waters.* |
| Policy | Zoning Ordinance | *Zoning Ordinance implements the City's General Plan by establishing specific regulations for development. It includes standards for where development can be located, how buildings must be sized, shaped, and positioned, and what types of activities can occur in an area. Hazard mitigation actions that pertain to new or substantially redeveloped buildings can be adopted into the Zoning Ordinance.* |
| Policy | Building Code | *Building Code specifies how new structures can be built. It includes the California Building Code, in addition to any amendments made by the City. Mitigation actions may involve amending the Building Code to improve a building's safety or structural stability.* |

**Q&A | ELEMENT A: PLANNING PROCESS | A4**

**Q:** Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))

**A:** See **Use of Existing Data** below.

## Use of Existing Data

The Planning Team gathered and reviewed existing data and plans during plan development. Numerous electronic and hard copy documents were used to support the planning process. Any time existing data, knowledge, and maps were used in the plan, they are noted as "Source:" in the Plan. Following are the data sources and location of citations:

**City of Bradbury General Plan and Elements (Circulation, Housing, Land Use, Safety)**
www.cityofbradbury.org
*Applicable Incorporation: Land Use map, Community Profile section – geography, environmental, population, housing, transportation and demographic data*

**City of Bradbury Emergency Operations Plan**
Provided by City of Bradbury
*Applicable Incorporation: Community Profile information and Hazard Section - landslide*

**County of Los Angeles All-Hazards Mitigation Plan (2014)**
www.lacoa.org
*Applicable Incorporation: Information about hazards in the County contributed to the hazard-specific sections in the City's Mitigation Plan.*

**California State Hazard Mitigation Plan (2013)**
www.caloes.ca.gov
*Applicable Incorporation: Used to identify hazards posing greatest hazard to State.*

**HAZUS Maps and Reports**
Created by Emergency Planning Consultants
*Applicable Incorporation: Numerous HAZUS results have been included for earthquake scenarios to determine specific risk to City of Bradbury.*

**California Department of Finance**
www.dof.ca.gov/
*Applicable Incorporation: Community Profile section – demographic and population data*

**FEMA "How To" Mitigation Series (386-1 to 386-9)**
www.fema.gov/media
*Applicable Incorporation: Mitigation Measures Categories and 4-Step Planning Process are quoted in the Executive Summary.*

**National Flood Insurance Program**
www.fema.gov/national-flood-insurance-program
*Applicable Incorporation: Used to confirm there are no repetitive loss properties within the City*

**Local Flood Insurance Rate Maps**
www.msc.fema.gov
*Applicable Incorporation: Provided by FEMA and included in Flood Hazard section.*

**California Department of Forestry and Fire Protection (CAL FIRE)**
www.fire.ca.gov
*Applicable Incorporation: Wildland fire hazard mapping*

**California Department of Conservation**
www.conservation.ca.gov/cgs
*Applicable Incorporation: Seismic hazards mapping*

**U.S. Geological Survey (USGS)**
www.usgs.gov
*Applicable Incorporation: Earthquake records and statistics*

**Q&A | ELEMENT E: PLAN ADOPTION | E1**

**Q:** Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))

**A:** See **Plan Adoption Process** below.

## Plan Adoption Process

Adoption of the plan by the local governing body demonstrates the City's commitment to meeting mitigation goals and objectives. Governing body approval legitimizes the plan and authorizes responsible agencies to execute their responsibilities.

In preparation for the public meeting with the City Council, the Planning Team prepared a Staff Report including an overview of the Planning Process, Risk Assessment, Mitigation Goals, and Mitigation Actions. The Staff Report concluded with a summary of the input received during the posting period in advance of the public meeting. The meeting participants were encouraged to present their views and make suggestions on possible mitigation actions.

The City Council heard the item on February 19, 2019. The City Council voted to adopt the updated Mitigation Plan with Resolution No. 19-03 which is located in the **Appendix**.

## Plan Approval

On January 4, 2019 FEMA issued an "Approval Pending Adoption". The City immediately scheduled the City Council public meeting to adopt the Plan. Upon receipt of adoption by City Council, FEMA issued a Letter of Approval dated February 21, 2019. The FEMA Letter of Approval is in the **Appendix**.

# Part II: RISK ASSESSMENT

## Community Profile

### Geography and the Environment


According to the 2007 General Plan (Source), the City of Bradbury is a small, residential/equestrian-oriented community of approximately 1.9 square miles (1,216-acres) nestled at the base of the San Gabriel Mountains below Angeles National Forest in Los Angeles County.

According to the 2010 City of Bradbury Emergency Operations Plan (Source), the City has three distinct areas: 1) Bradbury Estates, consisting mostly of 5-acre minimum estates, has a manned gate at its entrance; 2) Woodlyn Lane is also gated- with a keypad for entry- and is characterized by mostly 2-acre lots; 3) the balance of the City is not gated, and has lots generally ranging in size from 7500 square feet to one acre. There is a fairly large population of horses within the City, especially within the gated areas.

The community includes 3.2 miles of public streets and privately owned and maintained roads. Most of the City is zoned for agriculture/residential uses of land on parcels that range in size from 1 to 5 acres. A significant portion of the City (302 acres) is identified as open space, privately owned undeveloped that is subject to development constraints and is presumed to be developed with 16 units on the 8 existing parcels. Other areas of the City are zoned for single-family detached residential development on parcels ranging in size between 7,500 and 20,000 square feet. The City prohibits development other than single-family detached residential dwelling units. The City's location at the base of the foothills provides incredible views of the San Gabriel Valley and downtown City of Los Angeles. Planning and development challenges are created because of the steep slopes, potentially sensitive ecological areas, and natural hazard.

### Climate

According to the General Plan (Source), the City has a moderate climate, including dry summers with an average temperature of about 72°F and cool, wet winters with an average temperature of 51°F.

Although the State of California and the Los Angeles region experienced a multi-year drought, rainfall is now returning to normal. The average annual rainfall for the region is between 14-18 inches. Furthermore, actual rainfall in the Southern California region tends to fall in large amounts during sporadic and often heavy storms rather than consistently over storms at somewhat regular intervals. In short, rainfall in Southern California might be characterized as feast or famine within any single year.

## Population and Demographics

According to the General Plan (Source), in 1957 at the time of Bradbury's incorporation, the City's population was approximately 500 residents. According to the California Department of Finance (2014), the population has grown to 1,082 as of 2014. From 2000 to 2014, the City has experienced an average growth rate of 1.7 percent annually. Similarly, the population of Los Angeles County experienced a growth rate of 0.4 percent per year.

According to the California Department of Finance (2014), the demographic makeup of the City is as follows:

**Table: City of Bradbury Demographics**
**(Source: California Department of Finance, E-5, 2014)**

| Racial/Ethnic Group | 2010 | 2014 | Change | Change % |
|---|---|---|---|---|
| White | 514 | 580 | 66 | 13% |
| Black | 20 | 19 | (1) | -5% |
| American Indian Eskimo | 0 | 0 | 0 | 0% |
| Asian or Pacific Islander | 270 | 245 | (25) | -9% |
| Hispanic | 218 | 210 | (8) | -4% |
| Other | 26 | 28 | 2 | 8% |
| Total | 1,048 | 1,082 | 34 | 3% |

## Housing and Community Development

**Table: City of Bradbury Housing**
**(Source: California Department of Finance, E-5, 2014)**

| 2014 | Number | Percent % |
|---|---|---|
| **Housing Type:** | | |
| 1-unit, detached | 389 | 95.6 % |
| 1-unit, attached | 7 | 1.7 % |
| 2-4 Units | 0 | 0 % |
| 5+ Units | 11 | 2.7 % |
| Mobile homes/Other | 0 | 0 % |
| **Housing Statistics:** | | |
| Total Available Housing Units | 407 | 100 % |
| Owner-Occupied Housing | 256 | 62.9 % |

| 2014 | Number | Percent % |
|---|---|---|
| Renter-Occupied | 151 | 37.1 % |
| **Average Household Size:** | 3.0 persons | |
| **Median Home Price:** | $1,595,000 | |

## Employment and Industry

According to the General Plan's Safety Element, 1993 (Source), the residents of Bradbury are employed in a variety of industries. While the table below identifies 3 persons employed in farming, forestry or fishing industries, City business license records identify at least six (6) farms in the City. Therefore, it is likely that there are additional farm workers residing in the City, working on equestrian farms or orchards. Staff observed that these farm workers either live in second units on the property or in single rooms attached to the house or other accessory buildings.

**Table: City of Bradbury Industry**
**(Source: American Community Survey - 2014)**

| Industry | 2014 | |
|---|---|---|
| | Number | Percent % |
| Agriculture, forestry, fishing and hunting, and mining | 3 | 0.7 % |
| Construction | 33 | 7.9 % |
| Manufacturing | 41 | 9.8 % |
| Wholesale Trade | 31 | 7.4 % |
| Retail Trade | 43 | 10.3 % |
| Transportation and Warehousing, and Utilities | 17 | 4.1 % |
| Information | 12 | 2.9 % |
| Finance and insurance, and real estate and rental and leasing | 34 | 8.2 % |
| Professional, scientific, and management, and administrative and waste management services | 81 | 19.4 % |
| Educational services, and health care and social assistance | 74 | 17.7 % |
| Arts, entertainment, and recreation, and accommodation and food services | 22 | 5.3 % |
| Other services, except public administration | 8 | 1.9 % |
| Public administration | 18 | 4.3 % |

**Table: City of Bradbury Occupation**
**(Source: American Community Survey - 2014)**

| Occupation | 2014 | |
|---|---|---|
| | Number | Percent |
| Civilian employed population (16 years and over) | 417 | 100.0 % |
| Management, business, science, and arts occupations | 264 | 63.3 % |
| Service occupations | 27 | 6.5 % |
| Sales and office occupations | 104 | 24.9 % |
| Natural resources, construction, and maintenance occupations | 18 | 4.3 % |
| Production, transportation, and material moving | 4 | 1.0 % |

## Transportation and Commuting Patterns

According to the General Plan's Circulation Element (Source), the principal regional access to the City is provided by two nearby freeways: San Gabriel River Freeway (Interstate Route 605) and the Foothill Freeway (Interstate Route 210). The nearest freeway access to the City includes the Mount Olive/Huntington Drive ramps at the I-57/I-210 freeway interchange. Vehicles exiting at this location can continue northbound on Mount Olive Drive into Bradbury. Additional freeway access is provided by the Buena Vista Street and Mountain off-ramps on the I-210 freeway.

The principal east-west major roadway that serves the City of Bradbury is Huntington Drive located in the City of Duarte, one-quarter mile to the south. Huntington Drive is a fully improved four-lane highway with a raised, landscaped median and separate left-turn lanes. This highway has an interconnected system of traffic signals which provides and maintains an efficient and reasonable flow of traffic. Royal Oaks Drive, an east-west secondary highway, is located at the City's southerly boundary.

The City of Bradbury does not maintain any fixed transit routes within the City. Fixed route transit is provided by the Metropolitan Transit Authority, through connections in the City of Duarte.

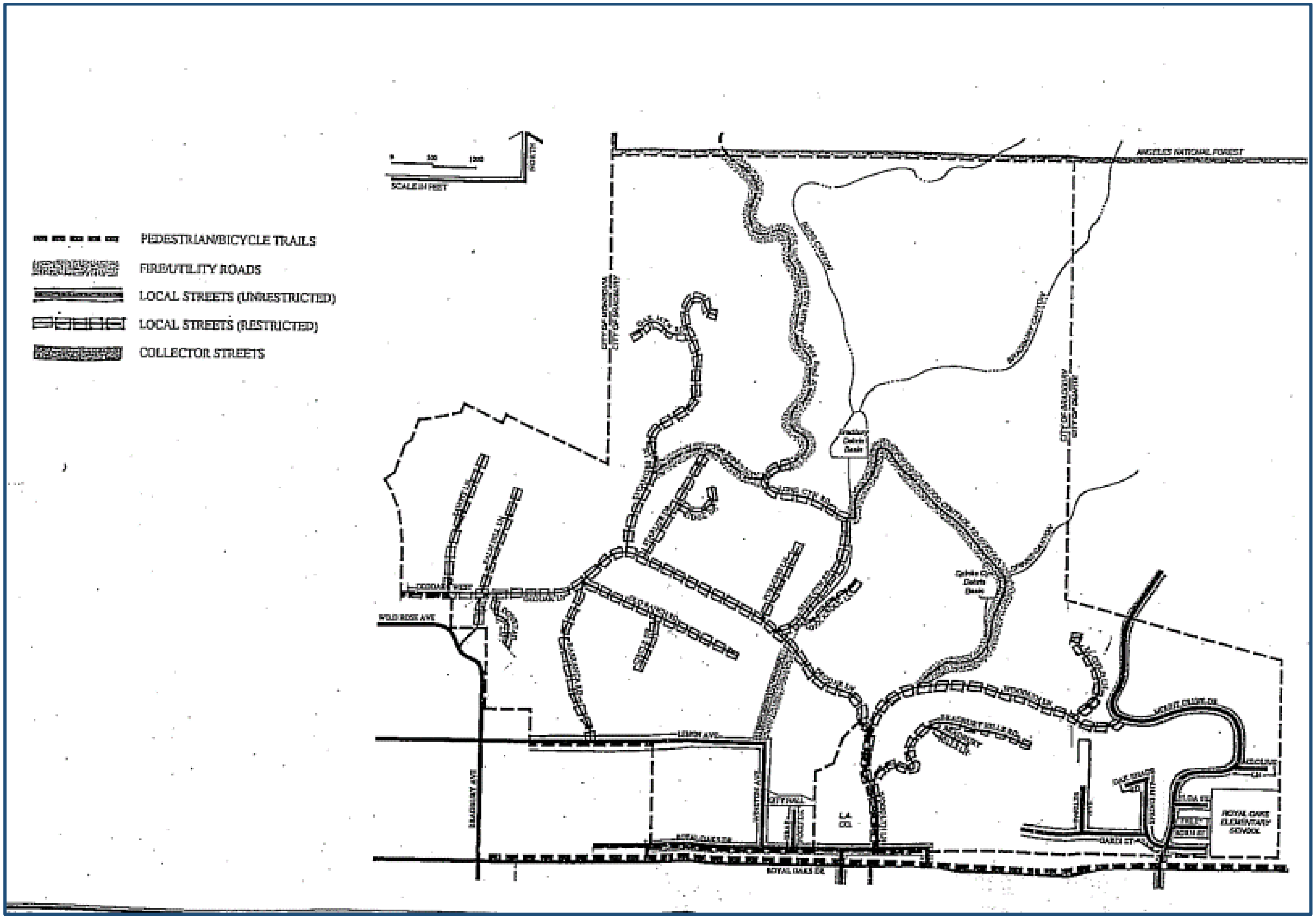
Bicycle riding is permitted and encouraged on City streets. Regional bicycle and pedestrian travel routes exist on the Duarte Bikeway and the San Gabriel River Trail. The Duarte Bikeway is located along the railroad right-of-way between Buena Vista Street and Los Lomas Drive. The San Gabriel River Trail extends from Azusa to Seal Beach.

At present, no freight or passenger rail service is available within Bradbury. The closest railroad facility is the AT&SF tracks and right-of-way located one mile south of the community. Additionally, Metro Gold Line owns the former AT&SF right-of-way. A Gold Line commuter rail station is located nearby in the City of Duarte at the intersection of Duarte Road and Highland Avenue.

Future traffic will not increase significantly over the next 20 years. Under theoretical buildout, only about 50 new homes will be constructed Citywide. This new housing will translate into approximately 500 additional vehicle trips. This represents an increase of about 18% over the existing traffic volumes. The majority of this additional traffic will occur on collector roads.

CITY OF BRADBURY

## Map: Major Roadways
## (Source: City of Bradbury General Plan – Circulation Element 2007)



# Risk Assessment

## What is a Risk Assessment?

Conducting a risk assessment can provide information regarding: the location of hazards; the value of existing land and property in hazard locations; and an analysis of risk to life, property, and the environment that may result from natural hazard events. Specifically, the five levels of a risk assessment are as follows:

1. *Hazard Identification*
2. *Profiling Hazard Events*
3. *Vulnerability Assessment/Inventory of Existing Assets*
4. *Risk Analysis*
5. *Assessing Vulnerability/Analyzing Development Trends*

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1a.**

**Q:** Does the plan include a general **description** of all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Hazard Identification** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1b.**

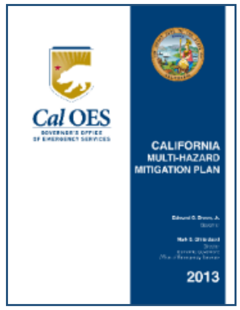
**Q:** Does the plan provide rationale for the omission of any natural hazards that are commonly recognized to affect the jurisdiction(s) in the planning area? (Requirement §201.6(c)(2)(i))

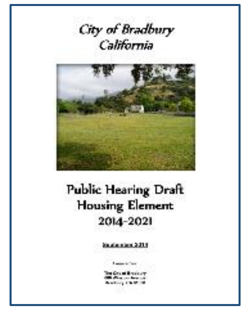
**A:** See **Hazard Identification** below.

### *1) Hazard Identification*

This section is the description of the geographic extent, potential intensity, and the probability of occurrence of a given hazard. Maps are used in this plan to display hazard identification data. ***As a baseline, the Planning Team utilized the categorization of hazards as identified in California's State Hazard Mitigation Plan, including: Earthquakes, Floods, Levee Failures, Wildfires, Landslides and Earth Movements, Tsunami, Climate-Related Hazards, Volcanoes, and Other Hazards (including Droughts)***.

Next, the Planning Team reviewed existing documents to determine which of these hazards posed the most significant threat to the City. In other words, which hazard would likely result in a local declaration of emergency.


The geographic extent of each of the identified hazards was identified by the Planning Team utilizing maps and data contained in the City's General Plan and City's Emergency Operations Plan. In addition, numerous internet resources and the County of Los Angeles All-Hazard Mitigation Plan served as valuable resources. Utilizing the Calculated Priority Risk Index (CPRI) ranking technique, the Planning Team concluded the following hazards posed a significant threat against the City:

**Earthquake | Wildfire | Flooding | Landslide | Windstorm | Drought**

The hazard ranking system is described in **Table: Calculated Priority Risk Index**, while the actual ranking is shown in **Table: Calculated Priority Risk Index Ranking for City of Bradbury**.

**Table: Calculated Priority Risk Index**
**(Source: Federal Emergency Management Agency)**

| CPRI Category | Degree of Risk | | | Assigned Weighting Factor |
|---|---|---|---|---|
| | Level ID | Description | Index Value | |
| Probability | Unlikely | Extremely rare with no documented history of occurrences or events.<br>Annual probability of less than 1 in 1,000 years. | 1 | 45% |
| | Possibly | Rare occurrences.<br>Annual probability of between 1 in 100 years and 1 in 1,000 years. | 2 | |
| | Likely | Occasional occurrences with at least 2 or more documented historic events.<br>Annual probability of between 1 in 10 years and 1 in 100 years. | 3 | |
| | Highly Likely | Frequent events with a well-documented history of occurrence.<br>Annual probability of greater than 1 every year. | 4 | |
| Magnitude/ Severity | Negligible | Negligible property damages (less than 5% of critical and non-critical facilities and infrastructure.<br>Injuries or illnesses are treatable with first aid and there are no deaths.<br>Negligible loss of quality of life. Shut down of critical public facilities for less than 24 hours. | 1 | 30% |
| | Limited | Slight property damage (greater than 5% and less than 25% of critical and non-critical facilities and infrastructure). Injuries or illnesses do not result in permanent disability, and there are no deaths. Moderate loss of quality of life. Shut down of critical public facilities for more than 1 day and less than 1 week. | 2 | |
| | Critical | Moderate property damage (greater than 25% and less than 50% of critical and non-critical facilities and infrastructure). Injuries or illnesses result in permanent disability and at least 1 death. Shut down of critical public facilities for more than 1 week and less than 1 month. | 3 | |
| | Catastrophic | Severe property damage (greater than 50% of critical and non-critical facilities and infrastructure). Injuries and illnesses result in permanent disability and multiple deaths.<br>Shut down of critical public facilities for more than 1 month. | 4 | |
| Warning Time | > 24 hours | Population will receive greater than 24 hours of warning. | 1 | 15% |
| | 12–24 hours | Population will receive between 12-24 hours of warning. | 2 | |
| | 6-12 hours | Population will receive between 6-12 hours of warning. | 3 | |
| | < 6 hours | Population will receive less than 6 hours of warning. | 4 | |
| Duration | < 6 hours | Disaster event will last less than 6 hours | 1 | 10% |
| | < 24 hours | Disaster event will last less than 6-24 hours | 2 | |
| | < 1 week | Disaster event will last between 24 hours and 1 week. | 3 | |
| | > 1 week | Disaster event will last more than 1 week | 4 | |

Table: Calculated Priority Risk Index Ranking for City of Bradbury

| Hazard | Probability | Weighted 45% (x.45) | Magnitude Severity | Weighted 30% (x.3) | Warning Time | Weighted 15% (x.15) | Duration | Weighted 10% (x.1) | CPRI Ranking |
|---|---|---|---|---|---|---|---|---|---|
| Wildfire | 3 | 1.35 | 3 | 0.9 | 4 | 0.6 | 3 | 0.3 | **3.15** |
| Earthquake – San Andreas M8.0 | 3 | 1.35 | 3 | 0.9 | 4 | 0.6 | 1 | 0.1 | **2.95** |
| Earthquake – Sierra Madre M7.2 | 3 | 1.35 | 3 | 0.9 | 4 | 0.6 | 1 | 0.1 | **2.95** |
| Earthquake – Puente Hills M7.5 | 3 | 1.35 | 3 | 0.9 | 4 | 0.6 | 1 | 0.1 | **2.95** |
| Landslide | 2 | .90 | 2 | 0.6 | 4 | 0.6 | 1 | 0.1 | **2.20** |
| Drought | 2 | .90 | 2 | 0.6 | 1 | 0.15 | 4 | 0.4 | **2.05** |
| Windstorm | 3 | 1.35 | 1 | 0.3 | 1 | 0.15 | 2 | 0.2 | **2.00** |
| Flooding | 1 | .45 | 1 | 0.3 | 2 | 0.30 | 1 | 0.1 | **1.15** |

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1c.**

**Q:** Does the plan include a description of the **location** for all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Profiling Hazard Events** below.

## *2) Profiling Hazard Events*

This process describes the causes and characteristics of each hazard and what part of the City's facilities, infrastructure, and environment may be vulnerable to each specific hazard. A profile of each hazard discussed in this plan is provided in the City-Specific Hazard Analysis. **Table: Vulnerability: Location, Extent, and Probability for City of Bradbury** indicates a generalized perspective of the community's vulnerability of the various hazards according to extent (or degree), location, and probability.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1d.**

**Q:** Does the plan include a description of the **extent** for all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Table: Vulnerability: Location, Extent, and Probability for City of Bradbury** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2b.**

**Q:** Does the plan include information on the **probability** of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Table: Vulnerability: Location, Extent, and Probability for City of Bradbury** below.

**Table: Vulnerability: Location, Extent, and Probability for City of Bradbury**

| Hazard | Location (Where) | Extent (How Big an Event) | Probability (How Often) * |
|---|---|---|---|
| Drought | Entire Project Area | Droughts in urban areas vary considerably in scope and intensity. Likely emergency water shortage regulations would restrict such activities as watering of landscape, washing of cars, and other non-safety related activities. The community's reliance on imported water increases its vulnerability to drought. | Possibly |
| Earthquake | Entire Project Area | The Southern California Earthquake Center (SCEC) in 2007 concluded that there is a 99.7 % probability that an earthquake of M6.7 or greater will hit California within 30 years.[1] | Likely |
| Flooding | Unknown - Unmapped | Urban flooding from severe weather. | Unlikely |
| Landslide | Northern Hillside Portions of City | Earthquake-induced and rain-induced landslide events possibly impacting dozens of structures. | Possibly |
| Wildfire | Entire Project Area | Severe FRAP ratings. | Likely |
| Windstorm | Entire Project Area | 50 miles per hour or greater. | Likely |
| * Probability is defined as: Unlikely = 1:1,000 years, Possibly = 1:100-1:1,000 years, Likely = 1:10-1:100 years, Highly Likely = 1:1 year | | | |
| [1] Uniform California Earthquake Rupture Forecast | | | |

### 3) Vulnerability Assessment/Inventory of Existing Assets

A Vulnerability Assessment in its simplest form is a simultaneous look at the geographical location of hazards and an inventory of the underlying land uses (populations, structures, etc.). Facilities that provide critical and essential services following a major emergency are of particular concern because these locations house staff and equipment necessary to provide important public safety, emergency response, and/or disaster recovery functions.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3a.**

**Q:** Is there a description of each hazard's **impacts** on each jurisdiction (what happens to structures, infrastructure, people, environment, etc.)? (Requirement §201.6(c)(2)(ii))

**A:** See **Critical and Essential Facilities** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3b.**

**Q:** Is there a description of each identified hazard's overall **vulnerability** (structures, systems, populations, or other community assets defined by the community that are identified as being susceptible to damage and loss from hazard events) for each jurisdiction? (Requirement §201.6(c)(2)(ii))

**A:** See **Critical and Essential Facilities** below.

## Critical and Essential Facilities

FEMA categorizes critical facilities into two (2) groups: essential facilities and high potential loss facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

**Table: Critical Facilities Vulnerable to Hazards** illustrates the hazards with potential to impact essential and high potential loss facilities within or providing services to Bradbury.

**Table: Critical and Essential Facilities Vulnerable to Hazards**

| Type and Name of Facility | Earthquake | Wildfire | Flooding | Landslide | Windstorm | Drought |
|---|---|---|---|---|---|---|
| **Santa Teresita Hospital (not owned by City)**<br>819 Buena Vista Street | X | | | | X | X |
| **City Hall**<br>600 Winston Avenue | X | X | | X | X | X |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Royal Oaks Elementary School (not owned by City)**<br>2499 Royal Oaks Drive | X | X | | X | X | X |
| **Los Angeles County Fire Department – Fire Station #44 (not owned by City)**<br>1105 Highland Avenue, Duarte | X | | | | | X |
| **Los Angeles County Sheriff's Department – Temple Station (not owned by City)**<br>8838 E. Las Tunas Dr., Temple City | X | | X | | | X |

## *4) Risk Analysis*

Estimating potential losses involves assessing the damage, injuries, and financial costs likely to be sustained in a geographic area over a given period of time. This level of analysis involves using mathematical models. The two measurable components of risk analysis are magnitude of the harm that may result and the likelihood of the harm occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. For each hazard where data was available, quantitative estimates for potential losses have been included in the hazard assessment. Data was not available to make vulnerability determinations in terms of dollar losses for all of the identified hazards. The **Mitigation Actions Matrix** includes an action item to conduct such an assessment in the future.

## *5) Assessing Vulnerability/ Analyzing Development Trends*

This step provides a general description of City facilities and contents in relation to the identified hazards so that mitigation options can be considered in land use planning and future land use decisions. This Mitigation Plan provides comprehensive description of the character of the City of Bradbury in the **Community Profile Section**. This description includes the geography and environment, population and demographics, land use and development, housing and community development, employment and industry, and transportation and commuting patterns. Analyzing these components of the City of Bradbury can help in identifying potential problem areas and can serve as a guide for incorporating the goals and ideas contained in this mitigation plan into other community development plans.

Hazard assessments are subject to the availability of hazard-specific data. Gathering data for a hazard assessment requires a commitment of resources on the part of participating organizations and agencies. Each hazard-specific section of the plan includes a section on hazard identification using data and information from City, County, state, or federal sources.

Regardless of the data available for hazard assessments, there are numerous strategies the City can take to reduce risk. These strategies are described in the action items detailed in the Mitigation Actions Matrix in the **Mitigation Strategies Section**. Mitigation strategies can further reduce disruption to critical services, reduce the risk to human life, and alleviate damage to personal and public property and infrastructure.

## Land and Development

The General Plan provides the framework for the growth and development of the City. This Plan is one of the City's most important tools in addressing environmental challenges including transportation and air quality; growth management; conservation of natural resources; clean water and open spaces.

According to the General Plan's Land Use Element (Source), the City is predominantly a residential community with no land set aside for commercial or industrial development. The southern two-thirds of the City have been subdivided with the remaining one-third of the City to the north consisting of hillsides located at the base of the San Gabriel Mountains. Those areas of the City developed as residential typically consist of lots ranging in size between one and five acres. Development densities in these areas are low largely because of the topography, lack of infrastructure, and other development constraints.

**Q&A | ELEMENT D: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION | D1**

**Q:** D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))

**A:** See **Changes in Development** below.

### *Changes in Development*

This section is intended to discuss land and overall development since the writing of the 2007 Mitigation Plan as well as planned potential development, or conditions that may affect the risks and vulnerabilities (e.g. addition of high-risk industrial uses). Since the adoption of the 2007 Mitigation Plan, there have been no significant alterations to the land use designations or development pattern of the City in the hazard areas.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3a.**

**Q:** Is there a description of each hazard's **impacts** on each jurisdiction (what happens to structures, infrastructure, people, environment, etc.)? (Requirement §201.6(c)(2)(ii))

**A:** See **Impacts to Types of Land Uses** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3b.**

**Q:** Is there a description of each identified hazard's overall **vulnerability** (structures, systems, populations, or other community assets defined by the community that are identified as being susceptible to damage and loss from hazard events) for each jurisdiction? (Requirement §201.6(c)(2)(ii))

**A:** See **Impacts to Types of Land Uses** below.

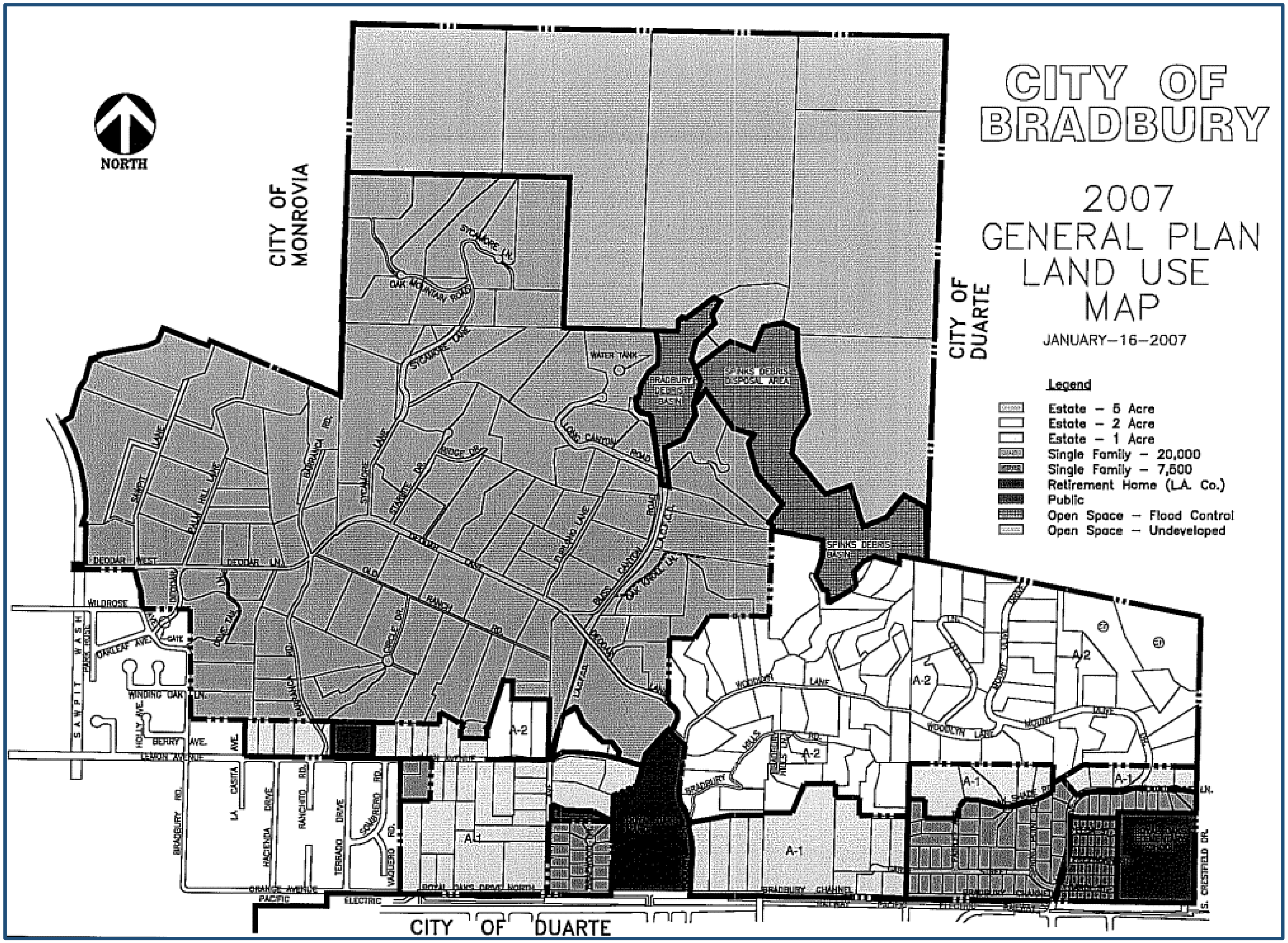
## Impacts to Types of Land Uses

City of Bradbury's General Plan identifies primarily residential land uses with other land uses consisting of open space and miscellaneous public uses. For purposes of analysis, the residential uses have been placed into categories of lot size which correspond to the Zoning Ordinance designations.

**Table: Impacts to Existing and Future Land Uses in the City of Bradbury**
**(Source: EPC Analysis Based on City of Bradbury General Plan – Land Use Element - 1993)**

| Category of Land Use Designation | Acres (Area) | Percent of Total | Earthquake | Wildfire | Flooding | Landslide | Windstorm | Drought |
|---|---|---|---|---|---|---|---|---|
| Estate – 5 Acre | 517 | 41% | X | X | | X | X | X |
| Estate (Hillside) – 5 Acre | 316 | 25.1% | X | X | | X | X | X |
| Estate – 2 Acre | 196 | 15.6% | X | X | | X | X | X |
| Estate – 1 Acre | 109 | 8.7% | X | X | | X | X | X |
| Single-Family 20,000 sq. ft. | 54 | 3.3% | X | X | | | X | X |
| Single-Family 7,500 sq. ft. | 7 | 0.5% | X | X | | | X | X |
| Public | 4 | 0.3% | X | X | | | X | X |
| Open Space | 55 | 4.5% | X | X | | X | X | X |

## Map: Land Use Map
## (Source: City of Bradbury General Plan – Land Use Element, 1993)



# Earthquake Hazards

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2a.**

**Q:** Does the plan include information on **previous occurrences** of hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Previous Occurrences of Earthquakes in the City of Bradbury** below.

## Previous Occurrences of Earthquakes in the City of Bradbury

The following earthquake events significantly impacted the region surrounding the City of Bradbury.

In January 1994, the magnitude 6.7 Northridge Earthquake (thrust fault) which produced severe ground motion, caused 57 deaths, 9,253 injuries and left over 20,000 displaced. Scientists have stated that such devastating shaking should be considered the norm near any large thrust earthquake. Recent reports from scientists of the U.S. Geological Survey and the Southern California Earthquake Center say that the Los Angeles Area could expect one earthquake every year of magnitude 5.0 or more for the foreseeable future.

Since the adoption of the 2007 Mitigation Plan, there have been no significant earthquake events in the City of Bradbury.

## Previous Occurrences of Earthquakes in Los Angeles County

Southern California has a history of powerful and relatively frequent earthquakes, dating back to the powerful magnitude 8.0+ 1857 San Andreas Earthquake which did substantial damage to the relatively few buildings that existed at the time.

Paleoseismological research indicates that large magnitude (8.0+) earthquakes occur on the San Andreas Fault at intervals between 45 and 332 years with an average interval of 140 years. Other lesser faults have also caused very damaging earthquakes since 1857. Notable earthquakes include the 1933 Long Beach Earthquake, the 1971 San Fernando Earthquake, the 1987 Whittier Earthquake and the 1994 Northridge Earthquake.

| Q&A \| ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT \| B1a. |
|---|
| **Q:** Does the plan include a general **description** of all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i)) |
| **A:** See **Local Conditions** below. |

| Q&A \| ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT \| B3b. |
|---|
| **Q:** Is there a description of each identified hazard's overall **vulnerability** (structures, systems, populations, or other community assets defined by the community that are identified as being susceptible to damage and loss from hazard events) for each jurisdiction? (Requirement §201.6(c)(2)(ii)) |
| **A:** See **Local Conditions** below. |

## Local Conditions

According to the General Plan's Safety Element, 1993 (Source), the City lies within a metropolitan area that has historically been seismically active. Faults are prevalent throughout California and are commonly classified as either "active" or "potentially active." An active fault is a break that has moved in recent geologic time (the last 11,000 years) and that is likely to move within the next approximately 100 years. Active faults are the primary focus of concern in attempting to prevent earthquake hazards. A potentially active fault is one that has shifted but not in the recent geologic period (or, between 11,000 and 3,000,000 years ago) and is therefore considered dormant or unlikely to move in the future.

Several active faults have been identified within close proximity or within the City boundaries which, most importantly, indicates that the community falls under the State Earthquake Fault Zoning Act and the State Hazards Mapping Act. These Acts require that local governments, in the general plan update process, adopt policies and criteria to ensure the structural adequacy of buildings erected across active faults for human occupancy. In some cases, the development of structures must be prohibited.

Earthquakes that could affect the City would most likely originate from the San Andreas, Sierra Madre, and Puente Hills Faults. These faults are close enough in proximity or expected to generate strong enough shaking that could affect the City.

### *San Andreas Fault Zone*

The San Andreas Fault Zone is located approximately 24 miles north of the City of Bradbury. This fault zone extends from the Gulf of California northward to the Cape Mendocino area where it continues northward along the ocean floor. The total length of the San Andreas Fault Zone is approximately 750 miles. The activity of the fault has been recorded during historic events, including the 1906 (M8.0) event in San Francisco and the 1857 (M7.9) event between Cholame and San Bernardino, where at least 250 miles of surface rupture occurred. These seismic events are among the most significant earthquakes in California history. Geologic evidence suggests that the San Andreas Fault has a 50 percent chance of producing a magnitude 7.5 to 8.5 quake (comparable to the great San Francisco earthquake of 1906) within the next 30 years.

### *Sierra Madre Fault Zone*

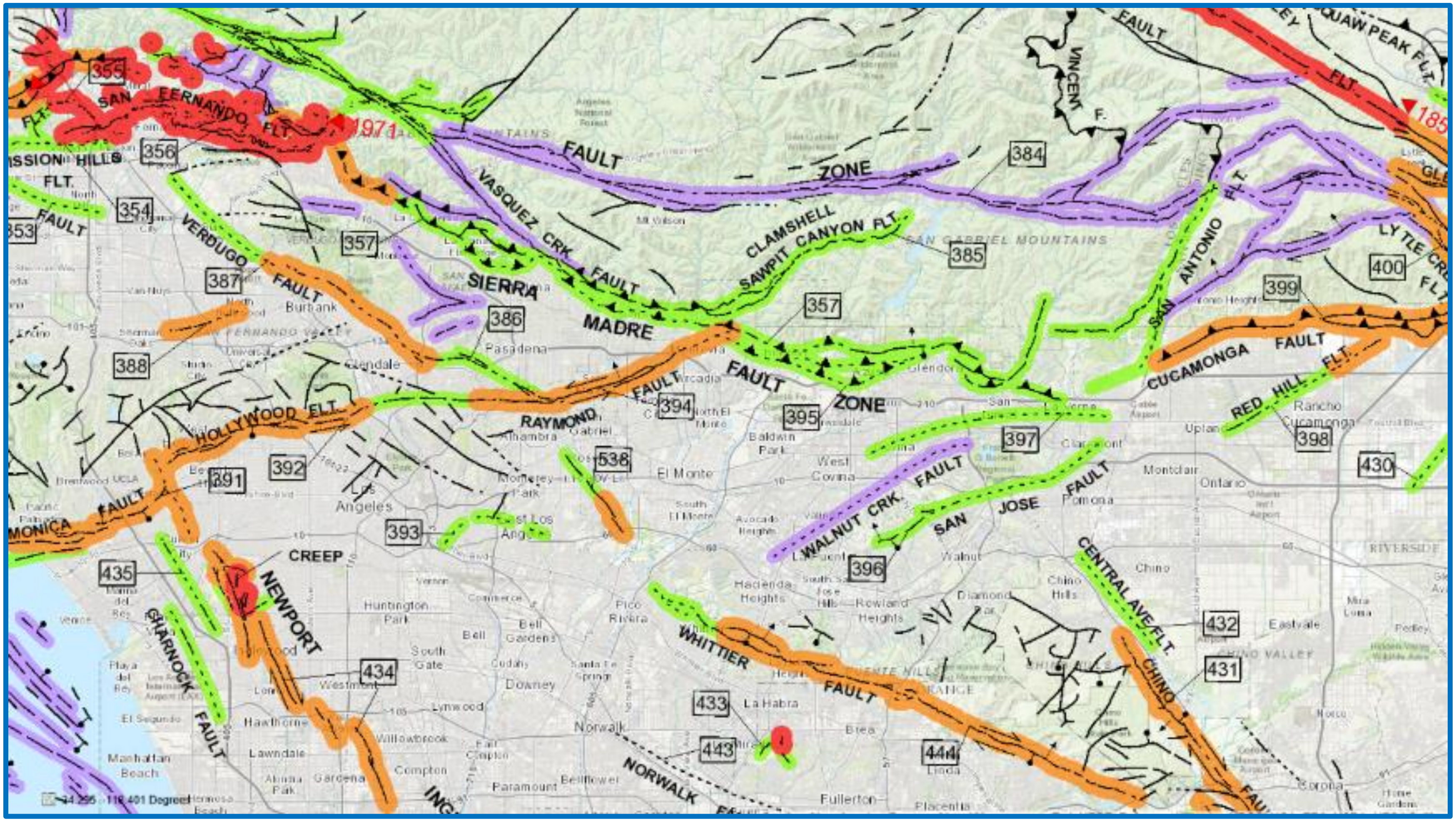
The City of Bradbury is bisected by the Sierra Madre Fault Zone. This fault zone is a series of moderate angle, north-dipping, reverse faults (thrust faults). Movement along these frontal faults has resulted in the uplift of the San Gabriel Mountains. According to the Southern California Earthquake Data Center, rupture on the Sierra Madre fault zone (theoretically) could be limited to one segment at a time, it has recently been suggested that a large event on the San Andreas Fault to the north (like that of 1857) could cause simultaneous rupture on reverse faults south of the San Gabriel Mountains – the Sierra Madre Fault Zone being a prime example of such. Whether this could rupture multiple Sierra Madre Fault Zone segments simultaneously is unknown. Seismic activity on the Sierra Madre Fault is expected to have a maximum magnitude of 7.2.

### *Puente Hills Fault*

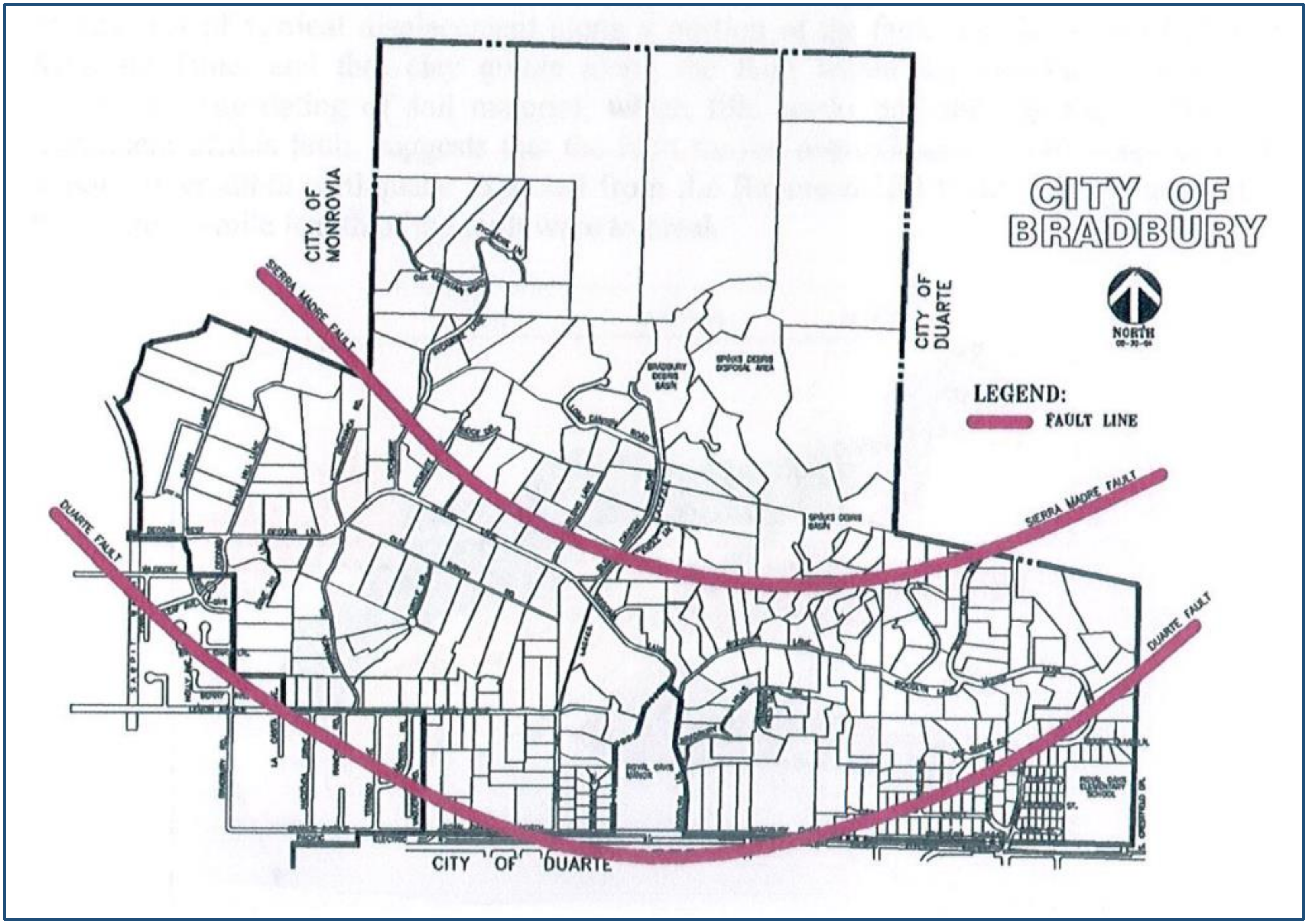
The Puente Hills Fault is located approximately 10 miles south of the City. According to USGS, the Puente Hills Fault was most recently responsible for the M5.1 La Habra earthquake on March 28, 2014 which caused an estimated $2.6 million in damage. The USGS estimates that a future, larger M7.5 earthquake along the Puente Hills Fault could kill 3,000 to 18,000 people and cause up to $250 billion in damage. In contrast, a larger M8.0 quake along the San Andreas would cause an estimated 1,800 deaths.

**Map: Regional Faults** plots the various major faults located closest to the City of Bradbury. Additionally, the City of Bradbury has two earthquake faults within the City limits as indicated on **Map: Local Faults**. The Sierra Madre Fault extends through the major portion of Bradbury along the base of the San Gabriel Mountains. This fault is clearly exposed in some areas of the San Gabriel Valley, with a reverse movement. The Duarte Fault extends across the southern portion of Bradbury and bisects an unincorporated County island. The existence of the Duarte Fault is determined by a groundwater barrier which could be a possible extension of the Sierra Madre Fault Zone to the north.

**Map: Regional Faults**
**(Source: California Department of Conservation)**



## Map: Local Faults
## (Source: City of Bradbury General Plan – Safety Element, 1993)



**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3a.**

**Q:** Is there a description of each hazard's **impacts** on each jurisdiction (what happens to structures, infrastructure, people, environment, etc.)? (Requirement §201.6(c)(2)(ii))

**A:** See **Impact of Earthquakes in the City of Bradbury** below.

## Impact of Earthquakes in the City of Bradbury

Based on the risk assessment, it is evident that earthquakes will continue to have potentially devastating economic impacts to certain areas of the City. Impacts that are not quantified, but can be anticipated in future events, include:

- ✓ Injury and loss of life;
- ✓ Commercial and residential structural damage;
- ✓ Disruption of and damage to public infrastructure;
- ✓ Secondary health hazards e.g. mold and mildew;
- ✓ Damage to roads/bridges resulting in loss of mobility;
- ✓ Significant economic impact (jobs, sales, tax revenue) upon the community;
- ✓ Negative impact on commercial and residential property values; and
- ✓ Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.

### *Earthquake-Induced Landslides*

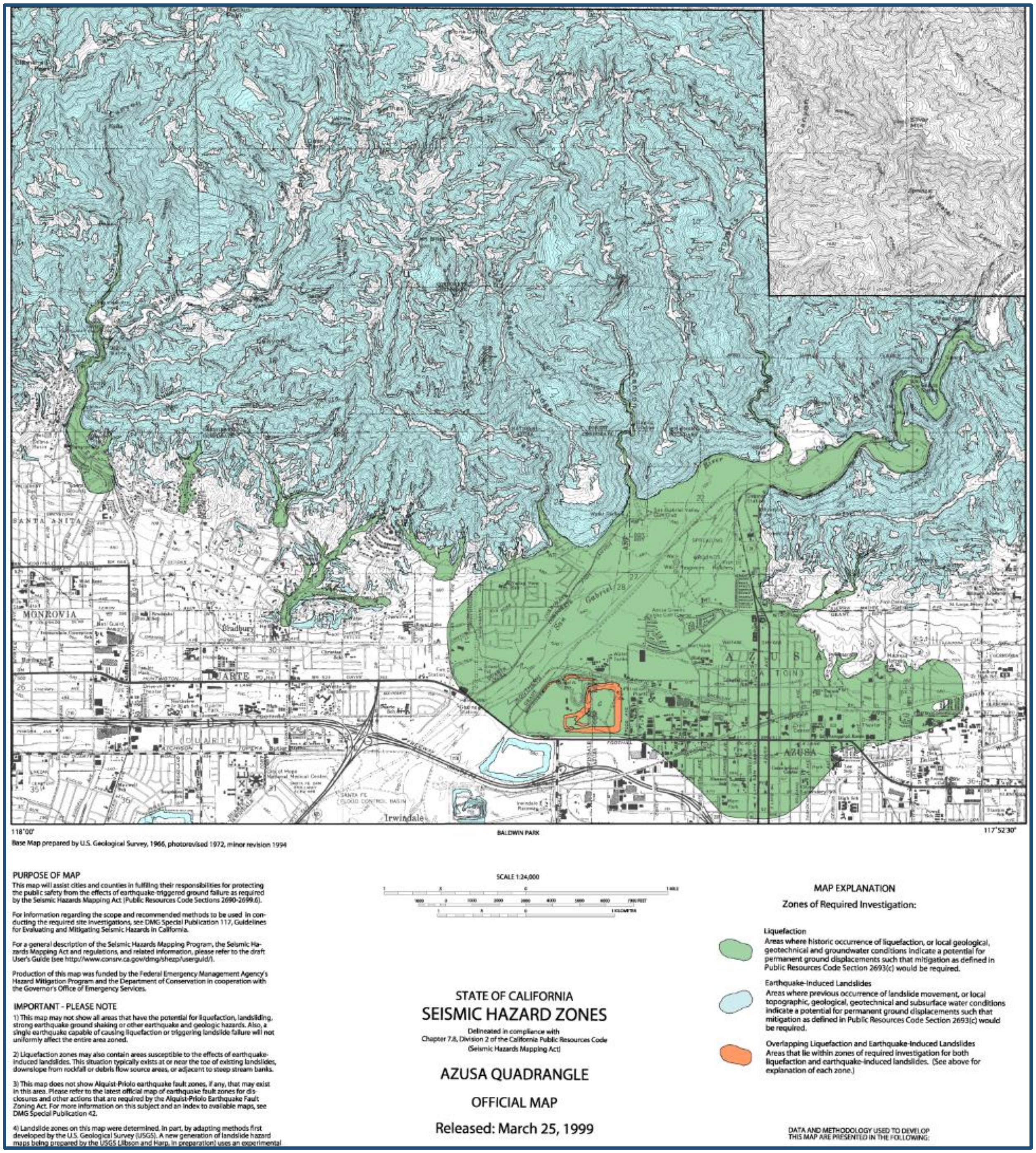
Earthquake-induced landslides are secondary earthquake hazards that occur from ground shaking. They can destroy the roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake. Many communities in Southern California have a high likelihood of encountering such risks, especially in areas with steep slopes.

**Map: Landslide and Liquefaction Zones** shows the moderate risk of earthquake-induced landslide risk within the City.

### *Liquefaction*

Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other events. Liquefaction occurs in saturated soils, which are soils in which the space between individual soil particles is completely filled with water. This water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together. Prior to an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to increase to the point where the soil particles can readily move with respect to each other. Because liquefaction only occurs in saturated soil, its effects are most commonly observed in low lying areas. Typically, liquefaction is associated with shallow groundwater, which is less than 50 feet beneath the earth's surface. According to the General Plan's Safety Element, 1993 (Source), the largest area in the City that may be subject to occurrence of liquefaction is located near the Long Canyon and Spinks Canyon Debris Basins. The area includes Bliss Canyon Road and Woodlyn Lane from Mount Olive Drive to Royal Oaks Drive North.

**Map: Landslide and Liquefaction Zones in Bradbury (Source: California Department of Conservation)**



## HAZUS-MH

## Exposure

The data in this section was generated using the HAZUS-MH program for earthquakes. Once the location and size of a hypothetical earthquake are identified, HAZUS-MH estimates the intensity of the ground shaking, the number of buildings damaged, the number of casualties, the amount of damage to transportation systems and utilities, the number of people displaced from their homes, and the estimated cost of repair and clean up.

### *Building Inventory*

According to the HAZUS estimates prepared by Emergency Planning Consultants, approximately 93% of the building stock within the City of Bradbury is residential housing consisting of wood frame construction.

### *Critical Facility Inventory*

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

**Table: Critical Facility Inventory – HAZUS**

| Essential Facilities | Count |
|---|---|
| Hospitals | 0 |
| Schools | 0 |
| Fire Stations | 0 |
| Police Stations | 0 |
| Emergency Operations Facilities | 0 |

| High Potential Loss (HPL) Facilities | Count |
|---|---|
| Dams | 0 |
| Levees | 0 |
| Military Installations | 0 |
| Nuclear Power Plants | 0 |
| Hazardous Material Sites | 1 |

### *Transportation and Utility Lifeline Inventory*

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. Transportation systems include highways, railways, light rail, bus, ports, ferry and airports. Utility systems include potable water, wastewater, natural gas, crude & refined oil, electric power and communications.

### *Casualties*

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows:

- ✓ **Severity Level 1:** Injuries will require medical attention, but hospitalization is not needed.

- ✓ **Severity Level 2:** Injuries will require hospitalization but are not considered life-threatening
- ✓ **Severity Level 3:** Injuries will require hospitalization and can become life threatening if not promptly treated.
- ✓ **Severity Level 4:** Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00AM, 2:00PM and 5:00PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00AM estimate considers that the residential occupancy load is maximum, the 2:00PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00PM represents peak commute time.

### *Building-Related Losses*

Building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

# HAZUS Earthquake Event Summary Results

## San Andreas M8.0 Earthquake Scenario

### *Building Damage*

**Table: Expected Building Damage by Occupancy – San Andreas M8.0 (note HAZUS included "home-based businesses as "Commercial")**

| | None | Slight | Moderate | Extensive | Complete |
|---|---|---|---|---|---|
| | Count | Count | Count | Count | Count |
| Agriculture | 3 | 3 | 2 | 1 | 0 |
| Commercial | 4 | 5 | 5 | 3 | 1 |
| Education | 0 | 0 | 0 | 0 | 0 |
| Government | 0 | 0 | 0 | 0 | 0 |
| Industrial | 3 | 3 | 4 | 2 | 1 |
| Other Residential | 3 | 2 | 1 | 0 | 0 |
| Religion | 0 | 0 | 0 | 0 | 0 |
| Single Family | 284 | 224 | 17 | 0 | 0 |
| Total | 297 | 238 | 29 | 6 | 3 |

**Table: Expected Building Damage by Building Type – San Andreas M8.0**

| | None | Slight | Moderate | Extensive | Complete |
|---|---|---|---|---|---|
| | Count | Count | Count | Count | Count |
| Wood | 288 | 228 | 18 | 1 | 0 |
| Steel | 1 | 2 | 4 | 2 | 1 |
| Concrete | 1 | 2 | 1 | 1 | 0 |
| Precast | 2 | 3 | 3 | 1 | 0 |
| RM | 5 | 4 | 2 | 1 | 0 |
| URM | 0 | 0 | 1 | 0 | 0 |
| MH | 0 | 0 | 0 | 0 | 0 |
| Total | 297 | 238 | 29 | 6 | 3 |

## *Transportation and Utility Lifeline Damage*

**Table: Expected Utility System Pipeline Damage – San Andreas M8.0**

| System | Total Pipelines (Length km) | Number of Leaks | Number of Breaks |
|---|---|---|---|
| **Potable Water** | 99 | 5 | 1 |
| **Waste Water** | 59 | 4 | 1 |
| **Natural Gas** | 39 | 1 | 0 |
| **Oil** | 0 | 0 | 0 |

**Table: Potable Water and Electric Power System Performance – San Andreas M8.0**

| | Total # of Households | Number of Households without Service | | | | |
|---|---|---|---|---|---|---|
| | | At Day 1 | At Day 3 | At Day 7 | At Day 30 | At Day 90 |
| **Potable Water** | **516** | 0 | 0 | 0 | 0 | 0 |
| **Electric Power** | | 0 | 0 | 0 | 0 | 0 |

### *Casualties*

The table below represents a summary of casualties estimated for San Andreas M8.0 earthquake scenario.

**Table: Casualty Estimates – San Andreas M8.0**

| Time | Sector | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|---|
| **2AM** | Commercial | 0 | 0 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 0 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single-Family | 0 | 0 | 0 | 0 |
| | **TOTAL** | **0** | **0** | **0** | **0** |
| **2PM** | Commercial | 3 | 1 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 1 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single-Family | 0 | 0 | 0 | 0 |
| | **TOTAL** | **4** | **1** | **0** | **0** |
| **5PM** | Commercial | 2 | 0 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 0 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single-Family | 0 | 0 | 0 | 0 |
| | **TOTAL** | **2** | **0** | **0** | **0** |

### *Economic Losses*

The total economic loss estimated for the San Andreas M8.0 earthquake scenario is $9.83 million dollars which includes building and lifeline related losses based on the region's available inventory. The following tables provide more detailed information about these losses.

**Table: Building-Related Economic Losses ($ Dollars) – San Andreas M8.0 (Note: HAZUS uses Census Tracks explaining some of the otherwise questionable statistics)**

| Category | Area | Single Family | Other Residential | Commercial | Industrial | Others | Total |
|---|---|---|---|---|---|---|---|
| **Income Losses** | Wage | $0 | $13,900 | $145,200 | $35,200 | $3,600 | $197,900 |
| | Capital-Related | $0 | $6,000 | $136,000 | $21,100 | $2,800 | $165,900 |
| | Rental | $33,500 | $64,200 | $74,100 | $9,700 | $2,400 | $183,900 |
| | Relocation | $95,700 | $32,200 | $109,000 | $34,900 | $20,200 | $292,000 |
| | **Subtotal** | **$129,200** | **$116,300** | **$464,300** | **$100,900** | **$29,000** | **$839,700** |
| **Capital Stock Losses** | Structural | $601,900 | $173,000 | $237,700 | $202,300 | $145,400 | $1,360,300 |
| | Non-Structural | $3,400,300 | $791,800 | $584,600 | $599,300 | $128,100 | $5,504,100 |
| | Content | $1,152,700 | $164,300 | $225,500 | $356,700 | $79,300 | $1,978,500 |
| | Inventory | $0 | $0 | $7,000 | $80,500 | $9,900 | $97,400 |
| | **Subtotal** | **$5,154,900** | **$1,129,100** | **$1,054,800** | **$1,238,800** | **$362,700** | **$8,940,300** |
| | **TOTAL** | **$5,284,100** | **$1,245,400** | **$1,519,100** | **$1,339,700** | **$391,700** | **$9,780,000** |

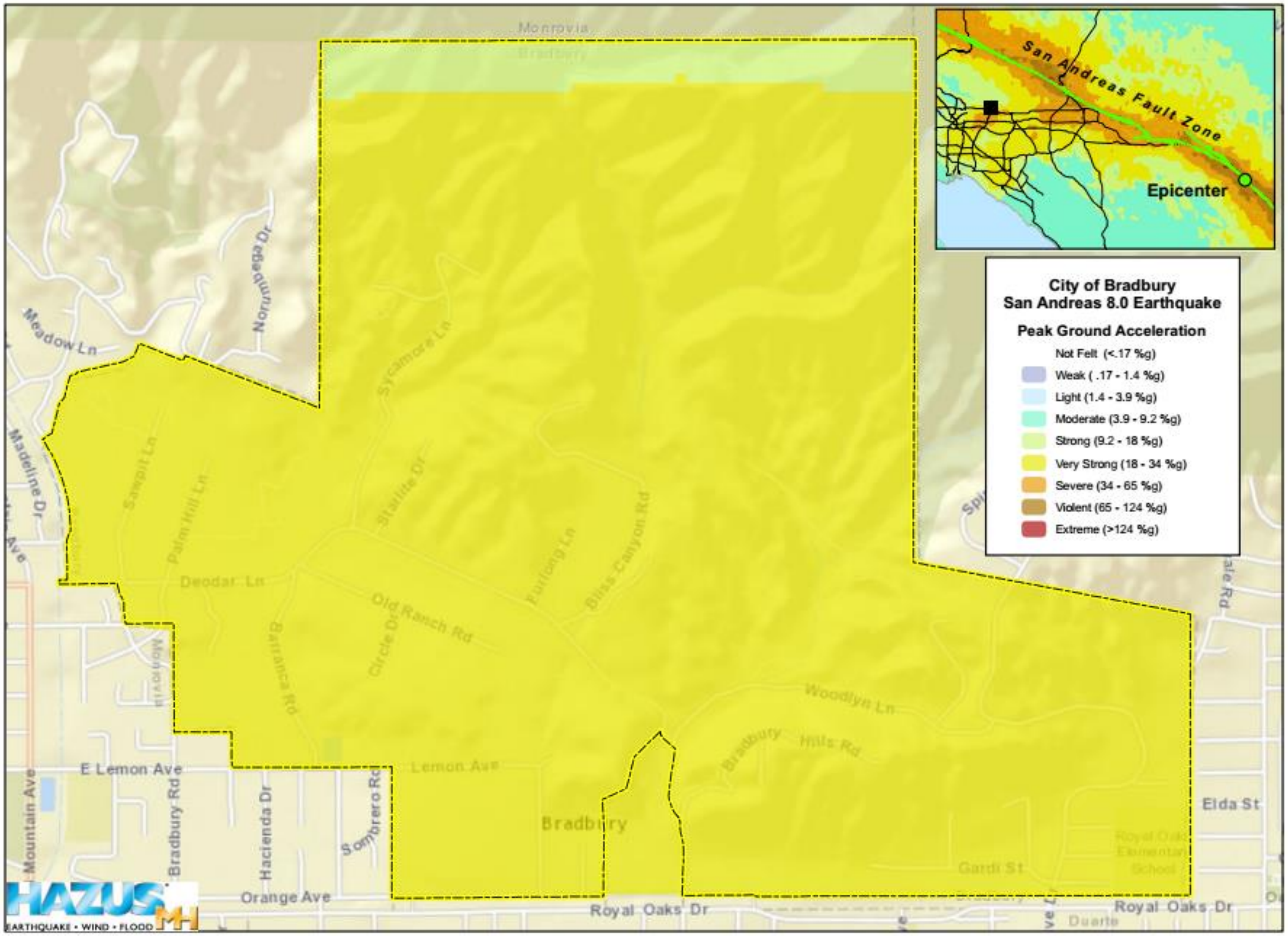
### Table: Transportation System Economic Losses ($ Dollars) – San Andreas M8.0

| System | Component | Total Inventory Value | Economic Loss | Loss Ratio % |
|---|---|---|---|---|
| **Highway** | Segments | $0 | $0 | 0% |
| | Bridges | $168,200 | $4,400 | 3% |
| | Tunnels | $0 | $0 | 0% |
| **Railways** | Segments | $0 | $0 | 0% |
| | Bridges | $0 | $0 | 0% |
| | Tunnels | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| **Light Rail** | Segments | $0 | $0 | 0% |
| | Bridges | $0 | $0 | 0% |
| | Tunnels | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| **Bus** | Facilities | $0 | $0 | 0% |
| **Ferry** | Facilities | $0 | $0 | 0% |
| **Port** | Facilities | $0 | $0 | 0% |
| **Airport** | Facilities | $0 | $0 | 0% |
| | **TOTAL** | **$168,200** | **$4,400** | |

Table: Utility System Economic Losses ($ Dollars) – San Andreas M8.0

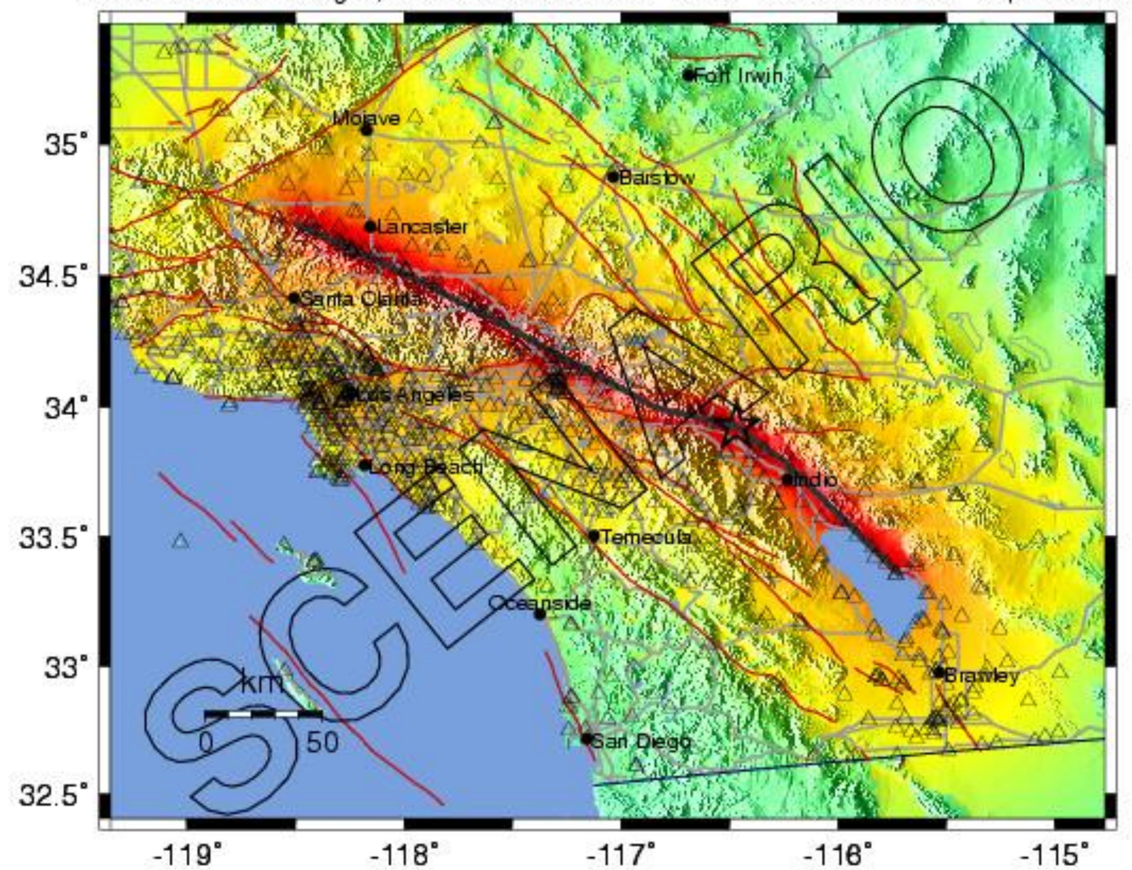
| System | Component | Total Inventory Value | Economic Loss | Loss Ratio % |
|---|---|---|---|---|
| **Potable Water** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| | Distribution Lines | $1,970,800 | $22,400 | 1% |
| **Waste Water** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| | Distribution Lines | $1,182,500 | $16,000 | 1% |
| **Natural Gas** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| | Distribution Lines | $788,300 | $4,600 | 1% |
| **Oil Systems** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| **Electrical Power** | Facilities | $0 | $0 | 0% |
| **Communication** | Facilities | $0 | $0 | 0% |
| | **TOTAL** | **$3,941,600** | **$43,000** | |

## Map: Shake Intensity Map – San Andreas M8.0
## (Source: Emergency Planning Consultants)



**Map: Seismic Shaking Intensities for the San Andrea Fault M7.8**
**(Source: California Department of Conservation)**

-- Earthquake Planning Scenario --
ShakeMap for Saf South7.8 Scenario
Scenario Date: Thu Aug 3, 2006 05:00:00 AM PDT M 7.8 N33.92 W116.47 Depth: 10.0km




PLANNING SCENARIO ONLY -- Map Version 1 Processed Thu Feb 8, 2007 11:47:37 AM PST

| PERCEIVED SHAKING | Not felt | Weak | Light | Moderate | Strong | Very strong | Severe | Violent | Extreme |
|---|---|---|---|---|---|---|---|---|---|
| POTENTIAL DAMAGE | none | none | none | Very light | Light | Moderate | Moderate/Heavy | Heavy | Very Heavy |
| PEAK ACC.(%g) | <.17 | .17-1.4 | 1.4-3.9 | 3.9-9.2 | 9.2-18 | 18-34 | 34-65 | 65-124 | >124 |
| PEAK VEL.(cm/s) | <0.1 | 0.1-1.1 | 1.1-3.4 | 3.4-8.1 | 8.1-16 | 16-31 | 31-60 | 60-116 | >116 |
| INSTRUMENTAL INTENSITY | I | II-III | IV | V | VI | VII | VIII | IX | X+ |

# Sierra Madre M7.2 Earthquake Scenario

## *Building Damage*

**Table: Expected Building Damage by Occupancy – Sierra Madre M7.2**

| | None | Slight | Moderate | Extensive | Complete |
|---|---|---|---|---|---|
| | Count | Count | Count | Count | Count |
| Agriculture | 1 | 2 | 3 | 2 | 1 |
| Commercial | 2 | 3 | 6 | 4 | 2 |
| Education | 0 | 0 | 0 | 0 | 0 |
| Government | 0 | 0 | 0 | 0 | 0 |
| Industrial | 1 | 2 | 4 | 3 | 2 |
| Other Residential | 1 | 2 | 2 | 1 | 0 |
| Religion | 0 | 0 | 0 | 0 | 0 |
| Single Family | 118 | 228 | 154 | 21 | 6 |
| **Total** | **123** | **238** | **169** | **31** | **11** |

**Table: Expected Building Damage by Building Type – Sierra Madre M7.2**

| | None | Slight | Moderate | Extensive | Complete |
|---|---|---|---|---|---|
| | Count | Count | Count | Count | Count |
| Wood | 120 | 232 | 156 | 20 | 6 |
| Steel | 1 | 1 | 3 | 3 | 2 |
| Concrete | 1 | 1 | 2 | 1 | 1 |
| Precast | 1 | 1 | 3 | 2 | 1 |
| RM | 2 | 2 | 4 | 3 | 1 |
| URM | 0 | 0 | 1 | 1 | 1 |
| MH | 0 | 0 | 0 | 0 | 0 |
| **Total** | **123** | **238** | **169** | **31** | **11** |

## Transportation and Utility Lifeline Damage

**Table: Expected Utility System Pipeline Damage – Sierra Madre M7.2**

| System | Total Pipelines (Length km) | Number of Leaks | Number of Breaks |
|---|---|---|---|
| **Potable Water** | 99 | 47 | 12 |
| **Waste Water** | 59 | 34 | 8 |
| **Natural Gas** | 39 | 10 | 2 |
| **Oil** | 0 | 0 | 0 |

**Table: Potable Water and Electric Power System Performance – Sierra Madre M7.2**

| | Total # of Households | Number of Households without Service | | | | |
|---|---|---|---|---|---|---|
| | | At Day 1 | At Day 3 | At Day 7 | At Day 30 | At Day 90 |
| **Potable Water** | **516** | 0 | 0 | 0 | 0 | 0 |
| **Electric Power** | | 416 | 287 | 137 | 31 | 1 |

## Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 25 households to be displaced due to the earthquake. Of these, 11 people (out of a total population of 1,292) will seek temporary shelter in public shelters.

### *Casualties*

The table below represents a summary of casualties estimated for the Sierra Madre M7.2 earthquake scenario.

**Table: Casualty Estimates – Sierra Madre M7.2**

| Time | Sector | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|---|
| **2AM** | Commercial | 0 | 0 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 0 | 0 | 0 | 0 |
| | Other-Residential | 1 | 0 | 0 | 0 |
| | Single-Family | 2 | 0 | 0 | 0 |
| | **TOTAL** | **3** | **0** | **0** | **0** |
| **2PM** | Commercial | 6 | 2 | 0 | 1 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 1 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single-Family | 1 | 0 | 0 | 0 |
| | **TOTAL** | **8** | **2** | **0** | **1** |
| **5PM** | Commercial | 4 | 1 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 1 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single-Family | 1 | 0 | 0 | 0 |
| | **TOTAL** | **6** | **1** | **0** | **0** |

## *Economic Losses*

The total economic loss estimated for the Sierra Madre M7.2 scenario earthquake is $38.09 million dollars which includes building and lifeline related losses based on the region's available inventory. The following tables provide more detailed information about these losses.

**Table: Building-Related Economic Losses ($ Dollars) – Sierra Madre M7.2**

| Category | Area | Single Family | Other Residential | Commercial | Industrial | Others | Total |
|---|---|---|---|---|---|---|---|
| **Income Losses** | Wage | $0 | $27,700 | $233,400 | $49,100 | $5,700 | $0 |
| | Capital-Related | $0 | $12,000 | $218,600 | $29,300 | $5,100 | $0 |
| | Rental | $321,800 | $165,600 | $122,100 | $13,200 | $3,800 | $321,800 |
| | Relocation | $1,234,400 | $95,200 | $181,300 | $48,200 | $34,400 | $1,234,400 |
| | **Subtotal** | **$1,556,200** | **$300,500** | **$755,400** | **$139,800** | **$49,000** | **$2,800,900** |
| **Capital Stock Losses** | Structural | $3,320,500 | $426,800 | $425,000 | $287,600 | $254,500 | $4,714,400 |
| | Non-Structural | $16,993,500 | $2,484,000 | $1,226,200 | $1,083,300 | $282,500 | $22,069,500 |
| | Content | $5,691,300 | $637,800 | $605,300 | $726,500 | $204,700 | $7,865,600 |
| | Inventory | $0 | $0 | $19,000 | $162,300 | $25,900 | $207,200 |
| | **Subtotal** | **$26,005,300** | **$3,548,600** | **$2,275,500** | **$2,259,700** | **$767,600** | **$34,856,700** |
| | **TOTAL** | **$27,561,500** | **$3,849,100** | **$3,030,900** | **$2,399,500** | **$816,600** | **$37,657,600** |

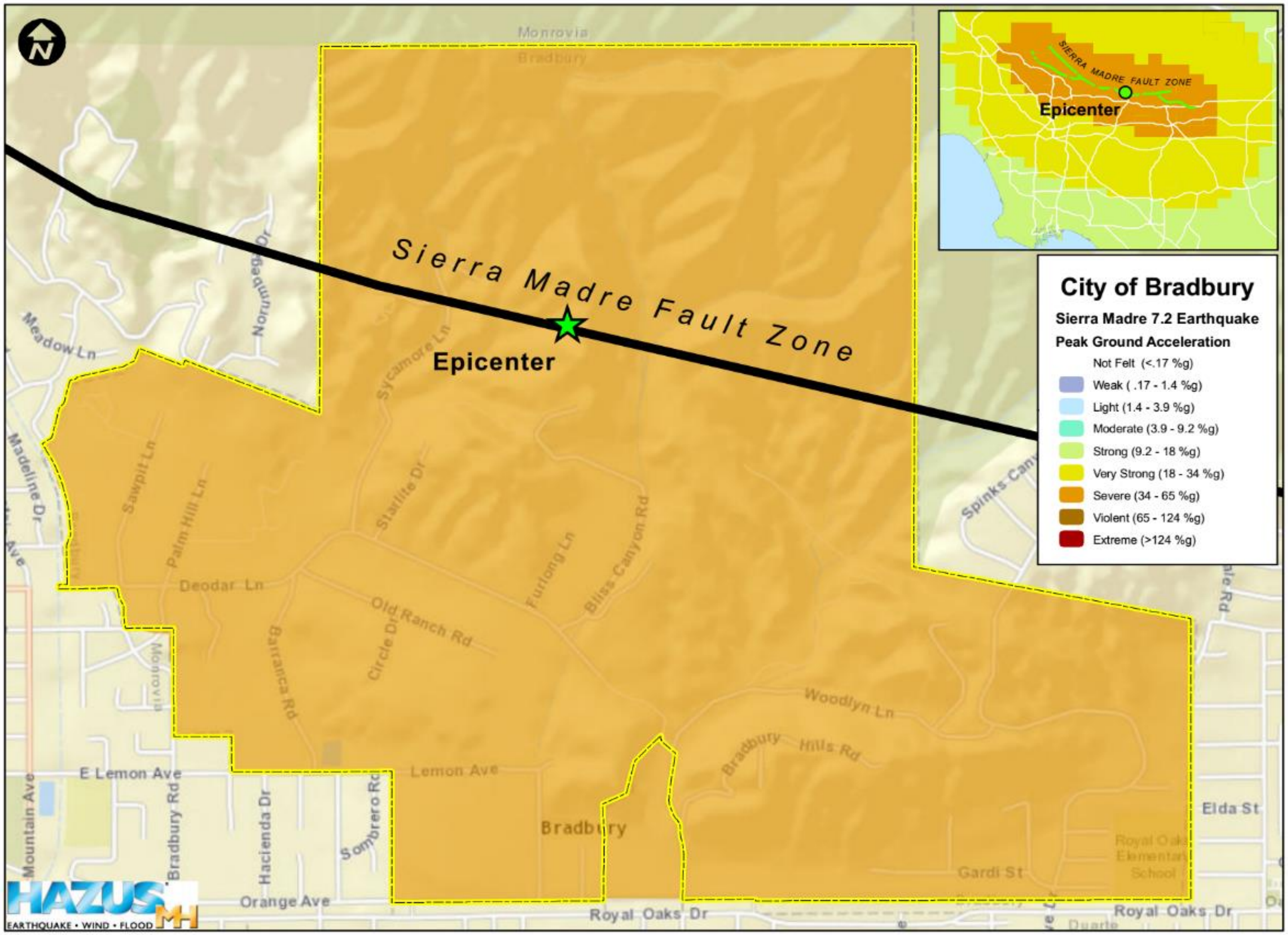
Table: Transportation System Economic Losses ($ Dollars) – Sierra Madre M7.2

| System | Component | Total Inventory Value | Economic Loss | Loss Ratio % |
|---|---|---|---|---|
| **Highway** | Segments | $0 | $0 | 0% |
| | Bridges | $168,200 | $26,600 | 16% |
| | Tunnels | $0 | $0 | 0% |
| **Railways** | Segments | $0 | $0 | 0% |
| | Bridges | $0 | $0 | 0% |
| | Tunnels | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| **Light Rail** | Segments | $0 | $0 | 0% |
| | Bridges | $0 | $0 | 0% |
| | Tunnels | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| **Bus** | Facilities | $0 | $0 | 0% |
| **Ferry** | Facilities | $0 | $0 | 0% |
| **Port** | Facilities | $0 | $0 | 0% |
| **Airport** | Facilities | $0 | $0 | 0% |
| | **TOTAL** | **$168,200** | **$168,200** | |

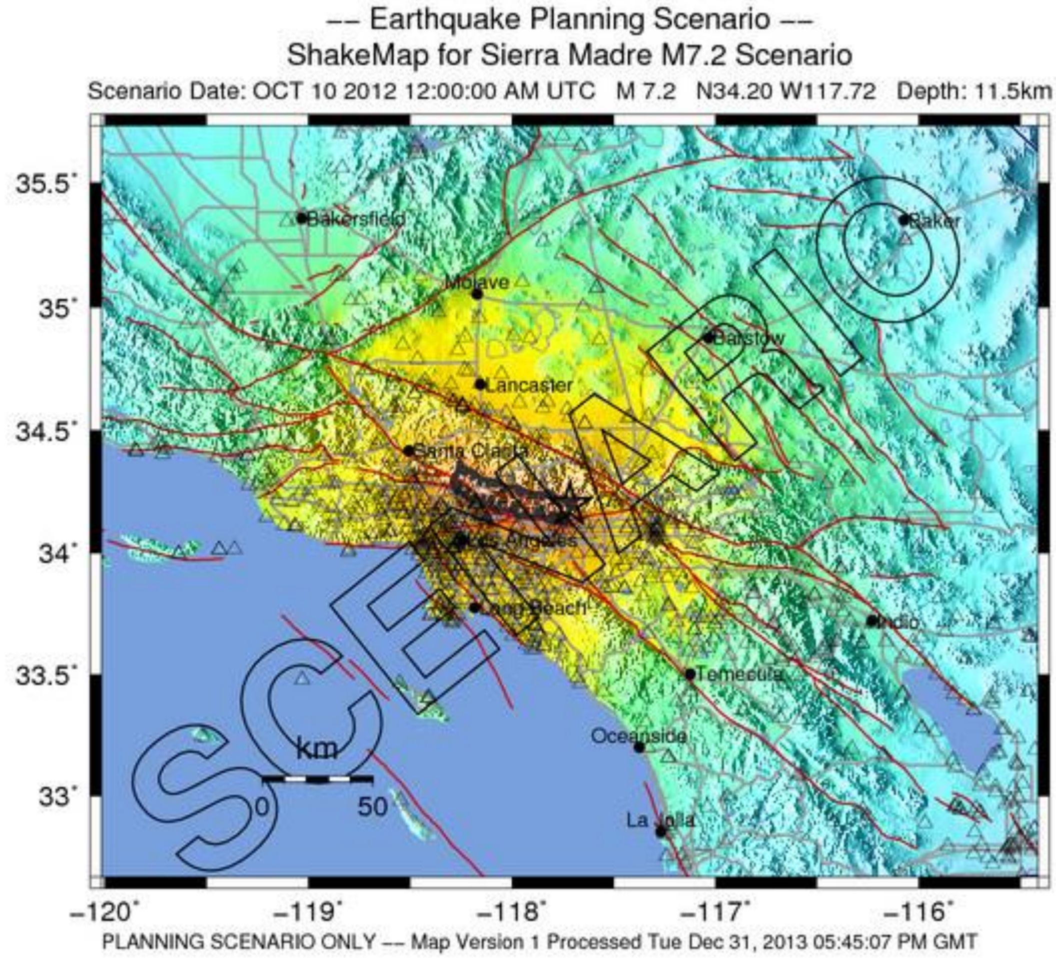
**Table: Utility System Economic Losses ($ Dollars) – Sierra Madre M7.2**

| System | Component | Total Inventory Value | Economic Loss | Loss Ratio % |
|---|---|---|---|---|
| **Potable Water** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| | Distribution Lines | $1,970,800 | $212,300 | 11% |
| **Waste Water** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| | Distribution Lines | $1,182,500 | $152,100 | 13% |
| **Natural Gas** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| | Distribution Lines | $788,300 | $43,600 | 5% |
| **Oil Systems** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| **Electrical Power** | Facilities | $0 | $0 | 0% |
| **Communication** | Facilities | $0 | $0 | 0% |
| | **TOTAL** | **$3,941,600** | **$408,000** | |

**Map: Shake Intensity Map – Sierra Madre M7.2**
**(Source: HAZUS - Emergency Planning Consultants)**



## Map: Seismic Shaking Intensities for the Sierra Madre M7.2 (Source: California Department of Conservation)




| PERCEIVED SHAKING | Not felt | Weak | Light | Moderate | Strong | Very strong | Severe | Violent | Extreme |
|---|---|---|---|---|---|---|---|---|---|
| POTENTIAL DAMAGE | none | none | none | Very light | Light | Moderate | Mod./Heavy | Heavy | Very Heavy |
| PEAK ACC.(%g) | <0.1 | 0.5 | 2.4 | 6.7 | 13 | 24 | 44 | 83 | >156 |
| PEAK VEL.(cm/s) | <0.07 | 0.4 | 1.9 | 5.8 | 11 | 22 | 43 | 83 | >160 |
| INSTRUMENTAL INTENSITY | I | II–III | IV | V | VI | VII | VIII | IX | X+ |

Scale based upon Wald, et al.; 1999

# Puente Hills M7.5 Earthquake Scenario

## *Building Damage*

**Table: Expected Building Damage by Occupancy – Puente Hills M7.5**

| | None | Slight | Moderate | Extensive | Complete |
|---|---|---|---|---|---|
| | Count | Count | Count | Count | Count |
| **Agriculture** | 5 | 2 | 1 | 0 | 0 |
| **Commercial** | 10 | 4 | 3 | 1 | 0 |
| **Education** | 0 | 0 | 0 | 0 | 0 |
| **Government** | 0 | 0 | 0 | 0 | 0 |
| **Industrial** | 7 | 3 | 2 | 1 | 0 |
| **Other Residential** | 4 | 1 | 1 | 0 | 0 |
| **Religion** | 1 | 0 | 0 | 0 | 0 |
| **Single Family** | 368 | 132 | 25 | 1 | 0 |
| **Total** | **394** | **143** | **32** | **3** | **0** |

**Table: Expected Building Damage by Building Type – Puente Hills M7.5**

| | None | Slight | Moderate | Extensive | Complete |
|---|---|---|---|---|---|
| | Count | Count | Count | Count | Count |
| **Wood** | 373 | 135 | 25 | 1 | 0 |
| **Steel** | 5 | 2 | 2 | 1 | 0 |
| **Concrete** | 3 | 1 | 1 | 0 | 0 |
| **Precast** | 5 | 2 | 2 | 1 | 0 |
| **RM** | 8 | 2 | 1 | 0 | 0 |
| **URM** | 1 | 0 | 0 | 0 | 0 |
| **MH** | 0 | 0 | 0 | 0 | 0 |
| **Total** | **394** | **143** | **32** | **3** | **0** |

## Transportation and Utility Lifeline Damage

**Table: Expected Utility System Pipeline Damage – Puente Hills M7.5**

| System | Total Pipelines (Length km) | Number of Leaks | Number of Breaks |
|---|---|---|---|
| **Potable Water** | 99 | 6 | 2 |
| **Waste Water** | 59 | 4 | 1 |
| **Natural Gas** | 39 | 1 | 0 |
| **Oil** | 0 | 0 | 0 |

**Table: Potable Water and Electric Power System Performance – Puente Hills M7.5**

| | Total # of Households | Number of Households without Service | | | | |
|---|---|---|---|---|---|---|
| | | At Day 1 | At Day 3 | At Day 7 | At Day 30 | At Day 90 |
| **Potable Water** | **516** | 0 | 0 | 0 | 0 | 0 |
| **Electric Power** | | 0 | 0 | 0 | 0 | 0 |

## Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 2 households to be displaced due to the earthquake. Of these, 1 person (out of a total population of 1,292) will seek temporary shelter in public shelters.

### *Casualties*

The table below represents a summary of casualties estimated for the Puente Hills M7.5 earthquake scenario.

**Table: Casualty Estimates – Puente Hills M7.5**

| Time | Sector | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|---|
| **2AM** | Commercial | 0 | 0 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 0 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single-Family | 0 | 0 | 0 | 0 |
| | **TOTAL** | **0** | **0** | **0** | **0** |
| **2PM** | Commercial | 1 | 0 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 0 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single-Family | 0 | 0 | 0 | 0 |
| | **TOTAL** | **1** | **0** | **0** | **0** |
| **5PM** | Commercial | 1 | 0 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 0 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single-Family | 0 | 0 | 0 | 0 |
| | **TOTAL** | **1** | **0** | **0** | **0** |

## *Economic Losses*

The total economic loss estimated for the Puente Hills M7.5 scenario earthquake is $6.67 million dollars which includes building and lifeline related losses based on the region's available inventory. The following tables provide more detailed information about these losses.

**Table: Building-Related Economic Losses ($ Dollars) – Puente Hills M7.5**

| Category | Area | Single Family | Other Residential | Commercial | Industrial | Others | Total |
|---|---|---|---|---|---|---|---|
| **Income Losses** | Wage | $0 | $4,200 | $45,500 | $11,000 | $1,100 | $61,800 |
| | Capital-Related | $0 | $1,800 | $41,700 | $6,600 | $700 | $50,800 |
| | Rental | $42,700 | $27,900 | $25,800 | $3,100 | $700 | $100,200 |
| | Relocation | $151,800 | $16,500 | $37,900 | $11,900 | $7,600 | $225,700 |
| | **Subtotal** | **$194,500** | **$50,400** | **$150,900** | **$32,600** | **$10,100** | **$438,500** |
| **Capital Stock Losses** | Structural | $548,600 | $72,800 | $72,000 | $55,700 | $49,000 | $798,100 |
| | Non-Structural | $3,078,000 | $435,500 | $203,400 | $189,800 | $49,400 | $3,956,100 |
| | Content | $1,011,400 | $111,800 | $103,100 | $124,900 | $35,500 | $1,386,700 |
| | Inventory | $0 | $0 | $3,100 | $27,900 | $4,500 | $35,500 |
| | **Subtotal** | **$4,638,000** | **$620,100** | **$381,600** | **$398,300** | **$138,400** | **$6,176,400** |
| **TOTAL** | | **$4,832,500** | **$670,500** | **$532,500** | **$430,900** | **$148,500** | **$6,614,900** |

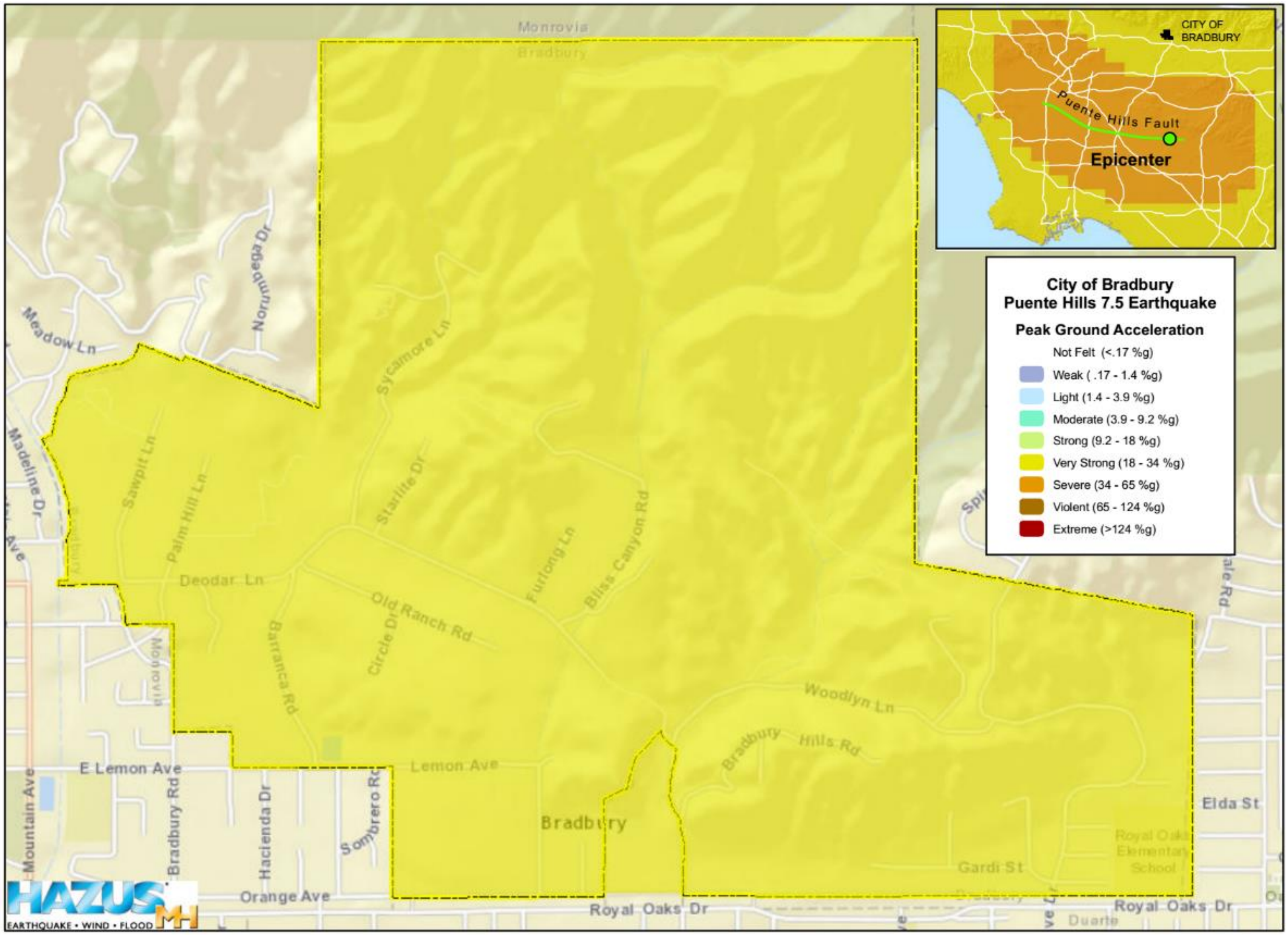
**Table: Transportation System Economic Losses ($ Dollars) – Puente Hills M7.5**

| System | Component | Total Inventory Value | Economic Loss | Loss Ratio % |
|---|---|---|---|---|
| **Highway** | Segments | $0 | $0 | 0% |
| | Bridges | $168,200 | $1,400 | 1% |
| | Tunnels | $0 | $0 | 0% |
| **Railways** | Segments | $0 | $0 | 0% |
| | Bridges | $0 | $0 | 0% |
| | Tunnels | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| **Light Rail** | Segments | $0 | $0 | 0% |
| | Bridges | $0 | $0 | 0% |
| | Tunnels | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| **Bus** | Facilities | $0 | $0 | 0% |
| **Ferry** | Facilities | $0 | $0 | 0% |
| **Port** | Facilities | $0 | $0 | 0% |
| **Airport** | Facilities | $0 | $0 | 0% |
| | **TOTAL** | **$168,200** | **$0** | |

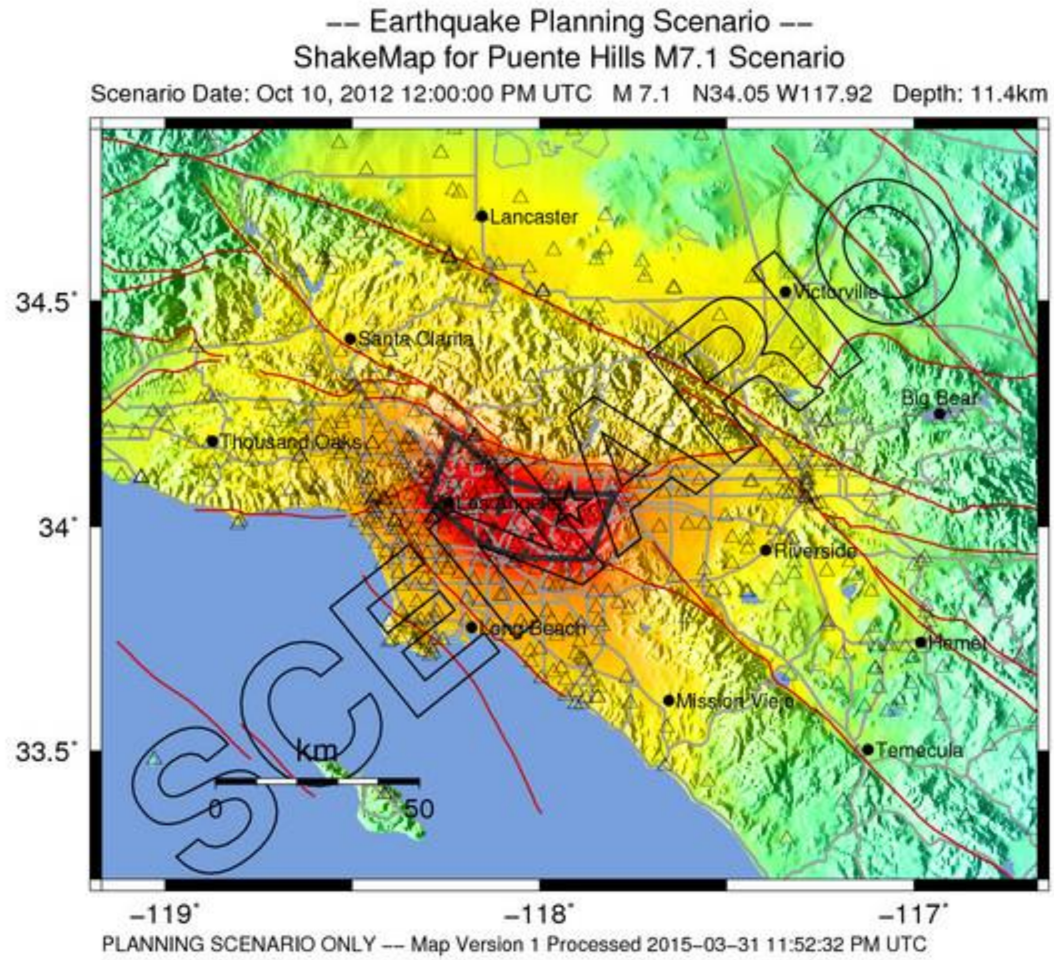
Table: Utility System Economic Losses ($ Dollars) – Puente Hills M7.5

| System | Component | Total Inventory Value | Economic Loss | Loss Ratio % |
|---|---|---|---|---|
| **Potable Water** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| | Distribution Lines | $1,970,800 | $27,400 | 1% |
| **Waste Water** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| | Distribution Lines | $1,182,500 | $19,600 | 2% |
| **Natural Gas** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| | Distribution Lines | $788,300 | $5,600 | 1% |
| **Oil Systems** | Pipelines | $0 | $0 | 0% |
| | Facilities | $0 | $0 | 0% |
| **Electrical Power** | Facilities | $0 | $0 | 0% |
| **Communication** | Facilities | $0 | $0 | 0% |
| | **TOTAL** | **$3,941,600** | **$52,600** | |

**Map: Shake Intensity Map – Puente Hills M7.5**
**(Source: HAZUS - Emergency Planning Consultants)**



## Map: Seismic Shaking Intensities for the Puente Hills M7.1 (Source: California Department of Conservation)




| PERCEIVED SHAKING | Not felt | Weak | Light | Moderate | Strong | Very strong | Severe | Violent | Extreme |
|---|---|---|---|---|---|---|---|---|---|
| POTENTIAL DAMAGE | none | none | none | Very light | Light | Moderate | Mod./Heavy | Heavy | Very Heavy |
| PEAK ACC.(%g) | <0.1 | 0.5 | 2.4 | 6.7 | 13 | 24 | 44 | 83 | >156 |
| PEAK VEL.(cm/s) | <0.07 | 0.4 | 1.9 | 5.8 | 11 | 22 | 43 | 83 | >160 |
| INSTRUMENTAL INTENSITY | I | II–III | IV | V | VI | VII | VIII | IX | X+ |

Scale based upon Wald, et al.; 1999

## Structures and Building Code

The built environment is susceptible to damage from earthquakes. Buildings that collapse can trap and bury people. Lives are at risk, and the cost to clean up the damages is great. In most California communities, including the City of Bradbury, many buildings were built before 1993 when building codes were not as strict. In addition, retrofitting is not required except under certain conditions and can be expensive. Therefore, the number of buildings at risk remains high. The California Seismic Safety Commission makes annual reports on the progress of the retrofitting of unreinforced masonry buildings. According to the General Plan's Safety Element, 1993 (Source), all URM buildings within the City have been identified and upgraded to meet current requirements.

Implementation of earthquake mitigation policy most often takes place at the local government level. The City of Bradbury Planning Department enforces building codes pertaining to earthquake hazards.

Additionally, the City has implemented basic building requirements that are above and beyond what the State demands for hazard mitigation. Newly constructed buildings in Bradbury that are built in an area subject to Earthquake-induced landslide or liquefaction are typically built with extra foundation support. Such support is found in the post-tension reinforced concrete foundation; this same technique is used by coastal cities to prevent home destruction during cases of liquefaction.

Generally, these codes seek to discourage development in areas that could be prone to flooding, landslide, wildfire and/or seismic hazards; and where development is permitted, that the applicable construction standards are met. Developers in hazard-prone areas may be required to retain a qualified professional engineer to evaluate level of risk on the site and recommend appropriate mitigation measures.

# Wildfire Hazards

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2a.**

**Q:** Does the plan include information on **previous occurrences** of hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Previous Occurrences of Wildfire in the City of Bradbury** below.

## Previous Occurrences of Wildfire in the City of Bradbury

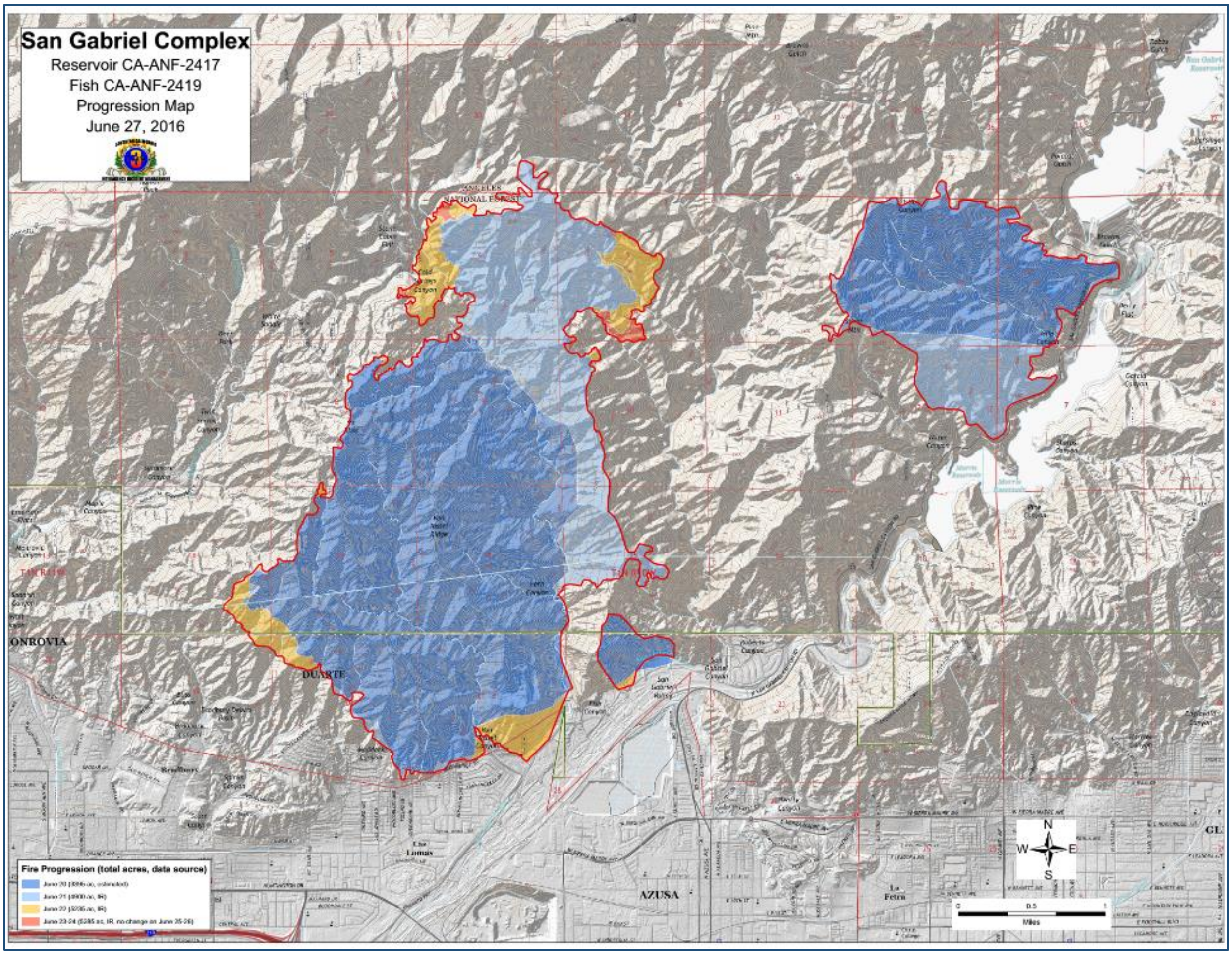
Fortunately, there have been limited wildfire outbreaks within the City. However, bordering areas are highly prone to wildfires and, therefore, the City is exposed to a threat from wildfires originating outside the City.

The most recent wildfire outbreak closest to Bradbury was the San Gabriel Complex fire which ignited the morning of June 20, 2016. According to InciWeb (Source), the San Gabriel Complex fire consisted of 2 fires, the Reservoir Fire and the Fish Fire. Both fires originated northeast of the City limits as shown on **Map: San Gabriel Complex Fire Progression**. The cause of the Reservoir Fire was due to a vehicle crash while the cause of the Fish Fire is still under investigation. The fires were burning in fuel that was 7-10 years old with 6 to 8-foot chaparral and large grass crop.

At the height of the fire, 1,376 homes were evacuated. The American Red Cross established an Evacuation Center and 1,460 staff from multiple local, state and federal agencies worked to protect property and suppress the fire. Road closures were in place and law enforcement patrolled for security while firefighters worked through the night to contain the fire.

Although the San Gabriel Complex Fire threatened homes in the City, no property damage was reported. Since the writing of the 2007 Mitigation Plan, there have been no significant wildfire events within the City of Bradbury.


**Map: San Gabriel Complex Fire Progression**
**(Source: CAL FIRE)**




## Previous Occurrences of Wildfire in Los Angeles County

Due to its weather, topography, and native vegetation, the majority of Los Angeles County is at risk from wildland fires. The extended droughts characteristic of California's Mediterranean climate result in large areas of dry vegetation that provide fuel for wildland fires. Furthermore, the native vegetation typically has a high oil content that makes it highly flammable. The area is also intermittently impacted by Santa Ana winds, the hot, dry winds that blow across southern California in the spring and late fall.

The most recent significant wildfire event to impact the County of Los Angeles was the Station Fire in 2009. The Station Fire destroyed 209 structures and burned a total of 160,577 acres within Los Angeles County. According to the United States Forest Service (Source), the Station Fire was the 10th largest in modern California history, and the largest wildfire in Los Angeles County to date.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1a.**

**Q:** Does the plan include a general **description** of all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Local Conditions** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3b.**

**Q:** Is there a description of each identified hazard's overall **vulnerability** (structures, systems, populations, or other community assets defined by the community that are identified as being susceptible to damage and loss from hazard events) for each jurisdiction? (Requirement §201.6(c)(2)(ii))

**A:** See **Local Conditions** below.

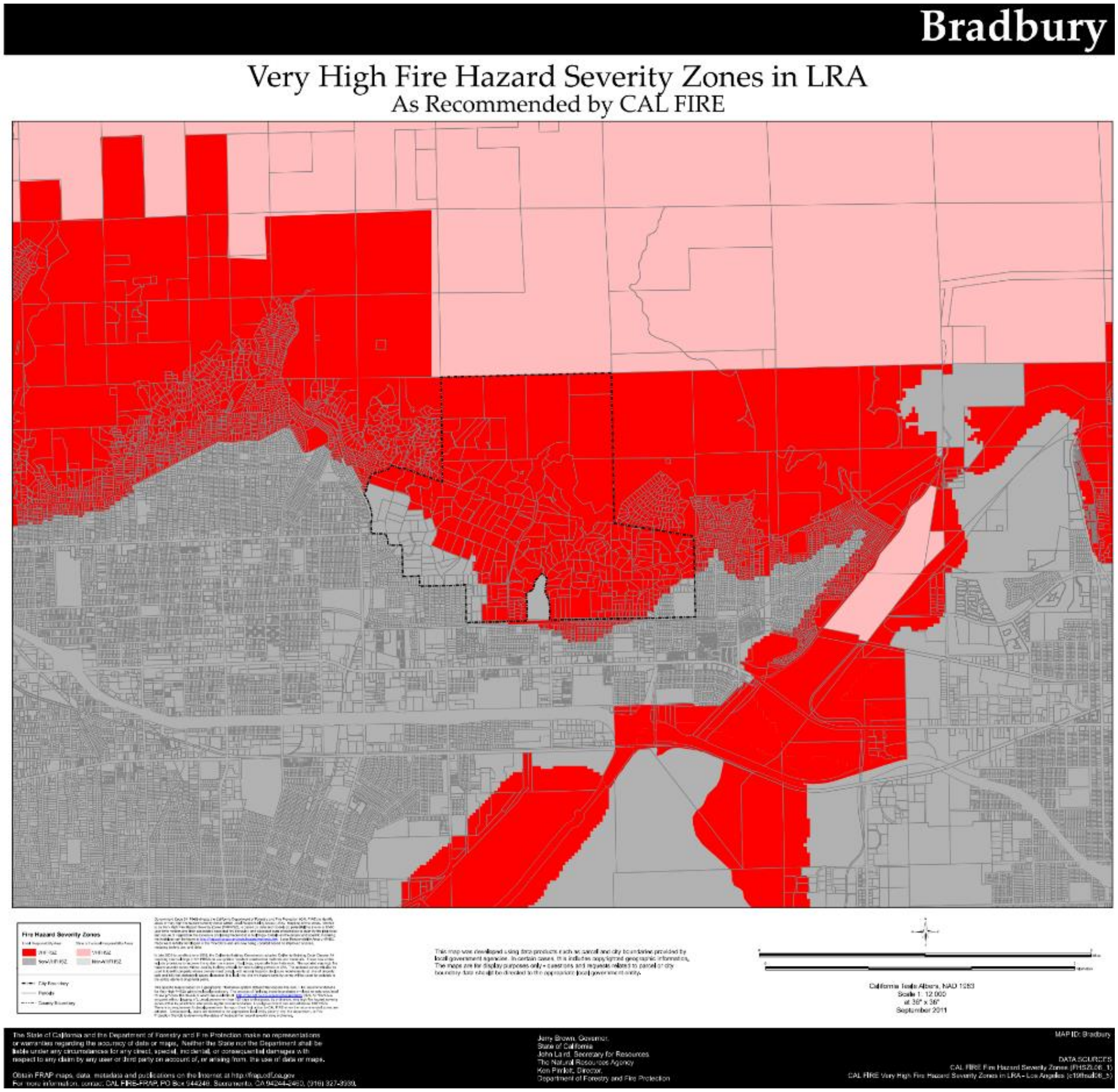
## Local Conditions

Bradbury's location at the base of the San Gabriel Mountains creates an urban/wildland interface that makes Bradbury more susceptible to wildfires than cities that do not border the foothills. According to **Map: Very High Fire Hazard Severity Zones** the majority of the City closest to the foothills is considered to be at special risk to wildfires. These areas are at significant risk during the summer months, extended periods of heat, and long periods of no rain. Strong periodic Santa Ana winds add to the fire danger in the City.

According to the City of Bradbury's Emergency Operations Plan (2010), the wildland interface area runs across the entire north border of the City and includes populated residential properties. All streets north of Royal Oaks Drive North in the City are considered to be in the *Very High Fire Severity Hazard Zone* and are at significant risk in the event of a wildland fire. Areas in the Southern and Western portions of the City that are not highlighted in **Map: Very High Fire Hazard Severity Zones** are considered to be in the *Moderate* and/or *High Fire Hazard Zone*. Structures in these areas may sustain minor damage, while structures inside the *Very High Extreme Fire Zone* can sustain heavy damage or complete destruction during a fire.


ROYAL OAKS

**Map: Very High Fire Hazard Severity Zones**
**Note: City limits of Bradbury are outlined on the map**
**(Source: CAL FIRE)**



**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3a.**

**Q:** Is there a description of each hazard's **impacts** on each jurisdiction (what happens to structures, infrastructure, people, environment, etc.)? (Requirement §201.6(c)(2)(ii))

**A:** See **Impact of Wildfire in the City of Bradbury** below.

## Impact of Wildfire in the City of Bradbury

Wildfires and their impacts vary by location and severity of any given wildfire event and will likely only affect certain areas of the county during specific times. Based on the risk assessment, it is evident that wildfires will have a potentially devastating economic impact to certain areas of the City.

Impacts that are not quantified, but which may be anticipated in future events include:

- ✓ Injury and loss of life
- ✓ Commercial and residential structural damage
- ✓ Disruption of and damage to public infrastructure
- ✓ Secondary health hazards e.g. mold and mildew
- ✓ Damage to roads/bridges resulting in loss of mobility
- ✓ Significant economic impact (jobs, sales, tax revenue) upon the community
- ✓ Negative impact on commercial and residential property values
- ✓ Significant disruption to students and teachers as temporary facilities and relocations would likely be needed

# Flood Hazards

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2a.**

**Q:** Does the plan include information on **previous occurrences** of hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Previous Occurrences of Flooding in the City of Bradbury** below.

## Previous Occurrences of Flooding in the City of Bradbury

Flooding has not been a serious hazard to Bradbury in several decades, and the risk of disastrous flooding in the City is considered minimal. Bradbury does not lie within a 100- or 500- year floodplain, as delineated by the Federal Emergency Management Agency (FEMA). However, the potential for a localized flood event still exists within Bradbury, and it is an important hazard to be addressed in the City's Hazard Mitigation Plan.

Since the writing of the 2007 Mitigation Plan, there have been no significant flooding events in the City of Bradbury.

## Previous Occurrences of Flooding in Los Angeles County

Los Angeles County records reveal since 1861, the Los Angeles River has flooded 30 times, on average once every 6.1 years. But averages are deceiving, for the Los Angeles basin goes through periods of drought and then periods of above average rainfall. Between 1889 and 1891 the river flooded every year, from 1941 to 1945, the river flooded 5 times. Conversely, from 1896 to 1914, and again from 1944 to 1969, a period of 25 years, the river did not have serious floods.

Average annual precipitation in Los Angeles County ranges from 13 inches on the coast to approximately 40 inches on the highest point of the Peninsular Mountain Range that transects the County. Several factors determine the severity of floods, including rainfall intensity and duration. A large amount of rainfall over a short time span can result in flash flood conditions. A sudden thunderstorm or heavy rain, dam failure, or sudden spills can cause flash flooding. The National Weather Service's definition of a flash flood is a flood occurring in a watershed where the time of travel of the peak of flow from one end of the watershed to the other is less than six hours.

The towering mountains that give the Los Angeles region its spectacular views also wring a great deal of rain out of the storm clouds that pass through. Because the mountains are so steep, the rainwater moves rapidly down the slopes and across the coastal plains on its way to the ocean.

Naturally, this rainfall moves rapidly downstream, often with severe consequences for anything in its path. In extreme cases, flood-generated debris flows will roar down a canyon at speeds near 40 miles per hour with a wall of mud, debris and water, tens of feet high. Flooding occurs when climate, geology, and hydrology combine to create conditions where water flows outside of its usual course.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1a.**

**Q:** Does the plan include a general **description** of all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Local Conditions** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3b.**

**Q:** Is there a description of each identified hazard's overall **vulnerability** (structures, systems, populations, or other community assets defined by the community that are identified as being susceptible to damage and loss from hazard events) for each jurisdiction? (Requirement §201.6(c)(2)(ii))

**A:** See **Local Conditions** below.

## Local Conditions

According to the City of Bradbury General Plan (Source), the San Gabriel River Channel lies east of the City of Bradbury and is designed to contain a 100-year flood. The Channel is fully operational and is maintained by the U.S. Army Corps of Engineers and the Los Angeles County Department of Public Works. The construction of San Gabriel River improvements in 1947 reduced the local area's risk of flooding. Los Angeles County Drainage Area studies performed by the Corps have shown no deficiencies along the San Gabriel River. The elevated nature of the City removes Bradbury from flood danger from the San Gabriel River.

Serious flooding has not been a recent problem in Bradbury because the low density residential development has permitted the retention of natural ground cover which retards serious floods. In addition to the natural ground cover, the Bradbury Debris Basin and the Spinks Debris Basin and check dams also provide the City with protection from large scale floods. As such, the residential areas within Bradbury rely heavily on the existence and maintenance of the debris basins. The City should continue to work closely with the USCE and LACPW to ensure maximum functionality of all flood control facilities.

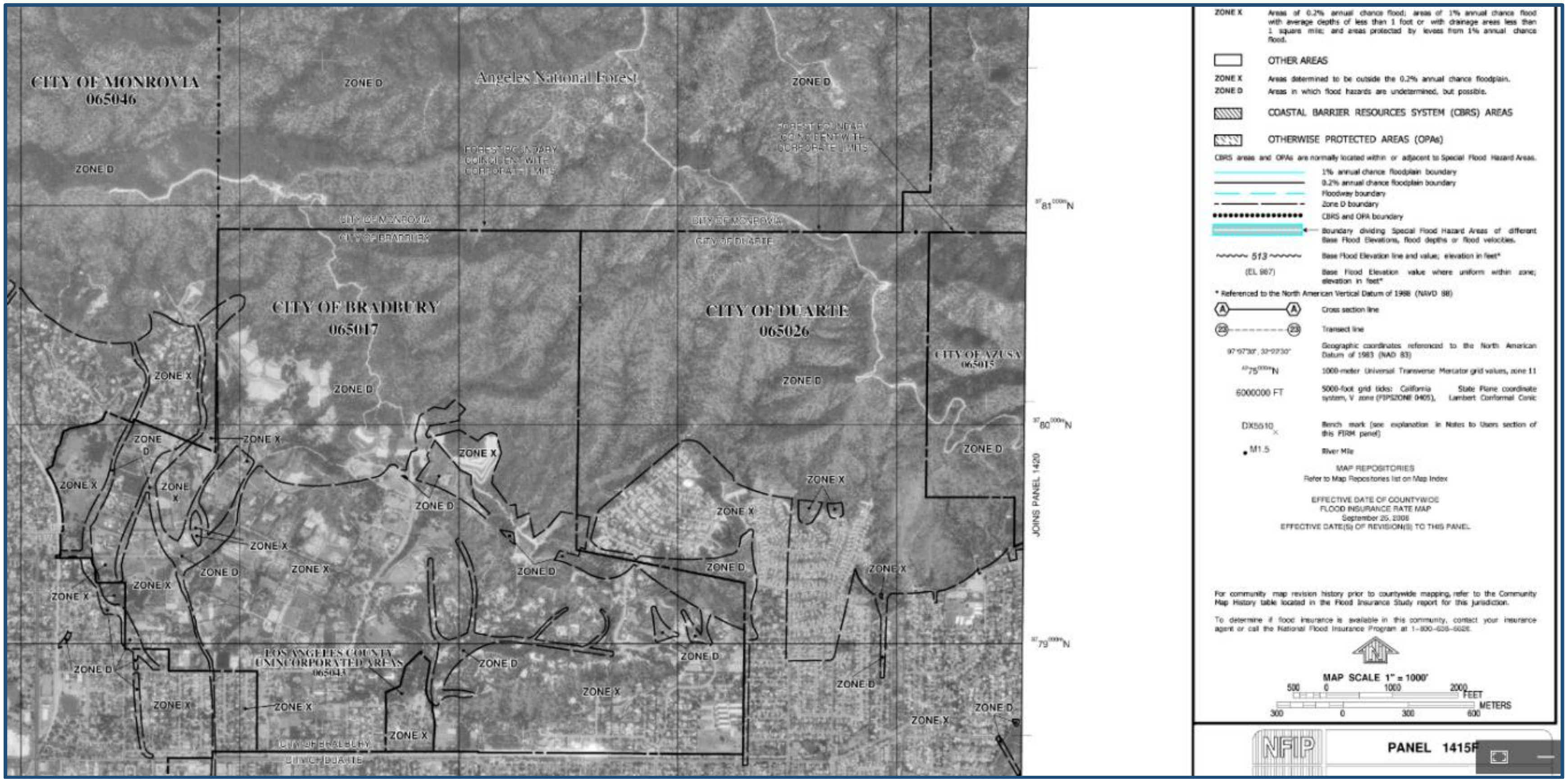
Minor problems concerning water runoff occurred in the past during wet years. These problems tend to be localized and primarily relate to very small mudslides and small erosion problems in areas where the natural grade has been disturbed. Much of the soil in Bradbury canyon areas is of an alluvium base material and is susceptible to runoff problems if the natural ground cover has been removed and not replaced with landscaping or other mitigating measures. The City maintains a policy of investigating any localized runoff or mudslide problems through the assistance of the Los Angeles County Engineers Office.

### *National Flood Insurance Program*

The City participates in the National Flood Insurance Program (NFIP). Created by Congress in 1968, the NFIP makes flood insurance available in communities that enact minimum floodplain management rules consistent with the Code of Federal Regulations §60.3.

According to **Map: Flood Insurance Rate Map**, the built areas of the City are in “Flood Zone X” and “Flood Zone D”. Zone X is defined as the area outside the 500-year flood and protected by levee from 100-year flood. Zone D is defined as areas in which flood hazards are undetermined (no analysis of flood hazards has been conducted), but possible.

## Map: Flood Insurance Rate Map
## (Source: FEMA Flood Map Service Center)



**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3a.**

**Q:** Is there a description of each hazard's **impacts** on each jurisdiction (what happens to structures, infrastructure, people, environment, etc.)? (Requirement §201.6(c)(2)(ii))

**A:** See **Impact of Flooding in the City of Bradbury** below.

## Impact of Flooding in the City of Bradbury

Floods and their impacts vary by location and severity of any given flood event, and likely only affect certain areas of the County during specific times. Based on the risk assessment, it is possible that flooding could impact certain areas of the City.

Impacts that are not quantified, buy may be anticipated in future events are:

- ✓ Injury and loss of life;
- ✓ Commercial and residential structural damage;
- ✓ Disruption of and damage to public infrastructure;
- ✓ Secondary health hazards e.g. mold and mildew
- ✓ Damage to roads/bridges resulting in loss of mobility
- ✓ Significant economic impact (jobs, sales, tax revenue) upon the community
- ✓ Negative impact on commercial and residential property values and
- ✓ Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.

# Landslide Hazards

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2a.**

**Q:** Does the plan include information on **previous occurrences** of hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Previous Occurrences of Landslides in the City of Bradbury** below.

## Previous Occurrences of Landslides in the City of Bradbury

In the Bradbury area, wildfires have contributed to debris and mudflows that impacted three residential neighborhoods in the adjacent City of Duarte. The first hazard event occurred in 1952 when large quantities of debris were carried down Vineyard Avenue. The second hazard event occurred in 1980 following the Stables Fire. The third hazard event occurred in January 2017 downslope of the Fish and Reservoir fires.

Although landslides have impacted neighboring cities, the City of Bradbury has not been significantly impacted by a landslide event.

Following the June 2016 Fish and Reservoir fires, Bradbury was impacted by fire-related mudflows that filled the Bradbury/Bliss Canyon Debris Basin and Spinks Canyon Debris Basin. Los Angeles County is in the process now of removing over 85,000 cubic yards of debris material from the two basins and trucking it to a nearby disposal site.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1a.**

**Q:** Does the plan include a general **description** of all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Local Conditions** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3b.**

**Q:** Is there a description of each identified hazard's overall **vulnerability** (structures, systems, populations, or other community assets defined by the community that are identified as being susceptible to damage and loss from hazard events) for each jurisdiction? (Requirement §201.6(c)(2)(ii))

**A:** See **Local Conditions** below.

## Local Conditions

There are portions of hillside around Bradbury that would be susceptible to landslides as a result of various events whether they be long periods of rain, exposed hillside as a result of a fire, or earthquake. The **Map: Landslide Zones** identifies areas in the City of Bradbury that are considered at highest risk for landslides.

## *1952 Landslide*

According to the U.S. Army Corp of Engineers, in September 1952, a fire burned 500 acres of watershed in the foothills north and northeast of the City of Bradbury. Of the 500 acres, approximately, 150 acres of vegetation cover was destroyed in the Maddock Canyon Area just north of Duarte Mesa and Vineyard Avenue in the City of Duarte. Maddock Canyon is one of two small canyons located between Fish Canyon and Spinks Canyon and it extends from the mountains toward Vineyard Avenue. In December 1952, four months after the fire, a light rainstorm caused post fire canyon flows in Maddock Canyon. The debris flow caused considerable damage to a new residential subdivision and other residential properties along Vineyard Avenue, Conata Street, and Royal Oaks Drive. Due to the potential for more debris flow and mudslides, the residents of the area sent a petition to the Los Angeles County Board of Supervisors requesting aid.

In July 1953, the County of Los Angeles committed to the building of a debris basin in Maddock Canyon. This was followed by the adoption of a U.S. Congress Bill that provided a million dollars in funding for the construction of five debris basins along the San Gabriel foothills as well as improvements for Sawpit Wash.

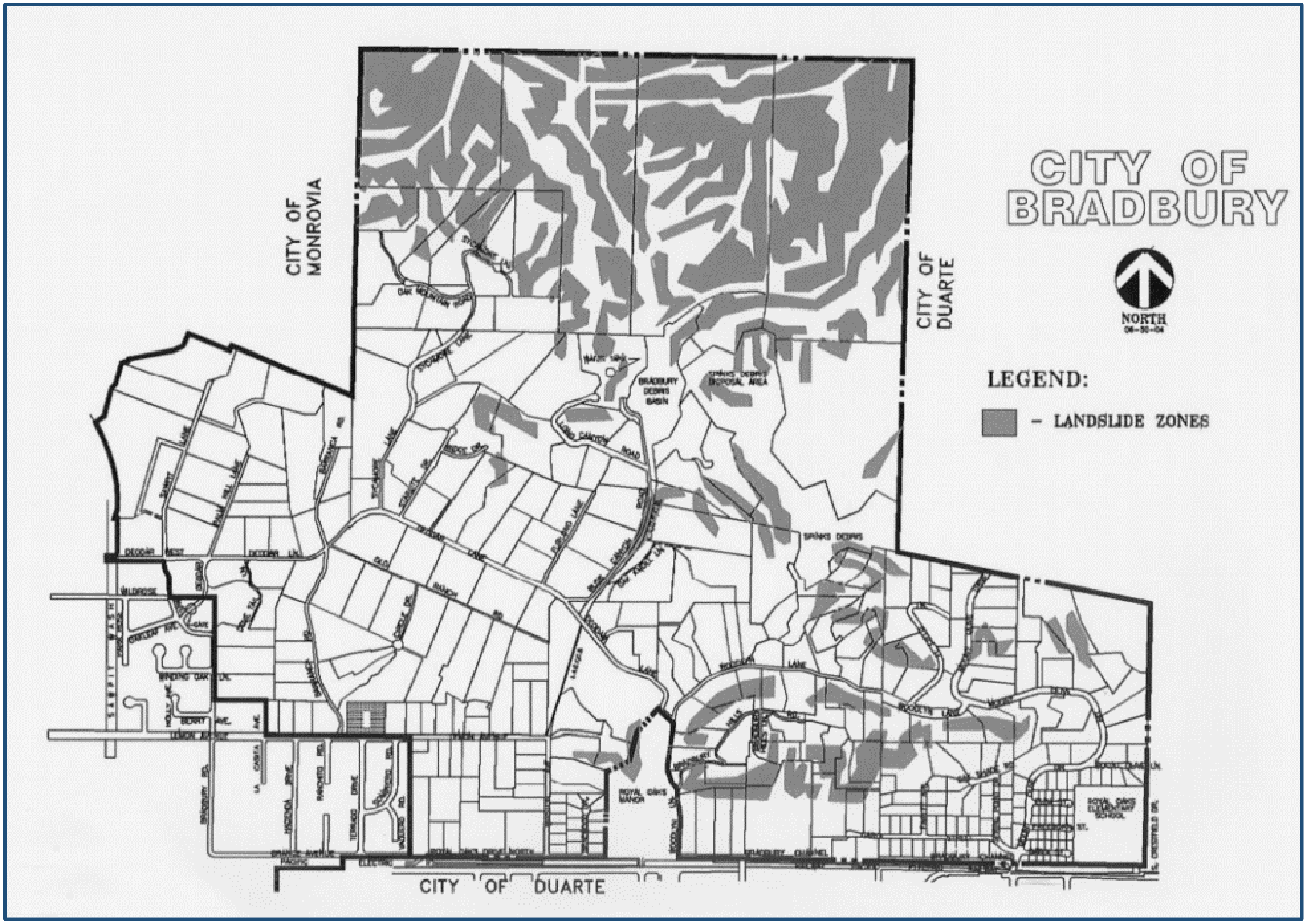
## *1980 Landslide*

On November 16, 1980 the Stables Fire fanned by Santa Ana Wind conditions swept down from the foothills and destroyed 14 homes in the City of Bradbury. Reports indicated that the fire had moved from the City of Azusa, east of the San Gabriel River to the Duarte and Bradbury homes in 8 to 10 minutes, due to strong shift in winds. The fire was responsible for defoliating several steep slopes and exposed a residential subdivision to mudslides.

Immediately after the “Stable Fire”, City and County personnel began taking measures to deal with possible floods and mudslides. Mud diversion structures were constructed, 50,000 sandbags were distributed, and parking was restricted on streets with potential slides. Since the Stable Fire occurred during California’s rainy season, “Storm Watch” flyers were also issued to residents in Bradbury’s hillside areas. A Disaster Center was also established at City Hall to monitor weather reports and storm situations and to inform residents. The City prepared to mobilize personnel and equipment if needed to clear mud flows from the public streets and parkways.

As quickly as possible, several temporary debris basins were constructed and existing debris basins were cleared and reinforced with sandbags. The City also provided erosion control consultation to residents. Major mudslide damage was averted that winter due to the quick actions of the residents and the strategic steps taken by City of Bradbury, City of Duarte and County Personnel. In the months that followed the City encouraged the re-seeding of hillside areas.

Map: Landslide Zones
(Source: City of Bradbury Emergency Operations Plan - 2010)



**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3a.**

**Q:** Is there a description of each hazard's **impacts** on each jurisdiction (what happens to structures, infrastructure, people, environment, etc.)? (Requirement §201.6(c)(2)(ii))

**A:** See **Impacts of Landslides in the City of Bradbury** below.

## Impacts of Landslides in the City of Bradbury

Based on the risk assessment, it is evident that landslides continue to have potentially devastating economic impact to certain areas of the City.

Impacts that are not quantified, but can be anticipated in future events, include:

- ✓ Injury and loss of life
- ✓ Commercial and residential structural damage
- ✓ Disruption of and damage to public infrastructure
- ✓ Secondary health hazards e.g. mold and mildew
- ✓ Damage to roads/bridges resulting in loss of mobility
- ✓ Significant economic impact (jobs, sales, tax revenue) upon the community
- ✓ Negative impact on commercial and residential property values
- ✓ Significant disruption to students and teachers as temporary facilities and relocations would likely be needed

# Windstorm Hazards

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1a.**

**Q:** Does the plan include a general **description** of all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Previous Occurrences of Windstorms in the City of Bradbury** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2a.**

**Q:** Does the plan include information on **previous occurrences** of hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Previous Occurrences of Windstorms in the City of Bradbury** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3b.**

**Q:** Is there a description of each identified hazard's overall **vulnerability** (structures, systems, populations, or other community assets defined by the community that are identified as being susceptible to damage and loss from hazard events) for each jurisdiction? (Requirement §201.6(c)(2)(ii))

**A:** See **Previous Occurrences of Windstorms in the City of Bradbury below.**

## Previous Occurrences of Windstorms in the City of Bradbury

Severe windstorms pose a significant risk to life and property in the City of Bradbury by creating conditions that disrupt essential systems such as public utilities, telecommunications, and transportation routes. High winds can and do occasionally cause tornado-like damage to local homes and businesses in and near the community. High winds have destructive impact, especially to trees, power lines, and utility services.

According to the Planning Team (Source), the most damaging windstorm in Bradbury occurred in the winter of 1997. It was not related to Santa Ana wind conditions but rather was a short duration wind event with wind gusts that caused power poles to lean, electrical lines to fall, roof tiles to fly off, and tree branches to break off. The City of Bradbury suffered approximately $310,000 loss in the windstorms of January 6, and 7, 1997. The Bradbury City Council proclaimed a local emergency after the 1997 windstorm and emergency support was sought from the California Office of Emergency Services (OES). However, the OES denied the request because it was not demonstrated that "the damage caused by the windstorms were beyond the City's capability".

Based on the 1997 windstorm, it is not difficult to assume that a future windstorm event could generate similar damage. It is also possible that a strong Santa Ana wind condition could cause substantial damage in the City of Bradbury.

Since the adoption of the 2007 Mitigation Plan, there has been one windstorm event in the City, on November 30, 2011. The windstorm, which caused winds in excess of 90 mph in the Pasadena, Sierra Madre, Arcadia, Monrovia, and Bradbury area downed trees and resulted in extended power and utility outages. The City did not file a claim for any relief from damages as damage to city facilities was minimal.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3a.**

**Q:** Is there a description of each hazard's **impacts** on each jurisdiction (what happens to structures, infrastructure, people, environment, etc.)? (Requirement §201.6(c)(2)(ii))

**A:** See **Impacts of Windstorms in the City of Bradbury** below.

## Impacts of Windstorms in the City of Bradbury

Based on the risk assessment, it is evident that Windstorms continue to have potentially devastating economic impact to certain areas of the City.

Impacts that are not quantified, but which can be anticipated in future events, include:

- ✓ Injury and loss of life
- ✓ Commercial and residential structural damage
- ✓ Disruption of and damage to public infrastructure
- ✓ Secondary Health hazards e.g. mold and mildew
- ✓ Damage to roads/bridges resulting in loss of mobility
- ✓ Significant economic impact (jobs, sales, tax revenue) upon the community
- ✓ Negative impact on commercial and residential property values
- ✓ Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.

# Drought Hazards

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2a.**

**Q:** Does the plan include information on **previous occurrences** of hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Previous Occurrences of Drought in the City of Bradbury** below.

## Previous Occurrences of Drought in the City of Bradbury

According to the Planning Team (Source), there is no history of severe drought (e.g. restaurants with restricted hours, emergency water distribution to residents, etc.) within the City of Bradbury. However, the City is designated on the U.S. Drought Monitor as experiencing an "exceptional drought". This designation comes from a combination of a significant decrease in rain combined with water supply restrictions resulting from the state-wide California drought. These conditions were increasingly evident from 2012 to early in 2017.

Since the adoption of the 2007 Mitigation Plan, there have been no significant damages to the City from a drought.

## Previous Occurrences of Drought in Los Angeles County

The region's Mediterranean climate makes it especially susceptible to variations in rainfall. Though the potential risk to the City of Bradbury is in no way unique, severe water shortages could have a bearing on the economic well-being of the community. Comparison of climate (rainfall) records from Los Angeles with water well records beginning in 1930 from the San Gabriel Valley indicates the existence of wet and dry cycles on a 10-year scale as well as for much longer periods. The climate record for the Los Angeles region beginning in 1890 suggests drying conditions over the last century. With respect to the present day, climate data also suggests that the last significant wet period was the 1940s. Well level data and other sources seem to indicate the historic high groundwater levels (reflecting recharge from rainfall) occurred in the same decade. Since that time, rainfall (and groundwater level trends) appears to be in decline. This slight declining trend, however, is not believed to be significant.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1a.**

**Q:** Does the plan include a general **description** of all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i))

**A:** See **Local Conditions** below.

**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3b.**

**Q:** Is there a description of each identified hazard's overall **vulnerability** (structures, systems, populations, or other community assets defined by the community that are identified as being susceptible to damage and loss from hazard events) for each jurisdiction? (Requirement §201.6(c)(2)(ii))

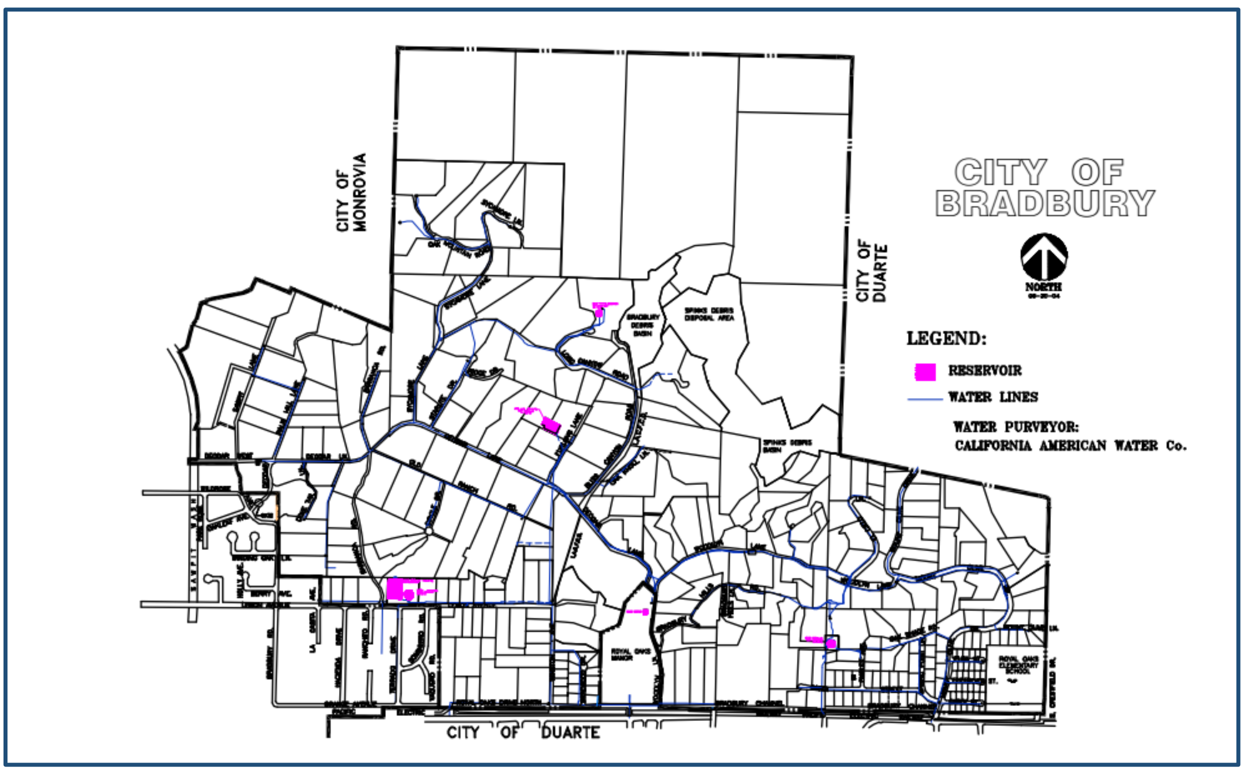
**A:** See **Local Conditions** below.

## Local Conditions

According to the City of Bradbury General Plan (Source), water is provided to the City by California American Water Company. According to California American Water, the City is served entirely by groundwater sources from the main San Gabriel Basin. In 2012, California American Water completed a multi-million-dollar water main replacement project throughout its Los Angeles County service district. In order to replace aging infrastructure and improve water delivery service, California American Water upgraded 13,300 feet of water distribution mains in the cities of Bradbury, Duarte and the Baldwin Hills area in unincorporated Los Angeles County. This infrastructure project involved a number of different water main segments throughout the mentioned areas.

A significant drought has impacted California since 2012. The drought depleted reservoir levels all across the state. In January of 2014, Governor Brown declared a state of emergency and directed state officials to take all necessary actions to prepare for water shortages. As the drought prolonged into 2015, to help cope with the drought, Governor Brown gave an executive order in April 2015 which mandated a statewide 25 percent reduction in water use. In January of 2016, the DWR and the U.S. Bureau of Reclamation have finalized the 2016 Drought Contingency Plan that outlines State Water Project and Central Valley Project operations for February 2016 to November 2016. The plan was developed in coordination with staff from State and federal agencies. Although the drought has more significantly impacted surface waters and other agencies that use water for agriculture, the City of Bradbury is affected by the possibility of reduced reliability of imported water.

**Map: Bradbury Water Distribution Improvements**
**(Source: California American Water)**



**Q&A | ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3a.**

**Q:** Is there a description of each hazard's **impacts** on each jurisdiction (what happens to structures, infrastructure, people, environment, etc.)? (Requirement §201.6(c)(2)(ii))

**A:** See **Impacts of Drought in the City of Bradbury** below.

## Impacts of Drought in the City of Bradbury

Based on the risk assessment, it is evident that drought events continue to have potentially devastating economic impacts to certain areas of the City.

Impacts that are not quantified, but can be anticipated in future events, include:

- ✓ Injury and loss of life
- ✓ Disruption of and damage to public infrastructure
- ✓ Significant economic impact (jobs, sales, tax revenue) upon the community
- ✓ Negative impact on commercial and residential property values
- ✓ Uncontrolled fires and associated injuries and damage

# PART III: MITIGATION STRATEGIES

## Mitigation Strategies

### Overview of Mitigation Strategy

As the cost of damage from natural disasters continues to increase nationwide, the City of Bradbury recognizes the importance of identifying effective ways to reduce vulnerability to disasters. Mitigation Plans assist communities in reducing risk from natural hazards by identifying resources, information and strategies for risk reduction, while helping to guide and coordinate mitigation activities throughout the City.

The plan provides a set of action items to reduce risk from natural hazards through education and outreach programs, and to foster the development of partnerships. Further, the plan provides for the implementation of preventative activities, including programs that restrict and control development in areas subject to damage from natural hazards.

The resources and information within the Mitigation Plan:

1. Establish a basis for coordination and collaboration among agencies and the public in the City of Bradbury;
2. Identify and prioritize future mitigation projects; and
3. Assist in meeting the requirements of federal assistance programs

The Mitigation Plan is integrated with other City plans including the City of Bradbury Emergency Operations Plan, General Plan as well as department-specific standard operating procedures.

### Mitigation Measure Categories

Following is FEMA's list of mitigation categories. The activities identified by the Planning Team are consistent with the six broad categories of mitigation actions outlined in FEMA publication 386-3 *Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies*.

- ✓ **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.
- ✓ **Property Protection:** Actions that involve modification of existing buildings or structures to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
- ✓ **Public Education and Awareness:** Actions to inform and educate citizens, property owners, and elected officials about hazards and potential ways to mitigate them.

  Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

- ✓ **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses preserve or restore the functions of natural systems. Examples include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- ✓ **Emergency Services:** Actions that protect people and property during and immediately following a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.
- ✓ **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, retaining walls, and safe rooms.

**Q&A | ELEMENT C. MITIGATION STRATEGY | C3**

**Q:** Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))

**A:** See **Goals** below.

**Q&A | ELEMENT D. MITIGATION STRATEGY | D3**

**Q:** Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))

**A:** See **Mitigation Actions Matrix** below.

## Goals

The Planning Team developed mitigation goals to avoid or reduce long-term vulnerabilities to hazards. These general principles clarify desired outcomes.

The goals are based on the risk assessment and Planning Team input and represents a long-term vision for hazard reduction or enhanced mitigation capabilities. They are compatible with community needs and goals expressed in other planning documents prepared by the City.

Each goal is supported by mitigation action items. The Planning Team developed these action items through its knowledge of the local area, risk assessment, review of past efforts, identification of mitigation activities, and qualitative analysis.

The five mitigation goals and descriptions are listed below. (Note: The 2004 Bradbury Hazard Mitigation Plan included a goal for “Public Participation” however the Planning Team chose to eliminate that as a goal since public participation is integrated into every aspect of the updated Hazard Mitigation Plan.)

FEMA defines **Goals** as general guidelines that explain what you want to achieve. They are usually broad policy-type statements, long-term, and represent global visions.

FEMA defines **Mitigation Activities** as specific actions that help you achieve your goals and objectives.

### *Protect Life and Property*

Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to losses from natural hazards.

Improve hazard assessment information to make recommendations for avoiding new development in high hazard areas and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

### *Enhance Public Awareness*

Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.

Provide information on tools; partnership opportunities, and funding resources to assist in implementing mitigation activities.

### *Preserve Natural Systems*

Support management and land use planning practices with hazard mitigation to protect life.

Preserve, rehabilitate, and enhance natural systems to serve hazard mitigation functions.

### *Encourage Partnerships and Implementation*

Strengthen communication and coordinate participation with public agencies, citizens, non-profit organizations, business, and industry to support implementation.

Encourage leadership within the City and public organizations to prioritize and implement local and regional hazard mitigation activities.

### *Strengthen Emergency Services*

Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.

Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.

Coordinate and integrate hazard mitigation activities where appropriate, with emergency operations plans and procedures.

The Planning Team also developed hazard-specific mitigation goals, which appear in the **Mitigation Strategies Section**.

## How are the Mitigation Action Items Organized?

The action items are a listing of activities in which City agencies and citizens can be engaged to reduce risk. Each action item includes an estimate of the timeline for implementation.

The action items are organized within the following **Mitigation Actions Matrix**, which lists all of the multi-hazard (actions that reduce risks for more than one specific hazard) and hazard-specific action items included in the mitigation plan. Data collection and research and the public participation process resulted in the development of these action items. The Matrix includes the following information for each action item:

## Funding Source

The action items can be funded through a variety of sources, possibly including: operating budget/general fund, development fees, Hazard Mitigation Grant Program (HMGP), other Grants, private funding, Capital Improvement Program, and other funding opportunities.

## Planning Mechanism

It's important that each action item be implemented. Perhaps the best way to ensure implementation is through integration with one or many of the City's existing "planning mechanisms" including the General Plan, Capital Improvement Program, General Fund and Grants. Opportunities for integration will be simple and easy in cases where the action item is already compatible with the content of the planning mechanism. As an example, if the action item calls for the creation of a floodplain ordinance and the same action is already identified in the General Plan's policies, then the General Plan will assist in implementation. On the contrary, if preparation of a floodplain ordinance is not already included in the General Plan policies then the item will need to be added during the next update to the General Plan. As pointed out earlier in the Mitigation Plan, the General Plan was last updated in 2007 however that did not include updates to the 1993 Land Use Element or 1993 Safety Element – both critical resources to the community at large as well as a vital resource to the Mitigation Plan. It is unknown when the entire General Plan will be updated.

The Capital Improvement Program, depending on the budgetary environment, is updated every 5 years. The CIP includes infrastructure projects built and owned by the City of Bradbury. As such, the CIP is an excellent medium for funding and implementing action items from the Mitigation Plan. The Mitigation Actions Matrix includes several items from the existing CIP. The authors of the CIP served on the Planning Team and are already looking to funding addition Mitigation Plan action items in future CIPs.

The General Fund is the budget document that guides all of the City's expenditures and is updated on an annual basis. Although primarily a funding mechanism, it also includes descriptions and details associated with tasks and projects.

Grants come from a wide variety of sources – some annually and other triggered by events like disasters. Whatever the source, the City uses the General Fund to identify successful grants as funding sources.

## Coordinating Organization

The Mitigation Actions Matrix assigns primary responsibility for each of the action items. The hierarchies of the assignments vary – some are positions, other departments, and other committees. The primary responsibility for implementing the action items falls to the entity shown as the "Coordinating Organization". The coordinating organization is the agency with regulatory responsibility to address hazards, or that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation. Coordinating organizations may include local, County, or regional agencies that are capable of or responsible for implementing activities and programs.

## *Plan Goals Addressed*

The plan goals addressed by each action item are included as a way to monitor and evaluate how well the mitigation plan is achieving its goals once implementation begins.

The plan goals are organized into the following five areas:

- ✓ Protect Life and Property
- ✓ Enhance Public Awareness
- ✓ Preserve Natural Systems
- ✓ Encourage Partnerships and Implementation
- ✓ Strengthen Emergency Services

**Q&A | ELEMENT C. MITIGATION STRATEGY | C5a.**

**Q:** Does the plan explain how the mitigation actions and projects will be prioritized (including cost benefit review)? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

**A:** See **Benefit/Cost Ratings and Priority Rating** below.

## *Benefit/Cost Ratings*

The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant program. A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

**Cost ratings** were defined as follows:

**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.

**Benefit ratings** were defined as follows:

> **High**: Project will provide an immediate reduction of risk exposure for life and property.
>
> **Medium**: Project will have a long-term impact on the reduction of risk exposure for life and 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.

**Q&A | ELEMENT D. MITIGATION STRATEGY | D3**

**Q:** Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))

**A:** See **Priority Rating** below.

## *Priority Rating*

To assist with implementing the Hazard Mitigation Plan the Planning Team adopted the following process for rating the priority of each mitigation action item. Designations of "High", "Medium", and "Low" priority have been assigned to each action item using the following criteria:

Does the Action:

- ☐ solve the problem?
- ☐ address Vulnerability Assessment?
- ☐ reduce the exposure or vulnerability to the highest priority hazard?
- ☐ address multiple hazards?
- ☐ benefits equal or exceed costs?
- ☐ implement a goal, policy, or project identified in the General Plan or Capital Improvement Plan?

Can the Action:

- ☐ be implemented with existing funds?
- ☐ be implemented by existing state or federal grant programs?
- ☐ be completed within the 5-year life cycle of the LHMP?
- ☐ be implemented with currently available technologies?

Will the Action:

- ☐ be accepted by the community?
- ☐ be supported by community leaders?
- ☐ adversely impact segments of the population or neighborhoods?
- ☐ require a change in local ordinances or zoning laws?
- ☐ positive or neutral impact on the environment?
- ☐ comply with all local, state and federal environmental laws and regulations?

Is there:

- ☐ sufficient staffing to undertake the project?
- ☐ existing authority to undertake the project?

During the prioritization meeting of the Planning Team, department representatives were provided worksheets for each of their assigned action items. Answers to the criteria above determined the priority according to the following scale.

- 1-6 = Low priority
- 7-12 = Medium priority
- 13-18 = High priority

**Q&A | ELEMENT C. MITIGATION STRATEGY | C1b.**

**Q:** Does the plan document each jurisdiction's ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))c

**A:** See **Mitigation Actions Matrix** below.

**Q&A | ELEMENT C. MITIGATION STRATEGY | C4a.**

**Q:** Does the plan identify and analyze a comprehensive range (different alternatives) of specific mitigation actions and projects to reduce the impacts from hazards? (Requirement §201.6(c)(3)(ii))

**A:** See **Mitigation Actions Matrix** below.

**Q&A | ELEMENT C. MITIGATION STRATEGY | C4b.**

**Q:** Does the plan identify mitigation actions for every hazard posing a threat to each participating jurisdiction? (Requirement §201.6(c)(3)(ii))

**A:** See **Mitigation Actions Matrix** below.

**Q&A | ELEMENT C. MITIGATION STRATEGY | C4c.**

**Q:** Do the identified mitigation actions and projects have an emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))

**A:** See **Mitigation Actions Matrix** below.

**Q&A | ELEMENT C. MITIGATION STRATEGY | C5a.**

**Q:** Does the plan explain how the mitigation actions and projects will be prioritized (including cost benefit review)? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

**A:** See **Mitigation Actions Matrix** below.

**Q&A | ELEMENT C. MITIGATION STRATEGY | C5b.**

**Q:** Does the plan identify the position, office, department, or agency responsible for implementing and administering the action/project, potential funding sources and expected timeframes for completion? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

**A:** See **Mitigation Actions Matrix** below.

**Q&A | ELEMENT D. MITIGATION STRATEGY | D2**

**Q:** Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))

**A:** See **Mitigation Actions Matrix** below.

**Q&A | ELEMENT D. MITIGATION STRATEGY | D3**

**Q:** Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))

**A:** See **Mitigation Actions Matrix** below.

## Mitigation Actions Matrix

Following is **Table: Mitigation Actions Matrix** which identifies the existing and future mitigation activities developed by the Planning Team. *Note: all 2007 action items were revised to add "Building & Infrastructure", "Funding Source", "Planning Mechanism", "Benefit, Cost, and Priority".

**Table: Mitigation Actions Matrix**

| **Item Identifier** | **Action Item and Ideas for Implementation** | **Coordinating Agency** | **Timeline** | Goal: Protect Life and Property | **Goal**: Public Awareness | **Goal**: Natural Systems | **Goal**: Emergency Services | **Goal:** Partnerships and Implementation | **Buildings & Infrastructure:** Does the Action item involve New and/or Existing Buildings and/or Infrastructure? Yes (Y) | **Funding Source:** GF- General Fund, GR-Grant | **Planning Mechanism:** GP-General Plan, CIP, GF-General Fund, GR-Grant | **Benefit:** L-Low, M-Medium, H-High | **Cost:** L-Low, M-Medium, H-High | **Priority:** L-Low, M-Medium, H-High | **2019 Comments and Status -** Completed, Revised, Deleted, New, Deferred, and Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MULTI-HAZARD ACTION ITEMS** | | | | | | | | | | | | | | | |
| MH-1 | Integrate the goals and action items from the City of Bradbury's Hazard Mitigation Plan into existing regulatory documents and programs, where appropriate. | City Staff | Ongoing | X | X | X | X | X | | GF | GF | H | L | H | |
| MH-2 | Use the Mitigation Plan to help the City's General Plan institutionalize and enforce guidelines for sustainable development | Public Safety Committee | Ongoing | X | X | X | X | X | Y | GF | GP | H | L | M | Note: Green building codes and fire department regulations |

| Item Identifier | Action Item and Ideas for Implementation | Coordinating Agency | Timeline | Goal: Protect Life and Property | Goal: Public Awareness | Goal: Natural Systems | Goal: Emergency Services | Goal: Partnerships and Implementation | Buildings & Infrastructure: Does the Action item involve New and/or Existing Buildings and/or Infrastructure? Yes (Y) | Funding Source: GF- General Fund, GR-Grant | Planning Mechanism: GP-General Plan, CIP, GF-General Fund, GR-Grant | Benefit: L-Low, M-Medium, H-High | Cost: L-Low, M-Medium, H-High | Priority: L-Low, M-Medium, H-High | 2019 Comments and Status - Completed, Revised, Deleted, New, Deferred, and Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | in all new construction and development projects according to the Hazards that impact the City of Bradbury. | | | | | | | | | | | | | | already exist to create safe sustainable development. |
| MH-3 | Integrate the City's Mitigation Plan into current capital improvement projects to ensure that development does not encroach on known hazard areas. | Hazard Mitigation Planning Team | Annual | X | X | X | X | X | Y | GF | CIP | H | L | M | |
| MH-4 | Identify and pursue funding opportunities to develop and implement local and city mitigation activities. | Hazard Mitigation Planning Team | 1-5 years | X | X | X | X | X | Y | GF | GP | H | L | M | |
| MH-5 | Develop incentives for citizens to pursue hazard mitigation projects. | Public Safety Committee | 1 year | | | | | X | Y | GF | GF | H | L | H | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MH-6 | Establish measurable standards to evaluate mitigation policies and programs and provide a mechanism to update and revise the mitigation plan. | Hazard Mitigation Planning Team | 1 year | X | X | X | X | X | | GF | GF | H | L | H | |
| MH-7 | Provide training for Elected Officials and Public Safety Committee members to remain current on developing issues in the natural hazard loss reduction field. | City Staff | 1-5 years | X | X | | | X | | GF | GF | H | L | M | |
| MH-8 | Identify, improve, and sustain collaborative programs focusing on the real estate and insurance industries, and private sector organizations, and | Hazard Mitigation Planning Team | 1-5 years | X | X | X | X | X | | GF | GF | H | L | H | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | individuals to avoid activity that increases risk to natural hazards. | | | | | | | | | | | | | | |
| MH-9 | Distribute information about flood, fire, earthquake, windstorms, landslides and other forms of natural hazards insurance to property owners in areas identified to be at risk. | Public Safety Committee | 1-5 years | X | X | X | X | X | | GF | GP | H | H | L | |
| MH-10 | Educate individuals on the benefit of engaging in mitigation activities such as earthquake retrofitting and wildfire defensible space. | Public Safety Committee | Ongoing | X | X | X | X | X | Y | GF | GP | M | H | M | |
| MH-11 | Encourage homeowner mitigation activities. | Public Safety Committee | 1 year | X | X | | X | X | Y | GF | GF | H | L | H | Note: Bradbury has several HOA's that would |

| Item Identifier | Action Item and Ideas for Implementation | Coordinating Agency | Timeline | Goal: Protect Life and Property | Goal: Public Awareness | Goal: Natural Systems | Goal: Emergency Services | Goal: Partnerships and Implementation | Buildings & Infrastructure: Does the Action item involve New and/or Existing Buildings and/or Infrastructure? Yes (Y) | Funding Source: GF- General Fund, GR-Grant | Planning Mechanism: GP-General Plan, CIP, GF-General Fund, GR-Grant | Benefit: L-Low, M-Medium, H-High | Cost: L-Low, M-Medium, H-High | Priority: L-Low, M-Medium, H-High | 2019 Comments and Status - Completed, Revised, Deleted, New, Deferred, and Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | be interested in participating in homeowner projects. |
| MH-12 | Maintain communication between city departments to work together to prioritize and identify strategies to deal with road problems. | City Staff, City Engineer | Ongoing | X | | | | X | Y | GF | GF | H | L | H | |
| MH-13 | Establish protocol for communication between the City and the various utility purveyors. | | | | | | | | | | | | | | Completed |
| MH-14 | Develop inventories of City-owned at-risk buildings and infrastructure in order to prioritize mitigation projects. | Building and Safety | 2 Years | X | | | | X | Y | GF | GF | H | H | M | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MH-15 | Based on results of "at-risk inventory" above, develop priorities for retrofit, relocation, or other strategies to mitigate hazards impacting City-owned buildings and infrastructure. | Building and Safety | 3 Years | X | | | | X | Y | GF | GF | H | H | M | New |
| MH-16 | Develop strategies to mitigate risk to these facilities or to utilize alternative facilities should natural hazard events cause damages to the facilities in question. | City Staff, Building and Safety | | | | | | | | | | | | | Completed |
| MH-17 | Identify the two bridges under the maintenance of the City that are at risk from flood or earthquake | City Engineer, Building and Safety | | | | | | | | | | | | | Completed |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | hazards and complete any necessary retrofits or repairs. | | | | | | | | | | | | | | |
| MH-18 | Strengthen emergency services preparedness and response by linking emergency services with natural hazard mitigation programs and enhancing public education. | City Staff, Public Safety Committee | Ongoing | | X | | X | X | | GF | GF | H | M | M | |
| MH-19 | Develop a process to encourage private property owners to upgrade their access roads and driveways to accommodate fire trucks and other emergency vehicles. | Building and Safety, Planning Commission, LACoFD | 1 year | X | | | X | X | Y | GF | GF | H | L | H | The City partners with HOA's and LACoFD to ensure that new development is obligated to allow sufficient space for fire response vehicle to turn around. |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MH-20 | Encourage individual and family preparedness through City Newsletter and City emails. | City Staff | Ongoing - Monthly | X | X | X | X | X | Y | GF | GF | H | L | H | |
| MH-21 | Maintain emergency evacuation routes based on ongoing communication with emergency response agencies. | City Staff; City Engineer | Ongoing | X | | | X | X | Y | GF | GF | H | H | H | |
| MH-22 | Establish opportunities for partnering with citizens, private contractors, and other jurisdictions to increase availability of equipment and manpower for efficiency of response efforts. | City Staff; Public Safety Committee | 1 year | | X | | X | X | | GF | GF | H | H | M | |
| MH-23 | Work with Los Angeles County Fire Department | Public Safety Committee | 1-5 years | X | X | | X | X | | GR | GR | H | M | H | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | to establish a Community Emergency Response Team for Bradbury. | | | | | | | | | | | | | | |
| MH-24 | Maintain the Hazard Mitigation Plan on the website. | | | | | | | | | | | | | | Completed |
| MH-25 | Enhance hazard map capabilities by creating a website that includes information specific to City of Bradbury residents, including site-specific hazards information, Building & Safety Codes information, insurance companies that provide earthquake insurance for city residents, and educational information on damage prevention. | City Staff | 1-5 years | X | X | | X | | Y | GF | GF | H | M | H | New |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MH-26 | Develop and complete a baseline survey to gather perceptions of private citizens regarding natural hazard risks and identify mitigation needs. | City Staff | Every 5 years | X | X | | | X | | GF | GF | H | L | H | New |
| MH-27 | Use local cable television facilities as a conduit for advertising public forums. | Public Safety Committee | Ongoing | X | X | | | | Y | GF | GF | H | L | H | New |
| MH-28 | Develop outreach materials for mitigation, preparedness, response and recovery. | City Staff | Ongoing | X | X | | | | Y | GR | CIP | H | M | M | |
| MH-29 | Use technical knowledge of natural ecosystems and events to link natural resource management and land use organizations to mitigation activities and technical | City Engineer | Ongoing | | | X | | | Y | GF | GP | M | H | L | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | assistance. | | | | | | | | | | | | | | |
| MH-30 | Review ordinances that protect natural systems and resources to mitigate for natural Hazard for possible enhancements. | | | | | | | | | | | | | | Completed |
| MH-31 | Pursue vegetation restoration practices that assist in enhancing and restoring the natural watershed. | City Staff, City Landscape | Ongoing | X | X | X | | | Y | GR | GR | H | H | L | New |
| MH-32 | Develop education and outreach programs that focus on protecting natural watershed systems. | City Staff, External EWIMP Group | Ongoing | X | X | X | | | | GF | GF | H | H | H | New |
| MH-33 | Purchase, install, and maintain generators for emergency power to pump water supply from | City of Bradbury | 2 years | | | | X | | Y | GR, GF | GF | H | M | H | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | City-owned wells. | | | | | | | | | | | | | | |
| MH-34 | Develop outreach programs and recovery activities for responding to the community during and immediately following a wildfire. | Public Safety Committee | 2-5 years | X | X | | | | | GF | GF | H | | | |
| MH-35 | Attend Disaster Cost Recovery Training | | | | | | | | | | | | | | New, Completed |
| MH-36 | Subscribe to Blackboard Connect that allows for pre-recorded message to inform public of wildfire response and recovery activities. | | | | | | | | | | | | | | Completed |
| MH-37 | During an emergency, post public information on the City web site and on the public access channel on cable television. | | | | | | | | | | | | | | Completed |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MH-38 | Purchase and encourage use of Nixle – a mass notification system. | Public Safety Committee | 1 year | X | X | X | X | X | | GF, GR | GF, GR | H | M | H | New |
| MH-39 | Review the Los Angeles County Uniform Building Code and all other applicable City development codes with the Chief Building Official to update wind safety standards and construction codes to reduce windstorm hazards to new buildings and infrastructure. | Building and Safety | Ongoing (6-10year cycle) | X | | | | | Y | GF | GF | H | L | H | |
| MH-40 | Continue public education program on sandbag techniques and expand to include other landslide protection measures. | LA County Fire Department, City Staff | Ongoing (3 to 5-year cycle) | | X | | | X | | GF | GF | H | L | M | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MH-41 | Seek funding to prepare a Debris Management Plan. | City Manager | 1 year | X | | | X | | Y | GR | GR | H | M | H | New |
| MH-42 | Prepare an update to the Emergency Operations Plan. | City Manager | 1 year | X | X | X | X | X | | GF, GR | GF, GR | H | M | H | New |
| **EARTHQUAKE ACTION ITEMS** | | | | | | | | | | | | | | | |
| EQ-1 | Integrate new information on the Sierra Madre and Duarte Faults as it becomes available. The new information will be added to the City's General Plan and other planning documents and maps. | City Planning Department, Engineer consultant | 2 years | X | | | | | Y | GF | GF | H | M | M | |
| EQ-2 | Coordinate with the California Department of Conservation on obtaining new data and maps related to the Sierra | | | | | | | | | | | | | | Completed |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Madre and Duarte Faults. | | | | | | | | | | | | | | |
| EQ-3 | Update the City's General Plan Safety Element (1993) with new mapping information on the Sierra Madre and Duarte Faults. | City Planning Department | 2 years | X | | | | | Y | GF | GF | M | M | M | Deferred |
| EQ-4 | Update all current zoning maps, development standards and guidelines to address all new information received from the California Department of Conservation related to earthquake fault zones. | | | | | | | | | | | | | | Completed |
| EQ-5 | Develop public education program related to earthquake hazard insurance. | City Administration Department | 2 years | | X | | | | | GF | GF | M | M | M | Deferred |
| EQ-6 | Utilizing the City's newsletter, produce | | | | | | | | | | | | | | Completed |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | articles that will provide information to Bradbury residents on the availability of earthquake insurance. | | | | | | | | | | | | | | |
| EQ-7 | Coordinate with insurance companies to produce brochure or public information leaflet related to the availability of earthquake insurance that can be distributed at community events and placed in government buildings. | City Administration Department | 2 years | | X | | | X | | GF | GF | M | L | M | Deferred |
| EQ-8 | Review Federal, State, County, and City Guidelines on seismic safety standards and construction codes on an | City Planning, Building & Safety | Ongoing (Annual) | X | | | | | Y | GF | GF | H | L | H | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | annual basis to reduce earthquake hazards to new buildings and infrastructure. | | | | | | | | | | | | | | |
| EQ-9 | Review all code amendments and modifications of the Los Angeles County Uniform Building Code with the City's Chief Building Official. | City Planning, Building & Safety | Ongoing (Annual) | X | | | | | Y | GF | GF | H | L | H | |
| EQ-10 | Review all recommendations of the California State Seismic Safety Commission pertaining to the construction of new buildings and infrastructure. | City Planning, Building & Safety | Ongoing (Annual) | X | | | | | Y | GF | GF | H | L | H | |
| EQ- | Review the guidelines of | City Planning, | Ongoing | X | | | | | Y | GF | GF | H | L | H | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | the National Earthquake Hazards Reduction Program (NEHRP) and consider changes to Bradbury 's plan checking program for new construction based on these guidelines. | Building & Safety | (Annual) | | | | | | | | | | | | |
| EQ-12 | Prepare Hillside Development Standards to incorporate all new information related to earthquake fault zones. | | | | | | | | | | | | | | Completed |
| EQ-13 | Update City's evacuation route map and distribute it to appropriate city departments. | | | | | | | | | | | | | | Completed |
| EQ-14 | Meet with representatives of the three local homeowner associations | Planning and Public Works Departments | 3-5 years | | | | | X | X | GR | GR | H | M | H | Note: 1 New egress road has been built; |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | to access existing evacuation routes and plan secondary routes if possible. | | | | | | | | | | | | | | modifications to 2nd egress location is being considered. |
| EQ-15 | Ensure that evacuation routes are part of the review process for all new development proposals. | Planning and Public Works Departments | Ongoing | | | | | X | Y | GF | GF | H | L | H | |
| EQ-16 | Encourage reduction of nonstructural and structural earthquake hazards in homes, schools and government offices. | | | | | | | | | | | | | | Completed |
| EQ-17 | Provide information to the community on securing bookcases, furniture, water heaters, and other objects that can cause injuries or block exits. | City Administration Department | Ongoing | | X | | | | Y | GF | GF | H | L | L | |

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| EQ-18 | Obtain public information brochures produced by FEMA and state agencies related to earthquake safety and make brochures available to the public at City Hall. | | | | | | | | | | | | | | Completed |
| EQ-19 | Inspect all City-owned buildings and infrastructure with the purpose of identifying seismic repairs and retrofit recommendations. | Building and Safety Department | 1-2 years | X | X | X | X | X | Y | GF | GF | H | L | H | New |
| EQ-20 | Prioritize and seek funding for seismic repair and retrofit projects. | Building and Safety Department | 1-2 years | X | X | X | X | X | Y | GF | GF | H | L | H | New |
| **WILDFIRE ACTION ITEMS** | | | | | | | | | | | | | | | |
| WF-1 | Encourage Los Angeles County Fire Department (through contract | City Manager and Los Angeles County Fire | Ongoing | | | | X | | | GF | GF | H | L | H | |

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| | services) to replace out-of-date apparatus and equipment on a scheduled basis. | Department | | | | | | | | | | | | | |
| WF-2 | Identify alternative firefighting water sources and coordinate with Los Angeles County fire department on inventory of alternate sources. | City of Bradbury and Los Angeles County Fire Department | Ongoing | | | | X | | Y | GF | GF | H | L | H | |
| WF-3 | Identify all swimming pools to be used for emergency pumping. | City of Bradbury and Los Angeles County Fire Department | 3 years | X | X | X | X | X | Y | GF | GF | H | L | H | Note: To date, encouraged residents to purchase and display placards indicating their pool's use for fire prevention. |
| WF-4 | Increase communication and coordination between | Public Safety Committee | Ongoing | X | X | | | | | GF | GF | H | L | H | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | County fire personnel, city planners, contractors and property owners to address risks and mitigation measures that are available in wildland/urban interface areas of the city. | | | | | | | | | | | | | | |
| WF-5 | Continue fire inspections and brush clearance programs sponsored by the Los Angeles County Fire Department. | City of Bradbury and Los Angeles County Fire Department | Ongoing | X | X | | | | Y | GF | GF | H | L | H | |
| WF-6 | Provide development standards and zoning handouts to property owners and contractors that describe the fire prevention measures contained within the | City Planning, Building & Safety | Ongoing | X | X | | | | Y | GF | GF | H | L | H | |

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| | Hillside Development Standards including unobstructed fire protection equipment access easements, Class A roof materials, fire hydrant locations, and water main minimum requirements. | | | | | | | | | | | | | | |
| WF-7 | Enhance outreach and education programs aimed at mitigating wildfire hazards. | City of Bradbury, Los Angeles County Fire Department | Ongoing | X | X | | | | | GF | GF | H | L | H | |
| WF-8 | Distribute public information brochures that encourage residents to plant fire-resistant landscaping, to clear dry brush, and to consider fire-resistant building | City of Bradbury and Los Angeles County Fire Department | Ongoing | X | X | | | | | GF | GF | H | L | H | |

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| | materials. | | | | | | | | | | | | | | |
| WF-9 | Publish fire prevention articles in City Newsletter related to fire evacuation, fire escape plans, and fire safety. | City of Bradbury, Los Angeles County Fire Department | Ongoing | X | X | | | | Y | GF | GF | H | L | H | |
| WF-10 | Hold May Day Emergency Expo to educate the residents on fire prevention methods. | City of Bradbury and Los Angeles County Fire Department | Ongoing | X | X | | | | Y | GF | GF | H | L | H | Note: May event |
| WF-11 | Explore funding sources and advocate with Cal-American Water Company to install fire-resistant electrical pump systems or to install back-up power generators at each water tank to ensure adequate fire suppression. | City Manager | 3-5 years | X | | | X | X | Y | GF | GF | H | M | H | Deferred |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WF-12 | Coordinate and advocate with the U.S. Forest Service to install portable tanks filled with water or flame-retardant chemical in strategic locations in the forest areas north of Bradbury. | City Manager | 3-5 years | X | | | X | X | Y | GR, GF | GF | H | L | H | Deferred |
| WF-13 | Develop outreach programs for response and recovery activities for the community regarding a wildfire. | Public Safety Committee | Ongoing | X | X | | | | Y | GF | GF | H | L | H | |
| WF-14 | Apply for Fire Safety Grant for brush clearance. | | | | | | | | | | | | | | New. Completed - Grant was approved for $200,000. |
| WF-15 | Seek grant funding for preparation of a Community Wildfire | City Manager | 1 year | X | X | X | X | X | Y | GR | GR | H | H | H | New |

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| | Protection Plan. | | | | | | | | | | | | | | |
| WF-16 | Work with LACoFD on identifying defensible space and other technique that will protect the City's buildings and infrastructure from the impacts of wildfire. | City Manager | 1 year | X | X | X | X | X | Y | GF | GF | H | H | H | New |
| **FLOODING ACTION ITEMS** | | | | | | | | | | | | | | | |
| FLD-1 | Coordinate with LA County Flood Control District on flood warning system for San Gabriel River and San Gabriel Canyon Dams and establish city procedures to handle early warnings. | City Manager, Los Angeles County Flood Control District | Ongoing | X | X | X | X | X | | GF | GF | H | L | H | |
| FLD-2 | Coordinate with Army Corps of Engineers and Los Angeles County | City Manager, Los Angeles County Flood Control | Ongoing | X | | | X | | | GF | GF | H | L | H | |

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| | Flood Control District on establishing early flood warning system and communications methods among all government agencies. | District | | | | | | | | | | | | | |
| FLD -3 | Develop program for capping sewer inlets during major storms and flood events to prevent water surges in sewer lines. | City Manager, Los Angeles County Public Works Department | 2-4 years | X | | X | X | X | Y | GF, GR | GF, GR | H | M | H | Note: Still seeking funding |
| FLD -4 | Continue public education program on sandbag techniques and expand to include other flood protection measures. | City Manager, Los Angeles County Public Works Department | Ongoing | | X | | | | | GF | GF | H | L | H | |
| FLD -5 | Expand education program to include other flood protection measures | City Planning, Building & Safety, Los Angeles | 2-4 years | X | X | X | X | X | | GF | GF | H | M | M | Deferred |

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| | such as grading, drain clearance, and erosion control planting. | County Public Works Department, City Engineer | | | | | | | | | | | | | |
| FLD -6 | Upon completion of a Flood Hazard Study or Mapping by the Federal Emergency Management Agency (FEMA), implement proper floodplain management policies. | City Engineer, FEMA | 5-7 years | X | | | | | Y | GF | GF | H | M | M | Deferred – no updated maps |
| FLD -7 | Work with FEMA on identifying flood risk. | City Engineer, FEMA | Ongoing | X | X | X | X | X | Y | GF | GF | H | M | M | |
| FLD -8 | Develop sound floodplain management standards. | | | | | | | | | | | | | | Completed |
| FLD -9 | Revise zoning standards, development codes, and building codes, based on the Flood Hazard Study to | | | | | | | | | | | | | | Completed |

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| | address the construction of new buildings and infrastructure within the identified floodplain areas. | | | | | | | | | | | | | | |
| FLD -10 | Identify areas that are subject to urban flooding and develop programs to minimize or eliminate the flooding. | | | | | | | | | | | | | | |
| FLD -11 | Work with LA County Public Works Department to conduct engineering studies to determine the appropriate size of storm drain facilities that are needed to alleviate urban flooding. | City Engineer, Los Angeles County Public Works Department | Ongoing | X | X | X | X | X | Y | GF, GR | GF, GR | H | L | H | |
| **LANDSLIDE ACTION ITEMS** | | | | | | | | | | | | | | | |
| LS- | Increase public | City Staff | 2 years | X | X | X | | X | Y | GF | GF | H | L | H | New |

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| 1 | awareness of Earthquake-Induced Landslide Hazard Areas as delineated on State of California Seismic Hazard Zones Official Map. | | | | | | | | | | | | | | |
| LS-2 | Amend Hillside Development Standards as needed to align with the Landslide Hazard Areas as delineated on the Official State maps. | Planning Department | Ongoing | | X | | | | Y | GF | GF | H | M | M | |
| LS-3 | Identify safe evacuation routes in high-risk debris flow and landslide areas. | | | | | | | | | | | | | | |
| LS-4 | Identify potential debris removal resources. | City Staff, City Engineer | 2 years | | | | X | | Y | GF | GF | H | L | H | Deferred |
| LS-5 | Review existing soil stability construction practices and determine | Engineering | 3-5 years | X | | | | | Y | GF | GF | M | M | M | Deferred |

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| | if additional measures are needed. | | | | | | | | | | | | | | |
| LS-6 | Review Hillside Development Standards to determine if additional grading regulation measures are needed to safeguard new construction and new buildings. | Planning Department | 3-5 years | X | | | | | Y | GF | GF | M | L | M | New |
| LS-7 | Review erosion-control requirements pertaining to vegetation on slopes and other erosion control measures. | | | | | | | | | | | | | | |
| LS-8 | Expand education program to include other landslide protection measures such as grading and erosion | City Engineer, Landscaper | 3-5 years | | X | | | | | GF | GF | M | M | M | Deferred |

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| | control plantings. | | | | | | | | | | | | | | |
| LS-9 | Closely monitor mudflow potential resulting from the 2016 Reservoir and Fish Fire. | City Engineer, LA County Fire Department | 1-5 years | X | | | | X | | GF, GR | GP | H | M | H | New |
| LS-10 | Examine City Hall structure for vulnerability to landslide given its proximity to an area previously identified as active. Prepare priorities for mitigating against landslide hazards (retaining walls, etc.) | City Engineer | 1-5 years | X | X | X | X | X | Y | GF | GF | H | L | M | New |
| **WINDSTORM ACTION ITEMS** | | | | | | | | | | | | | | | |
| WS-1 | Identify trees in City right-of way prone to damage during a windstorm event and implement measures to prevent trees from | | | | | | | | | | | | | | |

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| | causing damage to property, public infrastructure and threatening lives. | | | | | | | | | | | | | | |
| WS -2 | Coordinate with utility companies and other responsible agencies to design and disseminate educational information to property owners to reduce risk of tree failure. | City Staff, Utility Purveyors | Ongoing | X | | | | X | Y | GF | GF | H | L | M | |
| WS -3 | Develop partnerships between utility providers, city, and county agencies to document known hazard areas. | City Staff, Utility Purveyors, County | Ongoing | X | | | | X | Y | GF | GF | H | L | M | |
| WS -4 | Develop and identify debris drop-off sites for residents to bring tree and vegetation debris that can | | | | | | | | | | | | | | |

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| | be collected and disposed of by city personnel or contractors. | | | | | | | | | | | | | | |
| WS -5 | Seek funding to collect windstorm risk analysis data including failure rates, frequency of events, and locations around the City that have the highest incidence of property damage from windstorm events. | City Engineer | Ongoing | X | | | X | | Y | GF, GR | GF, GR | M | M | M | |
| WS -6 | Increase public awareness of windstorm mitigation activities in order to protect life and property before, during, and after a windstorm. | Administration | Ongoing | | X | | | | Y | GF | GF | M | L | M | |
| WS -7 | Develop ordinance to encourage utility | Building & Safety, City Engineering | 1-5 years | X | X | | X | X | Y | GF | GF | H | H | M | Deferred |

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| | companies and land developers to use underground utility methods where possible to reduce power outages from windstorms. | | | | | | | | | | | | | | |
| WS -8 | Collect and review historical data and structural damage reports related to windstorms in Bradbury. | Building & Safety | 1-5 years | X | | | X | | Y | GF | GF | M | M | M | Deferred |
| WS -9 | Review updated wind safety standards with the Chief Building Official and determine if additional measures are needed to protect new buildings and infrastructure. | | | | | | | | | | | | | | |
| WS -10 | Remove dead trees located in the City's right- | | | | | | | | | | | | | | Completed |

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| | of-way. | | | | | | | | | | | | | | |
| WS -11 | Conduct tree inventory. | | | | | | | | | | | | | | Completed |
| **DROUGHT ACTION ITEMS** | | | | | | | | | | | | | | | |
| DR-1 | Coordinate with Cal American Water Company on water conservation education, enforcement of water conservation regulations, and other drought-related topics. | City Staff | 1 year | X | X | X | X | X | | GF | GF | H | L | H | New |
| DR-2 | Continue to encourage homeowners to follow water conservation practices. | City Staff | Ongoing | X | X | X | X | X | | GF | GF | H | L | H | New |

# Plan Maintenance

The plan maintenance process includes a schedule for monitoring and evaluating the Plan annually and producing a plan revision every fifth year. This section describes how the City will integrate public participation throughout the plan maintenance process.

## Method and Scheduling of Plan Implementation

The Planning Team that was involved in research and writing of the Plan will also be responsible for implementation. The Planning Team will be led by the City Manager Kevin Kearney who will serve as the Chair of the Planning Team and the Local Mitigation Officer. *It's important to note the both Planning Team Chairs noted in the Acknowledgements were Management Assistants in the City Manager's Office however both left the City during the review phase of the planning process.*

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| **Monitoring** | XXXX | XXXX | XXXX | XXXX | XXXX |
| **Evaluating** | | | | | X |
| Internal Planning Team Evaluation | X | X | X | X | X |
| Cal OES and FEMA Evaluation | | | | | X |
| **Updating** | | | | | X |

## Monitoring and Implementing the Plan

### *Plan Adoption*

Adoption of the Mitigation Plan by the City's governing body is one of the prime requirements for approval of the plan. Following receipt of FEMA's "Approval Pending Adoption", the plan will be forwarded to the City Council for adoption. The governing body has the responsibility and authority to promote sound public policy regarding hazards and will have the authority to periodically update the plan as it is revised to meet changes in the hazard risks and exposures. The approved Mitigation Plan will be significant in the future growth and development of the City.

Once the plan has been adopted by the City Council, the Chair of the Planning Team (Local Mitigation Officer) will be responsible for submitting evidence of the Council's approval and request FEMA to issue a Final Approval. Upon acceptance by FEMA, City of Bradbury will gain eligibility for Hazard Mitigation Grant Program funds.

**Q&A | ELEMENT A: PLANNING PROCESS | A6a.**

**Q:** Does the plan identify how, when, and by whom the plan will be **monitored** (how will implementation be tracked) over time? (Requirement §201.6(c)(4)(i))

**A:** See **Local Mitigation Officer** below.

**Q&A | ELEMENT A: PLANNING PROCESS | A6c.**

**Q:** Does the plan identify how, when, and by whom the plan will be **updated** during the 5-year cycle? (Requirement §201.6(c)(4)(i))

**A:** See **Local Mitigation Officer** below.

## *Local Mitigation Officer*

Under the direction of the Local Mitigation Officer (Chair of the Planning Team), the Planning Team will take responsibility for plan maintenance and implementation. Quarterly meetings will be established to ensure the identified mitigation action items are being accomplished. On the fifth year of the planning cycle, the Planning Team will meet to evaluate the effectiveness of the planning process and to update the overall content of the Plan. The Local Mitigation Officer will coordinate with City leadership to ensure funding for 5-year updates to Plan as required by FEMA.

The Planning Team will be responsible for coordinating implementation of plan by monitoring the progress of the mitigation action items and documenting progress notes for each item. It will be up to the Local Mitigation Officer to hold either a live meeting versus tasking the coordinating agencies with status updates on their own assigned mitigation action items. The monitoring meetings will take place no less than quarterly. These meetings will provide an opportunity to discuss the progress of the action items and maintain the partnerships that are essential for the sustainability of the mitigation plan. See the **Quarterly Implementation Report** discussed below which will be a valuable tool for the Planning Team to measure the success of the Hazard Mitigation Plan. The focus of the quarterly meetings will be on the progress and changes to the Mitigation Action Items.

**Quarterly Implementation Report**

The Quarterly Implementation Report is the same as the Mitigation Action Matrix but with a column added to the far right to track the quarterly status of each Action Item. Upon approval and adoption of the Plan, the entire Quarterly Implementation Report will be added to the Appendix of the Plan. Following is a view of the Quarterly Implementation Report:

| Quarterly Implementation Report<br>First Quarter 2019 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Item Identifier** | **Action Item and Ideas for Implementation** | **Coordinating Agency** | **Timeline** | Goal: Protect Life and Property | **Goal:** Public Awareness | **Goal:** Natural Systems | **Goal:** Emergency Services | **Goal:** Partnerships and Implementation | **Buildings & Infrastructure:** Does the Action item involve New and/or Existing Buildings and/or Infrastructure? Yes (Y) | **Funding Source: GF- General Fund, GR-Grant** | **Planning Mechanism: GP-General Plan, CIP, GF-General Fund, GR-Grant** | **Benefit: L-Low, M-Medium, H-High** | **Cost: L-Low, M-Medium, H-High** | **Priority: L-Low, M-Medium, H-High** | **First Quarter 2019 Comments** |
| **MULTI-HAZARD ACTION ITEMS** | | | | | | | | | | | | | | | |
| MH-1 | Integrate the goals and action items from the City of Bradbury's Natural Hazard Mitigation Plan into existing regulatory documents and programs, where appropriate. | Planning Commission and City Council | Ongoing | | | | | X | | GF | | H | L | H | |
| MH-2 | Use the Mitigation Plan to help the City's General Plan institutionalize guidelines for sustainable development in all new construction and development projects according to the Hazards that impact the City of Bradbury | Public Safety Committee | Ongoing | X | | | | X | Y | GF | GP | H | L | M | |

An equally part of the monitoring process is the need to maintain a strategic planning process which needs to include funding and organizational support. In that light, at least one year in advance of the FEMA-mandated 5-year submission of an update, the Local Mitigation Officer will convene the Planning Team to discuss funding and timing of the update planning process.

On the fifth year of the planning cycles, the Planning Team will broaden its scope to include discussions and research on all of the sections within the Plan with particular attention given go goal achievement and public participation.

**Q&A | ELEMENT C. MITIGATION STRATEGY | C6a.**

**Q:** Does the plan identify the local planning mechanisms where hazard mitigation information and/or actions may be incorporated? (Requirement §201.6(c)(4)(ii))

**A:** See **Implementation through Existing Program** below.

## *Implementation through Existing Programs*

The City of Bradbury addresses statewide planning goals and legislative requirements through its General Plan, its Capital Improvement Plan, and City Building and Safety Codes. The Mitigation Plan provides a series of recommendations - many of which are closely related to the goals and objectives of existing planning programs. The City of Bradbury will implement recommended mitigation action items through existing programs and procedures.

The City of Bradbury Building and Safety Department is responsible for adhering to the State of California's Building and Safety Codes. In addition, the Planning Team will work with other agencies at the state level to review, develop and ensure Building and Safety Codes are adequate to mitigate or present damage by hazards. This is to ensure that life-safety criteria are met for new construction.

Some of the goals and action items in the Mitigation Plan will be achieved through activities recommended in the CIP. Various City departments develop the CIP and review it on an annual basis. Upon annual review of the CIP, the Planning Team will work with the City departments to identify areas that the Mitigation Plan action items are consistent with CIP goals and integrate them where appropriate.

As indicated in the Mitigation Actions Matrix, several action items have been added to ensure implementation through other existing planning mechanisms. Also, the **Table: Capability Assessment: Existing Processes and Programs** identifies the need to maintain balance and diversify the Hazard Mitigation Planning Team to accomplish an efficient and effective implementation of the Plan. These actions have been added because during the 2019 planning process, the Planning Team recognized that some of the 2007 action items were completed by the City but not necessarily as a deliberate act to implement the Mitigation Plan. The 2019 Plan's success will be ensured by the following:

- Diversity of Planning Team membership
- Quarterly implementation meetings and reporting
- Including Planning Team in review of development projects
- Sharing Mitigation Plan with the Public Safety Committee

Upon FEMA approval, the Planning Team will begin the process of incorporating existing planning mechanisms at the City level. The meetings of the Planning Team will provide an opportunity for Planning Team members to report back on the progress made on the integration of mitigation planning elements into City planning documents and procedures. The General Plan was last updated in 2007 however many critical elements tied to hazard mitigation (Land Use, Safety) have not been amended since 1993. Hopefully soon, the City will self-fund or seek other funding to update the entire General Plan. Of all the implementation tools available to a jurisdiction, a determination of "General Plan conformance" is required for each development project. This critical tool must be updated in order to assist with implementation of the 2019 Hazard Mitigation Plan.

## *Economic Analysis of Mitigation Projects*

FEMA's approach to identify the costs and benefits associated with hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis.

Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later.

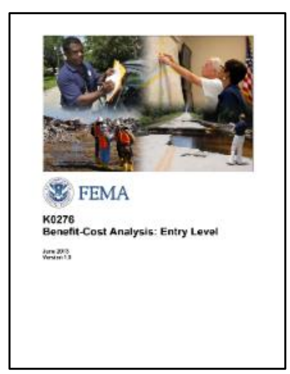
Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating hazards can provide decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Given federal funding, the Planning Team will use a FEMA-approved benefit/cost analysis approach to identify and prioritize mitigation action items. For other projects and funding sources, the Planning Team will use other approaches to understand the costs and benefits of each action item and develop a prioritized list.

The "benefit" and "cost" of each mitigation action item was included in the Mitigation Actions Matrix located in Part III: Mitigation Strategies. A more technical assessment will be required in the event grant funding is pursued through the Hazard Mitigation Grant Program. FEMA Benefit-Cost Analysis Guidelines are discussed below.

## *FEMA Benefit-Cost Analysis Guidelines*

The Stafford Act authorizes the President to establish a program to provide technical and financial assistance to state and local governments to assist in the implementation of hazard mitigation measures that are cost effective and designed to substantially reduce injuries, loss of life, hardship, or the risk of future damage and destruction of property. To evaluate proposed hazard mitigation projects prior to funding FEMA requires a Benefit-Cost Analysis (BCA) to validate cost effectiveness. BCA is the method by which the future benefits of a mitigation project are estimated and compared to its cost. The end result is a benefit-cost ratio (BCR), which is derived from a project's total net benefits divided by its total project cost. The BCR is a numerical expression of the cost effectiveness of a project. A project is considered to be cost effective when the BCR is 1.0 or greater, indicating the benefits of a prospective hazard mitigation project are sufficient to justify the costs.




Although the preparation of a BCA is a technical process, FEMA has developed software, written materials, and training to support the effort and assist with estimating the expected future benefits over the useful life of a retrofit project. It is imperative to conduct a BCA early in the project development process to ensure the likelihood of meeting the cost-effective eligibility requirement in the Stafford Act.

The BCA program consists of guidelines, methodologies and software modules for a range of major natural hazards including:

- ✓ Flood (Riverine, Coastal Zone A, Coastal Zone V)
- ✓ Hurricane Wind
- ✓ Hurricane Safe Room
- ✓ Damage-Frequency Assessment
- ✓ Tornado Safe Room
- ✓ Earthquake
- ✓ Wildfire

The BCA program provides up to date program data, up to date default and standard values, user manuals and training. Overall, the program makes it easier for users and evaluators to conduct and review BCAs and to address multiple buildings and hazards in a single BCA module run.

## Evaluating and Updating the Plan

**Q&A | ELEMENT A: PLANNING PROCESS | A6b.**

**Q:** Does the plan identify how, when, and by whom the plan will be **evaluated** (assessing the effectiveness of the plan at achieving stated purpose and goals) over time? (Requirement §201.6(c)(4)(i))

**A:** See **Evaluation** below.

### *Evaluation*

At the conclusion of the 4th Quarterly Report meeting each year, the Local Mitigation Officer will lead a discussion with the Planning Team on the success (or failure) of the Mitigation Plan to meet the Plan Goals. The results of that discussion will be added to the 4th Quarterly Report and inclusion in the 5-year update to the Plan. Efforts will be made immediately by the Local Mitigation Officer to address any failed Plan Goals.

**Q&A | ELEMENT A: PLANNING PROCESS | A6c.**

**Q:** Does the plan identify how, when, and by whom the plan will be **updated** during the 5-year cycle? (Requirement §201.6(c)(4)(i))

**A:** See **Formal Update Process** below.

### *Formal Update Process*

The Mitigation Plan will be monitored on a quarterly basis to determine the effectiveness of mitigation action items and to reflect changes in land development or programs that may affect mitigation actions or their priorities. The evaluation process includes a firm schedule and timeline, and identifies the agencies and organizations participating in plan evaluation. The Local Mitigation Officer or designee will be responsible for contacting the Planning Team members and organizing the quarterly meeting. Planning Team members will also be responsible for participating in the formal update to the Plan every fifth year of the planning cycle.

The Planning Team will review the goals and mitigation action items to determine their relevance to changing situations in the City, as well as changes in State or Federal policy, and to ensure they are addressing current and expected conditions. The Planning Team will also review the Plan's **Risk Assessment** portion of the Plan to determine if this information should be updated or modified, given any new available data. The **coordinating organizations** responsible for the various action items will report on the status of their projects, including the success of various implementation processes, difficulties encountered, success of coordination efforts, and which strategies should be revised. Amending will be made to the Mitigation Actions Matrix and other sections in the Plan as deemed necessary by the Planning Team.

**Q&A | ELEMENT A: PLANNING PROCESS | A5**

**Q:** Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))

**A:** See **Continued Public Involvement** below.

## *Continued Public Involvement*

The City of Bradbury is dedicated to involving the public directly in the continual review and updates to the Mitigation Plan. Copies of the plan will be catalogued and made available at City Hall and at all City operated public libraries. The existence and location of these copies will be publicized in City newsletters and on the City website. This site will also contain an email address and phone number where people can direct their comments and concerns. A public meeting will also be held after each evaluation or when deemed necessary by the Planning Team. The meetings will provide the public a forum in which they can express their concerns, opinions, or ideas about the Plan.

The Local Mitigation Officer will be responsible for using City resources to publicize the annual public meetings and maintain public involvement through the public access channel, web page, and newspapers.

# PART IV: APPENDIX

## General Hazard Overviews

### Earthquake Hazards

#### Measuring and Describing Earthquakes

An earthquake is a sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of the Earth's tectonic plates. The effects of an earthquake can be felt far beyond the site of its occurrence. They usually occur without warning and, after just a few seconds, can cause massive damage and extensive casualties. Common effects of earthquakes are ground motion and shaking, surface fault ruptures, and ground failure. Ground motion is the vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter. Soft soils can further amplify ground motions. The severity of these effects is dependent on the amount of energy released from the fault or epicenter. One way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. The acceleration due to gravity is often called "g". A ground motion with a peak ground acceleration of 100%g is very severe. Peak Ground Acceleration (PGA) is a measure of the strength of ground motion. PGA is used to project the risk of damage from future earthquakes by showing earthquake ground motions that have a specified probability (10%, 5%, or 2%) of being exceeded in 50 years. These ground motion values are used for reference in construction design for earthquake resistance. The ground motion values can also be used to assess relative hazard between sites, when making economic and safety decisions.

**When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter.**

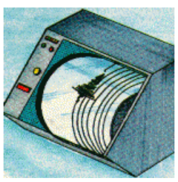
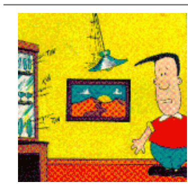
Another tool used to describe earthquake intensity is the Magnitude Scale. The Magnitude Scale is sometimes referred to as the Richter Scale. The two are similar but not exactly the same. The Magnitude Scale was devised as a means of rating earthquake strength and is an indirect measure of seismic energy released. The Scale is logarithmic with each one-point increase corresponding to a 10-fold increase in the amplitude of the seismic shock waves generated by the earthquake. In terms of actual energy released, however, each one-point increase on the Richter scale corresponds to about a 32-fold increase in energy released. Therefore, a Magnitude 7 (M7) earthquake is 100 times (10 X 10) more powerful than a M5 earthquake and releases 1,024 times (32 X 32) the energy.

An earthquake generates different types of seismic shock waves that travel outward from the focus or point of rupture on a fault. Seismic waves that travel through the earth's crust are called body waves and are divided into primary (P) and secondary (S) waves. Because P waves move faster (1.7 times) than S waves, they arrive at the seismograph first. By measuring the time delay between arrival of the P and S waves and knowing the distance to the epicenter, seismologists can compute the magnitude for the earthquake.

The duration of an earthquake is related to its magnitude but not in a perfectly strict sense. There are two ways to think about the duration of an earthquake. The first is the length of time it takes for the fault to rupture and the second is the length of time shaking is felt at any given point (e.g. when someone says, "I felt it shake for 10 seconds" they are making a statement about the duration of shaking). (Source: www.usgs.gov)

The Modified Mercalli Scale (MMI) is another means for rating earthquakes, but one that attempts to quantify intensity of ground shaking. Intensity under this scale is a function of distance from the epicenter (the closer to the epicenter the greater the intensity), ground acceleration, duration of ground shaking, and degree of structural damage. The Modified Mercalli Intensity Scale below rates the level of severity of an earthquake by the amount of damage and perceived shaking.

**Table: Modified Mercalli Intensity Scale**

| | MMI Value | Description of Shaking Severity | Summary Damage Description Used on 1995 Maps | Full Description |
|---|---|---|---|---|
|  | I | N/A | N/A | Not Felt |
|  | II | N/A | N/A | Felt by persons at rest, on upper floors, or favorably placed. |
|  | III | N/A | N/A | Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake. |
|  | IV | N/A | N/A | Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motorcars rock. Windows, dishes, doors rattle. In the upper range of IV, wooden walls and frame creak. |
|  | V | Light | Pictures Move | Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clock stop, start, change rate. |

| | MMI Value | Description of Shaking Severity | Summary Damage Description Used on 1995 Maps | Full Description |
|---|---|---|---|---|
|  | VI | Moderate | Objects Fall | Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. |
|  | VII | Strong | Nonstructural Damage | Difficult to stand. Noticed by drivers of motorcars. Hanging objects quiver. Furniture broken. Damage to masonry, including cracks. Weak chimneys broken at roofline. Fall of plaster, loose bricks, stones, tiles, cornices. Some cracks in masonry C. Small slides and caving in along sand or gravel banks. Concrete irrigation ditches damaged. |
|  | VIII | Very Strong | Moderate Damage | Steering of motorcars affected. Damage to masonry C, partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, and elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Cracks in wet ground and on steep slopes. |
|  | IX | Violent | Heavy damage | General panic. Damage to masonry buildings ranges from collapse to serious damage unless modern design. Wood-frame structures rack, and, if not bolted, shifted off foundations. Underground pipes broken. |
|  | X | Very Violent | Extreme Damage | Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. |
|  | XI | N/A | N/A | Rails bent greatly. Underground pipelines completely out of services. |

| | MMI Value | Description of Shaking Severity | Summary Damage Description Used on 1995 Maps | Full Description |
|---|---|---|---|---|
|  | XII | N/A | N/A | Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air. |

## Earthquake Related Hazards

Ground shaking, landslides, liquefaction, and amplification are the specific hazards associated with earthquakes. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to the fault, earthquake magnitude, and the type of earthquake.

### *Ground Shaking*

Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by the earthquake. It is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, and distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

Seismic activity along nearby or more distant fault zones are likely to cause ground shaking within the City limits.

### *Earthquake-Induced Landslide Potential*

Generally, these types of failures consist of rock falls, disrupted soil slides, rock slides, soil lateral spreads, soil slumps, soil block slides, and soil avalanches. Areas having the potential for earthquake-induced landslides generally occur in areas of previous landslide movement, or where local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements.

### *Liquefaction*

Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these structures. Liquefaction generally occurs during significant earthquake activity, and structures located on soils such as silt or sand may experience significant damage during an earthquake due to the instability of structural foundations and the moving earth. Many communities in Southern California are built on ancient river bottoms and have sandy soil. In some cases, the soil may be subject to liquefaction, depending on the depth of the water table.

# Wildfire Hazards
## Description

A wildfire is an uncontrolled fire spreading through vegetative fuels and exposing or possibly consuming structures. They often begin unnoticed and spread quickly. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires. A wildland fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines and similar facilities. A wildland/urban interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

People start more than 80 percent of wildfires, usually as debris burns, arson, or carelessness. Lightning strikes are the next leading cause of wildfires. Wildfire behavior is based on three primary factors: fuel, topography, and weather. The type, and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential and behavior. The continuity of fuels, expressed in both horizontal and vertical components is also a determinant of wildfire potential and behavior. Topography is important because it affects the movement of air (and thus the fire) over the ground surface. The slope and shape of terrain can change the speed at which the fire travels, and the ability of firefighters to reach and extinguish the fire. Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity and wind (both short and long term) affect the severity and duration of wildfires. Much of Los Angeles County's topography, consisting of semi-arid plains and rolling highlands, when fueled by shrub overgrowth, occasional Santa Ana winds and high temperatures, creates an ever-present threat of wildland fire. Extreme weather conditions such as high temperature, low humidity, and/or winds of extraordinary force may cause an ordinary fire to expand into one of massive proportions.

For thousands of years, fires have been a natural part of the ecosystem in Southern California. However, wildfires present a substantial hazard to life and property in communities built within or adjacent to hillsides and mountainous areas. There is a huge potential for losses due to wildland/urban interface fires in Southern California.

## Wildfire Threat

In urban areas, the effectiveness of fire protection efforts is based upon several factors, including the age of structures, efficiency of circulation routes that ultimately affect response times and availability of water resources to combat fires. In wildland areas, taking the proper precautions, such as the use of fire resistant building materials, a pro-active fire Prevention inspection program, and the development of defensible space around structures where combustible vegetation is controlled, can protect developed lands from fires and, therefore, reduce the potential loss of life and property.

Other factors contribute to the severity of fires including weather and winds. Specifically, winds commonly referred to as Santa Ana winds, which occur during fire season (typically from June to the first significant rain in November) are particularly significant. Such "fire weather" is characterized by several days of hot dry weather and high winds, resulting in low fuel moisture in vegetation.

California experiences large, destructive wildland fires almost every year, and Los Angeles County is no exception. Wildland fires have occurred within the County, particularly in the fall of the year, ranging from small, localized fires to disastrous fires covering thousands of acres. The most severe fire protection problem in the area is wildland fire during Santa Ana wind conditions.

### *The 2003 Southern California Fires*

The fall of 2003 marked the most destructive wildfire season in California history. In a ten-day period, 12 separate fires raged across Southern California in Los Angeles, Riverside, and San Bernardino, San Diego and Ventura counties. The massive "Cedar Fire" in San Diego County alone consumed 2,800 homes and burned over a quarter of a million acres.

In October 2003, Southern California experienced the most devastating wildland fire disaster in state history. According to the Governor's Blue Ribbon Panel Fire Commission Report (2004), over 739,597 acres burned; 3,631 homes, 36 commercial properties, and 1,169 outbuildings were destroyed; 246 people were injured; and 24 people died, including one firefighter. At the height of the siege, 15,631 personnel were assigned to fight the fires.

### *The 2007 Southern California Fires*

In late October 2007, Southern California experienced an unusually severe fire weather event characterized by intense, dry, gusty Santa Ana winds. This weather event drove a series of destructive wildfires that took a devastating toll on people, property, natural resources, and infrastructure. Although some fires burned into early November, the heaviest damage occurred during the first three days of the siege when the winds were the strongest.

According to CAL FIRE, during this siege, 17 people lost their lives, ten were killed by the fires outright, three were killed while evacuating, four died from other fire siege related causes, and 140 firefighters, and an unknown number of civilians were injured. A total of 3,069 homes and other buildings were destroyed, and hundreds more were damaged. Hundreds of thousands of people were evacuated at the height of the siege. The fires burned over half a million acres, including populated areas, wildlife habitat and watershed. Portions of the electrical power distribution network, telecommunications systems, and even some community water sources were destroyed. Transportation was disrupted over a large area for several days, including numerous road closures. Both the Governor of California and the President of the United States personally toured the ongoing fires. Governor Schwarzenegger proclaimed a state of emergency in seven counties before the end of the first day. President Bush quickly declared a major disaster. While the total impact of the 2007 fire siege was less than the disastrous fires of 2003, it was unquestionably one of the most devastating wildfire events in the history of California.

## Wildfire Characteristics

There are three categories of wildland/urban interface fire: The classic wildland/urban interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas; the mixed wildland/urban interface is characterized by isolated homes, subdivisions, and small communities situated predominantly in wildland settings. The occluded wildland/urban interface exists where islands of wildland vegetation occur inside a largely urbanized area. Certain conditions must be present for significant interface fires to occur. The most common conditions include: hot, dry and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, several conditions influence its behavior, including fuel topography, weather, drought, and development.

Southern California has two distinct areas of risk for wildland fire. The foothills and lower mountain areas are most often covered with scrub brush or chaparral. The higher elevations of mountains also have heavily forested terrain. The lower elevations covered with chaparral create one type of exposure.

The higher elevations of Southern California's mountains are typically heavily forested. The magnitude of the 2003 fires is the result of three primary factors: (1) severe drought, accompanied by a series of storms that produce thousands of lightning strikes and windy conditions; (2) an infestation of bark beetles that has killed thousands of mature trees; and (3) the effects of wildfire suppression over the past century that has led to buildup of brush and small diameter trees in the forests.

### *The Interface*

One challenge Southern California faces regarding the wildfire hazard is from the increasing number of houses being built on the urban/wildland interface. Every year the growing population expands further into the hills and mountains, including forest lands. The increased "interface" between urban/suburban areas, and the open spaces created by this expansion, produces a significant increase in threats to life and property from fires, and pushes existing fire protection systems beyond original or current design and capability. Property owners in the interface are not aware of the problems and fire hazards or risks on their own property. Furthermore, human activities increase the incidence of fire ignition and potential damage.

### *Fuel*

Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is classified by volume and by type. Volume is described in terms of "fuel loading," or the amount of available vegetative fuel.

The type of fuel also influences wildfire. Chaparral is a primary fuel of Southern California wildfires. Chaparral habitat ranges in elevation from near sea level to over 5,000 feet in Southern California. Chaparral communities experience long dry summers and receive most of their annual precipitation from winter rains. Although chaparral is often considered as a single species, there are two distinct types; hard chaparral and soft chaparral. Within these two types are dozens of different plants, each with its own particular characteristics.

An important element in understanding the danger of wildfire is the availability of diverse fuels in the landscape, such as natural vegetation, manmade structures and combustible materials. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread. After decades of fire suppression "dog-hair" thickets have accumulated, which enable high intensity fires to flare and spread rapidly.

### *Topography*

Topography influences the movement of air, thereby directing a fire course. For example, if the percentage of uphill slope doubles, the rate of spread in wildfire will likely double. Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Solar heating of dry, south-facing slopes produces up slope drafts that can complicate fire behavior. Unfortunately, hillsides with hazardous topographic characteristics are also desirable residential areas in many communities. This underscores the need for wildfire hazard mitigation and increased education and outreach to homeowners living in interface areas.

### *Weather*

Weather patterns combined with certain geographic locations can create a favorable climate for wildfire activity. Areas where annual precipitation is less than 30 inches per year are extremely fire susceptible. High-risk areas in Southern California share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. The so-called "Santa Ana" winds, which are heated by compression as they flow down to Southern California from Utah, create a particularly high risk, as they can rapidly spread what might otherwise be a small fire.

### *Drought*

Recent concerns about the effects of climate change, particularly drought, are contributing to concerns about wildfire vulnerability. The term 'drought' is applied to a period in which an unusual scarcity of rain causes a serious hydrological imbalance. Unusually dry winters, or significantly less rainfall than normal, can lead to relatively drier conditions and leave reservoirs and water tables lower. Drought leads to problems with irrigation and contributes to additional fires, or increased difficulty in fighting fires.

### *Development*

Growth and development in scrubland and forested areas is increasing the number of human-caused structures in Southern California interface areas. Wildfire affects development, yet development can also influence wildfire. Owners often prefer homes that are private with scenic views, nestled in vegetation, and use natural materials. A private setting is usually far from public roads, or hidden behind a narrow, curving driveway. These conditions, however, make evacuation and firefighting difficult. The scenic views found along mountain ridges can also mean areas of dangerous topography. Natural vegetation contributes to scenic beauty, but it may also provide a ready trail of fuel leading a fire directly to the combustible fuels of the home itself.

# Flood Hazards

## Flood Terminology

### *Floodplain*

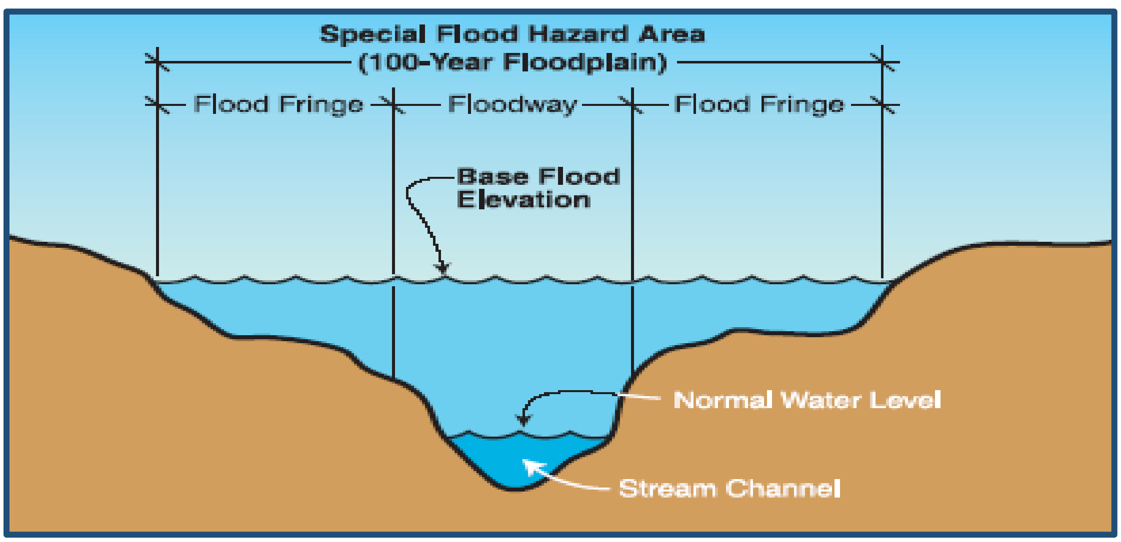
A floodplain is a land area adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding. This area, if left undisturbed, acts to store excess flood water. The floodplain is made up of two sections: the floodway and the flood fringe.

### *100-Year Flood*

The 100-year flooding event is the flood having a one percent chance of being equaled or exceeded in magnitude in any given year. Contrary to popular belief, it is not a flood occurring once every 100 years. The 100-year floodplain is the area adjoining a river, stream, or watercourse covered by water in the event of a 100-year flood. Schematic: Floodplain and Floodway shows the relationship of the floodplain and the floodway.

The 100-year flooding event is the flood having a 1% chance of being equaled or exceeded in magnitude in any given year. **Contrary to popular belief, it is not a flood occurring once every 100 years.**

**Figure: Floodplain and Floodway**
**(Source: FEMA How-To-Guide Assessing Hazards)**




## Floodway

The floodway is one of two main sections that make up the floodplain. Floodways are defined for regulatory purposes. Unlike floodplains, floodways do not reflect a recognizable geologic feature. For NFIP purposes, floodways are defined as the channel of a river or stream, and the overbank areas adjacent to the channel. The floodway carries the bulk of the flood water downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures that would obstruct or divert flood flows onto other properties.

## Base Flood Elevation (BFE)

The term "Base Flood Elevation" refers to the elevation (normally measured in feet above sea level) that the base flood is expected to reach. Base flood elevations can be set at levels other than the 100-year flood. Some communities use higher frequency flood events as their base flood elevation for certain activities, while using lower frequency events for others. For example, for the purpose of storm water management, a 25-year flood event might serve as the base flood elevation; while the 500-year flood event serves as base flood elevation for the tie down of mobile homes. The regulations of the NFIP focus on development in the 100-year floodplain.

## Types of Flooding

Two types of flooding primarily affect the City of Bradbury: slow-rise or flash flooding. Slow-rise floods in Bradbury may be preceded by a warning period of hours or days. Evacuation and sandbagging for slow-rise floods have often effectively lessened flood related damage. Conversely, flash floods are most difficult to prepare for, due to extremely limited, if any, advance warning and preparation time. Unlike most of California, the areas of Los Angeles County that are subject to slow-rise flooding are not associated with overflowing rivers, aqueducts, canals or lakes. Slow-rise flooding in Bradbury is usually the result of one or a combination of the following factors: extremely heavy rainfall, saturated soil, area recently burned in wild fires with inadequate new ground cover growth, or heavy rainfall with runoff from melting mountain snow.

### *Urban Flooding*

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds, to the ground, and into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in flood waters that rise very rapidly and peak with violent force.

The City of Bradbury has a high concentration of impermeable surfaces that either collect water, or concentrate the flow of water in unnatural channels. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Drainage systems within the City of Bradbury are well maintained and expected to be fully functional in an emergency.

### *Riverine Flooding*

Riverine flooding is the overbank flooding of rivers and streams. The natural processes of riverine flooding add sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the 100-year flood with flood depths of only one to three feet. These areas are generally flooded by low velocity sheet flows of water.

# Definitions of FEMA Flood Zone Designations

Flood zones are geographic areas that the FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding in the area.

## *Moderate to Low Risk Areas*

In communities that participate in the NFIP, flood insurance is available to all property owners and renters in these zones:

| ZONE | DESCRIPTION |
|---|---|
| B and X (shaded) | Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile. |
| C and X (unshaded) | Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood. |

## *High Risk Areas*

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all of these zones:

| ZONE | DESCRIPTION |
|---|---|
| A | Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones. |
| AE | The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones. |
| A1-30 | These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format). |
| AH | Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones. |
| AO | River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones. |

| ZONE | DESCRIPTION |
|---|---|
| AR | Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations. |
| A99 | Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones. |

### *Undetermined Risk Areas*

| ZONE | DESCRIPTION |
|---|---|
| D | Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk. |

# Landslide Hazards

## Hazard Characteristics

Landslides are a serious geologic hazard in almost every state in America. Nationally, landslides cause 25 to 50 deaths each year. The best estimate of direct and indirect costs of landslide damage in the United States range between $1 and $2 billion annually. As a seismically active region, California has a significant number of locations impacted by landslides. Some landslides result in private property damage; other landslides impact transportation corridors, fuel and energy conduits, and communication facilities. They can also pose a serious threat to human life.

Landslides can be broken down into two categories: 1) rapidly moving (generally known as debris flows), and; 2) slow moving. Rapidly moving landslides or debris flows present the greatest risk to human life, and people living in or traveling through areas prone to rapidly moving landslides, are at increased risk of serious injury. Slow moving landslides can cause significant property damage but are less likely to result in serious human injuries.

The primary effects of mudslides/landslides include: abrupt depression and lateral displacement of hillside surfaces over distances of up to several hundreds of feet, disruption of surface drainage, blockage of flood control channels and roadways, displacement or destruction of improvements such as roadways, buildings, and water wells.

## Historic Southern California Landslides

### *1956 Portuguese Bend*

Cost, $14.6 million (2000 Dollars) California Highway 14, Palos Verdes Hills. Land use on the Palos Verdes Peninsula consists mostly of single-family homes built on large lots, many of which have panoramic ocean views. All of the houses were constructed with individual septic systems, generally consisting of septic tanks and seepage pits. Landslides have been active here for thousands of years, but recent landslide activity has been attributed in part to human activity. The Portuguese Bend Landslide began its modern movement in August 1956, when displacement was noticed at its northeast margin. Movement gradually extended downslope so that the entire eastern edge of the slide mass was moving within 6 weeks. By the summer of 1957, the entire slide mass was sliding towards the sea.

### *1958-1971 Pacific Palisades*

Cost, $29.1 million (2000 Dollars) California Highway 1 and house damaged.

### *1961 Mulholland Cut*

Cost, $41.5 million (2000 Dollars) On Interstate 405, 11 miles north of Santa Monica, Los Angeles County.

### *1969 Glendora*

Cost, $26.9 million (2000 Dollars) Los Angeles County, 175 houses damaged, mainly by debris flows.

### 1969 Seventh Ave., Los Angeles County

Cost, $14.6 million (2000 Dollars) California Highway 60.

### 1970 Princess Park

Cost, $29.1 million (2000 Dollars) California Highway 14, ten miles north of Newhall, near Saugus, northern Los Angeles County.

### 1971 Upper and Lower Van Norman Dams, San Fernando

Cost, $302.4 million (2000 Dollars) Earthquake-induced landslides. Damage due to the February 9, 1971, Magnitude 7.5 San Fernando, Earthquake.
The earthquake of February 9 severely damaged the Upper and Lower Van Norman Dams.

### 1971 Juvenile Hall, San Fernando

Cost, $266.6 million (2000 Dollars) Landslides caused by the February 9, 1971, San Fernando earthquake. In addition to damaging the San Fernando Juvenile Hall, this 1.2 km-long slide damaged trunk lines of the Southern Pacific Railroad, San Fernando Boulevard, Interstate Highway 5, the Sylmar electrical converter station, and several pipelines and canals.

### 1977-1980 Monterey Park, Repetto Hills, Los Angeles County

Cost, $14.6 million (2000 Dollars) 100 houses damaged in 1980 due to debris flows.

### 1978 Bluebird Canyon Orange County

Cost, $52.7 million (2000 Dollars) October 2, 60 houses destroyed or damaged. Unusually heavy rains in March of 1978 may have contributed to initiation of the landslide. Although the 1978 slide area was approximately 3.5 acres, it is suspected to be a portion of a larger, ancient landslide.

### 1979 Big Rock, California, Los Angeles County

Cost, $1.08 billion (2000 Dollars) California Highway 1 rockslide.

### 1980 Southern California Slides

Cost, $1.1 billion in damage (2000 Dollars) Heavy winter rainfall in 1979-90 caused damage in six Southern California counties. In 1980, the rainstorm started on February 8. A sequence of 5 days of continuous rain and 7 inches of precipitation had occurred by February 14. Slope failures were beginning to develop by February 15 and then very high-intensity rainfall occurred on February 16. As much as eight inches of rain fell in a six-hour period in many locations. Records and personal observations in the field on February 16 and 17 showed that the mountains and slopes literally fell apart on those two days.

### 1983 San Clemente, Orange County

Cost, $65 million (2000 Dollars), California Highway 1. Litigation at that time involved approximately $43.7 million (2000).

### *1983 Big Rock Mesa*

Cost, $706 million (2000 Dollars) in legal claims condemnation of 13 houses, and 300 more threatened rockslide caused by rainfall.

### *1978-1980 San Diego County*

Experienced major damage from storms in 1978, 1979, and 1979-80, as did neighboring areas of Los Angeles and Orange County. One hundred and twenty landslides were reported to have occurred in San Diego County during these 2 years. Rainfall for the rainy seasons of 78-79 and 79-80 was 14.82 and 15.61 inches (37.6 and 39.6 cm) respectively, compared to a 125-year average (1850-1975) of 9.71 inches (24.7 cm). Significant landslides occurred in the Friars Formation, a unit that was noted as slide-prone in the Seismic Safety Study for the City of San Diego. Of the nine landslides that caused damage in excess of $1 million, seven occurred in the Friars Formation, and two in the Santiago Formation in the northern part of San Diego County.

### *1994 Northridge Earthquake Landslides*

As a result of the Magnitude 6.7 Northridge Earthquake, more than 11,000 landslides occurred over an area of 10,000 km$^2$. Most were in the Santa Susana Mountains and in mountains north of the Santa Clara River Valley. Destroyed dozens of homes, blocked roads, and damaged oil-field infrastructure. Caused deaths from Coccidioidomycosis (valley fever) the spore of which was released from the soil and blown toward the coastal populated areas. The spore was released from the soil by the landslide activity.

### *March 1995 Los Angeles and Ventura Counties*

Above normal rainfall triggered damaging debris flows, deep-seated landslides, and flooding. Several deep-seated landslides were triggered by the storms, the most notable was the La Conchita landslide, which in combination with a local debris flow, destroyed or badly damaged 11 to 12 homes in the small town of La Conchita, about 20 km west of Ventura. There also was widespread debris-flow and flood damage to homes, commercial buildings, and roads and highways in areas along the Malibu coast that had been devastated by wildfire two years before.

### *January 2005 Ventura County*

On January 10, 2005, a landslide once again struck the community of La Conchita, killing ten people and destroying or seriously damaging 36 houses.

## Landslide Characteristics

### *What is a landslide?*

"A landslide is defined as, the movement of a mass of rock, debris, or earth movement down a slope. Landslides are a type of "mass wasting" which denotes any down slope movement of soil and rock under the direct influence of gravity. The term "landslide" encompasses events such as rock falls, topples, slides, spreads, and flows.

Landslides are initiated by rainfall, earthquakes, volcanic activity, changes in groundwater, disturbance and change of a slope by human-caused construction activities, or any combination of these factors. Landslides also occur underwater, causing tidal waves and damage to coastal areas. These landslides are called submarine landslides."

The size of a landslide usually depends on the geology and the initial cause of the landslide. Landslides vary greatly in their volume of rock and soil, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials. Landslides are given different names, depending on the type of failure, and their composition and characteristics.

Slides move in contact with the underlying surface. These movements include rotational slides where sliding material moves along a curved surface and translational slides where movement occurs along a flat surface. These slides are generally slow moving and can be deep. Slumps are small rotational slides that are generally shallow. Slow-moving landslides occur on relatively gentle slopes and cause significant property damage but are far less likely to result in serious injuries than rapidly moving landslides.

### *What is a Debris Flow?*

A debris or mud flow is a river of rock, earth and other materials, including vegetation that is saturated with water. This high percentage of water gives the debris flow a very rapid rate of movement down a slope. Debris flows move with speeds greater than 20 miles per hour, and often move much faster. This high rate of speed makes debris flows extremely dangerous to people and property in its path.

### *Areas Particularly Susceptible to Landslides*

Locations at risk from landslides or debris flows include areas with one or more of the following conditions:

- ✓ On or close to steep hills
- ✓ Steep road-cuts or excavations
- ✓ Existing landslides or places of known historic landslides (such sites often have tilted power lines, trees tilted in various directions, cracks in the ground, and irregular-surfaced ground)
- ✓ Steep areas where surface runoff is channeled, such as below culverts, V-shaped valleys, canyon bottoms, and steep stream channels
- ✓ Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons
- ✓ Canyon areas below hillside and mountains that recently (within 1-6 years) were subjected to a wildland fire

## Excavation and Grading

Slope excavation is common in the development of home sites or roads on sloping terrain. Grading these slopes results in slopes that are steeper than the pre-existing natural slopes. Since slope steepness is a major factor in landslides, these steeper slopes are at an increased risk for landslides.

The added weight of fill placed on slopes also results in an increased landslide hazard. Small landslides are fairly common along roads, in either the road cut or the road fill. Landslides occurring below new construction sites are indicators of the potential impacts stemming from excavation.

## Drainage and Groundwater Alterations

Water flowing through or above ground, is often the trigger for landslides. Any activity that increases the amount of water flowing into landslide-prone slopes increases landslide hazards. Broken or leaking water or sewer lines can be especially problematic, as does water retention facilities that direct water onto slopes. However, even lawn irrigation in landslide prone locations results in damaging landslides. Ineffective storm water management and excess runoff also cause erosion and increase the risk of landslide hazards. Drainage is affected, naturally by the geology and topography of an area. Development that results in an increase in impervious surface impairs the ability of the land to absorb water and redirects water to other areas. Channels, streams, ponding, and erosion on slopes indicate potential slope problems.

Road and driveway drains, gutters, downspouts, and other constructed drainage facilities concentrates and accelerates flow. Ground saturation and concentrated velocity flow are major causes of slope problems and triggers landslides.

## Changes in Vegetation

Removing vegetation from very steep slopes increases landslide hazards. Areas that experience wildfire and land clearing for development may have long periods of increased landslide hazard. Also, certain types of ground cover require constant watering to remain green. Changing away from native ground cover plants increases the risk of landslide.

# Windstorm Hazards

## Hazard Characteristics


Santa Ana wind conditions results in two general disaster conditions. The most common is fire fanned by the high winds. This was the situation in 1993 in Laguna Beach when a massive fire destroyed a number of homes in the surrounding hills. Wind driven flames again caused the destruction of more than 3,000 homes in Southern California in October of 2003. Other forms of disaster would be direct building damage, damage to utilities and infrastructure as a result of the high winds. This has occurred in the past few years in many southland communities including Los Angeles County.

Santa Ana winds commonly occur between October and February, with December having the highest frequency of events. Summer events are rare. Wind speeds are typically north to east at 35 knots through and below passes, and canyons with gusts to 50 knots. Stronger Santa Ana winds has gusts greater than 60 knots over widespread areas, and gusts greater than 100 knots in favored areas. Frequently, the strongest winds in the basin occur during the night and morning hours due to the absence of a sea breeze. The sea breeze which typically blows onshore daily, can moderate the Santa Ana winds during the late morning and afternoon hours. Santa Ana winds are an important forecast challenge because of the high fire danger associated with them. Also, unusually high surf conditions on the northeast side of the Channel Islands normally accompany a Santa Ana event.

The Beaufort Scale below, coined and developed by Sir Francis Beaufort in 1805, illustrates the effect that varying wind speed can have on sea swells and structures:

**Table: Beaufort Scale**
**(Source : NOAA Storm Prediction Center)**

| Beaufort Force | Speed (mph) | Wind Description - State of Sea - Effects on Land |
|---|---|---|
| 0 | Less 1 | Calm - Mirror-like - Smoke rises vertically |
| 1 | 1-3 | Light - Air Ripples look like scales; No crests of foam - Smoke drift shows direction of wind, but wind vanes do not |
| 2 | 4-7 | Light Breeze - Small but pronounced wavelets; Crests do not break - Wind vanes move; Leaves rustle; You can feel wind on the face |
| 3 | 8-12 | Gentle Breeze - Large Wavelets; Crests break; Glassy foam; A few whitecaps - Leaves and small twigs move constantly; Small, light flags are extended |
| 4 | 13-18 | Moderate Breeze - Longer waves; Whitecaps - Wind lifts dust and loose paper; Small branches move |
| 5 | 19-24 | Fresh Breeze - Moderate, long waves; Many whitecaps; Some spray - Small trees |

| Beaufort Force | Speed (mph) | Wind Description - State of Sea - Effects on Land |
|---|---|---|
| | | with leaves begin to move |
| 6 | 25-31 | Strong Breeze - Some large waves; Crests of white foam; Spray - Large branches move; Telegraph wires whistle; Hard to hold umbrellas |
| 7 | 32-38 | Near Gale - White foam from breaking waves blows in streaks with the wind - Whole trees move; Resistance felt walking into wind |
| 8 | 39-46 | Gale - Waves high and moderately long; Crests break into spin drift, blowing foam in well-marked streaks - Twigs and small branches break off trees; Difficult to walk |
| 9 | 47-54 | Strong Gale - High waves with wave crests that tumble; Dense streaks of foam in wind; Poor visibility from spray - Slight structural damage |
| 10 | 55-63 | Storm - Very high waves with long, curling crests; Sea surface appears white from blowing foam; Heavy tumbling of sea; Poor visibility - Trees broken or uprooted; Considerable structural damage |
| 11 | 64-73 | Violent Storm - Waves high enough to hide small and medium sized ships; Sea covered with patches of white foam; Edges of wave crests blown into froth; Poor visibility - Seldom experienced inland; Considerable structural damage |
| 12 | >74 | Hurricane - Sea white with spray. Foam and spray render visibility almost non-existent - Widespread damage. Very rarely experienced on land. |

## Santa Ana Winds and Tornado-Like Wind Activity

Based on local history, most incidents of high wind in the City of Bradbury are the result of the Santa Ana and El Niño related wind conditions. While high impact wind incidents are not frequent in the area, significant wind events and sporadic tornado activity have been known to negatively impact the City. In addition, the City is increasingly concerned with "global warming" ramifications and potential increases in wind related events.

## What are Santa Ana Winds?

"Santa Ana winds are generally defined as warm, dry winds that blow from the east or northeast (offshore). These winds occur below the passes and canyons of the coastal ranges of Southern California and in the Los Angeles and Orange County basins. Santa Ana winds often blow with exceptional speed in the Santa Ana Canyon (the canyon from which it derives its name). Forecasters at the National Weather Service offices in Oxnard and San Diego usually place speed minimums on these winds and reserve the use of "Santa Ana" for winds greater than 25 knots." These winds accelerate to speeds of 35 knots as they move through canyons and passes, with gusts to 50 or even 60 knots.

"The complex topography of Southern California combined with various atmospheric conditions create numerous scenarios that may cause widespread or isolated Santa Ana events. Commonly, Santa Ana winds develop when a region of high pressure builds over the Great Basin (the high plateau east of the Sierra Mountains and west of the Rocky Mountains including most of Nevada and Utah). Clockwise circulation around the center of this high-pressure area forces air downslope from the high plateau. The air warms as it descends toward the California coast at the rate of five degrees F per 1,000 feet due to compressional heating. Thus, compressional heating provides the primary source of warming. The air is dry since it originated in the desert, and it dries out even more as it is heated."

These regional winds typically occur from October to March, and, according to most accounts are named either for the Santa Ana River Valley where they originate, or for the Santa Ana Canyon, southeast of Los Angeles, where they pick up speed.

## What are Tornados?

Tornadoes are spawned when there is warm, moist air near the ground, cool air aloft, and winds that speed up and change direction. An obstruction, such as a house, in the path of the wind causes it to change direction. This change increases pressure on parts of the house, and the combination of increased pressures and fluctuating wind speeds creates stresses that frequently cause structural failures.

In order to measure the intensity and wind strength of a tornado, Dr. T. Theodore Fujita developed the Fujita Tornado Damage Scale. This scale compares the estimated wind velocity with the corresponding amount of suspected damage. The scale measures six classifications of tornadoes with increasing magnitude from an “F0” tornado to a “F6+” tornado.

**Table: Fujita Tornado Damage Scale**
**(Source: NOAA Storm Prediction Center)**

| Scale | Wind Estimated (mph) | Typical Damage |
|---|---|---|
| F0 | < 73 | Light damage. Some damage to chimneys and TV antennas; breaks twigs off trees; pushes over shallow-rooted trees. |
| F1 | 73-112 | Moderate damage. Peels surface off roofs; windows broken; light trailer houses pushed or overturned; some trees uprooted or snapped; moving automobiles pushed off the road. 74 mph is the beginning of hurricane wind speed. |
| F2 | 113-157 | Considerable damage. Roofs torn off frame houses leaving strong upright walls; weak buildings in rural areas demolished; trailer houses destroyed; large trees snapped or uprooted; railroad boxcars pushed over; light object missiles generated; cars blown off highway. |
| F3 | 158-206 | Severe damage. Roofs and some walls torn off frame houses; some rural buildings completely demolished; trains overturned; steel-framed hangar-warehouse-type structures torn; cars lifted off the ground; most trees in a forest uprooted snapped, or leveled. |
| F4 | 207-260 | Devastating damage. Whole frame houses leveled, leaving piles of debris; steel structures badly damaged; trees debarked by small flying debris; cars and trains thrown some distances or rolled considerable distances; large missiles generated. |
| F5 | 261-318 | Incredible damage. Whole frame houses tossed off foundations; steel-reinforced concrete structures badly damaged; automobile-sized missiles generated; trees debarked; incredible phenomena can occur. |
| F6-F12 | 319 to sonic | Inconceivable damage. Should a tornado with the maximum wind speed in excess of F5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. will create serious secondary damage on structures. |

## Microbursts

Unlike tornados, microbursts are strong, damaging winds which strike the ground and often give the impression a tornado has struck. They frequently occur during intense thunderstorms. The origin of a microburst is downward moving air from a thunderstorm's core. But unlike a tornado, they affect only a rather small area. University of Chicago storm researcher Dr. Ted Fujita first coined the term “downburst” to describe strong, downdraft winds flowing out of a thunderstorm cell that he believed were responsible for the crash of Eastern Airlines Flight 66 in June of 1975.

A downburst is a straight-direction surface wind in excess of 39 mph caused by a small-scale, strong downdraft from the base of convective thundershowers and thunderstorms. In later investigations into the phenomena he defined two sub-categories of downbursts: the larger macrobursts and small microbursts.

Macrobursts are downbursts with winds up to 117 mph which spread across a path greater than 2.5 miles wide at the surface and which last from five to 30 minutes. The microburst, on the other hand is confined to an even smaller area, less than 2.5 miles in diameter from the initial point of downdraft impact. An intense microburst can result in damaging winds near 270 km/hr (170 mph) and often last for less than five minutes.

Downbursts of all sizes descend from the upper regions of severe thunderstorms when the air accelerates downward through either exceptionally strong evaporative cooling or by very heavy rain which drags dry air down with it. When the rapidly descending air strikes the ground, it spreads outward in all directions, like a fast-running faucet stream hitting the sink bottom.

When the microburst wind hits an object on the ground such as a house, garage or tree, it can flatten the buildings, and strip limbs and branches from the tree. After striking the ground, the powerful outward running gust can wreak further havoc along its path. Damage associated with a microburst is often mistaken for the work of a tornado, particularly directly under the microburst. However, damage patterns away from the impact area are characteristic of straight-line winds rather than the twisted pattern of tornado damage.”

Tornados, like those that occur every year in the Midwest and Southeast parts of the United States, are a rare phenomenon in most of California, with most tornado-like activity coming from micro-bursts.

## What is Susceptible to Windstorms?

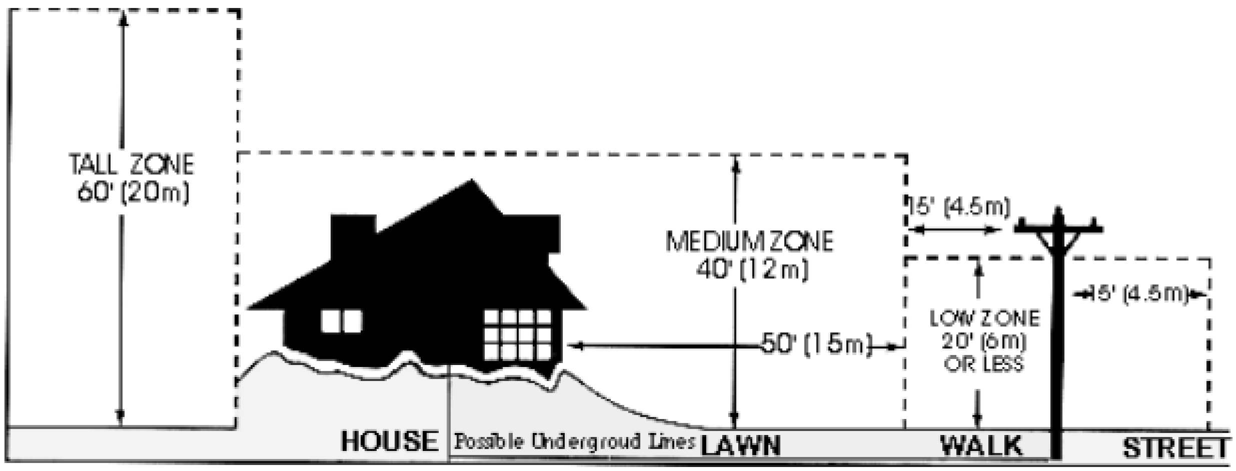
### *Life and Property*

Based on the history of the region, windstorm events can be expected, perhaps annually, across widespread areas of the region which can be adversely impacted during a windstorm event. This can result in the involvement of City emergency response personnel during a wide-ranging windstorm or microburst tornadic activity. Both residential and commercial structures with weak reinforcement are susceptible to damage. Wind pressure creates a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents creates lift suction forces that pull building components and surfaces outward. With extreme wind forces, the roof or entire building can fail causing considerable damage.

Debris carried along by extreme winds can directly contribute to loss of life and indirectly to the failure of protective building envelopes, siding, or walls. When severe windstorms strike a City, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery.

### *Utilities*

Historically, falling trees are the major cause of power outages in the region. Windstorms such as strong microbursts and Santa Ana Wind conditions cause flying debris and downed utility lines. For example, tree limbs breaking in winds of only 45 mph can be thrown over 75 feet, overhead power lines are damaged, even in relatively minor windstorm events. Falling trees bring electric power lines down to the pavement, creating the possibility of lethal electric shock.




### *Infrastructure*

Windstorms damage buildings, power lines, and other property, and infrastructure, due to falling trees and branches. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds.

### *Increased Fire Threat*

Perhaps the greatest danger from windstorm activity in Southern California comes from the combination of the Santa Ana winds with the major fires that occur every few years in the urban/wildland interface. With the Santa Ana winds driving the flames, the speed and reach of the flames is even greater than in times of calm wind conditions.

### *Transportation*

Windstorm activity impacts local transportation in addition to the problems caused by downed trees and electrical wires blocking streets and highways. During periods of extremely strong Santa Ana winds, major highways can be temporarily closed to truck and recreational vehicle traffic. However, typically these disruptions are not long lasting, nor do they carry a severe long term economic impact on the region.

# Drought Hazards

## Hazard Characteristics

### *Definition*

Drought is defined as a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area, a condition often perceived as "normal". It is also related to the timing (e.g., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness of the rains (e.g., rainfall intensity, number of rainfall events). Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity. Drought should not be viewed as merely a physical phenomenon or natural event. Its impacts on society result from the interplay between a natural event (less precipitation than expected resulting from natural climatic variability) and the demand people place on water supply. Human beings often exacerbate the impact of drought. Recent droughts in both developing and developed countries and the resulting economic and environmental impacts and personal hardships have underscored the vulnerability of all societies to this "natural" hazard.

One dry year does not normally constitute a drought in California but serves as a reminder of the need to plan for droughts. California's extensive system of water supply infrastructure - its reservoirs, groundwater basins, and inter-regional conveyance facilities - mitigates the effect of short-term dry periods for most water users. Defining when a drought begins is a function of drought impacts to water users. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere, or for water users having a different water supply. Individual water suppliers may use criteria such as rainfall/runoff, amount of water in storage, or expected supply from a water wholesaler to define their water supply conditions.

Many governmental utilities, the National Oceanic and Atmospheric Administration (NOAA), and the California Department of Water Resources, as well as academic institutions such as the University of Nebraska-Lincoln's National Drought Mitigation Center and the National Drought Mitigation Center, generally agree that there is no clear definition of drought. Drought is highly variable depending on location.

### *Drought Threat*

The region's Mediterranean climate makes it especially susceptible to variations in rainfall. Severe water shortages could have a bearing on the economic well-being of the community. Comparison of climate (rainfall) records from Los Angeles with water well records beginning in 1930 from the San Gabriel Valley indicates the existence of wet and dry cycles on a 10-year scale as well as for much longer periods. The climate record for the Los Angeles region beginning in 1890 suggests drying conditions over the last century. With respect to the present day, climate data also suggests that the last significant wet period was the 1940s. Well level data and other sources seem to indicate the historic high groundwater levels (reflecting recharge from rainfall) occurred in the same decade. Since that time, rainfall (and groundwater level trends) appears to be in decline. This slight declining trend, however, is not believed to be significant. Climatologists compiled rainfall data from 96 stations in the State that spanned a

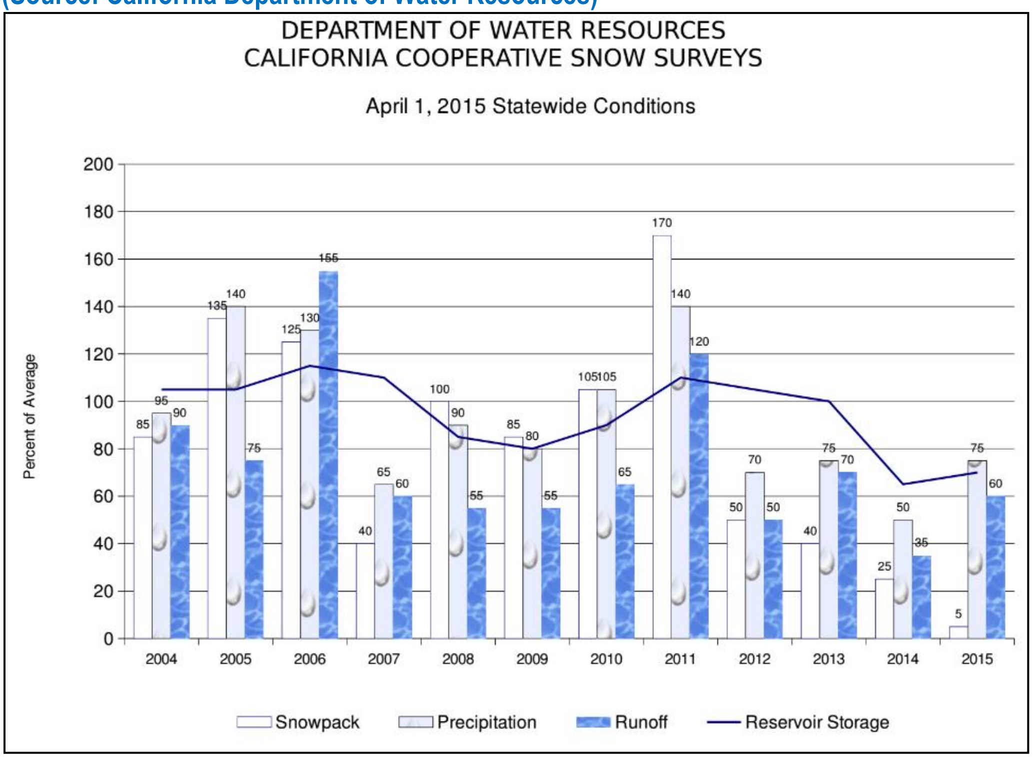
100-year period between 1890 and 1990. An interesting note is that during the first 50 years of the reporting period, there was only one year (1890) that had more than 35 inches of rainfall, whereas the second 50-year period recording of 5 year intervals (1941, 1958, 1978, 1982, and 1983) that exceeded 35 inches of rainfall in a single year. The year of maximum rainfall was 1890 when the average annual rainfall was 43.11 inches. The second wettest year on record occurred in 1983 when the State's average was 42.75 inches.

The driest year of the 100-year reported in the study was 1924 when the State's average rainfall was only 10.50 inches. The region with the most stations reporting the driest year in 1924 was the San Francisco Bay area. The second driest year was 1977 when the average was 11.57 inches. The most recent major drought (1987 to 1990) occurred at the end of a sequence of very wet years (1978 to 1983). The debate continues whether "global warming" is occurring, and the degree to which global climate change will have an effect on local micro-climates. The semi-arid southwest is particularly susceptible to variations in rainfall. A study that documented annual precipitation for California since 1600 from reconstructed tree ring data indicates that there was a prolonged dry spell from about 1755 to 1820 in California. Fluctuations in precipitation could contribute indirectly to a number of hazards including wildfire and the availability of water supplies.

## General Situation

**Figure: Water Supply Conditions** below illustrates several indicators commonly used to evaluate California water conditions. The percent of average values are determined for measurement sites and reservoirs in each of the State's ten major hydrologic regions. Snow pack is an important indicator of runoff from Sierra Nevada watersheds, the source of much of California's developed water supply.

**Figure: Water Supply Conditions**
**(Source: California Department of Water Resources)**



Drought is a gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multiyear period. There is no universal definition of when a drought begins or ends.

## Types of Drought

There are four different ways that drought can be defined:
(1) Meteorological - a measure of departure of precipitation from normal. Due to climatic differences what is considered a drought in one location may not be a drought in another location.
(2) Agricultural - refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop.
(3) Hydrological - occurs when surface and subsurface water supplies are below normal.
(4) Socioeconomic - refers to the situation that occurs when physical water shortage begins to affect people.

### *Historical California Droughts*

A significant drought, reported by many of the ranchers in southern California, occurred in 1860. The great drought of the 1930s, coined the "Dust Bowl," was geographically centered in the Great Plains yet ultimately affected water shortages in California. The drought conditions in the plains resulted in a large influx of people to the west coast. Approximately 350,000 people from Arkansas and Oklahoma immigrated mainly to the Great Valley of California. As more people moved into California, including Los Angeles County increases in intensive agriculture led to overuse of the Santa Ana River watershed and groundwater resulting in regional water shortages. Several bills have been introduced into Congress in an effort to mitigate the effects of drought. In 1998, President Clinton signed into law the National Drought Policy Act, which called for the development of a national drought policy or framework that integrates actions and responsibilities among all levels of government. In addition, it established the National Drought Policy Commission to provide advice and recommendations on the creation of an integrated federal policy. The most recent bill introduced into Congress was the National Drought Preparedness Act of 2003, which established a comprehensive national drought policy and statutorily authorized a lead federal utility for drought assistance. Currently there exists only an ad-hoc response approach to drought unlike other disasters (e.g., hurricanes, floods, and tornadoes) which are under the purview of FEMA.

Droughts exceeding three years are relatively rare in Northern California, the source of much of the State's developed water supply. The 1929-34 droughts established the criteria commonly used in designing storage capacity and yield of large Northern California reservoirs. The driest single year of California's measured hydrologic record was 1977. According to USGS, California's most recent multi-year droughts occurred between 1987-92, 2006-2010 and 2012-2016.

### *The Long-term Climatic Viewpoint*

The historical record of California hydrology is brief in comparison to geologically modern climatic conditions. The following sampling of changes in climatic conditions over time helps put California's twentieth century droughts into perspective. Most of the dates shown below are necessarily approximations.

Not only must the climatic conditions be inferred from indirect evidence, but the onset or extent of changed conditions may vary with geographic location. Readers interested in the subject of paleo-climatology are encouraged to seek out the extensive body of popular and scientific literature on this subject.

### Past California Droughts

The historical record of California hydrology is brief in comparison to the time period of geologically modern climatic conditions. The following samplings of changes in climatic and hydrologic conditions help put California's twentieth century droughts into perspective, by illustrating the variability of possible conditions. Most of the dates shown below are approximations, since the dates must be inferred from indirect sources.

### 11,000 years before present

Beginning of Holocene Epoch- Recent time, the time since the end of the last major glacial epoch.

### 6,000 years before present

Approximate time when trees were growing in areas now submerged by Lake Tahoe. Lake levels were lower then, suggesting a drier climate.

### 900-1300 A.D. (Approximate)

The Medieval Warm Period, a time of warmer global average temperatures. The Arctic ice pack receded, allowing Norse settlement of Greenland and Iceland. The Anasazi civilization in the Southwest flourished, its irrigation systems supported by monsoonal rains.

### 1300-1800 A.D. (approximate)

The Little Ice Age, a time of colder average temperatures. Norse colonies in Greenland failed near the start of the time period, as conditions became too cold to support agriculture and livestock grazing. The Anasazi culture began to decline about 1300 and had vanished by 1600, attributed in part to drought conditions that made agriculture infeasible.

### Mid - 1500s A.D.

Severe, sustained drought throughout much of the continental U.S., according to dendrochronology. Drought suggested as a contributing factor in the failure of European colonies at Parris Island, South Carolina and Roanoke Island, North Carolina.

### 1850s A.D.

Sporadic measurements of California precipitation began.

### 1890s A.D.

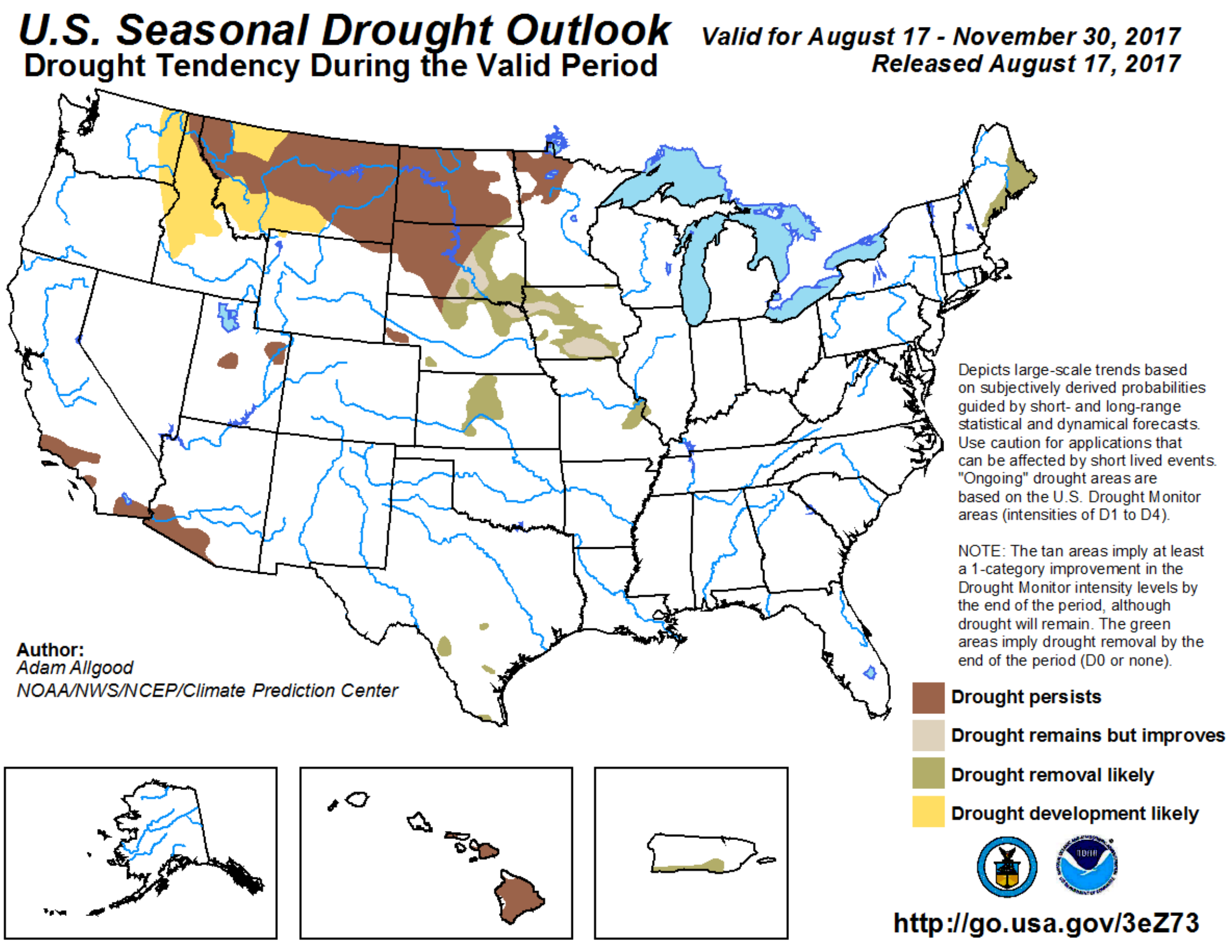
Long-term stream flow measurements began at a few California locations.

## Palmer Drought Severity Index

Of the many varied indexes used to measure drought, the "Palmer Drought Severity Index" (PDSI) is the most commonly used drought index in the United States. Developed by meteorologist Wayne Palmer, the PDSI is used to measure dryness based on recent temperature compared to the amount of precipitation. It utilizes a number range, 0 as normal, drought shown in terms of minus numbers, and wetness shown in positive numbers. The PDSI is most effective at analyzing long-range drought forecasts or predications. Thus, the PDSI is very effective at evaluation trends in the severity and frequency of prolonged periods of drought, and conversely wet weather. The National Oceanic and Atmospheric Administration (NOAA) publish weekly Palmer maps, which are also used by other scientists to analyze the long-term trends associated with global warming and how this has affected drought conditions.

The following map is the most current snapshot of drought conditions across the U.S. It is provided by NOAA's Climate Prediction Center.

**Map: U.S. Seasonal Drought Outlook**
**(Source: NOAA Climate Prediction Center)**



# Attachments

## FEMA Letter of Approval

U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA. 94607-4052

FEMA

February 21, 2019

Kevin Kearney
City Manager
City Manager's Office
600 Winston Avenue
Bradbury, CA 91008

Dear Mr. Kearney:

We have completed our final review of the *City of Bradbury Hazard Mitigation Plan*, officially adopted by the City of Bradbury on February 19, 2019 and found the plan to be in conformance with Title 44 Code of Federal Regulations (CFR) Part 201.6 *Local Mitigation Plans.*

The approval of this plan ensures the City of Bradbury's continued eligibility for project grants under FEMA's Hazard Mitigation Assistance programs, including the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program. All requests for funding, however, will be evaluated individually according to the specific eligibility, and other requirements of the particular program under which applications are submitted.

Also, approved hazard mitigation plans may be eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Additional information regarding the CRS can be found at https://www.fema.gov/national-flood-insurance-program-community-rating-system or through your local floodplain manager.

FEMA's approval of the *City of Bradbury Hazard Mitigation Plan* is for a period of five years, effective starting the date of this letter. Prior to **February 21, 2024**, City of Bradbury is required to review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval in order to continue to be eligible for mitigation project grant funding. The enclosed plan review tool provides additional recommendations to incorporate into the plan when City of Bradbury undertakes its identified plan maintenance process.

If you have any questions regarding the planning or review processes, please contact the FEMA Region IX Hazard Mitigation Planning Team at fema-r9-mitigation-planning@fema.dhs.gov.

Sincerely,

for
Juliette Hayes
Director
Mitigation Division
FEMA, Region IX

Enclosure

Cc: Julie Norris, Mitigation and Dam Safety Branch Chief, California Governor's Office of Emergency Service
Jennifer Hogan, State Hazard Mitigation Officer, California Governor's Office of Emergency Services

www.fema.gov

*Richard Barakat, Mayor (District 3)*
*Richard Hale, Mayor Pro Tem (District 1)*
*Monte Lewis, Council Member (District 2)*
*Bruce Lathrop, Council Member (District 4)*
*Elizabeth Bruny, Council Member (District 5)*

# City of Bradbury
## Agenda Memo

TO: Honorable Mayor and Members of the City Council

FROM: Kevin Kearney, City Manager
Carolyn Harshman, Project Manager, Emergency Planning Consultants

DATE: February 19, 2019

**SUBJECT: ADOPTION OF THE CITY OF BRADBURY HAZARD MITIGATION PLAN**

ATTACHMENTS:
1. Resolution No. 19-03
2. Final Draft Hazard Mitigation Plan

---

**SUMMARY**

The federal Disaster Management Act of 2000 (DMA 2000), which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act, requires every local, county and state government to have an approved Hazard Mitigation Plan. In addition to minimizing the impact of major hazard events on the community, completion of the Plan also maintains eligibility for future hazard mitigation funding following any significant disasters. As a result of the DMA 2000 legislation, hazard mitigation is now considered to be the first step in preparing for emergencies, rather than the final step in recovery.

The consequences of not having an approved Hazard Mitigation Plan are significant. Without one, the City will be ineligible for FEMA mitigation programs including the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and most importantly, the potential loss of public assistance for damaged facilities following a disaster. As an example, the County of Los Angeles received approximately $500 million in FEMA mitigation money following the 1994 Northridge Earthquake.

It is recommended that the City Council Adopt the City of Bradbury Hazard Mitigation Plan ("Plan") and adopt City Council Resolution No. 19-03. Adoption is required for FEMA approval and legitimizes the plan and authorizes departments and their staffs to execute their responsibilities. The 2019 Plan is an update to the Council-adopted 2007 Plan.

**FOR CITY COUNCIL AGENDA** 2-19 **AGENDA ITEM #** 3

## ANALYSIS

Emergency Planning Consultants was contracted to assist the City in drafting the Plan. A Planning Team was formed consisting of representatives from the City Manager's Office and Planning Department. The Team met a total of three times to examine hazards and impacts, update and develop mitigation actions, develop a strategy for public input, and review the First Draft Plan.

Information required for the Hazard Mitigation Plan was drawn from a variety of sources including the 2014 Los Angeles County All-Hazards Mitigation Plan.

As mentioned above, it was important to provide an opportunity for the general public as well as interested external agencies (e.g. adjoining jurisdictions, special districts, etc.) to participate in the planning process. This was accomplished by posting of the Second Draft Plan for input and solicitation for input by external agencies via email.

*Plan Structure*

The Hazard Mitigation Plan documents the mitigation planning process including how it was developed, the planning timeframe, and who was involved in drafting the document. A risk assessment was conducted and details the type of natural hazards that can affect the jurisdiction. The Plan also includes information on previous occurrences of hazard events and the probability of future events. The City's essential and critical facilities were assessed as to vulnerability. Demographic and land use data was also important in identifying present day and future vulnerabilities.

The core of the Plan is the Mitigation Strategy which outlines the City's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.

*Findings*

The Plan identifies a broad range of mitigation action items, including assigned departments, timelines, and priorities. The mitigation action items are aimed at activities that will minimize or eliminate the impact of hazards on the community and its vital resources.

*Plan Adoption and Approval*

The Third Draft Plan was submitted to Cal OES for input and forwarding to FEMA Region IX for a determination of Approval Pending Adoption which was received on January 4, 2019. The City Council is requested to adopt the Final Draft Plan. A copy of the City Council Resolution will be forwarded to FEMA along with a request for Final Approval.

## FINANCIAL ANALYSIS

There is no direct fiscal impact as a result of adopting the proposed Plan, however, such adoption and subsequent submittal to FEMA is a prerequisite for receiving any future disaster relief or mitigation funds.

## RECOMMENDATION

It is recommended that the City Council Adopt the City of Bradbury Hazard Mitigation Plan and adopt City Council Resolution No. 19-03. Adoption is required for FEMA approval and legitimizes the plan and authorizes departments and their staffs to executive their responsibilities. The 2019 Plan is an update to the Council-adopted 2007 Plan.

## City Council Resolution

**RESOLUTION NO. 19-03**

**A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF BRADBURY, CALIFORNIA, ADOPTING THE 2019 HAZARD MITIGATION PLAN**

**WHEREAS**, in 2000, the Federal Disaster Mitigation Act of 2000 was passed requiring state and local governments to prepare mitigation plans to document their mitigation planning process, and identify hazards, potential losses, mitigation needs, goals and strategies; and

**WHEREAS**, on January 1, 2017, California Assembly Bill 2140 was passed which places limits on the amount of additional state funding to local jurisdictions for certain disaster recovery projects funded by the California Disaster Assistance Act, unless a local jurisdiction has a state and federally approved local Hazard Mitigation Plan; and

**WHEREAS**, the City Council recognizes the threat that natural hazards pose to people and property within the City of Bradbury; and

**WHEREAS,** the City of Bradbury has prepared a multi-hazard mitigation plan, hereby known as the 2019 Hazard Mitigation Plan in accordance with the Disaster Mitigation Act of 2000; and

**WHEREAS,** the 2019 Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Bradbury from the impacts of future hazards and disasters; and

**WHEREAS,** adoption by the City Council demonstrates their commitment to the hazard mitigation and achieving the goals outlines in 2019 Hazard Mitigation Plan.

**MAYOR – CITY OF BRADBURY**

ATTEST:

Claudia Saldana
**CITY CLERK – CITY OF BRADBURY**

"I, Claudia Saldana, City Clerk, hereby certify that the foregoing Resolution, being Resolution No. 19-03, was duly adopted by the City Council of the City of Bradbury, California, at a regular meeting held on the 19th day of February, 2019 by the following roll call vote:"

AYES: Mayor Pro-Tem Hale, Councilmembers Bruny and Lathrop

NOES: None

ABSENT: Mayor Barakat, Councilmember Lewis

Claudia Saldana
**CITY CLERK – CITY OF BRADBURY**

Resolution No. 19-03
February 19, 2019

## Planning Team Sign-In Sheets

**City of Bradbury**
**Hazard Mitigation Plan – Planning Team Meeting #1**
**May 31, 2016**

| Name | Organization |
| --- | --- |
| CAROLYN HARSHMAN | EMERGENCY PLANNING CONSULTANTS |
| JULIO DONAYRE | CITY OF BRADBURY |
| ANNE McINTOSH | " " |
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**City of Bradbury**
**Hazard Mitigation Plan – Planning Team Meeting #2**
**July 7, 2016**

| Name | Organization |
|---|---|
| CAROLYN HARSHMAN | EMERGENCY PLANNING CONSULTANTS |
| JULIO DONAYRE | CITY of BRADBURY |
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**City of Bradbury**
**Hazard Mitigation Plan – Planning Team Meeting ~~#1~~ #3**
**~~May 31, 2016~~** AUGUST 25, 2016

| Name | Organization |
|---|---|
| CAROLYN HARSHMAN | EMERGENCY PLANNING CONSULTANTS |
| JULIO DONAYRE | CITY OF BRADBURY |
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## Web Postings and Notices

# Bradbury News

**Welcome to Bradbury**

**JULY 2017**

### Bradbury Hazard Mitigation Plan

The City of Bradbury's Hazard Mitigation Plan draft is available for review on the City website.

So that you are aware, the Hazard Mitigation Plan provides guidance on mitigating possible disasters, such as earthquakes, wildfire, mudslides, and other major disasters. Disasters can result in loss of life, property and infrastructure. In order to prevent or lessen the loss caused by disasters, the Hazard Mitigation Plan helps communities by assessing vulnerabilities and identifying actions to reduce those risks.

The City of Bradbury invites residents to read and review the Hazard Mitigation plan and provide feedback.

The plan can be found on the city website at: Cityofbradbury.org

Inside this issue



### 60 Years of Incorporation!

In July 26, 1957, the City of Bradbury was founded to preserve it's rural tranquility. As neighboring cities saw population increases and major developments, the residents of Bradbury wanted to preserve the calmness of their area.

After 60 years Bradbury still maintains its rural feel, and open space!

The City will celebrate its incorporation on August 1, 2017 as part of National Night Out.

**More information will be provided soon!**

City Council

Mayor Lathrop, District 4

bruce.lathrop@cityofbradbury.org

Mayor Pro Tem Pycz, District 5

rick.pycz@cityofbradbury.org

Councilmember Lewis, District 2

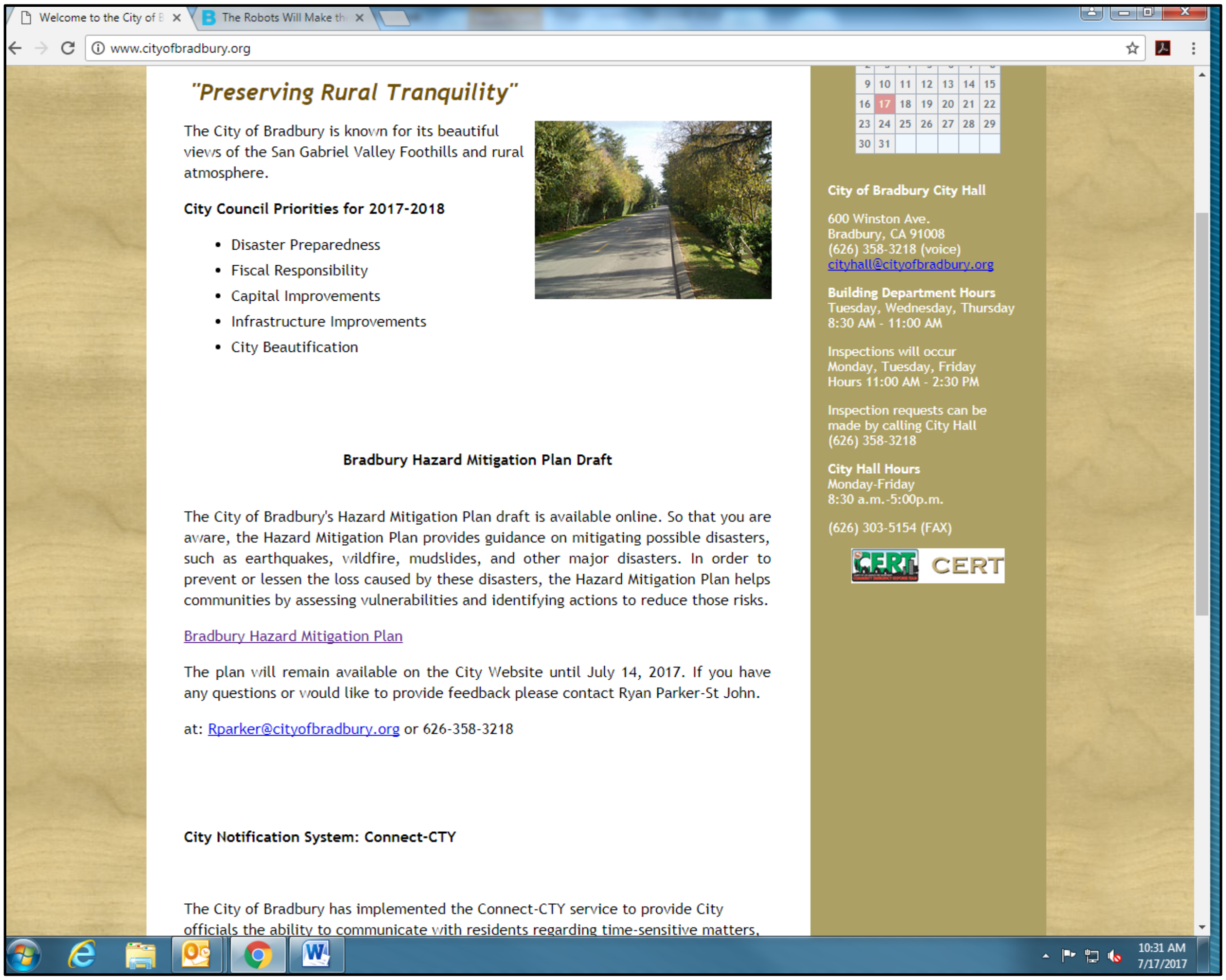
monte.lewis@cityofbradbury.org

Councilmember Barakat, District 3

rick.barakat@cityofbradbury.org

Councilmember Hale, District 1

dick.hale@cityofbradbury.org


Welcome to the City of B ×   The Robots Will Make th ×

www.cityofbradbury.org

"Preserving Rural Tranquility"

The City of Bradbury is known for its beautiful views of the San Gabriel Valley Foothills and rural atmosphere.

**City Council Priorities for 2017-2018**

- Disaster Preparedness
- Fiscal Responsibility
- Capital Improvements
- Infrastructure Improvements
- City Beautification

**Bradbury Hazard Mitigation Plan Draft**

The City of Bradbury's Hazard Mitigation Plan draft is available online. So that you are aware, the Hazard Mitigation Plan provides guidance on mitigating possible disasters, such as earthquakes, wildfire, mudslides, and other major disasters. In order to prevent or lessen the loss caused by these disasters, the Hazard Mitigation Plan helps communities by assessing vulnerabilities and identifying actions to reduce those risks.

Bradbury Hazard Mitigation Plan

The plan will remain available on the City Website until July 14, 2017. If you have any questions or would like to provide feedback please contact Ryan Parker-St John.

at: Rparker@cityofbradbury.org or 626-358-3218

**City Notification System: Connect-CTY**

The City of Bradbury has implemented the Connect-CTY service to provide City officials the ability to communicate with residents regarding time-sensitive matters,

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| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 | | | | | |

**City of Bradbury City Hall**

600 Winston Ave.
Bradbury, CA 91008
(626) 358-3218 (voice)
cityhall@cityofbradbury.org

**Building Department Hours**
Tuesday, Wednesday, Thursday
8:30 AM - 11:00 AM

Inspections will occur
Monday, Tuesday, Friday
Hours 11:00 AM - 2:30 PM

Inspection requests can be made by calling City Hall
(626) 358-3218

**City Hall Hours**
Monday-Friday
8:30 a.m.-5:00p.m.

(626) 303-5154 (FAX)

CERT

10:31 AM
7/17/2017

Dear Bradbury resident,

The City of Bradbury is pleased to inform you that its monthly newsletter is now available online. The City utilizes the newsletter to keep residents informed on what is taking place in Bradbury.

Click here to view.

**This Month's Special Highlight**

Bradbury's draft of the Hazard Mitigation Plan is available online. As a resident of Bradbury, the City would truly appreciate for you to review the plan and offer feedback, which could be incorporated in the final version.

So that you are aware, the Hazard Mitigation Plan provides guidance on mitigating possible disasters, such as earthquakes, fire, mudslides, and other major disasters. Disasters can result in loss of life, property and infrastructure. In order to prevent or lessen the loss caused by disasters, the Hazard Mitigation Plan helps communities by assessing vulnerabilities and identifying actions to reduce those risks.

The plan will remain available on the City website until July 14, 2017

If you have any questions about this email or the Hazard Mitigation Plan, please contact me at: Rparker@cityofbradbury.org

## Community Wildfire Protection Plan

The City of Bradbury has implemented a comprehensive, coordinated Community Wildfire Protection Plan (CWPP) to protect lives, property, and natural resources threatened by wildland fire. The CWPP was developed by Dudek, with input from the Los Angeles County Fire Department, the United States Forest Service, and other Stakeholders. Major funding for the development of the CWPP came from the State of California Governor's Office of Emergency Services' Hazard Mitigation Grant Program.

The final version of the CWPP was adopted by the Bradbury City Council on March 15, 2022 and was annexed into this Local Hazard Mitigation Plan on August 16, 2022.

The CWPP will be used to inform the risk assessment of the next 5-year update of the Local Hazard Mitigation Plan.

# City of Bradbury Community Wildfire Protection Plan

August 2022

Prepared for:

City of Bradbury
600 Winston Avenue
Bradbury, California 91008

CONTACT:
Kevin Kearney
City Manager

Prepared by:

DUDEK

MAIN OFFICE
605 THIRD STREET
ENCINITAS, CA 92024

CONTACTS:
Noah Stamm
Fire Protection Specialist III -
Fire Protection + Urban Forestry

Michael Huff
Discipline Director -
Fire Protection + Urban Forestry

Printed on 30% post-consumer recycled material.

# Table of Contents

## APPENDICES



## FIGURES



## TABLES

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# Acronyms and Abbreviations

| Acronym/Abbreviation | Definition |
|---|---|
| ACWM | Los Angeles County Agriculture Weights and Measures |
| ADU | Accessory Dwelling Unit |
| AFD | Arcadia Fire Department |
| APD | Arcadia Police Department |
| AMSL | Above Mean Sea Level |
| ANF | Angeles National Forest |
| BMP | Best Management Practice |
| CAD | Computer Aided Dispatch |
| CAWC | California American Water Company |
| CAL FIRE | California Department of Forestry and Fire Protection |
| Cal OES | California Office of Emergency Services |
| CalTrans | California Department of Transportation |
| CARB | California Air Resource Board |
| CBC | California Building Code |
| CEQA | California Environmental Quality Act |
| CFC | California Fire Code |
| CHP | California Highway Patrol |
| City | City of Bradbury |
| CWPP | Community Wildfire Protection Plan |
| EPA | U.S. Environmental Protection Agency |
| FHSZ | Fire Hazard Severity Zone |
| FMZs | Fuel Modification Zones |
| FRAP | Fire and Resource Assessment Program |
| FSAS | Fire Station Alerting System |
| GIS | Geographic Information System |
| HFRA | Healthy Forest Restoration Act |
| HFHSZ | High Fire Hazard Severity Zone |
| ICS | Incident Command System |
| IFC | International Fire Code |
| JADU | Junior Accessory Dwelling Unit |
| LACoFD | Los Angeles County Fire Department |
| LACoSD | Los Angeles County Sheriff's Department |
| LRA | Local Responsibility Area |
| MFD | Monrovia Fire Department |
| MPD | Monrovia Police Department |
| RAWS | Remote Automated Weather Station |
| SCAQMD | South Coast Air Quality Management District |
| SRA | State Responsibility Area |
| USFS | United States Forest Service |
| VHFHSZ | Very High Fire Hazard Severity Zone |
| WUI | Wildland Urban Interface |

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# 1 CWPP Authorization

The City of Bradbury CWPP was collaboratively developed. Interested parties, and local, state, and federal agencies managing land within or adjacent to the at-risk communities were consulted. This document identifies and prioritizes areas for hazardous fuel reduction treatments, provides recommendations for the types and methods of treatment that will protect the at-risk communities in the City, and recommends measures to reduce the ignitability of structures within the WUI areas. This CWPP is intended to better protect the community from the threat of wildfires by promoting community-level fuel reduction projects.

The following entities mutually agree with the contents of the City of Bradbury Community Wildfire Protection Plan:

Bruce Lathrop, Mayor
City of Bradbury

8-12-22

Kevin Kearney, City Manager
City of Bradbury

Anthony C. Marrone 8.5.22

Anthony C. Marrone, Acting Fire Chief
Los Angeles County Fire Department

ROBERT GARCIA Digitally signed by ROBERT GARCIA
Date: 2022.08.12 09:32:23 -07'00'

Robert Garcia, Angeles National Forest Fire Chief
U.S. Forest Service

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## 2 Executive Summary

The City of Bradbury (City) is proposing to implement a comprehensive, coordinated Community Wildfire Protection Plan (CWPP) to protect lives, property, and natural resources threatened by wildland fire. The City of Bradbury CWPP was developed by Dudek, with input from the Los Angeles County Fire Department (LACoFD), the United States Forest Service (USFS), and other Stakeholders. The recommendations and proposed Action Plan items within this CWPP are currently being collaborated with the City of Bradbury. Many of the recommendations and proposed Action Plan items are to be determined by the City, in collaboration with the cooperators/stakeholders, including the LACoFD and USFS. Implementation shall be determined by available budgets, Grants, and/or available resources.

Wildfires have and will continue to be a natural part of our ecosystem, however, as humans continue to expand into the Wildland-Urban Interface (WUI) areas and the reality of climate change fueled by drought and strong winds, wildfires will continue to grow and are become more destructive and less predictable. 2020 was a record-breaking wildfire season in the western United States with the cost exceeding billions of dollars in damage and suppression. With the growth and unpredictability of wildfires, many communities have taken advantage of developing a CWPP that focuses on identifying and addressing local hazards and risks from wildfire, as well as identifying potential projects intended to mitigate such risks. The City is located approximately 23 miles northeast of downtown Los Angeles, adjacent to the San Gabriel Mountains in the Angeles National Forest (ANF), a naturally vegetated mountain range exhibiting a complex wildfire environment that presents a significant wildfire risk due to steep and varied terrain, a mosaic of different vegetation types, and WUI development pattern. The City and the LACoFD recognize the catastrophic impact of wildfire in the community and is committed to reducing hazards and risk through fire protection, fuel hazard reduction, public education, preparedness, and community involvement. In order to mitigate for catastrophic wildfires, communities need to have a plan in place to prepare for, reduce the risk of, and adapt to wildfires. The implementation of CWPPs help accomplish these goals and provide recommendations.

Development of this CWPP included an assessment of wildfire hazard, which involved modeling potential fire behavior around the City under extreme wind and weather conditions, consistent with conditions experienced during a Santa Ana wind event. Other wildfire hazard variables were evaluated (terrain, weather, fuels, development patterns, fire department response, structure density, etc.) to identify the Very High Fire Hazard Areas adjacent to the City. City values potentially threatened by wildfire were also evaluated to understand the potential wildfire risk facing the City. The hazard assessment was used to evaluate the extent of the City's statutorily designated as a Very High Fire Hazard Severity Zone (VHFHSZ) by California Department of Forestry and Fire Protection (CAL FIRE) Fire and Resources Assessment Program (FRAP 2007).

The enactment of the 2003 Healthy Forest Restoration Act (HFRA) emphasized the need for federal agencies to work collaboratively with communities in the WUI in developing hazardous fuel reduction projects to reduce the risk from large-scale wildfire (Project Wildfire). The HFRA paved the way for communities to develop a compressive plan that would allow communities to develop and implement forest management and fuel reduction projects. This CWPP outlines a series of policies and action items which are intended to guide implementation of the CWPP. The policies and actions focus on codes and standards, funding, fire rehabilitation, evacuation, fire protection, vegetation/fuels management, and public education. Action items identify tasks to be implemented by the City and the LACoFD, and other responsible City Departments, to achieve the stated goal of protecting lives, property, and natural resources threatened by wildland fire. Additionally, this CWPP shall be treated as an ever-evolving plan and it will be important to monitor and evaluate the outcome of the plan. As the community continues to grow and change, so does the surrounding landscape within the adjacent San Gabriel Mountains, and the tasks and strategies to reduce the wildfire risk must also change. Although the HFRA doesn't provide a specific timeline to monitoring and updating the CWPP, it will be important to establish a schedule to ensure that the tasks continue to meet the needs of the community.

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# 3 Introduction

The City of Bradbury is located in Los Angeles County along the northern fringe of the urbanized portion of the Los Angeles Basin at the base of the San Gabriel Mountains in the ANF. The City is bordered by the City of Monrovia to the west and north and the City of Duarte to the south and east. Royal Oaks Drive serves as the southern boundary of the City's corporate limits. Royal Oaks Drive parallels the I-210 Freeway, located approximately one mile south of the City; access to this major regional transportation corridor is available through Duarte via Buena Vista Street and Mountain Avenue. The City and the surrounding landscape exhibit a complex wildfire environment that presents a significant risk to public and firefighter safety and the built and natural environment. This region of the San Gabriel Mountains has been subject to numerous damaging wildland fires, is influenced by local extreme wind and weather conditions (including Santa Ana wind events), has steep and varied terrain with a mosaic of different vegetation types, and is characterized by wildland urban interface (WUI) development patterns that can exacerbate wildfire risk. Although wildfires directly adjacent to the City have historically been relatively infrequent, the San Gabriel Mountains have a significant history of devastating and catastrophic wildland fires, including the 2009 Station Fire, which at the time was one of the 10 largest wildfires in California History, and the 2020 Bobcat Fire, currently one of Los Angeles County's largest wildfires. The 2009 Station Fire originated approximately 15 miles northwest of the City and burned over 160,000 acres, threatened over 12,000 structures in the Angeles National Forest, and resulted in two firefighter deaths. The 2020 Bobcat Fire initially spread south towards Bradbury, Sierra Madre, Monrovia, and Duarte, burning over 115,000 acres within the San Gabriel Mountains, injuring six, and threatening an estimated 6,000 structures, destroying 27 residences and damaging 28 more (CAL FIRE 2020).

As a key component of the Healthy Forest Restoration Act of 2003, a Community Wildfire Protection Plan (CWPP) serves as a mechanism for community input and identification of areas presenting high wildfire risk, as well as identification of potential projects intended to mitigate such risk. Further, the CWPP process is intended to provide the community a forum for identifying values at risk from wildfire, which may include people, property, natural resources, cultural values, economic interests, and infrastructure. The identification of these values at risk by the community strongly influences the potential wildfire hazard mitigation projects identified in this CWPP. With the intent to reduce the wildfire threat to the City of Bradbury, the City applied for and received a Cal OES (California Offices of Emergency Services) grant in 2019 to fund the development of the CWPP. And in the winter of 2020, the City hired Dudek to develop the City's CWPP.

This CWPP was developed for the City of Bradbury with input and direction from stakeholders and the community. The purpose of this collaboratively prepared CWPP is to serve as a fire protection planning document that presents the City's physical characteristics, wildfire hazard, assets at risk from wildfire, vegetation/fuel management projects and specifications, and goals and action items intended to reduce wildfire risk in the City. The ultimate goal of this CWPP is to protect lives, property, and natural resources threatened by wildland fire.

## 3.1 Purpose and Need

The City recognizes the potential for significant loss of life, property, and natural resources from wildland fire and has a history of prioritizing development and implementation of a comprehensive wildland fire program. The purpose of the CWPP is to create a community-based plan that focuses on identifying and addressing local hazards and risks from wildfire, as well as identifying potential projects intended to mitigate such risks. The CWPP process is intended to provide the community a forum for identifying values at risk from wildfire, which may include people, property, natural resources, cultural values, economic interests, and infrastructure. The identification of these values at risk by the community strongly influences the potential wildfire hazard mitigation projects identified within the CWPP. Additionally, identifying values at risk of wildfire increases the community member's understanding of living within the wildland-urban interface and instills a sense of personal responsibility among residents to take preventive actions around their properties in regard to wildfire.

The planning outline in '*Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities' (Sponsored By:* Communities Committee, National Association of Counties, National Association of State Foresters, Society of American Foresters, and Western Governors' Association, March 2004) was referred to throughout the development of this CWPP. A CWPP determines what is a wildfire risk, provides a roadmap of actions for a community to address the wildfire threat, and at a minimum, addresses the three following central components:

1. Collaboration
2. Identifying and Prioritizing Fuel Reduction
3. Identifying and treatment of Structural Ignitability

A CWPP must be collaboratively developed by local and state officials to meaningfully involve non-governmental stakeholders in the CWPP's process. This CWPP development included development of a Public Outreach and Engagement Plan to guide community engagement and coordination with other key stakeholders throughout the development of the CWPP. The City's central engagement goal was to develop a CWPP that builds on input from key stakeholders, including community members, City departments, neighboring jurisdictions (e.g. Monrovia Fire Department), Cal Fire and Federal agencies that manage lands within the vicinity of the community (e.g. United States Forest Service (USFS). The next step in the CWPP process is to identify and prioritize areas for hazardous fuel reduction treatments by recommending types and methods of treatment that, if acted upon and carried out when the City is threatened by a wildfire, it will make a difference of how that wildfire threatens the community and reduces the overall risk to that community. And the last step of the CWPP is the Treatment of Structural Ignitability. This CWPP will recommend measures that homeowners and communities can take to reduce the ignitability of structures and ensure their structures can withstand a wildfire. Not only will this include providing defensible space around your structure, but with the research and data over the past 15 to 20 years on structural enhancements, modifications can be made to the structure that will reduce the structures likelihood of catching fire.

There are eight steps identified within the *Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities,* that were used as a guide in the completion of the CWPP. The eight steps are:

**Step One: Convene the City's Decisionmakers.**

The City of Bradbury CWPP developed an operating group that included representatives from the Los Angeles County Fire Department (LACoFD Deputy Forester) and the Angeles National Forest/United States Forest Service (USFS); the City of Bradbury; other stakeholders; members of the community; and other members of the public.

**Step Two: Involve the State and Federal Agencies.**

Step two recommends engaging with local representatives of the nearby USFS and other federal agencies interested in the development of the CWPP, to gain an understanding of their perspectives, information about current and future fuel reduction/natural resources planning efforts, and other information relevant to the CWPP planning process. Representatives from the Angeles National Forest Division of the USFS have been involved in throughout the process of this CWPP and will a great benefit for implementing fuel reduction priorities identified within the CWPP.

**Step Three: Engage Interested People.**

Throughout the early stages of the Bradbury CWPP, community engagement meetings were held in order to include resident's, the City's Public Safety Committee, and homeowner's associations (HOAs) within the City of Bradbury, as well as community members from adjacent communities at risk, local business members, City Council members, and other organizations and individuals. These meetings were to introduce interested people to the CWPP process and allow for input from a diverse range of interested people to ensure that the final CWPP encompasses all concerns and ideas.

**Step Four: Establish a Community Base Map.**

Based upon existing fire hazard severity zone maps and community boundaries, a community base map was created to identify the Very High Fire Hazard Severity Zone (VHFHSZ) and High Fire Hazard Severity Zone (HFHSZ) areas, as well as potential ember zone areas based upon the fire behavior modeling results within adjacent naturally vegetated areas of the San Gabriel Mountains. The base map provides the residents within the City and adjacent communities a baseline visual of the areas within the City that are of the highest concern regarding wildfire threats.

**Step Five: Develop a Community Risk Assessment.**

After review of available City information, including topography, vegetation types, and fire history, a City-wide wildfire risk assessment was conducted to document existing vegetative fuel hazards within and adjacent to the City and identify and determine the highest priority areas where fuel treatment would reduce wildfire risk to the City. In addition to an assessment of existing vegetation, existing infrastructure and the City's overall emergency preparedness was assessed.

**Step Six: Establish Community Hazard Reduction Priorities and Recommendations to Reduce Structural Ignitability.**

Based on the City-wide assessment, key objectives, and goals of the CWPP were developed and recommended action items were identified to be implemented by the City that serve to minimize wildfire impacts to the community. Future project and actions identified would need to be funded and approved by the City prior to implementation.

**Step Seven: Develop an Action Plan and Assessment Strategy.**

This CWPP includes an action plan that identifies roles and responsibilities, potential funding needs, and timetables for carrying out the highest priority projects. Additionally, it will be important to establish a schedule to ensure that the tasks and action plan continue to meet the needs of the community over the long term.

**Step Eight: Finalize the Community Wildfire Protection Plan.**

A draft of the City of Bradbury CWPP will be available for public review prior to final approval, in order to allow for the interested parties to provide comments and feedback. Once comments and feedback have been addressed and mutual agreement throughout all interested parties about all aspects of the CWPP has been achieved, finalization of the CWPP can occur.

The purpose of this CWPP is intended to provide a comprehensive, coordinated plan to mitigate the impact of wildland fire to the City. This CWPP evaluates the City's existing VHFZSZ Areas based on hazard and risk, identifies policies and actions to reduce the community's threat from wildland fire, and identifies and prioritizes vegetation management projects to reduce wildfire threat. Intended users of this CWPP include the LACoFD, the USFS – Angeles National Forest, all City Departments, the Public Safety Committee, the City Council-City Manager, and members of the public. The policies and actions outlined in Chapter 6 include those proposed for implementation under this CWPP.

## 3.2 The Development Team

This section lists the representatives or organizations either involved in the development of the CWPP or who provided information for the completion of this CWPP. The organization, roles, and responsibilities are indicated in Table 1.

**Table 1. CWPP Development Key Stakeholders and Roles**

| CWPP Development Participant | Roles/Responsibilities |
|---|---|
| California Governor's Office of Emergency Services (Cal OES) | - Grant funding for CWPP<br>- Provide general guidance as needed<br>- Review and approve Final CWPP |
| City of Bradbury City Council - City Manager | - Provide general guidance as needed<br>- Receive comments from the public on the CWPP<br>- Approve Final CWPP |
| Los Angeles County Fire Department | - Provide guidance and support for the CWPP development<br>- Participate in CWPP Working Group and Team Meetings |
| CWPP Development Team:<br>• City Manager and City Management Analyst<br>• City's Public Safety Committee<br>• Los Angeles County Fire Department – Deputy Forester<br>• Los Angeles County Office of Emergency Management<br>• Los Angeles County Sheriff's Department<br>• Los Angeles County Public Works | - Provide guidance and expertise for the CWPP<br>- Coordinate with neighboring jurisdictions<br>- Provide guidance on key stakeholders<br>- Distribute media releases about the CWPP through City website<br>- Conduct direct outreach as appropriate |
| Key Stakeholders:<br>• LACoFD<br>• USFS - Angeles National Forest<br>• Neighboring Jurisdictions<br>• Utility Companies<br>• State Agencies<br>• Elected Officials | - Provide insights on the intersection of cross-jurisdictional hazard areas<br>- Collaborate on program and project development<br>- Review CWPP drafts<br>- Participate in public workshops, as appropriate |
| Stakeholders and Interested Parties including Communities Most Vulnerable to Wildfire Risk | - Attend stakeholder virtual workshops<br>- Read electronic newsletters<br>- Provide input on the CWPP |
| CWPP Consultant: Dudek | - Develop CWPP |

Table 1. CWPP Development Key Stakeholders and Roles

| CWPP Development Participant | Roles/Responsibilities |
|---|---|
| | - Facilitate virtual public meetings<br>- Develop CWPP community survey |

# 3.3 Community Involvement

## 3.3.1 Stakeholders

The City recognizes that implementation of the CWPP is not possible without the support of the people, businesses, and organizations that live and work in the City, especially in the City's VHFHSZ areas, as well as the many federal and local agencies that have jurisdiction in these areas. These are the stakeholders that are impacted by this plan and must share in the responsibility for protecting themselves and their community.

The roles of the LACoFD and USFS – Angeles National Forest are to assist in the development of the CWPP by helping identify wildland fire hazards and risks, recommend procedures and programs for City and private lands to minimize the threat of wildfire, educate the public about how to prepare and protect themselves from wildfire, enforce existing and new wildland fire codes to protect the public, and continue to develop partnerships and cooperation from other City departments, property owner groups, and individual property owners to effectively manage and respond to wildfire threat.

The role of stakeholders is to be aware of the hazards and risks that threaten their properties and safety, comply with wildland fire codes, formulate wildland fire evacuation plans, support neighborhood preparedness and community groups focused on wildland fire safety, and become part of the solution in mitigating the threat of wildfire that faces the City.

Since the creation and implementation of the LACoFD's 'Ready! Set! Go!' Wildfire Action Plan, residents living in the WUI and Very High/High Fire Hazard Areas throughout Los Angeles County, including those living in the City of Bradbury, have gained a greater understanding of the need to decrease the impact of wildfire and their personal responsibility in making that happen. Significant wildfires occurring near the City of Bradbury (including the 2002 Williams Fire, the 2014 Colby Fire, the 2016 Reservoir Fire, 2016 San Gabriel Complex Fire, and the most recent 2020 Bobcat Fire) have also increased public awareness of the wildfire threat facing the City. As a result, there has been a significant increase in public participation in wildland fire issues and public lobbying within City government to mitigate wildfire risk.

The LACoFD continues to work cooperatively with cities throughout Los Angeles County VHFHSZ areas to better plan, prepare, and reduce the potential hazards and risks associated with wildland fire. Federal, state, and other local fire agencies have also been working to develop community fire planning documents (for example, the Monrovia CWPP), coordinating with the City in a collaborative approach. The City and the LACoFD intend to continue these collaborative efforts.

Furthermore, members of the Fire Management Staff of the USFS - Angeles National Forest Division, are currently conducting hazardous fuel inventory data and fuel break research in areas of the Angeles National Forest adjacent to the City of Bradbury, which is crucial in decreasing the impact of wildfire to the City. The City and USFS – Angeles National Forest intend to continue looking for future opportunities to collaborate on potential Projects.

## 3.3.2 Public Outreach and Engagement Plan

During CWPP development, a Public Outreach and Engagement Plan was developed as a guide for engaging with members of the community and coordinating with other key stakeholders throughout the development of the CWPP. The City's central engagement goal was to develop a CWPP that builds on input from key stakeholders including:

- the communities most vulnerable to wildfire risk;
- City departments with a role in preventing and responding to the spread of wildfires into the community; and
- neighboring jurisdictions, including the Angeles National Forest

The plan outlined a tiered engagement strategy with different levels of engagement for each key stakeholder group. Different engagement opportunities were identified in the plan and included:

- **A CWPP section included on the City's website** (https://www.cityofbradbury.org/): The accessible website provides a central location for project information and is fully compliant with the Americans with Disabilities Act, Section 508 and WCAG 2.1AA requirements (which address web content accessibility). The site included meeting announcements, documents available for review, and a survey link for stakeholders to provide direct feedback. The website was updated throughout the CWPP development process and will function as the City's primary website for the final CWPP.
- **City of Bradbury Wildfire Protection Plan Survey**: A City CWPP survey page was created to gain an understanding of the community's wildland fire concerns and allow for stakeholders and interested people to provide feedback about their wildfire level of concern and actions they would like to have included in the CWPP to reduce the risk of wildfire (refer to Appendix A).
- **Public Zoom Meetings:** Public outreach meetings were held throughout the CWPP development phase. Two on-line public zoom meetings and one Public Safety Committee zoom meeting were held to obtain community feedback on the preliminary analysis and scoping of the CWPP, as identified below. Additional public meetings will be held at the City Council to provide updates on the development of the CWPP.

## 3.3.3 Public Outreach Meetings

The following community meetings were held during the preparation of the CWPP in order to provide community members an opportunity to contribute to the CWPP process. Specifically, community input was sought to better understand the vulnerability of City residents, businesses, and resources to wildfire and to promote awareness of the City's wildland fire hazard and propose workable solutions to reduce the risk of wildfire. The meetings also provided a forum for the community to discuss how to best mitigate wildfire risk in the City. Two on-line webinar community zoom meetings and one Public Safety Committee zoom meeting were conducted during CWPP development, as identified below:

- **September 3, 2020:** On-line webinar – zoom meeting was designed to outline the CWPP development process and gather feedback on community priorities. This meeting was held via online webinar due to coronavirus (COVID-19) shelter-in-place orders in effect at the time.
- **November 12, 2020**: On-line webinar – zoom meeting was designed to update the Public Safety Committee on the hazard assessment that was conducted and outline the CWPP development process. This meeting was held via online webinar due to coronavirus (COVID-19) shelter-in-place orders in effect at the time.
- **January 13, 2021:** On-line Webinar—workshop to introduce the hazard assessment conducted for the CWPP and gather community and stakeholder feedback. This meeting was held via online webinar due to coronavirus (COVID-19) shelter-in-place orders in effect at the time.

## 3.4 Funding/Grant Management

Funding for the preparation of this CWPP was made available from a California Governor's Office of Emergency Services (Cal OES) Community Fire Prevention Grants. The grant period started on October 2019 and extends through August 2022. Grant management and reporting is being conducted by the City of Bradbury City Manager.

## 3.5 Signatories

The signatories for the City of Bradbury Community Wildfire Protection Plan include:

1. Local Government: Kevin Kearney, City Manager, City of Bradbury
2. Local Government: Bruce Lathrop, Mayor, City of Bradbury
3. Los Angeles County Fire Department: Michael Inman, Deputy Fire Chief
4. United States Forest Service, Angeles National Forest Division (USFS): Robert Garcia, Angeles National Forest Fire Chief

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# 4 Plan Area Description

Fire environments are dynamic systems and include many types of environmental factors and site characteristics. Fires can occur in any environment where conditions are conducive to ignition and fire movement. Areas of naturally vegetated open space are typically comprised of conditions that may be favorable to wildfire spread. The three major components of the fire environment are climate, topography, and vegetation (fuel). The state of each of these components and their interaction with each other determine the potential characteristics and behavior of a wildfire at any given moment. It is important to note that wildland fire may transition to urban fire if structures are receptive to ignition. Structure ignition depends on a variety of factors and can be prevented through a layered system of protective features including fire resistive landscapes directly adjacent to the structure(s), application of known ignition resistive materials and methods, and suitable infrastructure for firefighting purposes. Understanding the existing wildland vegetation and urban fuel conditions on and adjacent to the City is necessary to understand the potential for wildfire within and around the City.

Wildfires are a regular and natural occurrence in most of California. However, the number of fires and acres burned annually has increased in recent years. These wildfires are mostly human-triggered, suggesting that the historic fire interval has been artificially affected across large areas. In addition, wildfire suppression efforts over the last several decades may have aided in the accumulation of fuels in some natural communities (Minnich 1983; Minnich and Chou 1997), resulting in larger and more intense wildfires. Large wildfires have had, and continue to have, a substantial and recurring role in California landscapes (Keeley and Fotheringham 2003), in part because (1) California landscapes become highly flammable each fall; (2) the climate in the region has been characterized by fire climatologists as the worst fire climate in the United States (Keeley 2004) with foehn winds[1] occurring during autumn after a 6-month drought period each year; and (3) ignitions via anthropogenic sources have increased or are increasing in many wildland or WUI areas.

## 4.1 City of Bradbury Location

The City of Bradbury is a small, residential/equestrian-oriented community located in Los Angeles County along the northern fringe of the urbanized portion of the Los Angeles basin at the base of the San Gabriel Mountains in the Angeles National Forest. The community encompasses 1.9 square miles, includes 3.2 miles of public streets and roads, and has an estimated population of just over 1,000 people. The City is bordered by the City of Monrovia to the west and north and the City of Duarte to the south and east. Royal Oaks Drive serves as the southern boundary of the City's corporate limits. Royal Oaks Drive parallels the I-210 Freeway, located approximately one mile south of the City; access to this major regional transportation corridor is available through Duarte via Buena Vista Street and Mountain Avenue (Figure 1, City of Bradbury Location Map and Figure 2, City of Bradbury Vicinity Map).

While many of the action items recommended in this CWPP focus on the VHFHSZ areas situated along the foothill communities within the City, this CWPP covers all portions of the City.

[1] A type of dry, warm, down-slope wind that occurs on the lee (downwind side) of a mountain range. Locally, Sundowner winds would be considered foehn winds.

## 4.2 Fire Hazard Areas

### 4.2.1 State Fire Hazard Severity Zones

Fire Hazard Severity Zones (FHSZs) are "geographical areas designated pursuant to California Public Resources Code, Sections 4201 through 4204 and classified as Very High, High, or Moderate in State Responsibility Areas (SRA) or as Local Responsibility Area (LRA) VHFHSZ or non-VHFHSZ designated pursuant to California Government Code, Sections 51175 through 51189" (California Building Standards Commission 2016). The City of Bradbury's VHFHSZ is a Local Agency VHFHSZ, as defined, and the City is considered an LRA. The LACoFD is the responsible agency for fire protection within the City's VHFHSZ and follows the Cal Fire VHFHSZ designation. The City abuts lands where the responsibility for fire protection lies with the Federal or State of California (FRA or SRA). The City's Local and Federal/State VHFHSZ is presented in Figure 3.

California Public Resources Code Sections 4201–4204 and Government Code Sections 51175–51189 direct CAL FIRE to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. The resulting FHSZs define the application of various mitigation strategies to reduce the risk associated with wildland fires (CAL FIRE 2020a). The model used to determine the extent of FHSZs is based on an analysis of potential fire behavior, fire probability predicated on the frequency of fire weather, ignition patterns, expected rate of spread, ember (brand) production, and past fire history (CAL FIRE 2020a). Structures built in FHSZs are subject to more stringent fire hardening requirements than those that are not.

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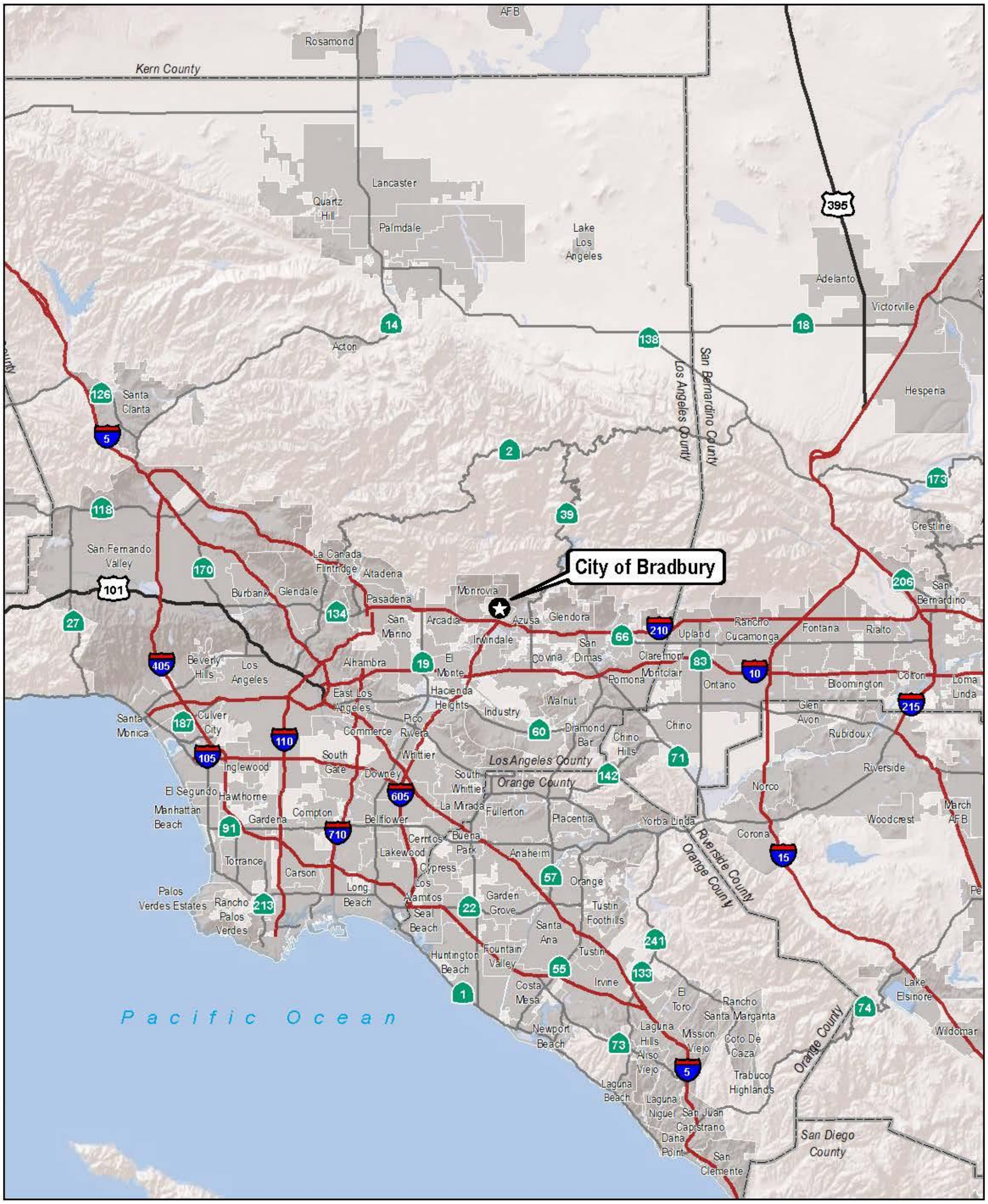


SOURCE: ESRI

DUDEK

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**FIGURE 1**
Regional Map
City of Bradbury Community Wildfire Protection Plan

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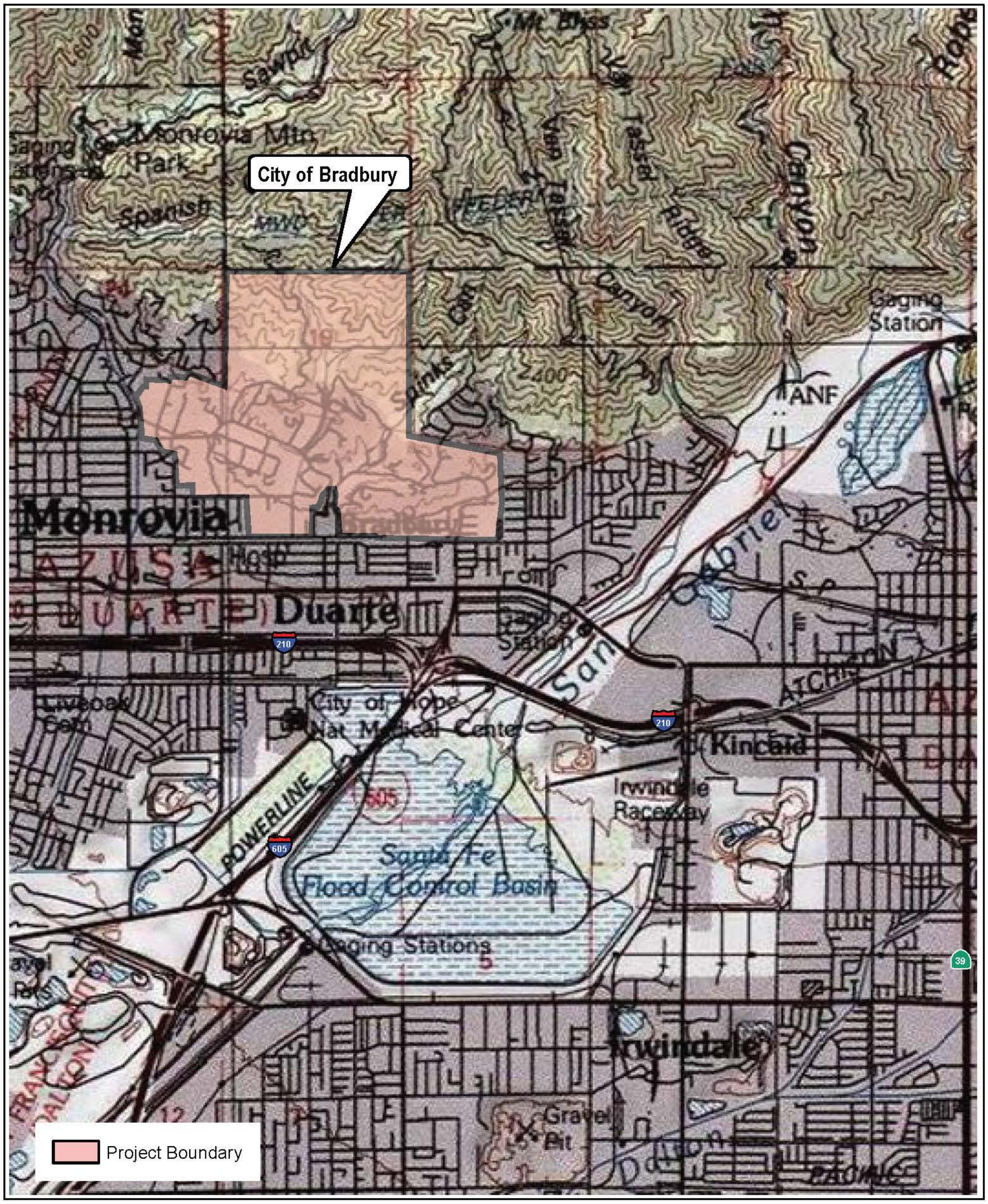


Document Path: Z:\Projects\j1124901\MAPDOC\MAPS\Community Wildfire Protection Plan\Fig2 Vicinity.mxd

SOURCE: USGS 7.5 Minute Series, Azusa Quadrangle

DUDEK

0 1,800 3,600 Feet

**FIGURE 2**

Vicinity Map

City of Bradbury Community Wildfire Protection Plan

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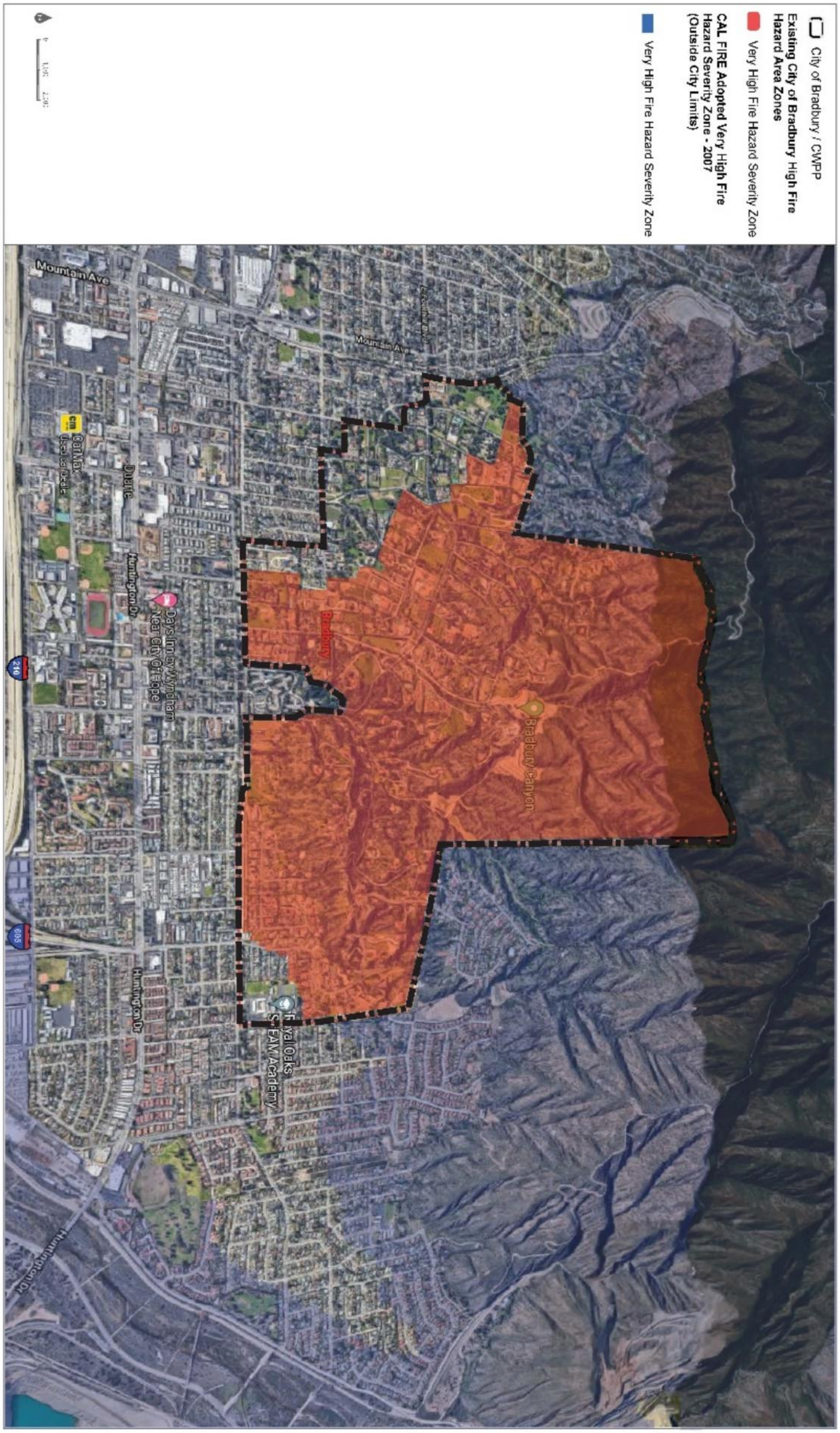


SOURCE: City of Bradbury, Los Angeles County Fire Department and CAL FIRE

CITY OF BRADBURY
COMMUNITY WILDFIRE PROTECTION PLAN

DUDEK

FIGURE 3
Current High Fire Hazard Areas
City of Bradbury Community Wildfire Protection Plan

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## 4.3 Climate

The City of Bradbury, like much of Southern California, is influenced by the Pacific Ocean and a seasonal, migratory subtropical high-pressure cell known as the "Pacific High." Wet winters and dry summers with mild seasonal changes characterize the Southern California climate. This climate pattern is occasionally interrupted by extreme periods of hot weather, winter storms, or dry, easterly Santa Ana winds. The average annual high temperature calculated from January 1917 to June 2016 for the San Gabriel Canyon area is 78.2° Fahrenheit (°F), with higher temperatures in summer and early fall (June through October) reaching up to an average of 91.7°F. The average annual low temperature is 52.8°F and can reach an average low temperature of 47.2°F. The average annual precipitation for the area is 22.28 inches, with the most rainfall concentrated in December (3.49 inches), January (4.40 inches), February (5.06 inches), March (3.50 inches), and April (1.69 inches). Rainfall is much less during June (0.19 inches), July (0.04 inches), and August (0.11 inches) (Western Regional Climate Center, 2020).

From a regional perspective, the fire risk in southern California can be divided into three distinct "seasons" (Nichols et al. 2011, Baltar et al 2014). The first season, the most active season and covering the summer months, extends from late May to late September. This is followed by an intense fall season characterized by fewer but larger fires. This season begins late September and continues until early November. The remaining months, November to late May cover the mostly dormant, winter season. Mensing et al. (1999) and Keeley and Zedler (2009) found that large fires in the region consistently occur at the end of wet periods and the beginning of droughts. Live fuel moisture content, a measure of the relative mass of water and indicator of ignitability, for most vegetation in the San Gabriel Mountains of the ANF reaches the driest point in the late summer or early fall period. Seasonal drying of vegetation produces conditions that can result in fuel-driven wildfires and fire-associated climatic changes. This condition is referred to as a plume-dominated wildfire. Plume-dominated wildfires are fires where the energy produced by the fire, in conjunction with atmospheric instability, creates significant convective forces and increased wind speeds. Such fires are incredibly unpredictable, spread in various directions simultaneously, and exhibit extreme fire behavior.

Typically, the highest fire danger in southern California coincides with Santa Ana winds. The Santa Ana wind conditions are a reversal of the prevailing southwesterly winds that usually occur on a region-wide basis near the end of fire season during late summer and early fall. They are dry, warm winds that flow from the higher desert elevations in the east through the mountain passes and canyons. As they converge through the canyons, their velocities increase. Consequently, peak velocities are highest at the mouths of canyons and dissipate as they spread across valley floors. Localized wind patterns on the Project Sites are strongly affected by both regional and local topography. The prevailing wind pattern is from the west (onshore), but the presence of the Pacific Ocean causes a diurnal wind pattern known as the land/sea breeze system. During the day, winds are from the west–southwest (sea) and at night winds are from the northeast (land), averaging 2 miles per hour (mph). During the summer season, the diurnal winds may average slightly higher (approximately 15 mph) than the winds during the winter season due to greater pressure gradient forces. Surface winds can also be influenced locally by topography and slope variations. The highest wind velocities are associated with downslope, canyon, and Santa Ana winds. The foothills adjacent to the City of Bradbury includes topography that would create unusual weather conditions; thus the City is subject to periodic extreme fire weather conditions that occur throughout foothill portions of Los Angeles County.

The fire season in the San Gabriel Mountain areas has historically occurred between June and October as the vegetation begins to dry out from regular, dry, offshore winds. The fire season would typically end in November with the onset of winter rainfall, cooler temperatures, and higher relative humidity, with fires less common from

December to April. However, climate change effects are extending fire season throughout the state, and the fire season in the Bradbury surrounding areas may ultimately be year-round. The greatest fire danger for this area coincides with the period when the Santa Ana winds are at their strongest.

Certain weather conditions can increase fire risk, resulting in the declaration of a Red Flag Warning. A Red Flag Warning is a forecast warning issued by the United States National Weather Service to inform area firefighting and land management agencies that conditions are ideal for wildland fire ignition and propagation. After drought conditions, and when humidity is very low, and especially when high or erratic winds which may include lightning are a factor, the Red Flag Warning becomes a critical statement for firefighting agencies, which often alter their staffing and equipment resources dramatically to accommodate the forecast risk (City of Bradbury). A Red Flag Warning is issued when their forecast includes any of the two following conditions:

- A sustained wind average 15 miles per hour (mph) or greater, and
- Relative humidity less than or equal to 25%, and
- 10-hour fuel moisture less than 8%.

To the public, a Red Flag Warning means high fire danger with increased probability of a quickly spreading vegetation fire within the area within 24 hours (City of Bradbury). The City is located in the Los Angeles County Mountains / Angeles National Forest Weather Zone (CAZ254). The City's webpage and Los Angeles County Emergency Response webpage identify policies and procedures to be followed by the LACoFD and Los Angeles County residents during Red Flag Warnings and High Risk Days and include monitoring weather conditions, notifying City Departments and the media, revoking burn permits, flying red flags at fire stations, and ensuring that staff and equipment are within the City should an event occur.

### 4.3.1 Climate Change

As noted above in the Executive Summary, California faces a dramatic increase in the number and severity of wildfires, with 10 of the most destructive fires occurring since 2015 (CAL FIRE 2019a). The state's major study on climate impacts, the Fourth Climate Assessment (OPR et al. 2019), projects that California's wildfire burn area is likely to increase by 77% by the end of the century. As identified in Governor Newsom's Strike Force report (State of California 2019), the growing risk of catastrophic wildfires has created an imperative for the state to act urgently and swiftly to expand fire prevention efforts. Current research has also identified that the frequency of autumn days with extreme fire weather has more than doubled in California since the early 1980s, a result of human-caused climate change. Such fire weather exhibits strong offshore winds (e.g., Santa Ana Winds) and is coincident with unusually dry vegetation resulting from warm conditions over the summer months prior to the onset of autumn precipitation (Goss et al. 2020).

Climate change is expected to make landscapes more susceptible to extreme wildfires by altering temperatures (Hayhoe et al. 2004) and the availability and aridity of fuels (Abatzoglou and Williams 2016). Anthropogenic climate change has emerged as a driver of increased fire activity, a trend that is expected to continue (Abatzoglou and Williams 2016). All analyses completed for fire occurrence and severity into the future predict more frequent fires, a greater number of fires, and higher fire severity under climate change scenarios (Fried et al. 2004; Lenihan 2008; Westerling et al. 2011; Westerling 2018).

A changing climate, combined with anthropogenic factors, has already contributed to more frequent and severe wildfires in the western United States (Abatzoglou and Williams 2016; Mann et al. 2016; Westerling 2016), with the number of human-caused fires being much higher in more populated regions of the state. Recently, the area burned by wildfires has increased consistent with increasing air temperatures (OEHHA 2018). Increased wildfire risk and severity are vulnerabilities that are anticipated throughout California (Westerling 2018; Krawchuk et al. 2009). Increased fire occurrence and severity under climate change would secondarily affect other areas of vulnerability, as noted below.

- **Increased Fire Risk:** Warmer air temperatures are expected to lengthen the fire season, drying out vegetation more quickly and increasing fire risk. Based on high- and low-emissions climate change scenarios, increases in the number of high-severity wildfires are anticipated (Westerling 2018). Multi-year severe drought is supported as a factor in increasing fire size and severity, as well as tree mortality (Crockett and Westerling 2018). On interannual and shorter time scales, climate variability affects the flammability of live and dead forest vegetation (Westerling 2016). Fire size in southern California and the Central Coast areas also increases with both air temperature in the month of ignition and with low precipitation in the preceding 12-month period (Westerling 2018). Additionally, the frequency of extreme fire weather in the fall months has increased over the past 40 years, a trend which is expected to continue under climate change models (Goss et al. 2020).
- **Greater Fuel Loads:** Years with widespread fires are historically preceded by wet years, which influence greater vegetation growth, especially in the understory. Highly flammable species, which often populate disturbed areas quickly, may have a competitive advantage over other species, typically resulting in a higher, more flammable fuel load. Drought may result in increased tree mortality, which contributes to higher fuel loading and wildfire size and severity (Crockett and Westerling 2018). Increasing fire size and severity and tree mortality are linked to increasing temperatures and aridity (Crockett and Westerling 2018). Increased prevalence of dead or desiccated fuels resulting from drought effects is conducive to crown fires, which require ladder fuels to move from volatile grasses to the less volatile mid-level forest to the dry and volatile canopy cover (Crockett and Westerling 2018). Increased fuel aridity contributes to larger forest areas experiencing increased periods of high fire potential (Abatzoglou and Williams 2016).
- **Ecological Impacts:** Increased fire severity is expected to amplify and accelerate the ecological impacts of climatic change. Drought years may increase the vulnerability of tree populations to insects and disease, and the lower occurrence of extended freezing periods in the winter would allow higher insect survivability. Climate-induced changes in fire behavior and frequency would influence species distribution, migration, and extinction (Flannigan 2000). Greater occurrence of fires increases the amount of carbon and particulates released into the atmosphere (Westerling 2008).
- **Social Impacts:** Increased expenditures for fire suppression are anticipated, and the amount of burned property (in total area and monetary value) in Southern California communities increases substantially under global climate models' high-emissions scenarios due to greater fire risk (Westerling and Bryant 2008; Levy 2018). In areas with the highest fire risk, wildfire insurance is estimated to see costs rise by 18% by 2055, and the number of properties insured lowered (Westerling 2018). Wildland fire smoke exposure is a growing risk to public health (Domitrovich et al. 2017). Secondary effects of increased fire, such as loss of recreational amenities, area closures, and excessive smoke, can have serious financial effects on regional business interests and local economies.

The management recommendations included in this CWPP include fuel management actions to reduce fuel loads, minimize ignitions, and reduce the potential for extreme fire behavior.

## 4.4 Topography

The City of Bradbury is located at the base of the San Gabriel Mountains in the ANF. The northern portion of the City is very steep, sloping from the northeast to the southwest. The southern portion of the City is fairly flat with some steep, rolling terrain sloping towards the south. Elevation within the City ranges from approximately 579 feet AMSL at the southern portion of the City to 1,800 feet AMSL at the highest point of the City to the north.

Topographic features that may present a fire spread facilitator are the slope and canyon alignments, which may serve to funnel or channel winds, thus increasing their velocity and potential for influencing wildfire behavior. From a regional perspective, the alignment of tributary canyons and dominant ridges are conducive to channeling and funneling wind, thereby increasing the potential for more extreme wildfire behavior in the region. Terrain affects wildfire movement and spread. Steep terrain typically results in faster upslope fire spread due to pre-heating of uphill vegetation. Flat areas typically result in slower fire spread when absent of windy conditions. Topographic features such as saddles, canyons, and chimneys (land formations that collect and funnel heated air upward along a slope) may form unique circulation conditions that concentrate winds and funnel or accelerate fire spread. For example, fire generally moves slower downslope than upslope. Terrain may also buffer, shelter, or redirect winds away from some areas based on canyons or formations on the landscape. Saddles occurring at the top of drainages or ridgelines may facilitate the migration of wildfire from one canyon to the next. Various terrain features can also influence fire behavior, as summarized in Table 2.

The narrow drainage and sub-drainage topographic features of the San Gabriel Mountains have the capability to funnel winds, increase wind speeds, erratically alter wind direction, and facilitate fire spread and promote extreme fire behavior. This is especially true during Santa Ana wind events when strong northerly/northeasterly winds are aligned with the downslope direction of the canyons and watersheds of the San Gabriel Mountains. The topography of within and adjacent to Bradbury is, therefore, capable of producing wind conditions that promote extreme wildfire behavior.

**Table 2. Effects of Topographic Features on Fire Behavior**

| Topographic Feature | Effect |
|---|---|
| Narrow Canyon | Surface winds follow canyon direction, which may differ from prevailing wind; wind eddies/strong upslope air movement expected, which may cause erratic fire behavior; radiant heat transfer between slopes facilitates spotting/ignition on opposite canyon side. |
| Wide Canyon | Prevailing wind direction not significantly altered; aspect significant contributor to fire behavior. Wide canyons not as susceptible to cross-canyon spotting except in high winds. |
| Box Canyon/ Chute | Air drawn in from canyon bottom; strong upslope drafts. No gaps or prominent saddles to let heated air escape. Fires starting at canyon bottom can move upslope very rapidly due to a chimney-like preheating of the higher-level fuels and upslope winds. |
| Ridge | Fires may change direction when reaching ridge/canyon edge; strong air flows likely at ridge point; possibility for different wind directions on different sides of ridge. Ridges experience more wind. Fires gain speed and intensity moving toward a ridge. Fires burning at a ridge can exhibit erratic fire behavior. Strong air flows can cause a whirling motion by the fire. As the wind crosses a ridge it usually has a leeward eddy where the wind rolls around and comes up the leeward side. |

**Table 2. Effects of Topographic Features on Fire Behavior**

| Topographic Feature | Effect |
|---|---|
| Saddle | Potential for rapid rates of fire spread; fires pushed through saddles faster during upslope runs. Winds can increase when blowing through saddles due to the funneling effect of the constricted pass. On the other side, winds will slow, but erratic winds potentially occur at the saddle due to eddies. |

**Sources:** Teie 1994; NFPA 2011.

## 4.5 Vegetation and Fuels

Vegetation types (fuels) present in the City and their contribution to fire hazard are summarized in this section. Hazardous fuels include live and dead vegetation that exists in a condition that readily ignites; transmits fire to adjacent structures or ground, surface, or overstory vegetation; and/or is capable of supporting extreme fire behavior.

### 4.5.1 Vegetative Fire Hazard

The following sections summarize vegetative fire hazard of dominant vegetation types that occur within and adjacent to the City. Hazardous fuels include live and dead vegetation that exists in a condition that readily ignites; transmits fire to adjacent structures or ground, surface, or overstory vegetation; and is capable of supporting extreme fire behavior. All vegetation burns; however, some plants exhibit characteristics that make them more flammable than others. Flammability can be defined as a combination of ignitability, combustibility, and sustainability. Ignitability is the ease of or the delay of ignition; combustibility is the rapidity with which a fire burns; and sustainability is a measure of how well a fire continues to burn with or without an external heat source (White and Zipperer 2010). Flammability is influenced by several factors, which can be classified into two groups: physical structure (e.g., branch size, leaf size, leaf shape, surface-to-volume ratio, and retention of dead material) and physiological elements (e.g., volatile oils, resins, and moisture content) (Moritz and Svihra 1998; UCCE 2016; UCFPL 1997; White and Zipperer 2010). Plants that are less flammable have low surface-to-volume ratios, high moisture contents, and minimal dead material or debris. Examples of such plants include agave, oleander, and olive trees. More flammable species have high surface-to-volume ratios, exhibit low moisture contents, contain volatile oils, and have high levels of dead material or debris (Moritz and Svihra 1998; UCFPL 1997; UCCE 2016; White and Zipperer 2010). Examples of such plants include pampas grass, juniper, and pine. Plant condition and maintenance is also an important factor in flammability potential. Some plants that have more flammable characteristics can become less flammable if well maintained and irrigated. Conversely, plants can be explosively flammable when poorly maintained, situated on south-facing slopes, in windy areas, or in poor soils (Moritz and Svihra 1998).

The LACoFD has developed a list of desirable plant species for use in the County's VHFHSZ Areas (Appendix B). These plants have the ability to store water in leaves or stems and withstand drought, produce limited dead and fine material, are prostrate or prone in form, have extensive root systems for controlling erosion, can withstand severe pruning, have high levels of salt or other compounds that contribute to fire resistance, have low levels of volatile oils or resins, and/or can resprout after a fire. The County has also adopted a list of plants that are prohibited in the County's VHFHSZ Areas. These plants are considered to be unacceptable in the landscape due to their flammable characteristics, which include large amounts of dead material retained within the plant, rough or peeling bark, production of profuse amounts of litter and the presence of volatile substances such as oils, resins, wax, and pitch. Certain native plants species contain these characteristics (e.g., sage, buckwheat, and coyote bush).

Insects, fungi, other microbes, and vertebrates are a natural component of California forests. Populations of pests are dynamic and fluctuate in response to climatic and environmental changes such as drought, stand density, fire, and other site disturbances. Healthy, vigorous trees are typically able to withstand pest attacks when pest populations are at low to moderate levels. When stressors exist in forests (e.g., overstocking, shading, drought), tree vigor is reduced, and tree susceptibility to pest attacks and infestations increases. Localized areas of infestations of pitch canker (*Fusarium circinatum*) and sudden oak death (*Phytophthora ramorum*) have been reported within Los Angeles County (Pitch Canker Task Force 2012; University of California 2004). Eucalyptus longhorned borer (*Phoracantha semipunctata* and *Phoracantha recurva*) has also been documented within the County (California Agriculture 1996). These diseases/pests can contribute to wildfire hazards by increasing dead surface fuel loads and hindering firefighting efforts.

### 4.5.2 Vegetation Types

The existing vegetation types present throughout the foothills of the San Gabriel Mountains adjacent to the City and their associated contribution to fire hazard. It should be noted that the majority of the City is considered as urban land cover. Urban land cover typically represents noncombustible types (e.g., pavement) or developed and maintained landscapes (e.g., buildings, turf in parks. Ornamental landscape vegetation also characterizes portions of areas considered as urban land cover. Such vegetation is a combination of native and introduced ground cover, grass, shrub, and tree species. Some ornamental vegetation may increase fire hazard due to plant composition and structure (as described above) and the lack of irrigation and maintenance.

To support the fire behavior modeling efforts conducted for this CWPP, the different vegetation types observed adjacent to the City were classified into the aforementioned numeric fuel models. As is customary for this type of analysis, the terrain and fuels directly adjacent to the property are used for determining flame lengths and fire spread. It is these fuels that would have the potential to affect the project's structures from a radiant and convective heat perspective as well as from direct flame impingement.

Vegetation types were derived from a site visit that was conducted on by a Dudek Fire Protection Planner. Based on the site visit numerous vegetation communities and land cover types exist, including Broom baccharis scrub, mafic chaparral, southern willow scrub (disturbed and undisturbed), southern mixed chaparral, coastal sage scrub, coast live oak and western sycamore riparian forests with non-native chaparral and shrub understory. Mature tree canopies for coast live oak trees (*Quercus agrifolia)* and western sycamore trees (*Platanus racemosa*) are assumed to have a canopy base height ranging from 35 to 45 feet off the ground. Canopy bulk density, the weight of canopy fuels per cubic foot of volume, is assumed to be the maximum allowable value in BehavePlus to represent broadleaf trees which, given canopy density and leaf size, have more weight per area than conifer trees (the standard for this value input in BehavePlus (Heinsch and Andrews 2010)). Foliar moisture, the moisture content of canopy foliage, is assumed to be 100%, a reasonable estimate in lieu of site-specific data (Scott and Reinhardt 2001).

Variations in vegetative cover type and species composition have a direct effect on fire behavior. Some plant communities and their associated plant species have increased flammability based on plant physiology (resin content), biological function (flowering, retention of dead plant material), physical structure (bark thickness, leaf size, branching patterns), and overall fuel loading. For example, the native shrub species that compose the coastal sage scrub and mixed chaparral plant communities on site are considered to exhibit higher potential hazard (higher intensity heat and flame length) than grass dominated plant communities (fast moving, but lower intensity) if ignition occurred. The corresponding fuel models for each of these vegetation types are designed to capture these differences. Additionally, vegetative cover influences fire suppression efforts through its effect on fire behavior. For example, while fires burning in grasslands may exhibit lower flame lengths and heat outputs than those burning in native shrub habitats, fire spread rates in grasslands are often more rapid.

As described, vegetation plays a significant role in fire behavior, and is an important component to the fire behavior models discussed in this CWPP. A critical factor to consider is the dynamic nature of vegetation communities. Fire presence and absence at varying cycles or regimes disrupts plant succession, setting plant communities to an earlier state where less fuel is present for a period of time as the plant community begins its succession again. In summary, high-frequency fires tend to convert shrublands to grasslands or maintain grasslands, and fire exclusion tends to convert grasslands to shrublands over time as shrubs sprout back or establish and are not disturbed by repeated fires. In general, biomass and associated fuel loading will increase over time, assuming that disturbance (e.g., fire, grazing, or farming) or fuel reduction efforts are not diligently implemented, which would not occur on this site due to the funded maintenance entity.

### 4.5.2.1 Grass/Herbaceous

Grass/herbaceous fuels in and adjacent to the City are represented by the California annual grassland vegetation type and are found throughout the foothills along the City's northern boundary. Grassland types may include scattered and widely spaced trees and/or shrubs, although grasses are the dominant cover type. Grasses are fine fuels that are loosely compacted with a low fuel load.[2] Grasses have a high surface area-to-volume ratio, requiring less heat to remove fuel moisture and raise fuel to ignition temperature. They are also subject to early seasonal drying in late spring and early summer. Live fuel moisture content in grasses typically reaches its low point in early summer, and grasses begin to cure soon after. Due to these characteristics, grasses have potential for a high rate of spread, rapid ignition, and facilitation of extreme fire behavior. Grasses are the vegetation type in and adjacent to the City with one of the highest risks for wildfire ignition. Their low overall fuel loads typically result in faster moving fires with lower flame lengths and heat output. Untreated grasses can help spread fire into other adjacent surface fuel types (e.g., shrubs) or facilitate surface to crown fire[3] transition where they exist beneath tree canopies.

### 4.5.2.2 Brush/Scrub

Brush/scrub fuels in the City are represented by the chaparral and coastal sage scrub vegetation types. Brush/ scrub types may include scattered and widely spaced trees, small patches of grass/herbaceous vegetation, or grass herbaceous vegetation occurring beneath shrub canopies, although shrubs are the dominant cover type. Chaparral and coastal sage scrub vegetation types are found throughout the foothills of the San Gabriel Mountains and within the ANF along the City's northern boundary.

Chaparral and coastal sage scrub are considered moderately fine fuels that are loosely compacted. Chaparral has a high fuel load, and coastal sage scrub has a moderate fuel load. Both types have high surface area-to-volume ratios, requiring less heat to remove fuel moisture and raise fuel to ignition temperature. Both are subject to early seasonal drying in the late spring and early summer, but do not fully cure in the way that grasses do. The live fuel moisture content reaches its

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2 The amount of available and potentially combustible material, usually expressed as tons/acre (NWCG 2020).
3 A crown fire is a forest fire that advances often at great speed from tree top to tree top.

low point in the late summer and early fall months. Dead fuels consist mainly of 1-hour and 10-hour fuel sizes, or twigs and small stems ranging from 0.25 inches to 1 inch in diameter. Chaparral and coastal sage scrub have the potential for a high rate of spread, rapid ignition, and extreme fire behavior. Chaparral also has a high content of volatile organic compounds, which also contributes to extreme fire behavior potential.

### 4.5.2.3 Tree/Woodland

Tree/woodland fuels in the City are represented by the coast live oak woodland, western sycamore, pine woodlands, and riparian woodland vegetation types. Also, eucalyptus is included in this section due to its existence in and adjacent to the City. Tree/woodland types may also include scattered shrubs or shrub groupings, small patches of grass/ herbaceous vegetation, or shrub and grass herbaceous vegetation occurring beneath tree canopies, although trees are the dominant cover type. Oak woodlands are found in the City's drainages and canyons throughout the foothill areas.

**Coast Live Oak Woodland**

Oak stands are composed of fuel structures ranging from fine to heavy. In closed canopy stands, a sparse understory of grass, leaves, twigs, branches, and bark litter may be present. In open stands, understory may include grass, shrubs, leaves, twigs, branches, and bark litter. Fuel buildup typically occurs very slowly in oak woodland stands in California (USFS 2020a), and litter forms a thick, compacted mat resulting in very low surface fuel loads. In closed-canopy oak woodlands, understory fuel loads are low. The reduction of fire as an ecosystem process in oak woodlands, however, allows for an accumulation of fuels that had previously been consumed during regular, low-intensity fires. This can cause a build-up of woody vegetation in the understory, including significant increases in dead and down woody material and ladder fuels connecting ground vegetation to tree canopies. As a result, some oak woodlands are more susceptible to severe, crown-consuming fires (McCreary 2004).

Oak trees are highly flame resistant as the leaves do not readily catch fire. Fires in oak stands tend to smolder in the duff, and consume surface fuels without generating enough heat to carry fire into the oak canopy (USFS 2020a). Oaks also do not spread fire crown-to-crown readily like many conifers. Oak woodland litter does little to facilitate fire spread as it has a low surface area-to-volume ratio and requires high heat levels to remove fuel moisture and raise fuel to ignition temperature. Oak woodland litter is subject to seasonal drying in the late summer and early fall months, but fog drip, solar shading, and the windbreak provided by oak canopies can sustain high fuel moisture content in the summer when fog is present. Oaks have a low content of volatile organic compounds, and the lack of highly combustible oils further reduces the fire hazard associated with oaks and oak woodlands.

Dead fuels consist of 1-hour (litter and duff < 0.25 inches in diameter), 10-hour (twigs and small stems 0.25 inches to 1 inch in diameter), 100-hour (branches 1 inch to 3 inches in diameter), and 1,000-hour (large stems and branches > 3 inches in diameter) sizes. Oak woodlands are mostly lacking in features that promote fire spread, but weather and topography have a strong influence on fire behavior. Given extreme fire weather and steep terrain, oak woodlands have the potential for a moderate rate of spread, torching and crown fire, and extreme fire behavior, especially those with higher surface fuel loads and ladder fuels. Fire behavior in oak woodlands and forests is typically much less intense than wildfires burning in chaparral and coastal scrub communities. Low, compacted leaf litter understory, canopy shading of ground fuels, and wind velocity reduction from tree canopies significantly reduces the intensity and spread rates of surface fires in oak woodlands. Transition from ground to canopy fire increases fire intensity, spotting, and tree mortality potential.

**Riparian Woodland**

Riparian woodlands are concentrated within the drainages of the San Gabriel Mountains and have a low fire hazard as their high moisture levels limit ignition potential and minimize the potential for wildfire spread. The vegetation within riparian woodlands responds slowly to changes in temperature and moisture, and significant surface shading from tree canopies limits fuel moisture loss. Surface fuels are relatively low in riparian woodlands; however, storm-related high-water streamflow can deposit debris and contribute to fuel buildup as it dries out later in the season. During severe weather conditions, high fuel loads can result in high intensity burning.

**Eucalyptus**

Eucalyptus stands are composed of fuel structures ranging from fine to heavy, and may include an understory of grass; brush; eucalyptus seedlings, saplings, and small trees; and eucalyptus leaf, twig, branch, and bark litter. Eucalyptus litter is generally moderately compacted with heavy to very heavy fuel loads; fuel loads in eucalyptus stands can reach between 45 and 100 tons per acre (Agee et al. 1973). Fuel buildup in eucalyptus stands is very rapid, exceeding that of other tree species, and its litter (dead leaves and debris) is especially flammable (Agee et al. 1973; NPS 2006; Wolf and DiTomaso 2016). Fuel reduction programs in eucalyptus stands are typically recommended to maintain low fuel load levels (USFS 2020b).

The leaves of many eucalyptus tree species may be moderately resistant to combustion under some circumstances (Dickinson and Kirkpatrick 1985); however, these trees are considered highly flammable as the bark catches fire readily, and deciduous bark streamers and lichen epiphytes tend to carry fire into the canopy, which tends to produce embers that can be carried by strong winds. These flying embers are carried downwind and result in the development of spot fires that have ignited in receptive fuel beds in advance of the fire's leading edge (Ashton 1981; USFS 2020b). Peeling bark is typical of many other eucalyptus species and contributes to ground-based fuels (litter) when it falls. Peeling bark is also retained for a period of time on tree trunks, where it can facilitate ground to canopy fire transition (ladder fuel). Eucalyptus litter has a moderate surface area to volume ratio, requiring moderate heat to remove fuel moisture and raise fuel to ignition temperature.

Like chaparral, eucalyptus also has a higher content of volatile organic compounds. Eucalyptus leaves produce a volatile (Gabbert 2014), highly combustible oil, and flammable gasses may be released from trees at very high temperatures, further increasing fire hazard (Gross 2013). The live fuel moisture content reaches its low point in the late summer and early fall months. Dead fuels consist of 1-hour (litter and duff < 0.25 inches in diameter), 10-hour (twigs and small stems 0.25 inches to 1 inch in diameter), 100-hour (branches 1 inch to 3 inches in diameter), and 1,000-hour (large stems and branches > 3 inches in diameter) sizes. Features that promote fire spread include heavy litter fall, flammable oils in the foliage, and open crowns bearing pendulous (i.e., downward-hanging) branches, which encourage maximum updraft (USFS 2020b). Given average weather conditions and terrain, eucalyptus has potential for a high rate of spread, torching and crown fire, and extreme fire behavior.

## 4.5.3 Wildfire Types and Potential Fire Behavior

Several wildfire types exist, as summarized below.

- **Ground Fire:** A fire burning on the ground or through understory vegetation and not reaching into the canopy (NWCG 2020).

- **Surface Fire:** A surface burning fire with low flame lengths (usually less than 1 meter) that does not result in significant movement into understory or overstory vegetation (NWCG 2020).
- **Crown Fire:** A fire that has burned upward from the ground and into the tree canopy. There are three types of crown fires:
  - **Passive Crown Fire:** A crown fire in which individual or small groups of trees torch out, but solid flaming in the canopy cannot be maintained except for short periods. Passive crown fire encompasses a wide range of crown fire behavior from the occasional torching of an isolated tree to a nearly active crown fire. Also called torching (Scott and Reinhardt 2001).
  - **Active Crown Fire:** A crown fire in which the entire fuel complex becomes involved, but the crowning phase remains dependent on heat released from the surface fuels for continued spread. Also called running and continuous crown fire (Scott and Reinhardt 2001).
  - **Independent Crown Fire:** A crown fire that spreads without the aid of a supporting surface fire (Scott and Reinhardt 2001).

Another component of fire behavior is spotting, the transfer of firebrands (embers) ahead of a fire front, which can ignite smaller vegetation fires (NWCG 2020). These smaller fires can burn independently or merge with the primary fire. Spotting can also result in structural ignitions when transported embers reach a receptive fuel bed (e.g., combustible roofing), especially in wind-driven fires, such as those occurring during the Santa Ana wind events in the San Gabriel Mountains. Structure fires, as well as vegetation-fueled fires, can generate firebrands. Additionally, landscape features like ridges can dramatically affect fire behavior by changing prevailing wind patterns, funneling air, and increasing wind speeds, thereby intensifying fire behavior.

Each of the fire types mentioned above may occur within or adjacent to the City, depending on site-specific conditions. Fire behavior is how a wildland fire reacts to weather, fuels, and topography. The difficulty of controlling and suppressing a wildfire is typically determined by fire behavior characteristics, such as rate-of-spread, fireline intensity, torching, crowning, spotting, fire persistence, and resistance to control (NWCG 2020). Extreme fire behavior is that which precludes methods of direct control (e.g., flame lengths 8 feet and greater), behaves unpredictably and erratically, and typically involves high spread rates, crowning and spotting, the presence of fire whirls, and a strong convective column (NWCG 2017).

Fire behavior characteristics are an essential component in understanding fire risk and fire agency response capabilities. Flame length—the length of the flame of a spreading surface fire within the flaming front—is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews et al. 2008). While it is a somewhat subjective and nonscientific measure of fire behavior, it is imperative to fireline personnel when evaluating fireline intensity and is worth considering as a vital fire variable (Rothermel 1993). Fireline intensity is a measure of heat output from the flaming front and also affects the potential for a surface fire to transition to a crown fire. The information in Table 3 presents an interpretation of flame length and its relationship to fire suppression efforts.

**Table 3. Fire Suppression Interpretation**

| Flame Length | Fireline Intensity | Interpretations |
|---|---|---|
| Under 4 feet | Under 100 BTU/ft/s | Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire. |
| 4 feet to 8 feet | 100–500 BTU/ft/s | Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective. |
| 8 feet to 11 feet | 500–1,000 BTU/ft/s | Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective. |
| Over 11 feet | Over 1,000 BTU/ft/s | Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective. |

**Source:** Roussopoulos and Johnson 1975. **Note:** BTU/ft/s = British thermal units per foot per second.

## 4.6 Fire History and Ignitions

Fire history is an important component of fire planning and can provide an understanding of fire frequency, fire type and behavior, most vulnerable community areas, and significant ignition sources, amongst others. One important use for this information is as a tool for pre-planning. It is advantageous to know which areas may have burned recently and therefore may provide a tactical defense position, what type of fire burned in the area, and how a fire may spread. Fire history represented in this CWPP uses the CAL FIRE - Fire and Resource Assessment Program (FRAP) database. FRAP summarizes fire perimeter data dating to the late 1800s, but which is incomplete due to the fact that it only includes fires over 10 acres in size and has incomplete perimeter data, especially for the first half of the 20th century (Syphard and Keeley 2016). However, the data does provide a summary of recorded fires and can be used to show whether large fires have occurred in the area, which indicates whether they may be possible in the future.

According to available data from the CAL FIRE in the FRAP database[4], approximately ninety-three (93) fires have burned within the San Gabriel Mountains of the Angeles National Forest within 5-miles of the City of Bradbury since the beginning of the historical fire data record. The topography, vegetation, and climatic conditions in the foothills above the City combine to create a unique situation capable of supporting large-scale, high-intensity, and sometimes damaging wildfires. Recorded wildfires within 5 miles range from 10.1 acres to 114,963 acres (2020 Bobcat Fire) and the average fire size is approximately 1,546 acres (not including the 2020 Bobcat Fire or fires smaller than 10 acres). The 2020 Bobcat Fire is the most recent fire, which occurred directly north of the City. Two fires have burned within the northern portion of the City. LACoFD may have data regarding smaller fires (less than 10 acres) that have occurred on the site that have not been included herein. Fire history for the general vicinity of the City is illustrated in the map in Table 4 and graphically presented in Figure 4.

4 Based on polygon GIS data from CAL FIRE's FRAP, which includes data from CAL FIRE, USDA Forest Service Region 5, BLM, NPS, Contract Counties and other agencies. The data set is a comprehensive fire perimeter GIS layer for public and private lands throughout the state and covers fires 10 acres and greater between 1878–2018.

### Table 4. Fire History within Five Miles of the City of Bradbury

| Fire Year* | Fire Name | Interval (years) | Total Area Burned (acres) |
|---|---|---|---|
| 1900 | Big Fire | N/A | 16,960 |
| 1909 | Un-named | 9 | 19 |
| 1909 | Un-named | 0 | 20 |
| 1909 | Un-named | 0 | 104 |
| 1910 | Un-named | 1 | 81 |
| 1910 | Un-named | 0 | 19 |
| 1910 | Un-named | 0 | 27 |
| 1911 | Un-named | 1 | 15,096 |
| 1912 | Un-named | 1 | 32 |
| 1915 | Un-named | 3 | 15,096 |
| 1916 | Duarte | 1 | 179 |
| 1917 | Hastings Ranch | 1 | 350 |
| 1918 | Fish Canyon | 1 | 51 |
| 1923 | Un-named | 5 | 119 |
| 1924 | Monrovia CC | 1 | 57 |
| 1924 | San Gabriel | 0 | 43,050 |
| 1928 | Bradbury No. 62 | 4 | 227 |
| 1928 | Marlborough | 0 | 73 |
| 1928 | Brush Flat No. 12 | 0 | 241 |
| 1928 | Un-named | 0 | 86 |
| 1929 | Rock Pit No. 46 | 1 | 145 |
| 1932 | Tunnel Fire | 3 | 31 |
| 1937 | Fralich | 5 | 38 |
| 1942 | Hiyon #135 | 5 | 184 |
| 1943 | Azusa Fire No. 42 | 1 | 188 |
| 1946 | Beatty No. 209 | 3 | 159 |
| 1947 | Azusa Fire No. 112 | 1 | 351 |
| 1950 | Un-named | 3 | 18 |
| 1952 | Arcadia | 2 | 10 |
| 1952 | Baird Fire | 0 | 138 |
| 1952 | Spinks | 0 | 179 |
| 1953 | Un-named | 1 | 95 |
| 1953 | Monrovia Peak Fire | 0 | 14,061 |
| 1953 | Maddock | 0 | 558 |
| 1954 | Monrovia Peak No. 2 | 1 | 13,870 |
| 1957 | Gale Fire | 3 | 24,708 |
| 1957 | Morris | 0 | 2,788 |
| 1958 | Un-named | 1 | 66 |
| 1958 | Un-named | 0 | 13,943 |
| 1959 | Un-named | 1 | 118 |
| 1961 | Un-named | 2 | 257 |

### Table 4. Fire History within Five Miles of the City of Bradbury

| Fire Year* | Fire Name | Interval (years) | Total Area Burned (acres) |
|---|---|---|---|
| 1961 | Un-named | 0 | 922 |
| 1962 | Un-named | 1 | 861 |
| 1962 | Norumbega Fire | 0 | 15 |
| 1965 | Un-named | 3 | 23 |
| 1968 | Canyon Inn Fire | 3 | 19,055 |
| 1968 | Newman Fire | 0 | 67 |
| 1968 | Un-named | 0 | 47 |
| 1968 | Un-named | 0 | 26 |
| 1969 | Un-named | 1 | 51 |
| 1969 | Un-named | 0 | 11 |
| 1969 | Bole Fire | 0 | 715 |
| 1970 | Un-named | 1 | 10 |
| 1975 | Lannen Fire | 5 | 160 |
| 1975 | Star Pine Fire | 0 | 115 |
| 1978 | Mountain Trail Fire | 3 | 1,295 |
| 1979 | Silver Fish Fire | 1 | 153 |
| 1980 | Stable Fire | 1 | 6,048 |
| 1982 | Un-named | 2 | 29 |
| 1988 | Un-named | 6 | 28 |
| 1993 | Kinneloa Fire | 5 | 5,454 |
| 1994 | Old San Gabriel Canyon Rd. | 1 | 3 |
| 1996 | Reservoir | 2 | 1,465 |
| 1997 | Canyon II Fire | 1 | 3,825 |
| 1997 | Roberts | 0 | 10 |
| 1998 | Foothill | 1 | 11 |
| 1999 | Santa Anita | 1 | 750 |
| 2002 | Santa Anita II | 2 | 28 |
| 2002 | Williams | 0 | 38,119 |
| 2008 | Santa Anita | 6 | 558 |
| 2009 | Morris | 1 | 2,237 |
| 2012 | Reservoir | 3 | 10 |
| 2013 | Madre | 1 | 209 |
| 2013 | Shooting | 0 | 11 |
| 2014 | Colby Fire | 1 | 1,951 |
| 2016 | Reservior Fire | 2 | 1,146 |
| 2016 | Fish Fire | 0 | 4,246 |
| 2020 | Bobcat Fire | 4 | 114,963 |

1 *CAL FIRE FRAP 2020

Nearly all significant wildfires have burned in the months of July, September, or October. This timeframe coincides with the end of the dry summer season, where vegetation has lower fuel moistures, and Santa Ana winds are prominent. While not all the fires shown in Table 4 were associated with Santa Ana winds, the largest and most damaging fires have occurred during such winds.

Based on an analysis of this fire history data set, specifically the years in which the fires burned, the average interval between wildfires within 5 miles of the City was calculated to be one year with intervals ranging between 0 (multiple fires in the same year) to 6 years. Based on this analysis, it is expected that there will be wildland fires within 5 miles of the City at least every six (6) years and on average, every 1.25 years, as observed in the fire history record. The proximity of the City to large expanses of open space to the north, northwest, and northeast and the terrain within the San Gabriel Mountains, including multiple sub-drainages and canyons, has the potential to funnel Santa Ana winds, thereby increasing local wind speeds and increasing wildfire hazard in the vicinity of the City.

## 4.7 Development Patterns

Nearly the entirety of the City of Bradbury's land area is designated and zoned for Agricultural residential land uses. This is reflected in the pattern of development and land use within the City's VHFHSZ area, which creates conditions that can be described as either a WUI or a wildland-urban intermix (Intermix). The WUI are areas where structures and other human development meets or intermingles with undeveloped wildland or vegetation fuels. This area typically consists of residential and commercial areas near or along foothills, such as found in Bradbury. Intermix areas predominately consist of low-to-medium density housing units and structures more closely interwoven with vegetative fuels that are capable of propagating fire. This condition exists throughout the Bradbury Estates, Woodlyn Lane community, and the remainder of the Bradbury community areas. where steep terrain and sensitive habitat prevents more dense development. Challenges with developments in WUI areas include narrow roads, long driveways, dead-end roads, steep slopes, and dense vegetation. Emergency response and evacuation from WUI areas during emergencies can also be hindered by these factors.

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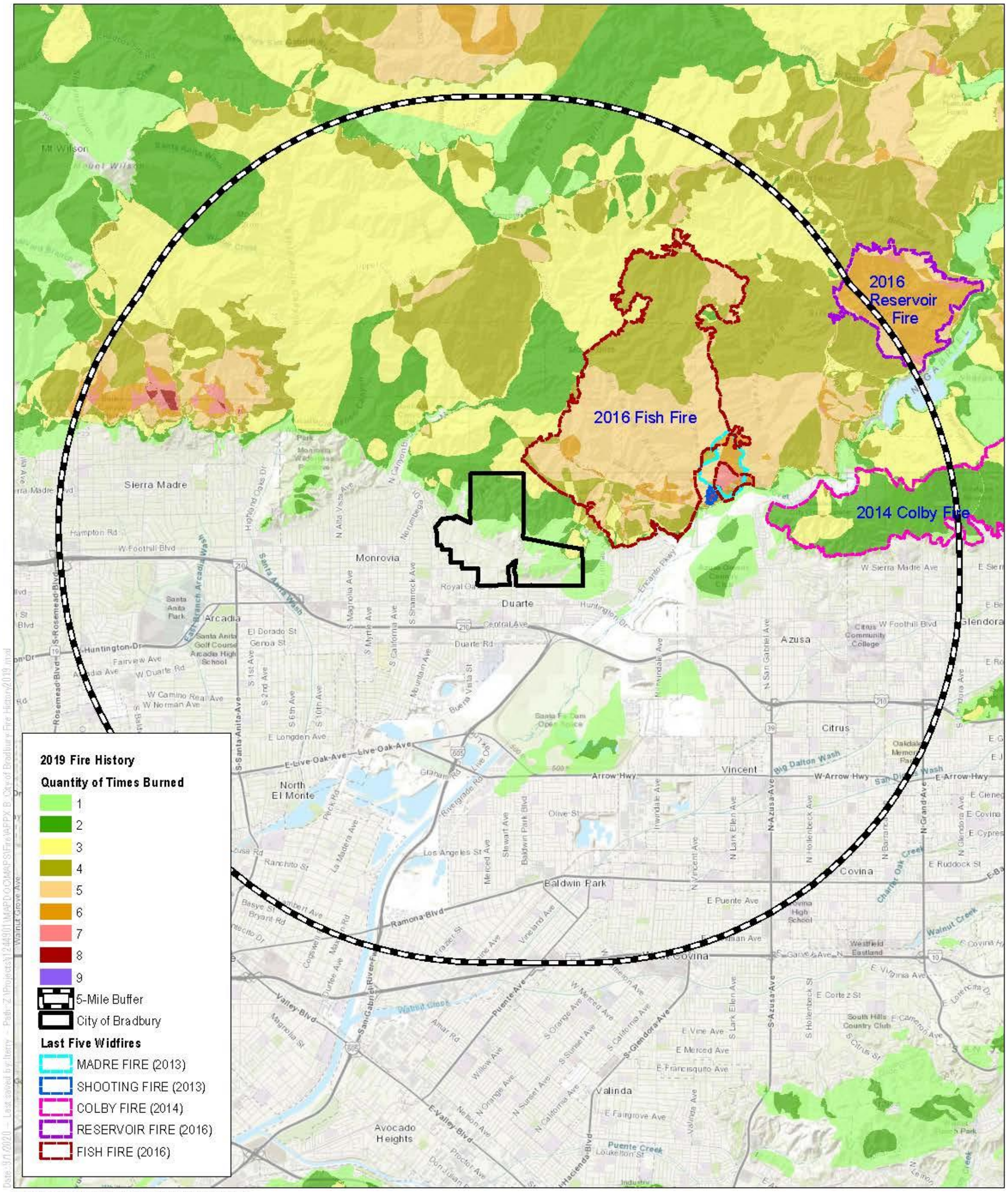


SOURCE: BASE-ESRI; FIRE DATA-CALFIRE 2019

DUDEK 0 1 2 Miles

**Figure 4**

Fire History Map

City of Bradbury Community Wildfire Protection Plan

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# 4.8 Existing Hazard Abatement/Fuels Treatment

## 4.8.1 LACoFD Defensible Space and Vegetation Management

An important component of a fire protection system for a City is the provision for fire resistant landscapes and modified vegetation buffers. Defensible space Fuel Modification Zone (FMZs) are designed to provide vegetation buffers that gradually reduce fire intensity and flame lengths from advancing fire by strategically placing thinning zones, restricted vegetation zones, and irrigated zones adjacent to each other on the perimeter of the WUI exposed structures.

As noted above, the City is exposed to naturally vegetated open space areas to the north, as well as being adjacent to residential communities to the west, east, and south. Based on the modeled extreme weather flame lengths within the naturally vegetated coastal scrub and chaparral fuels within the San Gabriel Mountains of the ANF, average wildfire flame lengths are projected to be approximately 40 to 45 feet high. The fire behavior modeling system used to predict these flame lengths was not intended to determine sufficient FMZs widths, but it does provide the average predicted length of the flames, which is a key element for determining "defensible space" distances for providing firefighters with room to work and minimizing structure ignition. Although Defensible Space is very important for setting back structures from adjacent unmaintained fuels, the highest concern is considered to be from firebrands or embers as a principal ignition factor.

### 4.8.1.1 Los Angeles County Fuel Modification Zone Standards

A FMZ is a strip of land where combustible vegetation has been removed and/or modified and partially or totally replaced with more adequately spaced, drought-tolerant, fire resistant plants in order to provide a reasonable level of protection to structures from wildland fire. Los Angeles County Fire Code (Title 32, Fire, Section 4908) is consistent with the 2019 California Fire Code (Section 4907 — Defensible Space), Government Code 51175 – 51189, and Public Resources Code 4291, which require that fuel modification zones be provided around every building that is designed primarily for human habitation or use within a VHFHSZ. Fuel modification consists of at least 100 feet, measured in a horizontal plane, from the exterior façade of all structures towards the undeveloped areas. A typical landscape/fuel modification installation per the County's Fire Code consists of a 30-foot-wide Zone A and a 70-foot-wide Zone B for a total of 100[5] feet in width. An additional 100-foot-wide Zone C may be required for the areas adjacent to natural-vegetated, open space areas.

**Zone A – From structure outward to minimum 30 feet**

Zone A is an irrigated, limited planting area measured from the outermost edge of the structure or appendage outward to 30 feet (horizontal distance), or to the property line for perimeter lots adjacent to native vegetation.

[5] In accordance with section 325.2.2 of the Los Angeles County Fire Code, Clearance of Brush and Vegetation Growth "Extra Hazard", it may be determined by the fire official that some sites pose an extra hazard. In such cases, Fuel Modification Zones may exceed 100 feet but not exceed 200 feet from structures.

1. Zone A should be planted with plants from Appendix B: Acceptable Plant List by FMZ. Plant selection for Zone A should consist of small herbaceous or succulent plants less than two to three feet in height or regularly irrigated and mowed lawns.

2. Plants identified as "Target" or undesirable plants (See Appendix C: Fuel Modification Zone Undesirable Plant List) by LACoFD shall not be planted within Zone A.

3. Trees should be spaced to allow a minimum 10-foot canopy clearance at full maturity to the structure.

4. Inorganic mulches, such as gravel, shall be used within 12 inches of the structure.

5. A 5-foot wide pathway shall be provided around and abutting any structures for firefighter access.

**Zone B – From outer edge of Zone A to 100 feet from structure**

Zone B is the area (may be irrigated or not irrigated) measured horizontally from the outer edge of Zone A to 100 feet from the structure or property line, whichever is first.

1. Zone B can be planted with slightly higher plant density than Zone A as long as landscape does not create any horizontal or vertical fuel ladders (e.g., fuel which can spread fire from ground to trees).
   **Exception:** Screen plantings are permissible if used to hide unsightly views.

2. Trees found in Appendix B can be planted, if they are Zone B appropriate and the tree canopies at maturity are not continuous.

3. Plants identified as "Target" or undesirable plants (See Appendix C) by LACoFD shall not be planted within Zone B.

4. Avoid planting woody plant species taller than 3 feet in height at maturity directly underneath any tree canopy.

5. Zone B may not be landscaped, but it is still subject to brush clearance standards (https://www.fire.lacounty.gov/forestry-division/fire-hazard-reduction-programs/)

**Zone C – Thinning Zone (from outer edge of Zone B to 200 feet from structure)**

Zone C is considered a thinning zone and is any FMZ greater than 100 feet from structures. When provided, either by conditions of a development, voluntary by the property owner, or required by the LACoFD, this zone is more of a progressive thinning zone to lessen spread of fire as it approaches the primary FMZ adjacent to structures. The amount of fuel reduction and removal should take into consideration the type and density of fuels, aspect, topography, weather patterns, and fire history. Thinning of less than 50 percent of the existing condition may be acceptable where erosion is of high concern, but the average cover throughout the Zone C will be reduced by 50 percent, resulting in approximately 50 percent ground cover by plant canopy.

### 4.8.2 LACoFD Vegetation Management Program

The LACoFD created the Vegetation Management Program in 1979 to develop strategies for responding to the growing fire hazard problem throughout Los Angeles County. The Vegetation Management Program includes an ongoing effort to analyze the history and effects of wildland fires in Los Angeles County, as well development of fuel management projects with stakeholders, including cities, community groups, and other agencies; experimentation with various methods of reducing or removing fuels in fire prone areas, as well as environmental impacts and effects of these practices. Many homes have been lost due to unmanaged vegetation around them. Vegetation can be modified and managed, but as long as people choose to live in wildland areas, the threat of major catastrophe exists. Vegetation management, related to wildland fire, refers to the total or partial removal of high fire hazard grasses, shrubs, or trees. In addition to fire hazard reduction, vegetation management has other benefits, including increased water yields, improved habitat for wildlife, reduction of invasive exotic plant species, and open access for recreational purposes (LACoFD, Fire Hazard Reduction[6]).

### 4.8.3 Neighboring Jurisdictions Establishment and Maintenance of Defensible Space

Mutual vegetation management is essential for fire prevention and fire management. Both the Monrovia Fire Department (MFD) and the Arcadia Fire Department (AFD) have brush clearance and fuel mitigation strategies independent of LACoFD, to reduce the potential or slow the progress of wildfires. These programs include fuel reduction through identified structural hardening (i.e., defensible spaces) and emergency preparedness. The LACoFD coordinates vegetation management efforts with the MFD and AFD in areas adjacent to the City, where feasible.

Additionally, the Fire Management Staff of the USFS - Angeles National Forest Division, are currently conducting hazardous fuel inventory data and fuel break research in areas of the Angeles National Forest adjacent to the City of Bradbury, which is crucial in decreasing the impact of wildfire to the City. The City and USFS – Angeles National Forest intend to continue looking for future opportunities to collaborate on potential Projects.

## 4.9 Evacuation

The City of Bradbury presents unique challenges for evacuation due to the speed and intensity at which wildfires occur as well as the high variability in transportation systems in the City, notably throughout the City's VHFHSZ Areas. Factors associated with evacuation, such as human behavior, population density, overloaded transportation routes, visitors, vulnerable populations, as well as the evacuation of pets and large animals, make the task of any evacuation more complex. Any combination of these factors may significantly increase the amount of time it takes to execute an evacuation. As a result, the decision by property owners and agencies to evacuate is often made quickly.

Evacuation during a wildfire in the City of Bradbury is not necessarily directed by the LACoFD, except in specific areas where fire personnel may enact evacuations on-scene. The Los Angeles County Sheriff's Department (LACoSD), Monrovia Police Department (MPD), Arcadia Police Department (APD), and other cooperating law enforcement agencies have the primary responsibility for evacuations. These agencies work closely within the Unified Incident Command System (ICS) with the County Office of Emergency Services and responding fire department personnel who assess fire behavior and spread, which should ultimately guide evacuation decisions. To that end, the LACoSD and Department of Public Works, Los Angeles County, have worked with a County Task Force to address wildland fire evacuation planning for cities throughout Los Angeles, including Bradbury. The task

[6] https://fire.lacounty.gov/fire-hazard-reduction-programs/#1566334036482-7a650ced-8cf5

force also received input from the Arcadia Police Department (APD), Monrovia Police Department (MPD), California Highway Patrol (CHP), the California Department of Transportation (CalTrans), as well as various property owners' associations throughout the Los Angeles area.

In 2008, the LACoSD along with the LACoFD, reviewed the evacuation routes throughout the City; these evacuation routes include:

- From the Estates: Exit out of the Deodar Main or Barranca Road. If possible, have incoming horse trailers stage on Lemon, and walk the horses down Barranca Road.
- From Woodlyn Lane: Exit towards Royal Oaks Drive North. If route is not accessible, exit towards Mount Olive Drive.
- From the East: The east end of the City exits down Mount Olive Drive from all feeder streets.

A map of the City's Emergency Evacuation Plan is presented in Figure 5.

### 4.9.1 Post Emergency Evacuation Community Repopulation

Once a wildfire has burned through an area, the damage to homes and infrastructure is usually unknown and there are many dangers to the homeowners wanting to return home days or sometimes weeks later that could remain, including downed trees and powerlines, unsafe roofs and exterior areas of a home, small ground hotspots or smoldering stumps, smoke and ash in the area that could irritate eyes and lungs, and even unsuspected wildlife in the area. Repopulation to an area would occur after an order is issued and once the law enforcement officers (LACoFD and LACoSD) allow for residents to return home. Fire jurisdictions, including the LACoFD, understand that evacuation orders cause additional unwanted stress and concerns to those who are eager to return home, however, it's important to understand that incident commanders are continuously evaluating the area for both fire and infrastructure conditions so that residents can return home as soon as possible and as safe as possible. According to a LACoFD Repopulation General Information sheet, before an evacuation order can be lifted, several factors are taken into consideration by the incident commander and law enforcement, including the amount of personnel still working in an area and the type of work being performed, public access conditions (damage to the road or downed trees blocking the road), damage to utility infrastructure that must be repaired prior to repopulation (power lines in the road or replacing downed power poles), or public health considerations (unhealth smoke and ash that remains). When repopulation begins to occur after evacuation orders have been lifted, repopulating in segments not only allows law enforcement and fire agencies to get some residents home as quickly as possible, but also reduces the impact on law enforcement checking for identification when areas are reopened to residents only. See Appendix D, Los Angeles County Fire Department Repopulation General Information Sheet for additional repopulation information.

As an area is being repopulated, it's extremely important to be aware of the hazardous environment and know what to look for when an evacuation order has been lifted. The California Department of Forestry and Fire Protection (Cal Fire) has additional information about returning home from a wildfire (Cal Fire, 2019 - After a Wildfire - Ready for Wildfire), including:

- Keep an eye out and be mindful of people working in the area, including road crews, firefighters, and other personnel and law enforcement workers.

- Watch for trees, brush, and rocks that may have been weakened or loosened by a wildfire.
- Be aware of debris or damage to roads or driveways, slowing traffic flow and reducing traffic lanes due to repairs and firefighting operations.
- Use extreme caution around trees, power poles, and other tall objects or structures that may have been weakened by a wildfire.
- Check for the smell of gas and use a battery-powered flashlight to inspect a damaged home.
- Check the ground for hot spots, smoldering stumps, and vegetation.
- Check the roof and exterior areas for sparks or embers.
- Check the attic and other areas throughout the home for hidden burning sparks or embers.
- Check for fire damage to the home, turn off all appliances and make sure the meter is not damaged before turning on the main circuit breaker.
- Do not drink water from the faucet until emergency officials say it's okay, as water supply systems can be damaged and become polluted during wildfires.
- Wildfires leave behind a lot of ash that can irritate eyes, nose, or skin and cause coughing; protect yourself against ash by wearing a mask to help you breath in dust from ash, wearing goggles to protect your eyes, and wearing gloves, long-sleeved shirts, long pants, and shoes and socks to protect your skin.

## 4.10 Water Supply

Water systems that supply adequate quantity, pressure, and duration are essential to structure protection. Without adequate water supply the ability to safely protect structures and suppress fires is compromised. The Fire Department Water Supply and Fire Hydrant standards (City Municipal Code, Chapter 8, Section 17.08.010) outline the City's water supply requirements. (Appendix E). The Public Works Department has developed an extensive water distribution system that consists of many components including reservoirs, pump stations, pressure zones, water mains, and fire hydrants. Fire hydrants (with fire flow ratings) and water reservoirs important for fire suppression were identified during development of the 2004 Wildland Fire Plan.

The City of Bradbury's domestic water service is owned and operated by the California American Water Company (CAWC), within the Los Angeles County Service Area of Duarte. The locations of City's existing fire hydrants are presented in Figure 6.

## 4.11 Communications

Radio communications systems are critical to fire department response capabilities and the life safety of firefighters and the public depends on reliable, functional communication tools that work in harsh environments. Radios are the lifeline that connect firefighters to command and outside assistance and serve as a critical tool for communicating site information accurately and efficiently. The County of Los Angeles operates an 800 MHz, trunked simulcast radio system. With the exception of the LACoFD and the LACoSD, all Los Angeles County departments participate. To communicate with LACoFD and LACoSD, there exists a bridging interface. In the event of a declared emergency Los Angeles County departments can communicate with each other and free up other communication channels.

The LACoFD currently provides fire protection and life safety services to more than 4 million residents, with a service area spanning 2,300 square miles to 60 cities and nearly 400,000 incidents annually. With rapid response from 177 County fire stations, LACoFD's Fire Station Alerting System (FSAS) serves as the central communication technology for getting first responders out the door quickly (RadioMobile, 2021). The LACoFD improved the performance and flexibility of their FSAS with new technology. The Departments old FSAS was a system compiled of relays, batteries, inverters, and a commercial public address system. The dispatch alerts were previously received via two-tone signals through the radio system that triggered the process of turning on station lights, generating a series of alert tones, and finally turning on the speaker so the voice dispatch could be heard.

The Department's communication system components are aging and were in need of an upgrade system, so the Department turned to collaboration with a new FSAS, based on modern technology, which would improve the response times and can be customized to meet the need of each fire station individually. With the new FSAS, the Computer Aided Dispatch (CAD) system would send a dispatch that is immediately converted to a signal by IQ FSAS and routed to the appropriate station(s)via the County's Land Mobile Radio (LMR) network. Some key features of the IQ FSAS include fully programmable and customizable lights and tones (RadioMobile, 2021).

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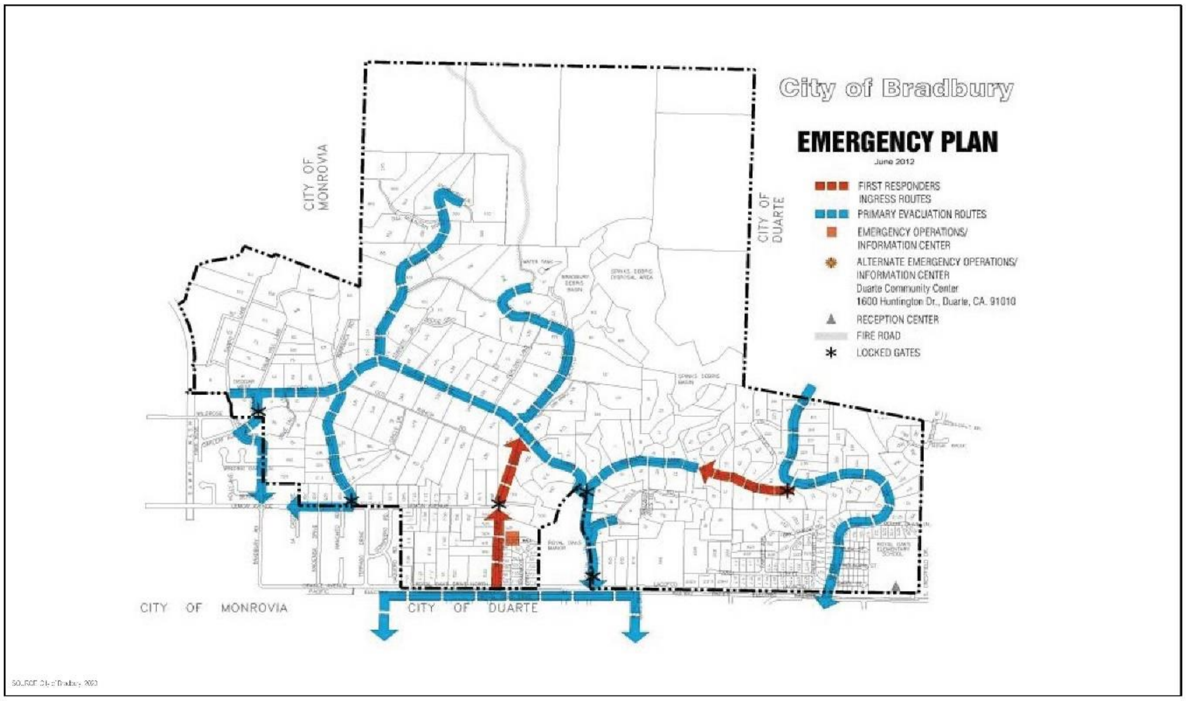


CITY OF BRADBURY
COMMUNITY WILDFIRE PROTECTION PLAN
DUDEK

FIGURE 5
City of Bradbury Evacuation Routes
City of Bradbury Community Wildfire Protection Plan

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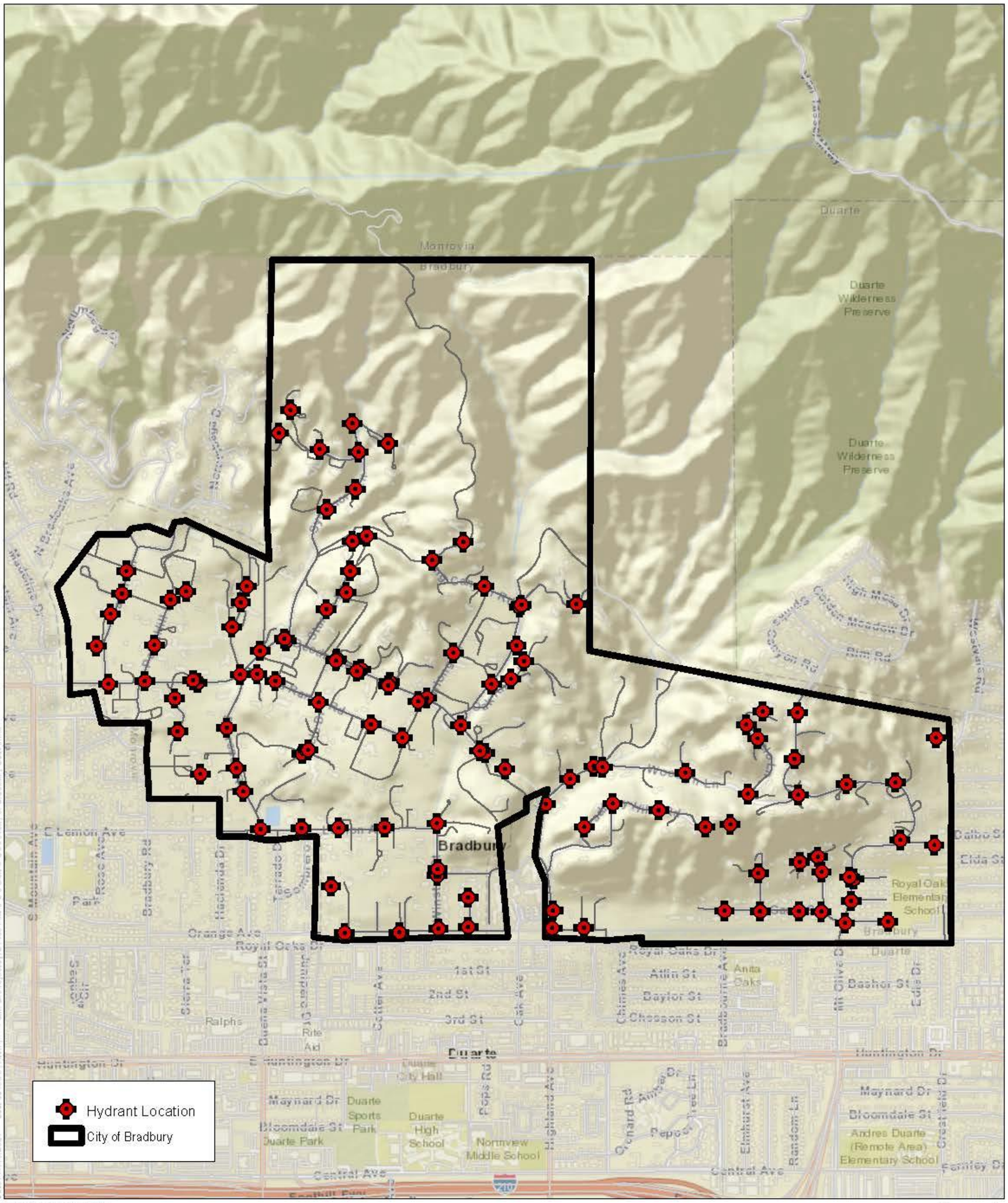


SOURCE: BASE-ESRI

DUDEK 0 750 1,500 Feet

Figure 6
City of Bradbury Fire Hydrant Locations
City of Bradbury Community Wildfire Protection Plan

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# 5 Planning and Regulatory Environment

The following section provides an analysis of the City of Bradbury in terms of current LACoFD Fire Service capabilities and resources to provide Fire Protection and Emergency Services, as well as existing codes and standards relevant to wildfire protection and fuels management to the City. The analysis that follows examines the ability of the existing LACoFD fire stations to adequately serve the Community. Response times were evaluated.

## 5.1 Fire Protection

The Project is located within the LACoFD jurisdictional response area. Regionally, LACoFD provides fire, emergency medical, and rescue services from 177 stations. The Department serves over 4 million residents throughout 60 cities and all unincorporated portions of Los Angeles County. The City lies within the East Operations Bureau, Division 2. Fire Station 44 would provide initial response; however, Stations 29, 32, and 48 within LACoFD's Division 2, and Station 169 within LACoFD's Division 9 are available to service the City, if needed. Figure 7 illustrates the station locations and Table 5 provides a summary of the LACoFD fire and medical delivery system for Fire Stations 29, 32, 44, 48, and 169.

### Table 5. Closest Los Angeles County Fire Department Responding Stations Summary

| Station | Location | Equipment | Staffing |
|---|---|---|---|
| Station 29 | 14334 Los Angeles Street, Baldwin Park, California, 91706 | - (1) Paramedic Engine Company<br>- (1) Paramedic Squad Truck<br>- (1) Quint [1] | - 3-Person Engine company<br>- 2-Person Paramedic Squad<br>- 4-Person Quint |
| Station 32 | 605 North Angeleno Avenue, Azusa, California, 91702 | - (1) Paramedic Engine Company<br>- (1) Paramedic Squad Truck | - 4-Person Engine Company<br>- 2 Person Paramedic Squad |
| Station 44 | 1105 Highland Avenue, Duarte, California, 91010 | - (1) Paramedic Engine Company<br>- (1) Assessment Engine Company | - 3-Person Engine Company<br>- 4-Person Assessment Engine Company[2] |
| Station 48 | 15546 Arrow Highway, Irwindale, California, 91706 | - (1) Engine Company | - 4-Person Engine Company |
| Station 169 | 5112 North Peck Road, El Monte, California, 91732 | - (1) Engine Company | - 3-Person Engine Company |

1. A quintuple combination pumper or "quint" is a fire-service apparatus that serves the dual purpose of an engine and a ladder truck.
2. An assessment engine company is an engine company with some limited paramedic capabilities.

The department is largely staffed and equipped for structural fire protection; however, its Forestry Fuel Modification and Fire Prevention Division Units focus on educating the community about the benefits of proper safety practices. These Department Units including full-time staffing of wildland fire experts, development of codes and standards for vegetation management and structural protection in the County's Very High Fire Hazard Severity Zone Areas, implementation of vegetation management projects and a defensible space inspection program, and working with the community to increase resilience in the event of a wildland fire. The LACoFD recognizes that wildland fire throughout the cities they serve is inevitable.

The City of Bradbury, along with the help of the LACoFD also recognizes the need to maintain a long-range wildland fire plan to reduce the catastrophic effects of wildfire. Without this plan, the ability to prioritize, fund, and implement projects and programs to minimize the impact of wildfire in the community would be jeopardized.

## 5.1.1 LACoFD's Fire Protection Philosophy

### 5.1.1.1 Public and Firefighter Safety

The mission of the LACoFD is to protect lives, the environment, and property by providing prompt, skillful, and cost-effective fire protection and life safety services. Protecting lives continues to be the number one priority in the Fire Chief's fire protection philosophy and strategic plan, as nearly 84% of the Department's emergency calls are medically related. However, addressing societal challenges through Countywide initiatives and partnerships, supporting community resilience by implementing environmental initiatives, catastrophic preparedness, and public education programs, and building tomorrow's fire department will help fulfill the LACoFD's vision of being an exemplary organization acclaimed for their national reputation, regional strength, and hometown attentiveness (Los Angeles County Fire Department 2017-2021 Strategic Plan). The LACoFD's mission and vision statements, Standard Operating Procedures, training, fire protection, and fire prevention activities all support this priority.

### 5.1.1.2 Protection of Structures

The protection of structures is another top priority of the LACoFD. The ability to protect structures during a wildfire is complex. The majority of the structures throughout the City were developed before the adoption of building and fire codes that required noncombustible roofing and building materials, adequate fire department access, and meet water supply standards in the VHFHSZ areas. These existing nonconforming structures are at greater risk of loss than structures that meet current building, access, and water standards and limit the ability of the LACoFD to provide adequate structure protection. Added to the complexity is the number of homes (both existing conforming and non-conforming structures) that do not have adequate defensible space or vegetation clearance around structures and along driveways and roadways. The LACoFD's Fire Prevention Division's mission is to educate the community about the benefits of proper safety practices and to identify and eliminate all types of hazardous conditions that pose a threat to life, property, and the environment (Los Angeles County Fire Department Overview, May 2021).

### 5.1.1.3 Protection of the Environment and Natural Resources

Another top priority for the LACoFD is to protect the environment and natural resources. The Forestry Division of the LACoFD is comprised of environmental professionals who deliver high quality fire prevention services to homeowners and public agency stakeholders and assist Emergency Operations with logistical support. The Forestry

Division is made up of three sections, including Brush Clearance Section, Natural Resources Section, and Forestry Operations Section, whose overall responsibilities include forest and natural resource management, fire prevention, environmental review, pre-fire planning, and public education. Fire suppression and fire prevention strategies and procedures attempt to balance the need for wildland fire safety and protection of resources. The complexity of protecting lives and property, along with natural resources, is a reality for the LACoFD.

The first of the three Sections is the Brush Clearance Section oversees inspection, abatement, and enforcement of brush clearance Fire Codes, reviews, and approves fuel modification plans, and assists homeowners in maintaining "Defensible Space."

Second, the Natural Resources Section reviews environmental documents for the Fire Department, ensuring compliance with the California Environmental Quality Act (CEQA), and monitors the implementation of the County of Los Angeles Oak Tree Ordinance. The Natural Resources Section is also responsible for bi-monthly live fuel moisture sampling of fire-prone plants and supports monitoring and mitigation of invasive insect species. It also completes the annual review, revision, and implementation of the Fire Department's Strategic Fire Plan, designed to minimize cost and losses from wildland fires by utilizing geographic information system software to identify high-hazard/high-value areas and communities at risk.

Thirdly, the Forestry Operations Section specializes in the propagation and distribution of native trees and shrubs to assist area residents with erosion control, slope stabilization, and wind breaks. Other services include conservation education, nursery tours, fire prevention consultations, hazard tree assessments, landscape design and installation on Fire Department facilities, pest assessment and control, and tree planting and maintenance projects throughout the County (Los Angeles County Fire Department Overview, May 2021).

The chaparral vegetation types within the surrounding areas of the City has adapted over millions of years with fire as a natural part of its ecosystem. Current and past fire exclusion and suppression policies have resulted in large accumulations of flammable vegetation on hillsides of the San Gabriel Mountains. When these areas burn under wildfire conditions, they result in intense fire behavior and increase the potential for resource damage. The City along with the LACoFD realize the best way to provide wildland fire protection and to protect natural resources is to implement a Community Wildfire Protection Plan that develops policies and actions to reduce accumulations of vegetation, and enhance natural resources and reduce their vulnerability to wildfire.

### 5.1.2 Fire Protection Partnerships and Mutual Aid Agreements

Like most California communities and jurisdictions, the LACoFD relies on mutual aid resources to augment firefighting resources if a wildfire or other emergency situation occurs through Appendix J – California Master Mutual Aid Agreement found in the Los Angeles County OA Emergency Response Plan. No community has the resources sufficient to cope with all emergencies for which the potential exists. In times of large scale wildfires and disasters, the City of Bradbury relies on the LACoFD and neighboring agencies within Area D, including the AFD and MFD, to provide equipment and personnel for fire suppression, prevention, and investigation of wildfires. Likewise, when called upon, LACoFD provides the same assistance to outside agencies in need.

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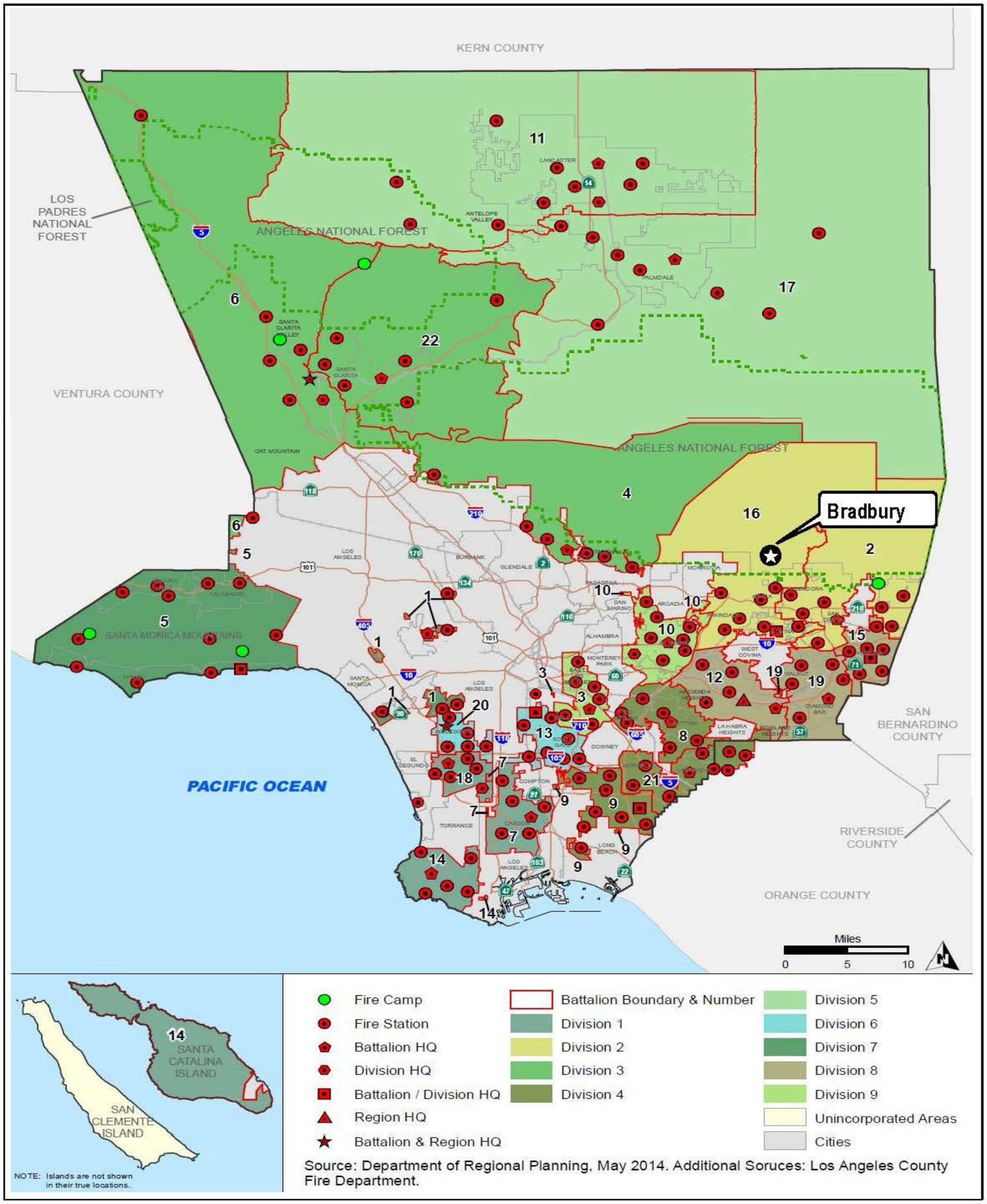


SOURCE: Los Angeles County Fire Department, 2020

DUDEK

**Figure 6**
Los Angeles County Fire Department Battalions and Stations Map
City of Bradbury Community Fire Protection Plan

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## 5.2 City of Bradbury Codes and Standards

### 5.2.1 Los Angeles County Fire Code

Through Title 32 of the 2020 Los Angeles County Fire Code, as amended, and adopting by reference the 2019 edition of the California Fire Code (CFC). Title 32 is hereafter referred to as the Los Angeles County Fire Code or "Fire Code". The 2019 edition of the CFC is based on the model International Fire Code (IFC), as published by the International Code Council (2016 Edition),[7] and all standards and secondary codes referenced in said codes, as defined in City of Bradbury Municipal Code Title IV, Chapter 3, Section 4.03.010 through 4.03.030.

Section 325 of the Los Angeles Fire Code outlines Clearance of Brush and Vegetative Growth. Specifically, Section 325.2.1 states:

'Persons owning, leasing, controlling, operating or maintaining any building, structure, or apiary upon or adjoining any mountainous-, or forest-, or brush-covered land or land covered with flammable growth, and person owning, leasing or controlling land adjacent to such structures, shall at all times:

1. Place or store firewood, manure, compost, and other combustible materials a minimum of 30 feet (9.14 m) from any building, structure, or apiary.
2. Maintain around and adjacent to such building, structure, or apiary an effective fire protection or firebreak made by removing and clearing away, for a distance of not less than 30 feet (9.14 m) on each side thereof, all flammable vegetation or other combustible growth. This includes ornamental plants and trees known to be flammable, including but not limited to acacia, cedar, cypress, eucalyptus, juniper, pine, and pampas grass.

**Exceptions:**

1. Ornamental plants and trees that are individually planted, spaced, and maintained in such a manner that they do not form a means of transmitting fire from native growth to the structure.
2. Cultivated ground cover such as green grass, ivy, succulents, or similar plants provided that they are maintained in a condition that does not form a means of transmitting fire from native growth to the structure.
3. When the fire code official or Commissioner finds that because of extra hazardous conditions, a firebreak of only 30 feet (9.14 m) around such building, structure, or apiary is not sufficient to provide reasonable fire safety, the person owning, leasing, controlling, operating, or maintaining the building, structure, or apiary shall maintain around or adjacent to any building, structure, or apiary an additional fire protection or firebreak made by removing all brush, flammable vegetation, or combustible growth located from 30 to 100 feet (9.14 to 30.48 m) from such building, structure, or apiary, as may be required by the fire code official or Commissioner. Grass and other vegetation located more than 30 feet (9.14 m) from such

7 This includes Chapters 1 through 80, and Appendices B, BB, C, CC, and D; the 2016 California Fire Code (Title 24, Part 9 of the California Code of Regulations).

building, structure, or apiary and less than 18 inches (45.72 cm) in height above the ground, may be maintained where necessary to stabilize the soil and prevent erosion.

4. That portion of any tree which extends within 10 feet (3.05 m) of the outlet of any chimney shall be removed.
5. Maintain any tree adjacent to or overhanging any building, structure, or apiary free of dead wood.
6. Maintain the roof of any building, structure or apiary free of leaves, needles, or other dead vegetative growth.
7. Nothing contained in this section shall be construed to require any person to maintain any clearing on land where such person does not have the legal right to maintain such clearing, nor shall any provision of this ordinance be construed to require any person to enter upon or to damage property of another without the consent of the owner thereof.

Section 325.2.2 of the Fire Code outlines Extra Hazards and states:

> 'The governing body finds that in many cases because of extra hazardous situations, a firebreak around buildings, structures, or apiaries of only 30 feet (9.14 m) is not sufficient and that a firebreak of 50 feet (15.24 m) or more may be necessary. If the fire code official or Commissioner finds that because of the location of any building, structure, or apiary and because of other conditions, a 30-foot (9.14-m) firebreak around such building, structure, or apiary as required by Section 325.2.1, is not sufficient, the fire code official or Commissioner may notify all owners of the properties affected that they must clear all flammable vegetation and other combustible growth or reduce the amount of fuel content for a distance greater than 30 feet (9.14 m), but not to exceed 200 feet (60.96 m).'

Section 4907.1 of the Fire Code outlines defensible space requirements in the throughout the County and within the City of Bradbury. Section 4907.1 states:

> 'Defensible space will be maintained around all buildings and structures in State Responsibility Areas (SRA) as required in Public Resources Code 429- and "SRA Fire Safe Regulations" California Code of Regulations, Title 14, Division 1.5, Chapter 7, Subchapter 2, Section 1270.

Buildings and structures within the VHFHSZs of a Local Responsibility Areas (LRA) shall maintain defensible space as outlined in Government Code 51175-51189, Chapter 3 of this code and any local ordinance of the authority having jurisdiction.'

## 5.2.2 City's Building Code

The City's Building Codes (Municipal Code Title XVII, Chapter 1, Section 17.01.101) adopts Title 26, Building Code, of Los Angeles County Code, adopting the California Building Code (CBC), 2016 Edition (Part 2 of Title 24 of California Code of Regulations), based on the model International Building Code and others (e.g., California Mechanical Code, Plumbing Code, Electrical Code, and Residential Code) by reference, subject to the amendments specified in Sections 17.02.010 through 17.08.010. Structural fire protection standards are addressed in the building codes and address structural hardening requirements for buildings located within a VHFHSZ area as defined by the LACoFD and consistent with Chapter 7A of the CBC. Structural hardening requirements address roofing, exterior coverings, decking materials, windows and doors, eaves, and vents, among others. The intent of these requirements is to minimize the potential for structural ignition through radiant or convective heat exposure or ember intrusion.

## 5.2.3 City of Bradbury's General Plan

The City of Bradbury's General Plan - 2012-2030 Update, is a long-range policy document designed to guide future conservation, enhancement, and development in the City. It defines the framework by which the City's environmental and economic resources are managed. The General Plan establishes goals, policies, and implementation measures to guide development and sustainability, and address issues related to the health, safety and welfare of its current and future citizens. The following elements of the City's General Plan include goals, policies, and implementation measures that address the impacts of wildland fires.

- **Land Use Element:** Contains goals, policies, and implementation actions related to land use, growth management, community design, and neighborhoods.
- **Environmental Resources Element:** Establishes goals and policies that specifically address hillside protection and conservation of open space, discourage development in high fire areas, and limit development on steep slopes.
- **Safety Element:** Contains goals and policies to reduce the potential risk of death, injuries, property damage, and economic and social dislocation resulting from large-scale hazards.

City of Bradbury General Plan policies applicable to wildfire are included in Appendix F.

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# 6 Wildfire Hazard Assessment

The wildfire hazard assessment conducted in support of this CWPP involved an evaluation of field conditions, processing and analyzing spatial datasets in a geographic information system (GIS), conducting GIS-based modeling to identify areas that may be subject to extreme fire behavior, and analyzing existing plans and data sets related to wildfire hazard. The assessment effort is presented in the following sections and was used to inform proposed modifications to the City's VHFHSZ Area.

## 6.1 Assessment Methods

### 6.1.1 Field Evaluations

Field assessments were conducted by Dudek and City of Bradbury staff in March 2020 and again in December 2020, in order to evaluate existing fuel load conditions, to gain an understanding of general fire hazard conditions in and around the City, and to better understand current vegetation management practices being conducted by the LACoFD and other agencies (MFD and AFD) within and adjacent to the City. During field assessments, site conditions were documented via photographs and, in some cases, noted on digital or hard-copy field maps.

### 6.1.2 GIS Analysis

Development of this CWPP included analysis and processing of various GIS datasets (in ArcGIS, version 10.7.1) for variables influencing wildfire hazard in the City. The following datasets were analyzed:

- Fire history
- Boundaries (VHFHSZ, High Fire Hazard Area, City Boundary, Parcels)
- Vegetation
- Terrain
- Roads
- Structure locations
- Fire station locations
- Evacuation blocks and routes
- Water Infrastructure

### 6.1.2.1 Structure Density

Individual building footprint data (2000 and 2010 US Census) was used to determine the proximity of structures to other structures. The 2010 Census identified a total of 400 dwelling units in the City of Bradbury. As of 2018, the Department of Finance identified a total of 409 housing units in Bradbury, all of which consist of single-family dwellings, either primary or second units on the same parcel of land. The City does not have group quarters or institutional facilities. The structure density is 204.2 structures per square mile which is considered low. Of the occupied units, 307 (86.7%) were owner-occupied and 47 (13.3%) were rented. The homeowner vacancy rate was 1.0%; the rental vacancy rate was 7.8%.

There are two primary concerns for structure ignition: (1) radiant and/or convective heat and (2) burning embers (National Fire Protection Association Standard 1144, Insurance Institute for Business and Home Safety, etc.). Burning embers have been a focus of building code updates for at least the last decade, and new structures in the WUI built to these codes have proven to be very ignition resistant. Likewise, radiant and convective heat impacts on structures have been minimized through the inclusion of structural hardening requirements included in Chapter 7A of the California Building Code, such as those for roofs, exterior walls, windows, and doors. However, in communities, or portions thereof, where structures are older and do not include ignition-resistant improvements (such as those identified in Chapter 7A), radiant heat from burning vegetation or adjacent structures is a primary concern. Areas with higher structure density (buildings are closer together) are therefore at greater risk of burning due to radiant heat exposure. The effect of radiant heat during wind-driven fires has been well documented (Cohen and Saveland 1997). Wind and slope can significantly increase the radiant heat exposure to surrounding structures. The type of building construction and the amount and kind of vegetation between structures also play a role in the ability of a structure to withstand radiant heat exposure.

The proximity of structures also limits the ability of property owners to maintain a minimum of 30 feet of defensible space between structures. The lack of defensible space inhibits firefighters from being able to safely maneuver around structures to provide protection.

### 6.1.2.2 LACoFD's Call Volume and Travel Times

Road network and fire station location data were used to evaluate the amount of travel time necessary to reach an individual parcel from existing fire station locations. Fire stations used in the analysis included LACoFD Fire Stations 29, 32, 44, 48, and 169, with Station 44 providing the initial response.

The closest existing fire station to the City of Bradbury is Station 44 located at 1105 Highland Avenue, Duarte, California, which includes a three (3)-person Engine Company staffed with a Captain, a Firefighter Specialist, and a Firefighter, and a four (4)-person Assessment Engine Company[8] with a Captain, a Firefighter Specialist, a Firefighter/Paramedic, and a Firefighter, 24-hours per day/seven days a week. Station 32, located at 605 North Angeleno Avenue, Azusa, California, is the next closest station, which includes a four (4)-person Paramedic Engine Company staffed with a Captain, a Firefighter Specialist, a Firefighter/Paramedic, and a Firefighter, and a two (2)-person Paramedic Squad truck with two (2) Firefighter/Paramedics, 24-hours per day/seven days per week

Additionally, Station 29 located at 14334 Los Angeles Street, Baldwin Park, California, Station 48 located at 15546 Arrow Highway, Irwindale, California, and Station 169 located at 5112 North Peck Road, El Monte, California could

[8] As Assessment Engine Company, is an engine company with some limited paramedic capabilities.

provide an effective firefighting force for the Chadwick Ranch Estates Project. Station 29 houses a three (3)-person Paramedic Engine Company, a four (4)-person Quint Company, and a tow (2)-person Paramedic Squad truck; Station 48 staffs a four (4)-person Engine Company; and Station 169 staffs a three (3)-person Engine Company.

The LACoFD documented 398,981 total incidents for 2019[9] generated by a County-wide service area total population of approximately 4,096,325 persons in 60 cities and all unincorporated communities within Los Angeles County (revised from LACoFD 2019). The County's per capita annual call volume is approximately 97 calls per 1,000 persons. The resulting per capita call volume is 0.097. It is estimated that the City of Bradbury has a total population of 1,069 persons[10].

### 6.1.2.3 Response Capability Impact Assessment

As presented in Table 6, using 2019 call volume data (Bagwell, pers. Email comm. 2020a), Engines 29, 32, 48, 169, 244, and Assessment Engine 44, the six closest Engines[11], ran calls in 2019, averaging 11, 8, 3, 4, 6, 3, and 7 calls per day, respectively. Quint 29, and Squads 29 and 32 with larger response jurisdictions ran 5, 15, and 14 calls per day, respectively.

**Table 6. LACoFD 2019 Call Volume Totals for Closest Fire Stations**

| Response Jurisdiction | *Engine 29* | *Quint 29* | *Squad 29* | *Engine 32* | *Squad 32* | *Assess. Engine 44* | *Engine 244* | *Engine 48* | *Engine 169* |
|---|---|---|---|---|---|---|---|---|---|
| Fire | 180 | 214 | 74 | 140 | 58 | 103 | 129 | 131 | 149 |
| Medical Aid (EMS) | 3,442 | 1,094 | 5,316 | 2,670 | 5,088 | 2,099 | 546 | 1,146 | 1,750 |
| Other | 429 | 309 | 142 | 347 | 128 | 328 | 280 | 334 | 349 |
| **Annual Total Response** | **4,051** | **1,617** | **5,532** | **3,157** | **5,274** | **2,530** | **955** | **1,611** | **2,248** |
| **Total Calls Per Day** | **11** | **5** | **15** | **8** | **14** | **7** | **3** | **4** | **6** |

Source: LACoFD Planning Division

The available firefighting and emergency medical resources in the vicinity of the City of Bradbury include an assortment of fire apparatus and equipment considered fully capable of responding to the type of fires and emergency medical calls potentially occurring within the City. For perspective, Assessment Engine 44 and Engine 244 ran 7 and 3 calls per day (Refer to Table 6 above). A busy suburban fire station would run 10 or more calls per day. An average station runs about 5 calls per day.

Land use in the City of Bradbury vicinity area varies greatly from urbanized and suburban clusters to vast rural areas. LACoFD's response time targets (Bagwell, pers. Email comm. 2020b) by land use type are:

- 5 minutes or less for urban areas
- 8 minutes or less for suburban areas

[9] https://fire.lacounty.gov/wp-content/uploads/2020/06/2019-Statistical-Summary-May-2020.pdf
[10] https://www.scag.ca.gov/Documents/Bradbury.pdf
[11] Engines 29, 32, and Assessment Engine are Paramedic Engines

- 12 minutes or less for rural areas

In an effort to understand fire department response capabilities, an analysis of the travel-time response coverage from the closest, existing station (Fire Station 44) was conducted. This response time analysis was conducted using travel distances that were derived from Google road data and Project development plan data. Travel times were calculated applying the distance at speed limit formula[12] (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH) as well as the nationally recognized Insurance Services Office (ISO) Public Protection Classification Program's Response Time Standard formula (T=0.65 + 1.7 D, where T= time and D = distance) for comparison. The ISO response travel time formula discounts speed for intersections, vehicle deceleration and acceleration, and does not include turnout time. Tables 7 and 8 present tabular results of the emergency response time analysis using the distance at speed formula and the ISO formula, respectively.

### Table 7. City of Bradbury Emergency Response Analysis using Speed Limit Formula

| LACoFD Station Nos. | Travel Distance to Furthest Point of the City[1] | Travel Time to Furthest Point of the City | Maximum Travel Distance[2] | Maximum Travel Time[2] | Total Response Time[3] |
|---|---|---|---|---|---|
| 29 | 6.9 miles | 11 minutes 48 seconds | 7.4 miles | 12 minutes 40 seconds | 14 minutes 40 seconds |
| 32 | 6.5 miles | 11 minutes 10 seconds | 7.0 miles | 12 minutes | 14 minutes |
| 44 | 2.8 miles | 4 minutes 47 seconds | 3.3 miles | 5 minutes 36 seconds | 7 minutes 36 seconds |
| 48 | 6.8 miles | 11 minutes 36 seconds | 7.3 miles | 12 minutes 30 seconds | 14 minutes 30 seconds |
| 169 | 6.0 miles | 10 minutes 16 seconds | 6.6 miles | 11 minutes 19 seconds | 13 minutes 19 seconds |

Notes:

1. Assumes travel distance and time to the furthest point of the City off Bliss Canyon Road from fire station, and application of the distance at speed limit formula (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH), a 35 mph travel speed, and does not include turnout time.
2. Assumes travel distance and time to the furthest point of the City from fire station, and application of the distance at speed limit formula (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH), a 35 mph travel speed, and does not include turnout time.
3. Emergency response time target thresholds include travel time to furthest point of the City from fire station, and application of the distance at speed limit formula (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH) a 35 mph travel speed along with dispatch and turnout time, which can add an additional two minutes to travel time.

[12] Using the speed limit of 35 MPH.

**Table 8. City of Bradbury Emergency Response Analysis using ISO Formula**

| LACoFD Station Nos. | Travel Distance to Furthest Point of the City[1] | Travel Time to Furthest Point of the City[1] | Maximum Travel Distance[2] | Maximum Travel Time[2] | Total Response Time[3] |
|---|---|---|---|---|---|
| 29 | 6.9 miles | 12 minutes 23 seconds | 7.4 miles | 13 minutes 15 seconds | 15 minutes 15 seconds |
| 32 | 6.5 miles | 11 minutes 42 seconds | 7.0 miles | 12 minutes 31 seconds | 14 minutes 31 seconds |
| 44 | 2.8 miles | 5 minutes 25 seconds | 3.3 miles | 6 minutes 15 seconds | 8 minutes 15 seconds |
| 48 | 6.8 miles | 12 minutes 13 seconds | 7.3 miles | 13 minutes 02 seconds | 15 minutes 02 seconds |
| 169 | 6.0 miles | 10 minutes 48 seconds | 6.6 miles | 11 minutes 48 seconds | 13 minutes 48 seconds |

Notes:

1. Assumes travel distance and time to the furthest point of the City off Bliss Canyon Road from fire station, and application of the ISO formula, T=0.65+1.7(Distance), a 35 mph travel speed, and does not include turnout time.
2. Assumes travel distance and time to the furthest point of the City from fire station, and application of the ISO formula, T=0.65+1.7(Distance), a 35 mph travel speed, and does not include turnout time.
3. Emergency response time target thresholds include travel time to furthest point of the City from fire station, and application of the ISO formula, T=0.65+1.7(Distance), a 35 mph travel speed along with dispatch and turnout time, which can add an additional two minutes to travel time.

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### 6.1.3 Fire Behavior Modeling

Modeling of potential fire behavior was also conducted to support development of this CWPP. Specifically, both the BehavePlus and FlamMap software packages were used to identify portions of the City that may be subject to extreme fire behavior, considering weather, fuels, and terrain variables.

#### 6.1.3.1 BehavePlus Fire Behavior Analysis

Fire behavior modeling has been used by researchers for approximately 50+ years to predict how a fire will move through a given landscape (Linn 2003). The models have had varied complexities and applications throughout the years. One model has become the most widely used as the industry standard for predicting fire behavior on a given landscape. That model, known as "BEHAVE", was developed by the U. S. Government (USDA Forest Service, Rocky Mountain Research Station) and has been in use since 1984. Since that time, it has undergone continued research, improvements, and refinement. The current version, BehavePlus 6.0, includes the latest updates incorporating years of research and testing. Numerous studies have been completed testing the validity of the fire behavior models' ability to predict fire behavior given site specific inputs. One of the most successful ways the model has been improved has been through post-wildfire modeling (Brown 1972, Lawson 1972, Sneeuwjagt and Frandsen 1977, Andrews 1980, Brown 1982, Rothermel and Rinehart 1983, Bushey 1985, McAlpine and Xanthopoulos 1989, Grabner, et. al. 1994, Marsden-Smedley and Catchpole 1995, Grabner 1996, Alexander 1998, Grabner et al. 2001, Arca et al. 2005). In this type of study, BehavePlus is used to model fire behavior based on pre-fire conditions in an area that recently burned. Real-world fire behavior, documented during the wildfire, can then be compared to the prediction results of Behave and refinements to the fuel models incorporated, retested, and so on.

Fire behavior modeling conducted within the adjacent naturally vegetated hillsides of the San Gabriel Mountains includes a relatively high-level of detail and analysis which results in reasonably accurate representations of how wildfire may move through available fuels on and adjacent the property. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. To objectively predict flame lengths, spread rates, and Fireline intensities, this analysis incorporated predominant fuel characteristics, slope percentages, and representative fuel models observed adjacent to the City. The BehavePlus fire behavior modeling system was used to analyze anticipated fire behavior within and adjacent to key areas just outside of the City. Predicting wildland fire behavior is not an exact science. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather and the limits of weather forecasting. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire prevention planning information. To be used effectively, the basic assumptions and limitations of BehavePlus must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuels less than one-quarter inch in diameter. These are the fine fuels that carry fire. Fuels greater than one inch have little effect while fuels greater than three inches have no effect on fire behavior.
- Second, the model bases calculations and descriptions on a wildfire spreading through surface fuels that are within six feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.

- Third, the software assumes that weather and topography are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
- Fourth, the BehavePlus fire behavior computer modeling system was not intended for determining sufficient fuel modification zone/defensible space widths. However, it does provide the average length of the flames, which is a key element for determining "defensible space" distances for minimizing structure ignition.

Although BehavePlus has some limitations, it can still provide valuable fire behavior predictions which can be used as a tool in the decision-making process. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur throughout the San Gabriel Mountains. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven fuel characteristics help define the 13 standard fire behavior fuel models[13] and the five custom fuel models developed for Southern California[14]. According to the model classifications, fuel models used in BehavePlus have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface to volume ratio. Observation of the fuels in the field (on site) determines which fuel models should be applied in BehavePlus. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models and the custom Southern California fuel models:

- Grasses — Fuel Models 1 through 3
- Brush — Fuel Models 4 through 7, SCAL 14 through 18
- Timber — Fuel Models 8 through 10
- Logging Slash — Fuel Models 11 through 13

In addition, the aforementioned fuel characteristics were utilized in the recent development of 40 new fire behavior fuel models[15] developed for use in BehavePlus modeling efforts. These new models attempt to improve the accuracy of the standard 13 fuel models outside of severe fire season conditions, and to allow for the simulation of fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the new 40 fuel models:

13 Anderson, Hal E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. USDA Forest Service Gen. Tech. Report INT-122. Intermountain Forest and Range Experiment Station, Ogden, UT.

14 Weise, D.R. and J. Regelbrugge. 1997. Recent chaparral fuel modeling efforts. Prescribed Fire and Effects Research Unit, Riverside Fire Laboratory, Pacific Southwest Research Station. 5p.

15 Scott, Joe H. and Robert E. Burgan. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

- Non-Burnable Models NB1, NB2, NB3, NB8, NB9
- Grass Models GR1 through GR9
- Grass-shrub Models GS1 through GS4
- Shrub Models SH1 through SH9
- Timber-understory Models TU1 through TU5
- Timber litter Models TL1 through TL9
- Slash blowdown Models SB1 through SB4

BehavePlus software was used in the development of this CWPP in order to evaluate potential fire behavior for the City. Existing site conditions were evaluated, and local weather data was incorporated into the BehavePlus modeling runs. A detailed discussion of the BehavePlus modeling process conducted for this CWPP is presented in Appendix G and a map depicting the run locations for the fire behavior modeling effort is presented in Figure 8.

#### 6.1.3.2 FlamMap Fire Behavior Analysis

In addition to the BehavePlus software package, FlamMap was used as well. FlamMap (version 5.0.3) is a GIS-driven computer program that incorporates fuels, weather, and topography data in generating static fire behavior outputs, including values associated with flame length and crown fire activity, among others (Finney et al. 2015). It is a flexible system that can be adapted to a variety of specific wildland fire planning and management needs. The calculations that come from FlamMap are based on the BehavePlus fire modeling system algorithms but result in geographically distinct datasets based on GIS inputs. FlamMap model outputs allow wildland resource managers to evaluate anticipated fire behavior, which provides important insight about the characteristics of wildfire spread within management areas. Each of the input variables used in FlamMap remain constant at each location, meaning that the input variables are applied consistently to each grid cell and the fire behavior at one grid cell does not impact that at a neighboring grid cell. Essentially, the model presents a "snapshot" in time and does not account for temporal changes in fire behavior or the movement of fire across the landscape. As such, the results of the models contained in this CWPP are best used as valuable information sources and tools to identify high hazard areas and prioritize fuel treatments based on potential risk rather than used as a forecast tool of an exact representation of how a fire would behave in the City.

The following are the basic assumptions and limitations of FlamMap:

- The model output files describe fire behavior only in the flaming front. The primary driving forces in the predictive calculations are the dead fuels less than 0.25 inches in diameter. These are the fine fuels that carry fire. Fuels greater than 1 inch in diameter have little effect in carrying fire, and fuels greater than 3 inches in diameter have no effect. While not contributing to the fire behavior calculation, larger fuels (1-inch and greater) are consumed by the fire and are components of the fuels being consumed. For example, the smaller portions (e.g., leaves, twigs, peeling bark) of a chaparral shrub will combust readily and affect fire behavior, while larger portions (e.g., trunk, main branches) do not affect fire behavior but are part of the overall fuel load and will combust after the flaming front has passed.

- The model bases calculations and descriptions on a wildfire spreading through surface fuels that are within 6 feet of the ground and contiguous to the ground. Surface fuels are classified as grass, brush, litter, or slash, which are general categories that are assigned to different vegetation types.
- The software assumes that fuel moisture conditions are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel must be carefully considered to obtain useful predictions.
- WindNinja software (version 2.1.0), which is incorporated into FlamMap, allows for the generation and incorporation of gridded wind data in the FlamMap simulation. This approach is preferable as it allows the model to account for the effect of terrain on wind speed and direction at different locations throughout the modeling area, rather than relying on one single input value applied to the entire modeling area (e.g., the entire City).

FlamMap was used to model flame length, crown fire activity, and spot fire potential for an area encompassing the entire City plus a buffer of approximately 5 miles. A detailed discussion of the FlamMap modeling process conducted for this CWPP is presented in Appendix G. A map depicting flame length outputs from the fire behavior modeling effort is presented in Figure 9.

The results presented in Figure 9 and discussed in Appendix H depict values based on inputs to the FlamMap software and are not intended to capture changing fire behavior as it moves across a landscape. For planning purposes, extreme fire behavior (e.g., that occurring during periods of low humidity and high, Santa Ana winds) is the most useful information for identifying high-hazard areas and prioritizing vegetation management activities. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

## 6.2 Hazard Assessment Results

The results presented in Table 9 depict values based on inputs to the BehavePlus software and are not intended to capture changing fire behavior as it moves across a landscape. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis. For planning purposes, the averaged worst-case fire behavior is the most useful information for conservative fuel modification design. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

Based on the BehavePlus analysis, worst-case fire behavior is expected in untreated, surface shrub and chaparral fuels northeast of the City under Peak weather conditions (represented by Fall Weather, Scenario 3). The fire is anticipated to be a wind-driven fire from the north/northeast during the fall. Under such conditions, expected surface flame lengths reach 42 feet with wind speeds of 50+ mph. Under this scenario, fireline intensities reach 18,499 BTU/feet/second with fast spread rates of 6.2 mph and could have a spotting distance up to 2.3 miles away.

## Table 9: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions

| Fire Scenario | Flame Length[1] (feet) | Spread Rate[1] (mph[5]) | Fireline Intensity[1] (Btu/ft/s) | Spot Fire[1] (miles) | Surface Fire to Tree Crown Fire | Tree Crown Fire Rate of Spread (mph) | Crown Fire Flame Length (feet) |
|---|---|---|---|---|---|---|---|
| *Scenario 1: 38% slope; Summer Onshore Wind (50th percentile)* | | | | | | | |
| Riparian Habitat - Timber Shrub[2,3] (Sh4) | 10.9' | 0.9 | 1,013 | 0.5 | Crowning[4] | 0.8 | 110.8' |
| Sagebrush scrub (Sh5) | 19.5' | 1.5 | 3,599 | 0.7 | No | N/A | N/A |
| *Scenario 2: 43% slope; Fall Offshore, Extreme Winds (97th percentile)* | | | | | | | |
| Riparian Habitat - Timber Shrub (Sh4) | 12.8' (23.5')[6] | 1.1 (4.2) | 1,453 (5,471) | 0.5 (1.5) | Crowning | 1.0 (4.1) | 133.1' |
| Sagebrush scrub (Sh5) | 25.0' (41.8') | 2.1 (6.4) | 6,184 (18,966) | 0.8 (2.3) | No | N/A | N/A |
| *Scenario 3: 20% slope; Fall, Offshore, Extreme Winds (97th percentile)* | | | | | | | |
| Sagebrush scrub (Sh5) | 24.0' (41.3') | 1.9 (6.2) | 5,697 (18,499) | 0.8 (2.3) | No | N/A | N/A |
| *Scenario 4: 18% slope; Summer Onshore Wind (50th percentile)* | | | | | | | |
| Riparian Habitat - Timber Shrub (Sh4) | 10.5' | 0.8 | 933 | 0.4 | Crowning | 0.8 | 110.8' |
| Sagebrush scrub (Sh5) | 18.8' | 1.4 | 3,328 | 0.6 | No | N/A | N/A |

**Note:**

1. Wind-driven surface fire.
2. Riparian overstory torching increases fire intensity. Modeling included canopy fuel over Sh4, which represents surface fuels beneath the tree canopies.
3. A surface fire in the mixed sycamore riparian forest would transition into the tree canopies generating flame lengths higher than the average tree height (25 feet). Viable airborne embers could be carried downwind for approximately 1.0 mile and ignite receptive fuels.
4. Crowning= fire is spreading through the overstory crowns.
5. MPH=miles per hour.
6. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph.

The following describes the fire behavior variables (Heisch and Andrews 2010) as presented in Table 9:

**Surface Fire:**

- Flame Length (feet): The flame length of a spreading surface fire within the flaming front is measured from midway in the active flaming combustion zone to the average tip of the flames.
- Fireline Intensity (Btu/ft/s): Fireline intensity is the heat energy release per unit time from a one-foot-wide section of the fuel bed extending from the front to the rear of the flaming zone. Fireline intensity is a function of rate of spread and heat per unit area and is directly related to flame length. Fireline intensity and the flame length are related to the heat felt by a person standing next to the flames.

- Surface Rate of Spread (mph): Surface rate of spread is the "speed" the fire travels through the surface fuels. Surface fuels include the litter, grass, brush and other dead and live vegetation within about 6 feet of the ground.

**Crown Fire:**

- Transition to Crown Fire: Indicates whether conditions for transition from surface to crown fire are likely. Calculation depends on the transition ratio. If the transition ratio is greater than or equal to 1, then transition to crown fire is Yes. If the transition ratio is less than 1, then transition to crown fire is No.
- Crown Fire Rate of Spread (mph): The forward spread rate of a crown fire. It is the overall spread for a sustained run over several hours. The spread rate includes the effects of spotting. It is calculated from 20-ft wind speed and surface fuel moisture values. It does not consider a description of the overstory.
- Fire Type: Fire type is one of the following four types: surface (understory fire), torching (passive crown fire; surface fire with occasional torching trees), conditional crown (active crown fire possible if the fire transitions to the overstory), and crowning (active crown fire; fire spreading through the overstory crowns). Dependent on the variables: transition to crown fire and active crown fire.

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### Table G-1: Existing Fuel Model Characteristics

| Fuel Model | Description | Location | Fuel Bed Depth (Feet) |
|---|---|---|---|
| Sh4 | Riparian Habitat (Timber Shrub) | Riverbed that runs near the base of the San Gabriel Mountains, north of the City of Bradbury | >8.0 ft. |
| Sh5 | High Load, Dry Climate Shrub | Scrub and chaparral naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury. | >4.0 ft. |
| Gs2 | Moderate load, Dry Climate Grass-Shrub | Scrub and grasses naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury. | <3.0 ft. |
| FM4 | Chaparral | Chaparral fuel model naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury | >6.0 ft. |

### Table G-2: Variables Used for Fire Behavior Modeling

| Model Variable | Summer Weather (50th Percentile) | Peak Weather (97th Percentile) |
|---|---|---|
| Fuel Models | FM4, Gs2, Sh4 and Sh5 | FM4, Gs2, Sh4, and Sh5 |
| 1 h fuel moisture | 5% | 2% |
| 10 h fuel moisture | 6% | 3% |
| 100 h fuel moisture | 9% | 5% |
| Live herbaceous moisture | 39% | 30% |
| Live woody moisture | 78% | 60% |
| 20 ft. wind speed | 19 mph (sustained winds) | 18 mph (sustained winds); wind gusts of 50 mph |
| Wind Directions from north (degrees) | 200 and 290 | 0 and 80 |
| Wind adjustment factor | 0.4 | 0.4 |
| Slope (uphill) | 18 to 38% | 20 to 45% |

### Table G-3: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions

| Fire Scenario | Flame Length[1] (feet) | Spread Rate[1] (mph[5]) | Fireline Intensity[1] (Btu/ft/s) | Spot Fire[6] (miles) | Surface Fire to Tree Crown Fire | Tree Crown Fire Rate of Spread (mph) | Crown Fire Flame Length (feet) |
|---|---|---|---|---|---|---|---|
| *Scenario 1: 38% slope; Summer Onshore Wind (50th percentile)* | | | | | | | |
| Riparian Habitat - Timber Shrub[2,3] (Sh4) | 10.9' | 0.9 | 1,013 | 0.5 | Crowning[4] | 0.8 | 110.8' |
| Sagebrush scrub (Sh5) | 19.5' | 1.5 | 3,599 | 0.7 | Crowning[4] | 0.8 | 116.3 |
| Moderate load grass-shrub (Gs2) | 7.8' | 2.3 | 9,509 | 0.4 | Crowning[4] | 0.8 | 109.0 |
| Chaparral (FM 4) | 30.4' | 0.7 | 500 | 1.0 | Crowning[4] | 0.8 | 123.2 |
| *Scenario 2: 43% slope; Fall Offshore, Extreme Winds (97th percentile)* | | | | | | | |
| Riparian Habitat - Timber Shrub (Sh4) | 12.8' (23.5')[6] | 1.1 (4.2) | 1,453 (5,471) | 0.5 (1.5) | Crowning[4] | 1.0 (4.1) | 133.1' |
| Sagebrush scrub (Sh5) | 25.0' (41.8') | 2.1 (6.4) | 6,184 (18,966) | 0.8 (2.3) | Crowning[4] | 1.0 (4.1) | 141.6' |
| Moderate load grass-shrub (Gs2) | 10.1' (19.1') | 1.0 (3.9) | 870 (3,450) | 0.4 (1.4) | Crowning[4] | 1.0 (4.1) | 131.0' |
| Chaparral (FM 4) | 38.1' (70.4') | 3.1 (11.9) | 15,517 (58,853) | 1.1 (3.3) | Crowning[4] | 1.0 (4.1) | 151.3' |
| *Scenario 3: 20% slope; Fall, Offshore, Extreme Winds (97th percentile)* | | | | | | | |
| Sagebrush scrub (Sh5) | 24.0' (41.3') | 1.9 (6.2) | 5,697 (18,499) | 0.8 (2.3) | No | N/A | N/A |
| Moderate load grass-shrub (Gs2) | 9.7' (18.9') | 0.9 (3.8) | 797 (3,380) | 0.4 (1.3) | No | N/A | N/A |
| Chaparral (FM 4) | 36.5' (69.6') | 2.9 (11.6) | 14,172 (57,575) | 1.1 (3.3) | No | N/A | N/A |

Note:

1. Wind-driven surface fire.
2. Riparian overstory torching increases fire intensity. Modeling included canopy fuel over Sh4, which represents surface fuels beneath the tree canopies.
3. A surface fire in the mixed sycamore riparian forest would transition into the tree canopies generating flame lengths higher than the average tree height (25 feet). Viable airborne embers could be carried downwind for approximately 1.0 mile and ignite receptive fuels.
4. Crowning= fire is spreading through the overstory crowns.
5. MPH=miles per hour
6. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph

SOURCE: AERIAL-BING MAPPING SERVICE 2019

DUDEK

FIGURE 8
BehavePlus Analysis Map
City of Bradbury Community Wildfire Protection Plan

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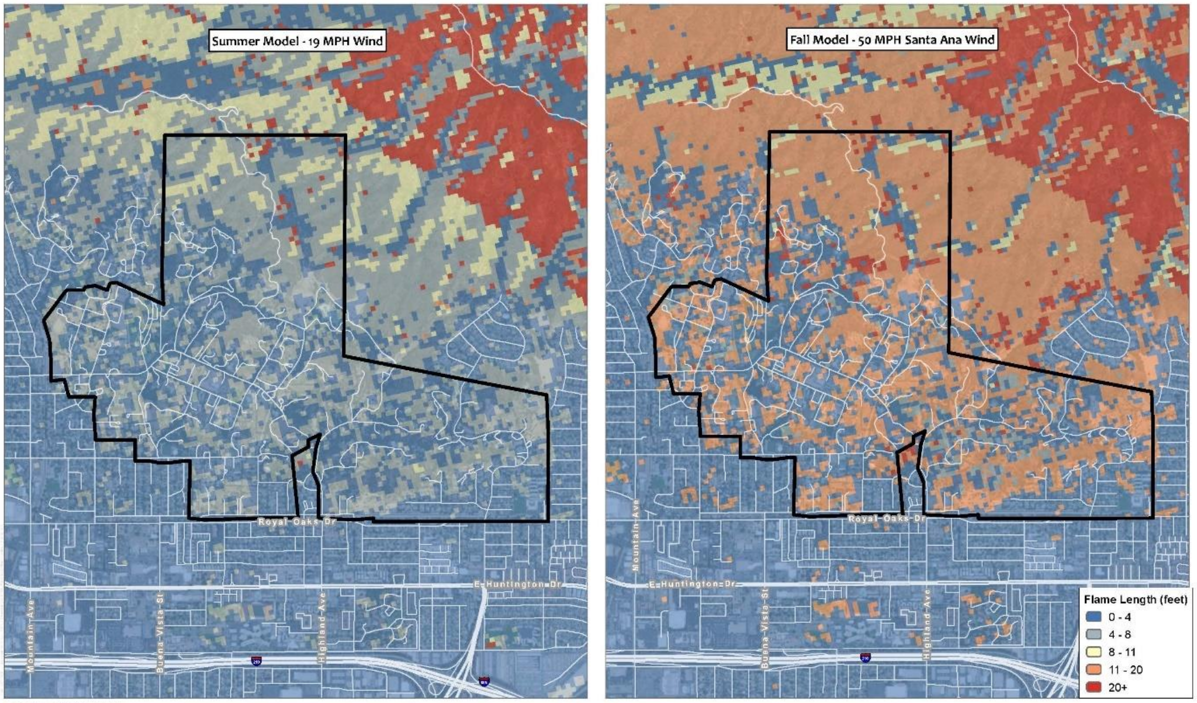


SOURCE: BASE: BING MAPPING SERVICE

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Figure 9
City of Bradbury FlamMap Exhibit
City of Bradbury Community Wildfire Protection Plan

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# 7 Values at Risk

## 7.1 At-Risk Community

The Healthy Forest Restoration Act of 2003 identifies at-risk communities as an area:

> (A) that is comprised of—
>
> (i) an interface community as defined in the notice entitled ''Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire'' issued by the Secretary of Agriculture and the Secretary of the Interior in accordance with title IV of the Department of the Interior and Related Agencies Appropriations Act, 2001 (114 Stat. 1009) (66 Fed. Reg. 753, January 4, 2001); or
>
> (ii) a group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) within or adjacent to Federal land.
>
> (B) in which conditions are conducive to a large-scale wildland fire disturbance event; and
>
> (C) for which a significant threat to human life or property exists as a result of a wildland fire disturbance event.

In addition to this definition, the Office of the State Fire Marshal maintains a list of Communities at Risk. The National Fire Plan directs funding to be provided for projects designed to reduce the fire risks to communities. These high-risk communities identified within the WUI were published in the Federal Register in 2001 and include those communities neighboring federal lands. The City of Bradbury is identified as a Community at Risk in the Federal Register.

## 7.2 Values at Risk

Values threatened by wildfire include life, property, and natural and economic resources. The LACoFD's mission statement is (Los Angeles County Fire Department 2020):

> "The mission of the Los Angeles County Fire Department is to protect lives, the environment, and property by providing prompt, skillful and cost-effective fire protection, and life safety services."

The lives and property threatened by wildfire are of paramount importance. However, natural resource and economic values threatened by wildfire are also significant. A major wildfire affecting the City would potentially result in the loss of biological, cultural, and visual resources. In addition, the potential economic loss from the drop in tourism and damage to homes, businesses, and City infrastructure could substantially impact the local economy.

Wildland fire has always been a part of the City's environment and is a natural process. What has changed is the potential for the loss of life, property and reduction in natural habitat from wildfires as development pushes into WUI areas. Additionally, as described in Section 2.3.1, climate change is anticipated to exacerbate wildfire hazard in the City. As development continues in these areas, the importance of programs and projects for structural protection, public and firefighter safety, and natural resources protection are critical.

### 7.2.1 Life Safety

The potential for loss of life threatened by wildfire is difficult to calculate. Locally, as represented in Table 4, the 2009 Station Fire resulted in two fatalities; the 1980 stable Fire resulted in one fatality; the 1968 Canyon (Canyon Inn) Fire resulted in eight firefighter fatalities; and the 2016 San Gabriel Complex Fire resulted in three fatalities. Furthermore, the potential for greater loss of life is possible during extreme wildfire events, as is evident in other wildfires throughout California, including in the 1991 Oakland Hills Fire, where 25 people, both emergency responders and residents, perished while trying to evacuate from the fire. 22 people perished in the 2017 Tubbs Fire and 85 in the 2018 Camp Fire as a result of these extreme wildfire events. Without a comprehensive approach to the problems that exist in the VHFHSZ Areas, the conditions that exist in these areas have the potential for greater loss of life, particularly as population increases.

Further, as seen after the devastating 2017 Thomas Fire, which burned approximately 281,893 acres, there is potential for loss of life as a result of heavy rains that occurred after the fire. Without vegetation and trees to stabilize hillsides, heavy rains that follow a fire event can result in mudslides and debris flows. The fire, which burned into the eastern part of the City of Santa Barbara, was followed by the catastrophic debris flow on January 9, 2018, which affected Montecito and the Coast Village Road area of the City of Santa Barbara, causing millions of dollars in damage and taking 23 lives.

### 7.2.2 Homes, Structures, and Neighborhoods

Home values in the City of Bradbury are some of the highest in the nation. The median listing price of a home within the City of Bradbury is presently $2,324,000 (RocketHomes, 2021). Based on the median home price within the City of Bradbury of $2,324,000 and the approximate number of 400 structures, the potential cost of property loss within the City would total over $929,000,000. The quantity of structures presented includes all single-family residential structure types in the VHFHSZ. For perspective, the 1980 Stable Fire destroyed 49 Bradbury homes and approximately $15 million in damage incurred. A fire that size destroying 49 homes would have an estimated property loss of nearly $114 million.

#### 7.2.2.1 Structural Hardening

As discussed, the topography, vegetation, climatic, and geological conditions in the foothills adjacent to the City of Bradbury combine to create a unique situation capable of supporting large-scale, high-intensity, and sometimes damaging wildfires. Vegetation management and defensible space are key components to an overall fire protection strategy; however, structural hardening also plays an important role in minimizing the potential for structure ignitions. Hardening refer to steps a property owner may take to enhance the survivability of an existing structure that may not be up to current building or residential code standards for wildland areas. Homes survive wildfires through a combination of vegetation management and maintenance, management of combustible materials on the property, and installation and maintenance of fire- and ember-resistant construction materials. Hardening of the homes and other structures to enhance survivability during a wildfire would include retrofitting the most vulnerable home features, including:

- roofs
- vents
- eaves and soffits
- windows
- walls
- decks

- rain gutters
- patio covers
- chimneys
- garages
- fences
- driveway and access roads
- address signage
- water supply

There are three ways your home can be exposed to wildfire: direct flames from a wildfire or burning neighboring home; radiant heat from nearby burning plants or structures; and flying embers. Communities located in wildfire-prone areas need to take extra measures to live safely. There are many ways to prepare communities and properties for wildfire, including creating and maintaining adequate defensible space and hardening homes through altering or replacing the construction components. The most effective way for homes to withstand wildfire is a "coupled approach" that considers the exterior construction materials and how they are put together, as well as the surrounding vegetation and other near-home combustible materials. Selection, location, and maintenance of vegetation and other combustible materials on a property can reduce the chance of a wildfire burning the home (Office of the State Fire Marshal, 2021). While high fire construction standards are mandatory for new buildings in the VHFHSZ Areas, hardening of existing structures is voluntary. Adopting mandatory home hardening provisions of building and fire codes is problematic because existing, nonconforming structures were typically approved and built to the codes in effect at the time of construction. The problem persists, however, that a burning structure in a wildfire contributes to the fire and presents a danger to other structures downwind by way of flying brands (embers). Retrofits to existing structures can reduce fire risk, and some cost-sharing and grant programs are available to offset costs.

Resources for hardening structures can be found on the following websites:

- https://www.readyforwildfire.org/prepare-for-wildfire/get-ready/hardening-your-home/
- Wildfire Home Retrofit Guide (readyforwildfire.org)
- Low-cost-Retrofit-List-Update-5-14-21.pdf (readyforwildfire.org)
- https://ucanr.edu/sites/fire/Prepare/Building/

### 7.2.2.2 Accessory Dwelling Units

Accessory Dwelling Units (ADUs) are self-contained residential units, typically used as a rental, and either incorporated within, detached from, or attached to the primary residential unit(s) on the same property. A Junior Accessory Dwelling Unit (JADU) is a unit up to 500 square feet in size contained within an existing or proposed home with a separate exterior entry and an efficiency kitchen. The state views ADUs/JADUs as one important strategy to increase housing statewide and in 2017 significantly amended state law to remove local government barriers for their construction. The Bradbury Municipal Code, Sections 9.85.020 and 9.85.050 provide definitions of an ADU and the development standards/requirements of an ADU.

In 2019, the state continued to be concerned about local government barriers to ADUs and signed a new package of legislation that again significantly amended state law for ADUs/JADUs effective January 1, 2020. New state law significantly expanded the types and numbers of ADUs allowed per parcel. The City has concerns regarding the impact of California's ADU Law that can affect fire safety. Specifically, the City has concerns related to setbacks and prohibition on fire sprinklers. Separate from the wildfire issues, State law continues to prohibit the City from requiring automatic fire sprinklers in ADU's when the main residence was not required to have fire sprinklers. Bradbury's concern over portions of State law's preemption of local requirements that can affect fire safety stems from Bradbury's location and fire history. As noted above, most of Bradbury is located within a VHFHSZ, a wildland urban interface area, an ember intrusion zone, and is officially recognized by the federal government as a community at high risk from wildfire.

### 7.2.3 Ready! Set! Go!

The City of Bradbury has adopted the LACoFD "Ready! Set! Go!" Wildfire Action Plan, which was designed to provide the community with information on creating defensible space around their home, retrofitting their home with fire-resistive materials, and preparing them to safely evacuate well ahead of a wildfire. The "Ready! Set! Go!" Action Plan provides a three step process that teaches homeowners to create their own Action Plan of preparedness, have situational awareness and leave early in the event of a fire. **READY** – Being ready for a wildfire starts with the property owner maintaining an adequate defensible space and hardening the home against flying embers by using fire resistive building materials. Get **SET** – Before a wildfire strikes, it's important to be set to get out. Creating an Wildfire Action Plan to include important phone numbers, what items to take and prepare to evacuate. Be sure to stay aware of the latest news from the local fire department and media outlet for updated information on the fire. And **GO** – If a wildfire strikes, be ready to go early for your safety. Take all evacuation steps necessary to give your family and home the best chance of surviving a wildfire. A copy of the LACoFD "Ready! Set! Go!" Action Plan can be found on the LACoFD website: Ready-set-go 04292021-High-Quality-B.pdf (lacounty.gov) and is included as Appendix I of this CWPP.

### 7.2.4 Critical Infrastructure

Critical infrastructure encompasses physical assets that are vital to maintaining essential services, such as water services, roads, and fire and police services. Damage to critical infrastructure during a wildland fire often results in the temporary delay or loss of critical services to some or all residents within the City.

#### 7.2.4.1 Evacuation Blocks and Routes

As presented in Section 2.9, the City has established evacuation blocks and wildland evacuation routes, which are presented in Figure 4. These evacuation blocks and routes, while not physical infrastructure, are critical components to mitigating wildfire hazard.

#### 7.2.4.2 Water Supply

As described in Section 2.10, water supplies are essential for firefighting efforts and structure protection.

### 7.2.5 Natural Resources

Natural resources include biological resources, cultural and historic resources, visual resources, streams and water resources, slopes and soil stability, and air quality. The following sections address these City assets in more detail.

### 7.2.5.1 Biological Resources

**Biotic Communities**

The City's vegetation (biotic) communities provide important biological habitats for plant and animal species. The vegetation that exists in these communities also becomes fuel available to burn during a wildland fire. The impact of a wildfire in many of these communities can be devastating, especially under extreme wind and weather conditions.

The City's General Plan Environmental Resources Element, General Plan Environmental Impact Report, and LCP identify sensitive biotic communities, which are defined as communities which cannot adapt to new environmental stresses. The Coastal Land Use Plan identifies "Environmentally Sensitive Habitat Area," which is any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem, and which could be easily disturbed or degraded by human activities and developments. The following sensitive biotic communities are present in the City and may be adversely affected by wildfire:

- California Annual Grassland
- Coastal Sage Scrub
- Mixed Chaparral
- Monarch Butterfly Autumnal and Winter Roost Sites
- Perennial Grasslands (Coastal Prairie)
- Hardwood Tree Species
- Conifer Tree Species
- Southern Oak Woodland
- Riparian Woodland/Creeks
- Freshwater Marsh
- Saltwater Marsh

**Rare, Endangered, or Threatened Plants and Wildlife**

Because of the diversity of biotic communities in the San Gabriel Mountains within the ANF, many different rare, endangered, and threatened animal species exist nearby the City. The protection of these plants and animals is required by law and is essential to biological diversity. Like biotic communities, these plants and animals are threatened by wildfire. The following rare, endangered, or threatened wildlife species may be present near the City in the San Gabriel Mountains within the Angeles National Forest and may be adversely affected by wildfire[16]:

[16] San Gabriel Watershed and Mountains – Special Resources Study and Environmental Assessment. September 2011. Draft_SANG_report_book.indb (npshistory.com)

- Braunton's Milk vetch (*Astragalus brauntonii)*
- Nevin's barberry (endemic) (*Berberis nevinii*)
- Thread-leaved brodiaea (endemic) (*Brodiaea filifolia*)
- Slender-horned spineflower (endemic) (*Dodecahema leptoceras*)
- California Orcutt grass (*Orcuttia californica*)
- Santa Ana sucker (*Catostomus santaanae*)
- Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni)*
- Southern steelhead trout (*Oncorhynchus mykiss*)
- Arroyo toad (*Ananysrus californicus*)
- California red-legged frog (*Rana draytonii*)
- Mountain yellow-legged frog (*Rana muscosa*)
- Desert tortoise (*Gopherus agassizii*)
- Swainson's hawk (*Buteo swainsoni*)
- Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)
- Southwestern willow flycatcher (*Empidonax traillii extimus*)
- California condor (*Gymnogyps californianus*)
- Bald eagle (*Haliaeetus leucocphalus*)
- Coastal California gnatcatcher (*Polioptila californica californica*)
- Least Bell's vireo (*Vireo bellii pusillus*)

The following rare and endangered plant species are present near the City in the San Gabriel Mountains within the Angeles National Forest and may be adversely affected by wildfire[17]:

- California muhly (endemic) (*Muhlenbergia californica*)
- Southern California black walnut (*Juglans californicavar. Californica*)
- Coulter's goldfields (*Lasthenia glabrata ssp. coulteri*)
- Crested milk-vetch (endemic) (*Astralgus bicristatus*)
- Davidson's bush mallow (endemic) (*Malacothamnus davidsonii*)
- Duran's rush (endemic) (*Juncus duranii*)
- Purple needlegrass (*Nasella pulchra*)
- Engelmann oak (*Quercus englemannii*)
- Coast Live Oak (*Quercus agrifolia)*
- fragrant pitcher sage (endemic) (*Lepechinia fragrans*)
- Johnston's bedstraw (endemic) (*Galium johnstonii*)
- lemon lily (*Lilium parryi*)
- Mojave phacelia (endemic) (*Phacelia mohavensis*)
- San Gabriel Mountains dudleya (endemic) (*Dudleya densiflora*)
- San Gabriel Mountains sunflower (endemic) (*Hulsea vestita ssp. gabrielensis*)
- Tehachapi ragwort (*Packera ionophylla*)

[17] San Gabriel Watershed and Mountains – Special Resources Study and Environmental Assessment. September 2011. Draft_SANG_report_book.indb (npshistory.com)

### 7.2.5.2 Cultural and Historic Resources

The City is committed to the conservation of its cultural and historic resources. The impact of a wildfire poses a threat to these resources through direct flame contact, radiant heat damage, fire byproducts such as smoke and ash, damage caused by fire suppression and rehabilitation activities, and post-fire erosion, debris flows, and flooding. The effects of wildland fire on cultural resources can be considered direct or indirect. Direct effects are those caused by fire and its byproducts (e.g., smoke and ash) and result from the physical state of the fire environment (fuels, weather, terrain) and the ignition pattern. Indirect effects are the biophysical processes acting on the fire-altered environment and human responses. Indirect effects occur when wildland fire or associated fire management actions change the context in which a cultural resource is found, leaving it vulnerable to impacts (e.g., post-fire erosion) (Ryan et al. 2012).

### 7.2.5.3 Visual Resources

The aesthetic qualities of the City vary as widely as the nature of the topography and land uses. The scenic foothills and ridgelines of the San Gabriel Mountains that provide the backdrop for the City are also the natural features that contribute to wildfire hazard (weather, topography, and fuel). Management of vegetation for fire hazard reduction purposes may impact public scenic views of the mountains above the City. However, large wildfire burn scars would also impact public scenic views until the vegetation recovers. The preservation and enhancement of scenic resources provides important social, recreational, and economic benefits for both residents and visitors. Vegetation management conducted throughout the City under the LACoFD's and Angeles National Forest's guidance, and as proposed in this CWPP, involves thinning and understory ladder fuel treatment, which retains tree canopies and leaves thinned shrublands in a mosaic pattern where 50% to 70% of existing plant material remains. This approach differs from fire break construction, which removes all vegetation down to bare soil, a practice that would have a significantly greater impact on public scenic views.

### 7.2.5.4 Streams and Water Resources

Vegetation in local watersheds and along streams and water courses provides many important functions in protecting water resources, water quality, and habitat in the watershed. Vegetated riparian corridors may provide water quality buffering benefits to the adjacent streams. Vegetation removal or treatment in riparian corridor areas must be conducted in careful consideration of potential effects on water quality and ecological function. Riparian vegetation provides habitat for terrestrial and aquatic wildlife species, provides streambank stability, reduces erosion, shades the water surface thereby affecting water temperature (which affects aquatic habitat), and is a source for large woody debris, which falls into streams and watercourses providing habitat and affecting flow patterns and pool development (Kocher and Harris 2007). However, when a watershed is catastrophically burned in an expansive wildfire, many of these functions and roles are lost or severely reduced until the vegetation recovers. Following a catastrophic watershed-wide fire, hillslope erosion and sediment yields through watershed tributary channels typically increase by an order of magnitude (or greater) over non-fire average conditions (Neary et al. 2008).

Therefore, sound vegetation management that reduces the extent and frequency of watershed-wide extreme fires also helps avoid and minimize potential sediment and water quality impacts in the watershed. Vegetation management activities seek to maintain the water resource and water quality benefits of watershed vegetation while reducing the hazard and fire risk.

Historic large fires within the Los Angeles area have been wind driven fires. Because of the east/west alignment of the San Gabriel mountain range, winds are funneled down through major drainages. Some creek areas have heavy concentrations of flammable vegetation. A wildfire burning through these areas has the potential for significant loss of riparian habitat and water quality. In addition, erosion occurring on steeper slopes above drainages where soil conditions are susceptible to erosion or are accelerated from a wildfire will end up being deposited in creek areas where flow velocities are sufficiently reduced.

### 7.2.5.5 Slopes and Soil Stability

Watersheds severely burned by wildfire are vulnerable to accelerated rates of soil erosion and can experience large amounts of post-fire sediment deposits. Increases in post-fire suspended sediments in streams can result from erosion and overland flow, channel scouring, and creep accumulations in stream channels after an event (USDA 2005). While less is known regarding the effect of fire on turbidity, it has been observed that post-fire turbidity levels in stream water are affected by the steepness of the burned watershed (USDA 2005). The little data available regarding post-fire turbidity levels has indicated that U.S. Environmental Protection Agency water quality standard for turbidity can be exceeded after a fire event (USDA 2005). In some cases, during severe, slow-moving fires, the combustion of vegetation during wildfires creates a gas that can penetrate the soil. As the soil cools, this gas condenses and forms a waxy coating that causes the soil to repel water. This phenomenon, called hydrophobicity, increases the rate of surface water runoff as water percolation into the soil is reduced (Moench and Fusaro 2012). This accelerated slope runoff can move dry soil material that has accumulated at the base of slopes, creating flooding and debris flows.

Vegetation helps stabilize slopes and minimize soil erosion by providing root strength and by absorbing soil moisture. Plant roots can anchor into bedrock or more stable soils and can bind weaker soils through fibrous root development. Excessive, haphazard, or indiscriminate vegetation removal can result in the loss of root strength in the soil, and their decay can increase soil moisture levels, increasing the potential for erosion and slope failure (Ziemer 1981). Vegetation also reduces stormwater runoff by capturing and storing rainfall in the canopy and releasing it through evapotranspiration. Vegetation also promotes infiltration of rainfall into the soil (Center for Watershed Protection and USFS 2008).

### 7.2.5.6 Air Quality

The California Air Resources Board (CARB) regulates the air quality within California. The South Coast Air Quality Management District (SCAQMD) is the air pollution control agency for all of Orange County and the urban portions of Los Angeles County and is mandated to develop plans to meet federal and state air quality standards, monitor air quality, and regulate activities that may result in air pollution within Los Angeles County.

Wildland fire affects air quality by producing smoke emissions that may exceed CARB's standards for carbon monoxide, carbon dioxide, methane and non-methane hydrocarbons, and particulate matter less than 10 and 2.5 microns in diameter ($PM_{10}$ and $PM_{2.5}$). The amount of chemicals and particulate matter produced in a wildland fire is directly related to the amount of fuel consumed.

Carbon dioxide, water vapor, carbon monoxide, particulate matter, hydrocarbons, and other constituent materials are all present in wildfire smoke. The specific composition of smoke depends largely on the fuel type (vegetation types contain different amounts of cellulose, oils, waxes, and starches, which when ignited produce different compounds). In addition, hazardous air pollutants and toxic air contaminants, such as benzene and formaldehyde, are also present in smoke. However, the principal pollutant of concern from wildfire smoke is particulate matter. In general, particulate matter from smoke is very small in size and can be inhaled into the deepest recesses of the lungs, presenting a serious health concern (Lipsett 2008).

Factors including weather, stage of fire, and terrain can all dictate fire behavior and the impact of wildfire smoke. Wind, for instance, generally results in lower smoke concentrations because wind causes smoke to mix with a larger volume of air. Large quantities of pollutants can also be released by wildland fires over a relatively short period of time. Air quality during large fires can become severely hazardous and can remain impaired for several days after the fire is ignited (Lipsett 2008). During the most recent 2020 Bobcat Fire, for example, Los Angeles County and the communities above the foothills of the San Gabriel Mountains experienced weeks of unhealthy or hazardous air quality (County of Los Angeles Public Health, 2020).

Wildland fire mitigation involves many fuels management practices such as prescribed burning, cutting, chipping, and mechanical methods. Prescribed burning, like wildfire, produces chemical and particulate matter that has the potential to exceed CARB standards. But unlike wildfire, prescribed burning can be mitigated through smoke management practices outlined by CARB and the SCAQMD to avoid exceeding air quality standards. Other fuel management practices where vegetation is not burned, but cut, chipped, or mechanically removed, do not exceed air quality standards and are considered a nonsignificant, short-term activity.

### 7.2.6 Economics

The potential impact of wildfire on structure loss is significant. The 1980 Stable Fire destroyed 49 Bradbury homes and approximately $15 million in damage incurred. With the buildup of fuels and the potential for new homes built in the VHFHSZ areas of Bradbury, a wildfire of that proportion would have similar results and a much greater dollar loss. Additionally, repair and rebuilding of infrastructure following a wildfire can be a significantly costly effort for municipalities and utilities.

The local Bradbury and Los Angeles County economy is heavily dependent on the beauty of its natural and cultural resources, with a significant amount of revenue generated by the tourism industry. There is a high potential for a wildland conflagration to temporarily disrupt both the quality of life and economic stability of the City. The potential for economic losses due to litigation resulting from wildfire damage is also a reality. Damage claims against the property owners where the fire originated and/or spread from or through their property, due to untreated wildland areas, represents potential economic loss to both the City and private property owners. Utility companies have also been found responsible for wildfire ignitions and resulting damages, with significant settlements being paid to fire victims and local municipalities. For example, Pacific Gas & Electric (PG&E) settled with Sonoma County and the City of Santa Rosa for over $300 million (combined)—their share of the $1 billion deal the utility made with local governments to settle claims for damages caused by wildfires in 2017 and 2018 (Press Democrat 2020). Other potential economic impacts associated with wildfires includes increased insurance costs for property owners, the potential for dropped policies, and public safety power shutoffs implemented by utility companies to reduce ignition potential. A side effect of public safety power shutoffs is the loss of business revenue due to business closures and the direct loss of business materials or assets that require energy to produce, store, or maintain.

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# 8 Action Plan

This section identifies the goals of the CWPP and identifies recommended action items to be implemented by the City that serve to minimize wildfire impacts to the community. The recommendations and proposed Action Plans within this CWPP are currently being collaborated with the City of Bradbury. Many of the recommendations and proposed Action Plans are to be determined by the City, in collaboration with the cooperators/stakeholders, including the LACoFD and USFS. Future project and actions identified in this section would need to be funded and approved by the City prior to implementation. Implementation shall be determined by available budgets, Grants, and/or available resources.

## 8.1 Goals

The goal of this CWPP is to identify action items that can be implemented by the City that serve to protect lives, property, and natural resources threatened by wildland fire. The City, along with the LACoFD and USFS – Angeles National Forest, recognize the catastrophic impact of wildfire in the community and are committed to reducing hazards and risk through fire protection, fuel hazard reduction, public education, preparedness, and community involvement.

## 8.2 Action Items

The policies and actions outlined in this section are proposed for implementation under this CWPP. Recommendations for each action are provided.

### 8.2.1 Codes and Standards

Table 10 outlines policies and actions to reduce wildfire hazards that are related to codes and standards.

Table 10. Policies and Actions Related to Codes and Standards

| Action Number | Description | Responsible Party |
|---|---|---|
| **Policy 1. Increase the survivability of homes in the City's Very High Fire Hazard Severity Zone Areas through the adoption of fire safe building codes.** | | |
| 1.1 | Monitor changes in Fire, Building, and Residential codes. Modify and adopt codes as needed. | Joint responsibility between the City of Bradbury and LACoFD |
| 1.2 | Encourage structural hardening retrofits for existing structures in the VHFHSZ Areas, consistent with the standards in the most current version of Chapter 7A of the California Building Code or other resources (Section 5.2.2.1). Structural retrofits may include, but are not limited to, the following:<br>• Class A roof system<br>• Ember-resistant vents<br>• Plug all openings to prevent ember intrusion<br>• Multi-paned windows with at least one or both panes tempered<br>• Noncombustible, ignition-resistant-compliant exterior siding and decks<br>• Automatic closing exterior doors<br>• Battery backup for garage door opener (works when power is out) | Joint responsibility between the City of Bradbury and LACoFD |
| **Policy 2. Increase the survivability of homes in the Very High Fire Hazard Severity Zone Areas through the adoption of defensible space standards and landscape guidelines on new, remodeled, and existing homes.** | | |
| 2.1 | Require additions or remodels 50% or greater than the existing residential structure's square footage in the VHFHSZ Areas to comply with the Fire Department Fuel Modification Zone and Defensible requirements and Fire Hazard Reduction Programs. | Joint responsibility between the City of Bradbury and LACoFD |
| 2.2 | Routinely review and update, as necessary, the County's Fuel Modification Zone and Defensible Space Landscape Requirements document (for defensible space), including the Plant Selection Guidelines and Plant Right document. | LACoFD |
| **Policy 3. Create a defensible community by increasing the number of homes that comply with the LACoFD's Defensible Space Requirements.** | | |
| 3.1 | Complete a survey of all homes in the City's VHFHSZ Areas to determine the percentage of homes that comply with the LACoFD Defensible Space and Fuel Modification Requirements. | LACoFD |

Table 10. Policies and Actions Related to Codes and Standards

| Action Number | Description | Responsible Party |
|---|---|---|
| 3.2 | Pursuant to the California Fire Code, Bradbury Municipal Code Title IV, Chapter 3, Section 4.03.010, and Title 32 of the Los Angeles County Code of Ordinances, examine current LACoFD enforcement capability and recommend policy, procedures, and funding sources to enhance the ability of the department to conduct initial inspections, follow-up enforcement of defensible space violations, and address issues where defensible space requirements span multiple parcels. | LACoFD |
| 3.3 | Continue vacant lot brush management and defensible enforcement on undeveloped and developed properties within the VHFHSZ Areas. | Los Angeles County Agriculture Weights and Measures (ACWM) Weed Abatement Division |
| 3.4 | Evaluate ways to allow the Fire Department to work with insurance companies and private property owners in reducing fire hazard on individual properties and within neighborhoods. | Joint responsibility between the City of Bradbury and LACoFD |

## 8.2.2 Funding

Table 11 outlines policies and actions to reduce wildfire hazards that are related to funding.

Table 11. Policies and Actions Related to Funding

| Action Number | Description | Responsible Party |
|---|---|---|
| Policy 4. Develop funding sources and incentive programs for residents of the Very High Fire Hazard Severity Zone Areas to encourage reduction of wildfire hazards and risks. | | |
| 4.1 | Research grant funding opportunities for wildland fire projects and apply for appropriate grants or cost-share programs. Wildland fire projects may include those associated with vegetation management or treatment, structural retrofits (structural hardening), planning, and community education or engagement. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 4.2 | Research grant funding to plan and develop a City Hazard Mitigation Plan to incorporate into the City's General Plan. | City of Bradbury |

**Table 11. Policies and Actions Related to Funding**

| Action Number | Description | Responsible Party |
|---|---|---|
| 4.3 | Develop additional funding sources to implement vegetation and fire management projects within the City. Funding sources could include private property owner funding, City general fund, cooperative funds, etc. | City of Bradbury and LACoFD |
| 4.4 | Secure grant funding to support the City of Bradbury residents and emergency responders (firefighter, first responders, law enforcement) to ensure the community is prepared to protect against, respond to, and recover from wildfire disasters and emergencies. This includes City radios, emergency supplies, wildfire cameras, a fuel cell for the City's generator, and other emergency related items that will benefit the City in the event of a wildfire. | City of Bradbury |
| 4.5 | Continue to develop and evaluate the permit fee schedule for misc. building and zoning report inspections, plan review, Pre-application Review Team, and Forestry Fuel Modification Plan Check submittals reviewed for VHFHSZ Area requirements (evaluated every three years). | LACoFD |
| 4.6 | As appropriate, evaluate the opportunity to incorporate projects and actions identified in this CWPP into the City's General Plan update. | City of Bradbury |

### 8.2.3 Fire Rehabilitation

Table 12 outlines policies and actions to reduce wildfire hazards that are related to fire rehabilitation.

**Table 12. Policies and Actions Related to Fire Rehabilitation**

| Action Number | Description | Responsible Party |
|---|---|---|
| **Policy 5. Post-fire rehabilitation guidelines should be established for the City.** | | |
| 5.1 | Develop appropriate post-fire rehabilitation guidelines for property owners that address post-fire effects of flooding and soil erosion. | Joint responsibility between the City of Bradbury and LACoFD |
| 5.2 | Develop a public education pamphlet on post-fire rehabilitation guidelines. | Joint responsibility between the City of Bradbury and LACoFD |

**Table 12. Policies and Actions Related to Fire Rehabilitation**

| Action Number | Description | Responsible Party |
|---|---|---|
| 5.3 | Ensure that post-fire rehabilitation guidelines are developed in cooperation with appropriate federal, state, and local agencies including Incident Command, if applicable, and Los Angeles County Flood Control. | Joint responsibility between the City of Bradbury and LACoFD |

## 8.2.4 Evacuation

Table 13 outlines policies and actions to reduce wildfire hazards that are related to evacuation.

**Table 13. Policies and Actions Related to Evacuation**

| Action Number | Description | Responsible Party |
|---|---|---|
| **Policy 6. Increase evacuation safety for residents and the general public in the Very High Fire Hazard Severity Areas.** | | |
| 6.1 | Continue educational campaign to make residents, businesses, schools, and the public aware of evacuation planning and hazards. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 6.2 | Promote an educational campaign with property owners' associations and neighborhoods on the creation of a Red Flag Warning Plan. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 6.3 | Continue to ensure that vegetation road clearance is implemented along primary response routes in the VHFHSZ Areas. | LACoFD |
| 6.4 | Investigate methods for publicly identifying evacuation routes in the VHFHSZ area roadways. | Joint responsibility between the City of Bradbury and LACoFD |
| 6.5 | Develop training bulletins for LACoSD employees identifying recommended evacuation routes and proposed traffic control points. LACoSD staff in cooperation with LACoFD staff would accomplish this action. | Joint responsibility between the City of Bradbury, LACoFD, and LACoSD |
| 6.6 | Develop a simple, straightforward directive for the use of LACoSD Watch Commanders and Field Supervisors identifying the duties and responsibilities of officers in the event of a major fire. This would be accomplished by LACoSD staff in cooperation with LACoFD staff. | Joint responsibility between the City of Bradbury, LACoFD, and LACoSD |

Table 13. Policies and Actions Related to Evacuation

| Action Number | Description | Responsible Party |
|---|---|---|
| 6.7 | Identify specific roads that do not meet LACoFD Access Standards and develop feasible mitigations and/or appropriate tools that can be used to reduce fire risk in these areas. Tools may include, but are not limited to, expanding roadside vegetation clearance requirements, enacting on-street parking restrictions, installing and maintaining warning and notification signage, enacting parking or traffic flow restrictions during Red Flag Warnings, identifying turnouts for vehicle passage, and establishing one-way traffic flows to facilitate evacuation traffic. | LACoFD |
| 6.8 | Conduct a detailed evacuation study for the City's VHFHSZ Areas. The study should address the impact of increased residential density on roadway capacities and evacuation capabilities. | Joint responsibility between the City of Bradbury and LACoFD |
| 6.9 | Routinely update the LACoFD's "Ready! Set! Go!" brochure to reflect changing conditions, policies, and best practices. | LACoFD |

## 8.2.5 Fire Protection

Table 14 outlines policies and actions to reduce wildfire hazards that are related to fire protection.

Table 14. Policies and Actions Related to Fire Protection

| Action Number | Description | Responsible Party |
|---|---|---|
| Policy 7. Reduce fire engine response times in all Very High Fire Hazard Severity Zone Areas to 8 minutes or Less. | | |
| 7.1 | Evaluate LACoFD response times for the VHFHSZ Areas. | LACoFD |
| 7.2 | Develop appropriate actions (development standards, vegetation management, signing, etc.) from evaluation of LACoFD response times. | LACoFD |
| Policy 8. Provide the highest level of fire protection services to the firefighters and residents within the Very High Fire Hazard Severity Zone Areas. | | |
| 8.1 | Conduct department training classes focused on Wildland-Urban Interface (WUI) Operations for all operations staff levels. | LACoFD |

Table 14. Policies and Actions Related to Fire Protection

| Action Number | Description | Responsible Party |
|---|---|---|
| 8.2 | Continue to implement the LACoFD annual defensible space inspections within the VHFHSZ to ensure annual "Fuel Modification and VHFHSZ Defensible Space Requirements" are met to satisfy the California Fire Code, Chapter 49, to slow the spread of approaching wildfire and increase firefighter safety (where feasible along the foothills). | LACoFD |
| 8.3 | Increase the amount of interagency wildland fire training to gain expertise in wildland firefighting strategies, tactics, communications, and equipment. | Joint responsibility between the LACoFD, USFS, and other agencies |
| 8.4 | Train firefighters to properly turn off water to compromised structures that have free-flowing water in order to maintain water system supply and pressure (for future proposed project related infrastructure). | Joint responsibility between the City of Bradbury, LACoFD, and Water Resources |
| 8.5 | Maintain and regularly update the existing wildland fire pre-attack, firefighting safety zones, and escape routes mapping and preplan VHFHSZ Areas using Geographic Information Systems (GIS). | LACoFD |
| 8.6 | Purchase a Remote Automatic Weather Station (RAWS) to monitor fire weather and get more accurate fire weather forecasts for the community. The closest RAWS is approximately 2.5 miles south of Bradbury, where terrain is different. The City may purchase a new RAWS and pay for annual maintenance to supplement the Fire Department's RAWS program. | City of Bradbury |
| 8.7 | Work with neighboring jurisdictions on wildland fire mitigation projects and operational concerns. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 8.8 | Develop appropriate improvements needed to make identified safety zones useable for fire suppression operations. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 8.9 | Improve LACoFD's radio communications via infrastructure upgrades or completing projects that enhance coverage throughout the City (as needed). | Joint responsibility between the City of Bradbury and LACoFD |
| 8.10 | Create, fund, and implement a communications system equipment replacement plan (as needed). | LACoFD |
| 8.11 | Research available funding and grants to underground the existing utility poles throughout the City and/or encase utility wires, as a way to mitigate wildfire. | City of Bradbury |

### 8.2.6 Vegetation/Fuels Management

Table 15 outlines policies and actions to reduce wildfire hazards that are related to vegetation/fuels management.

**Table 15. Policies and Actions Related to Vegetation/Fuels Management**

| Action Number | Description | Responsible Party |
|---|---|---|
| **Policy 9. Support collaborative fuels management projects between the City and residents of the Very High Fire Hazard Severity Zone Areas to encourage fire hazard reduction and protection of natural resources. This includes compliance with LACoFD Defensible Space and Fuel Modification Requirements, as well as additional vegetation management projects requested by property owners.** | | |
| 9.1 | Develop affordable incentive programs to allow property owners to maintain defensible space around homes. | City of Bradbury |
| 9.2 | Work with neighboring jurisdictions on wildfire mitigation projects such as defensible space chipping, vegetation road clearance, and fuels management projects. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 9.3 | Continue to develop and implement the LACoFD's Fuel Modification and Defensible Space Requirements through the Fire Code (State and County). This will ensure that fuels management projects on private lands decrease fire hazard and balance natural resource values. | Joint responsibility between the LACoFD and the State of California |

### 8.2.7 Public Education

Table 16 outlines policies and actions to reduce wildfire hazards that are related to public education.

**Table 16. Policies and Actions Related to Public Education**

| Action Number | Description | Responsible Party |
|---|---|---|
| **Policy 10. Increase the community's knowledge and awareness of wildland fire and develop training and education programs to prepare, motivate, and educate the community.** | | |
| 10.1 | Continue to work with the City Staff, council members, Public Safety Committee, and community members living in the VHFHSZ Areas to develop evacuation preplans and preparedness for wildfire. | Joint responsibility between the City of Bradbury and LACoFD |
| 10.2 | Develop a City of Bradbury Fire Safe Council to update the community on public education projects to increase wildland fire public awareness and preparedness. | Joint responsibility between the City of Bradbury and LACoFD |
| 10.3 | Work with communities, neighborhoods, and individuals to get the message across that reducing the wildland fire threat requires them to take personal responsibility for preparedness, evacuation, defensible space, driveways, and roadways, and community cooperation. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 10.4 | To reduce impacts to water availability and pressure during wildfire events, work with property owners to educate them not to use sprinkler systems to water down roofs during wildfires. | Joint responsibility between the City of Bradbury and LACoFD |
| 10.5 | Regularly update the County's Plant Selection Guidelines by Zone and Fire-Safe Landscaping brochures to educate the public on fire safe landscaping, power line hazards, and wildland fire safety. The brochure should include fire safe landscaping, native landscaping, water conservation, soil stabilization, and non-invasive plant species concerns. | LACoFD |
| 10.6 | Develop a bilingual public information strategy to educate Bradbury residents on wildland fire that is also culturally relevant. Topics to include defensible space, fire landscaping, road access, Red Flag Warning, wildfire ignition risks, resource concerns, and evacuation. Incorporate video and other visual engagement strategies where feasible. | Joint responsibility between the City of Bradbury and LACoFD |

Table 16. Policies and Actions Related to Public Education

| Action Number | Description | Responsible Party |
|---|---|---|
| 10.7 | Encourage residents to sign up and create a City of Bradbury Community Emergency Response Team (CERT) program through the LACoFD, so residents can learn about hazards that may impact their area. Once a CERT Program is created, work on the development of a wildfire module for the CERT Program that is focused on wildland fire.[18] | Joint responsibility between the City of Bradbury and LACoFD |
| 10.8 | Develop educational material for the public to eradicate and reduce the potential for the expansion of invasive species that has the potential to occur from defensible space projects. | Joint responsibility between the City of Bradbury and LACoFD |
| 10.9 | Routinely update the County's "Ready! Set! Go!" Brochure to reflect changing conditions, policies, and best practices and make available in both English and Spanish. | LACoFD |
| 10.10 | Conduct outreach with the real estate community to work though upcoming Assembly Bill 38 requirements associated with wildfire-related real estate disclosures and to coordinate delivery of the Defensible Space Requirements documents to home buyers in the VHFHSZ Areas. | Joint responsibility between the City of Bradbury and LACoFD |
| 10.11 | Coordinate with the South Coast Air Quality Management District (SCAQMD) to disseminate information related to air quality and wildfire smoke impacts. | Joint responsibility between the City of Bradbury, LACoFD, and SCAQMD |
| 10.12 | Continue to work with other agencies through the Connect-CTY platform on the City of Bradbury's webpage to disseminate pertinent information regarding wildfire emergencies.[19] | City of Bradbury |
| **Policy 11. Work with all City departments and staff to increase their knowledge, awareness, prevention, and preparedness for wildland fire.** | | |
| 11.1 | Develop a communication system between the City of Bradbury Staff and the Public Safety Committee; this would include coordinating a training course on the use of HAM radios (or other communication devises used in an emergency event) with the Los Angeles County Office of Emergency Preparedness. This will allow for the City Staff and the Public Safety Committee to effectively communicate with one another and develop a strategic communication action plan for the City. | City of Bradbury |
| 11.2 | Continue to work with the Planning Commission to ensure a clear understanding of landscape design, defensible space requirements, and vegetation management issues related to visual impacts. | City of Bradbury |

[18] https://fire.lacounty.gov/community-emergency-response-team/
[19] https://www.cityofbradbury.org/alert_detail.php

Table 16. Policies and Actions Related to Public Education

| Action Number | Description | Responsible Party |
|---|---|---|
| 11.2 | Develop annual City staff training on wildland fire safety to train City staff working in the VHFHSZ Areas. Training should include the development of a Red Flag Warning program, process for fire complaints, fire reporting procedures, fire prevention, and defensible space requirements. | Joint responsibility between the City of Bradbury and LACoFD |
| 11.3 | Coordinate with City Departments during planning, vegetation management, and other CWPP implementation tasks to streamline efforts and maximize the use of available City resources. | City of Bradbury |
| Policy 12. Work cooperatively with federal, state, and local jurisdictions to provide the highest level of fire protection, prevention, and mitigation projects and programs in the City's Wildland-Urban Interface area. | | |
| 12.1 | Establish communication with the Los Angeles County Office of Emergency Preparedness – Area D, to establish a mutual aid agreement to augment City Staff with nearby City's and/or municipalities during a wildfire emergency or another disaster, to assist City of Bradbury Staff with daily disaster activities. | City of Bradbury |
| 12.2 | Continue to work with cooperating agencies on suppression, training, prevention, evacuation, and public education in the VHFHSZ Areas that benefit the entire community. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 12.3 | Support collaborative vegetation management projects between the City and surrounding jurisdictions that reduce fire hazard and protect natural resources. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 12.4 | Ensure that the City and surrounding jurisdictions and agencies work cooperatively to address fire hazard and environmental impacts. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 12.5 | Coordinate vegetation management actions where needed with Los Angeles County Flood Control. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |
| 12.6 | Coordinate with stakeholders (Los Angeles County Fire Department, Monrovia Fire Department, Arcadia Fire Department, U.S. Forest Service, Southern California Edison, CAL FIRE, Area D, and others) to facilitate information and data sharing, resource sharing, coordination of management activities, facilitating property access, grant funding, and cost-sharing opportunities. | Joint responsibility between the City of Bradbury, LACoFD, and USFS |

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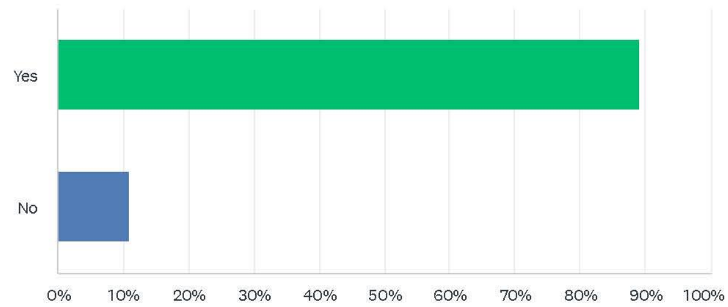
# Appendix A

## City of Bradbury Survey Questionnaire and Results

## Q1 Are you aware that a City of Bradbury Community Wildfire Protection Plan (CWPP) is being created?

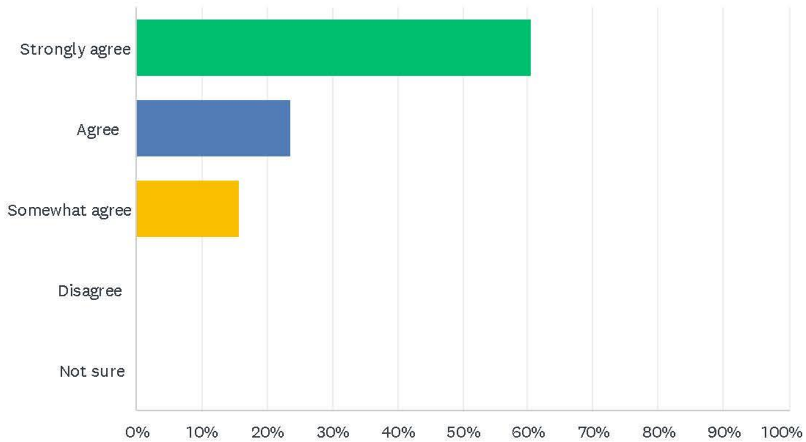
Answered: 37 Skipped: 1




| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| Yes | 89.19% | 33 |
| No | 10.81% | 4 |
| TOTAL | | 37 |

## Q2 Rate your reaction to the following statement: There is a wildfire threat to the City of Bradbury?

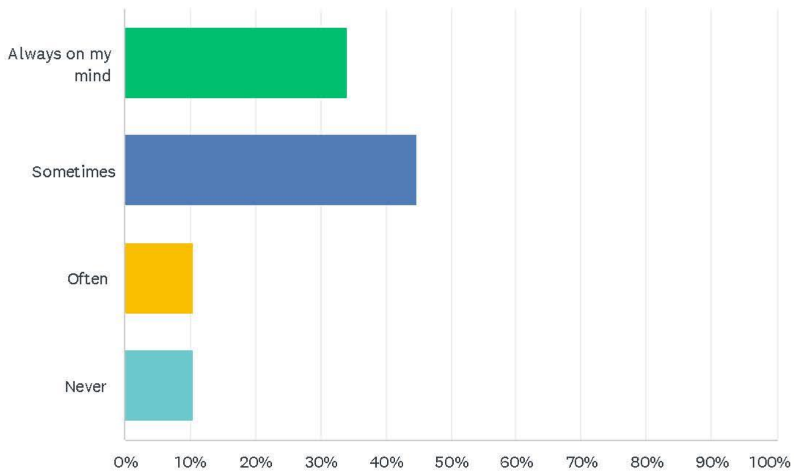
Answered: 38 Skipped: 0




| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| Strongly agree | 60.53% | 23 |
| Agree | 23.68% | 9 |
| Somewhat agree | 15.79% | 6 |
| Disagree | 0.00% | 0 |
| Not sure | 0.00% | 0 |
| TOTAL | | 38 |

## Q3 Rate your reaction to the following statement: I worry about wildfire:

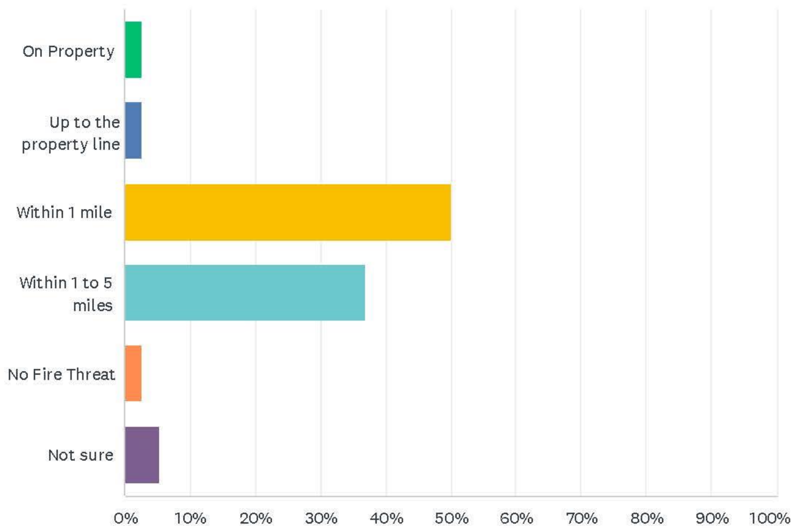
Answered: 38 Skipped: 0




| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| Always on my mind | 34.21% | 13 |
| Sometimes | 44.74% | 17 |
| Often | 10.53% | 4 |
| Never | 10.53% | 4 |
| TOTAL | | 38 |

# Q4 How close has wildfire has come to your residence during the time you've lived in your current location?

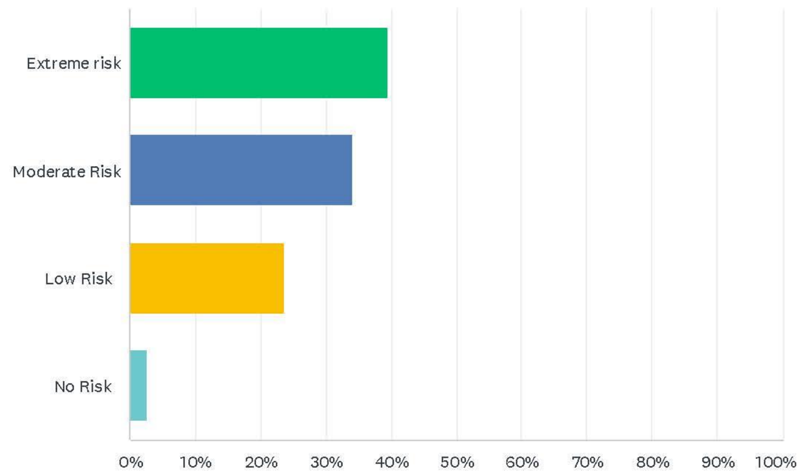
Answered: 38 Skipped: 0




| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| On Property | 2.63% | 1 |
| Up to the property line | 2.63% | 1 |
| Within 1 mile | 50.00% | 19 |
| Within 1 to 5 miles | 36.84% | 14 |
| No Fire Threat | 2.63% | 1 |
| Not sure | 5.26% | 2 |
| TOTAL | | 38 |

## Q5 What level of risk do you believe wildfires pose to your property?

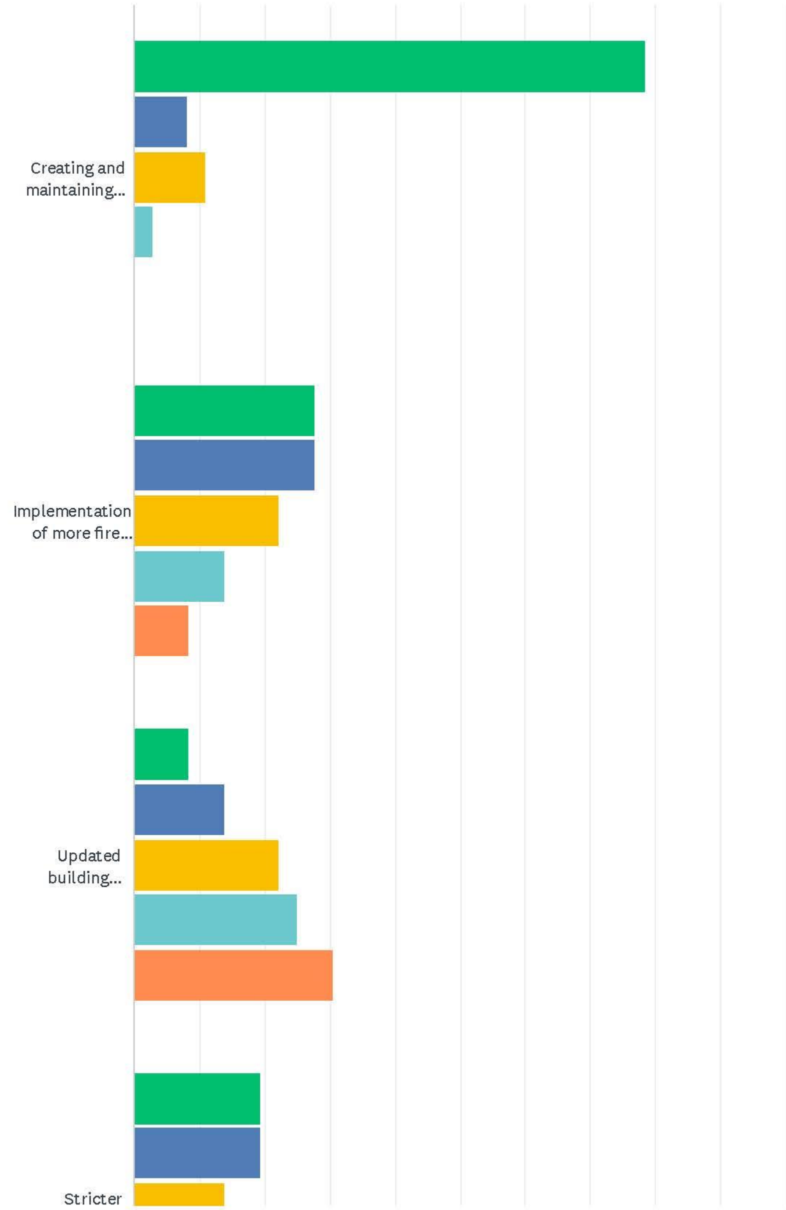
Answered: 38 Skipped: 0



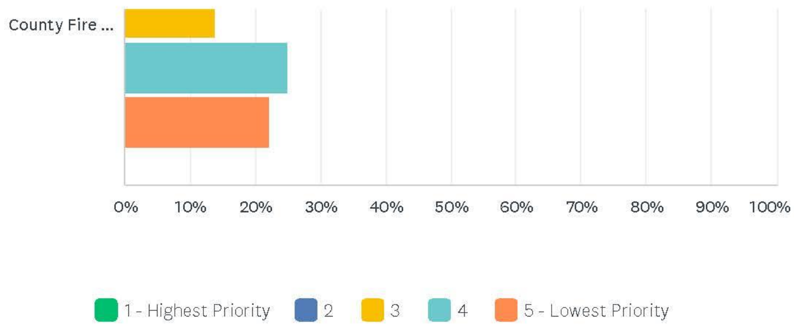

| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| Extreme risk | 39.47% | 15 |
| Moderate Risk | 34.21% | 13 |
| Low Risk | 23.68% | 9 |
| No Risk | 2.63% | 1 |
| TOTAL | | 38 |

## Q6 What do you think would be the best way to decrease wildfire hazards on your property (Rank answers with 1 for the highest priority and 5 for lowest priority)?

Answered: 38    Skipped: 0



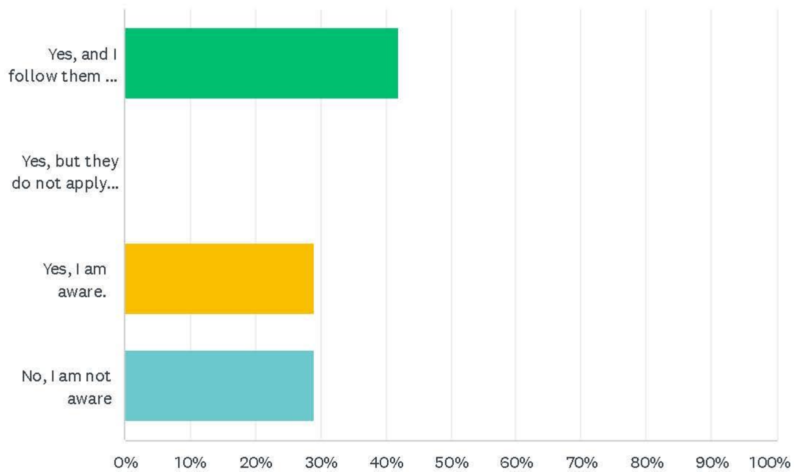
City of Bradbury Community Wildfire Protection Plan Survey




| | 1 - HIGHEST PRIORITY | 2 | 3 | 4 | 5 - LOWEST PRIORITY | TOTAL | WEIGHTED AVERAGE |
|---|---|---|---|---|---|---|---|
| Creating and maintaining fuel modification zones by managing vegetation and fuels (including grasses, shrubs, chaparral, trees, etc.) | 78.38% 29 | 8.11% 3 | 10.81% 4 | 2.70% 1 | 0.00% 0 | 37 | 1.38 |
| Implementation of more fire resistive landscape | 27.78% 10 | 27.78% 10 | 22.22% 8 | 13.89% 5 | 8.33% 3 | 36 | 2.47 |
| Updated building construction of older homes | 8.33% 3 | 13.89% 5 | 22.22% 8 | 25.00% 9 | 30.56% 11 | 36 | 3.56 |
| Stricter County Fire and City rules and regulations | 19.44% 7 | 19.44% 7 | 13.89% 5 | 25.00% 9 | 22.22% 8 | 36 | 3.11 |

## Q7 Are you aware that there are City guidelines available for landscaping to reduce wildfire risk?

Answered: 38    Skipped: 0

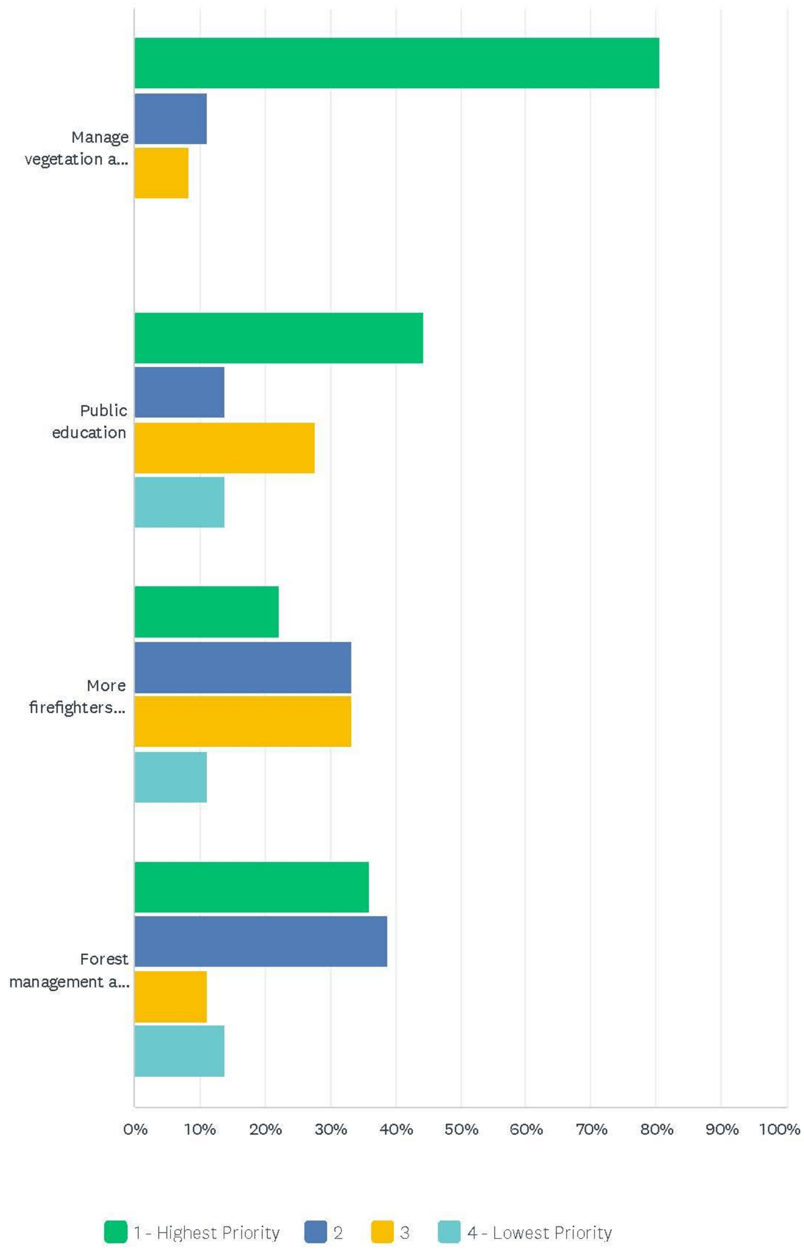



| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| Yes, and I follow them on my property. | 42.11% | 16 |
| Yes, but they do not apply to where I live. | 0.00% | 0 |
| Yes, I am aware. | 28.95% | 11 |
| No, I am not aware | 28.95% | 11 |
| TOTAL | | 38 |

## Q8 What do you believe would be the best way to decrease wildfire hazards within the Bradbury community? (Rank answers with 1 for the highest priority and 4 for lowest priority)

Answered: 37 Skipped: 1

City of Bradbury Community Wildfire Protection Plan Survey

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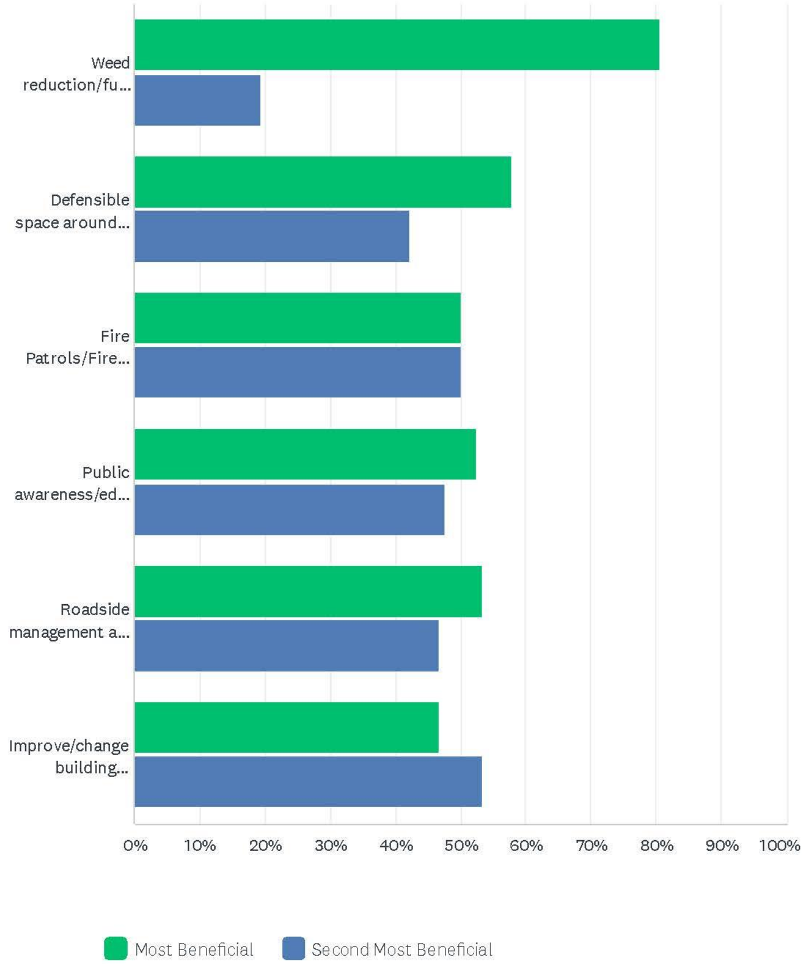
City of Bradbury Community Wildfire Protection Plan Survey

| | 1 - HIGHEST PRIORITY | 2 | 3 | 4 - LOWEST PRIORITY | TOTAL | WEIGHTED AVERAGE |
|---|---|---|---|---|---|---|
| Manage vegetation and fuels (i.e. grasses, shrubs, chaparral, trees, etc.) by mowing or thinning or controlled burning | 80.56%<br>29 | 11.11%<br>4 | 8.33%<br>3 | 0.00%<br>0 | 36 | 1.28 |
| Public education | 44.44%<br>16 | 13.89%<br>5 | 27.78%<br>10 | 13.89%<br>5 | 36 | 2.11 |
| More firefighters/fire fighter equipment and supplies | 22.22%<br>8 | 33.33%<br>12 | 33.33%<br>12 | 11.11%<br>4 | 36 | 2.33 |
| Forest management and increase in governmental funding | 36.11%<br>13 | 38.89%<br>14 | 11.11%<br>4 | 13.89%<br>5 | 36 | 2.03 |

## Q9 What do you feel are the top 2 most beneficial methods to reducing wildfire risk in your community?

Answered: 37 Skipped: 1

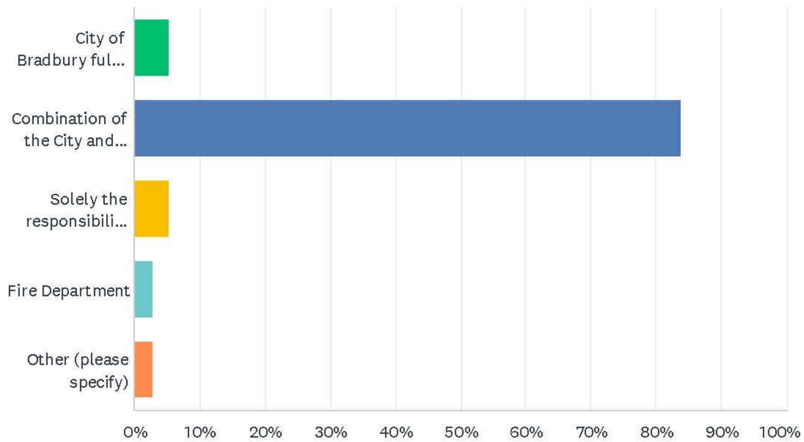


City of Bradbury Community Wildfire Protection Plan Survey

| | MOST BENEFICIAL | SECOND MOST BENEFICIAL | TOTAL | WEIGHTED AVERAGE |
|---|---|---|---|---|
| Weed reduction/fuel load reduction/brush management/dead tree removal | 80.65%<br>25 | 19.35%<br>6 | 31 | 1.19 |
| Defensible space around homes/in homes including installation of fire resistive and native/drought tolerant plantings | 57.69%<br>15 | 42.31%<br>11 | 26 | 1.42 |
| Fire Patrols/Fire Department Training/Effective Enforcement/Improved Fire Department Resources/Improved response times | 50.00%<br>11 | 50.00%<br>11 | 22 | 1.50 |
| Public awareness/education of wildfire risk | 52.38%<br>11 | 47.62%<br>10 | 21 | 1.48 |
| Roadside management and improved roadway accessibility | 53.33%<br>8 | 46.67%<br>7 | 15 | 1.47 |
| Improve/change building practices/maintenance/fire resistant homes | 46.67%<br>7 | 53.33%<br>8 | 15 | 1.53 |

# Q10 Who should be responsible for reducing the wildfire risk within the City of Bradbury?

Answered: 37 Skipped: 1



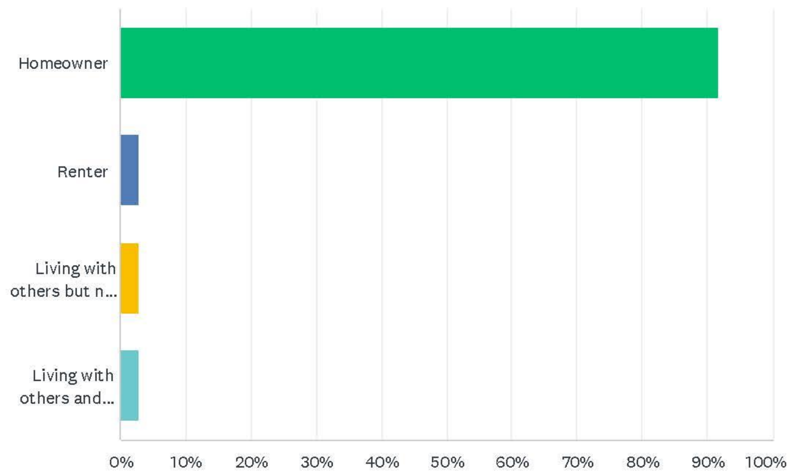

| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| City of Bradbury fully responsible | 5.41% | 2 |
| Combination of the City and individual property owners | 83.78% | 31 |
| Solely the responsibility of the individual property owner | 5.41% | 2 |
| Fire Department | 2.70% | 1 |
| Other (please specify) | 2.70% | 1 |
| TOTAL | | 37 |

## Q11 What actions would you like to have included in the CWPP and taken to reduce the risk of wildfire?

Answered: 22 Skipped: 16

## Q12 Which of the following best describes your current housing situation?

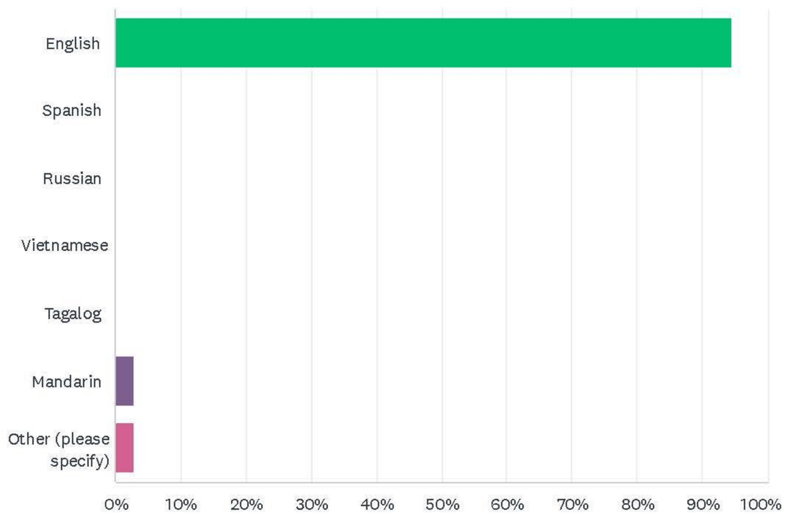
Answered: 36 Skipped: 2




| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| Homeowner | 91.67% | 33 |
| Renter | 2.78% | 1 |
| Living with others but not paying rent or mortgage | 2.78% | 1 |
| Living with others and assisting with paying rent or mortgage | 2.78% | 1 |
| TOTAL | | 36 |

# Q13 What is the primary language spoken in your home?

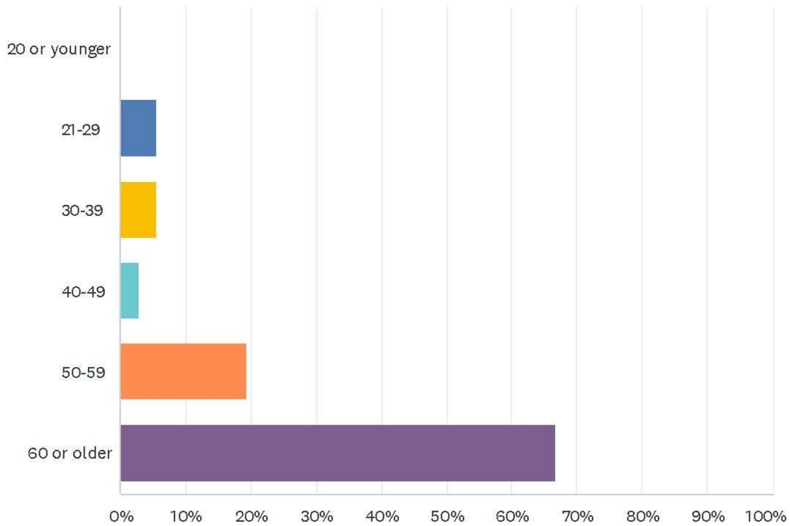
Answered: 36 Skipped: 2




| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| English | 94.44% | 34 |
| Spanish | 0.00% | 0 |
| Russian | 0.00% | 0 |
| Vietnamese | 0.00% | 0 |
| Tagalog | 0.00% | 0 |
| Mandarin | 2.78% | 1 |
| Other (please specify) | 2.78% | 1 |
| TOTAL | | 36 |

# Q14 Which category below includes your age?

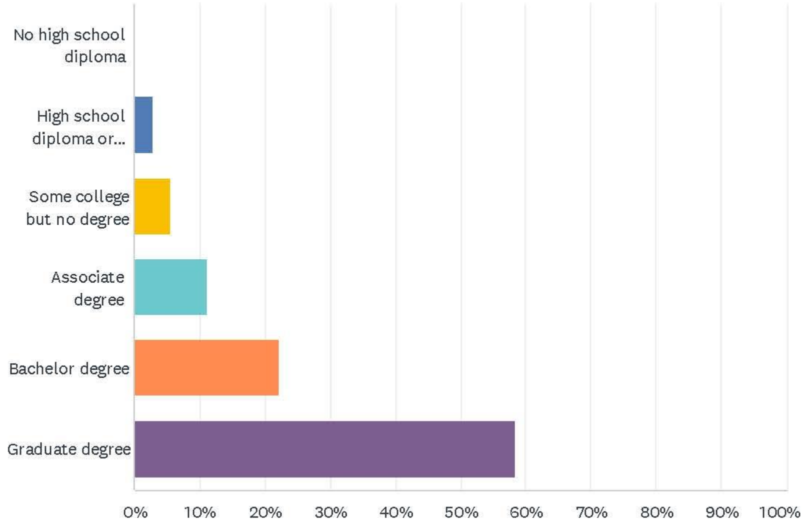
Answered: 36  Skipped: 2




| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| 20 or younger | 0.00% | 0 |
| 21-29 | 5.56% | 2 |
| 30-39 | 5.56% | 2 |
| 40-49 | 2.78% | 1 |
| 50-59 | 19.44% | 7 |
| 60 or older | 66.67% | 24 |
| TOTAL | | 36 |

# Q15 What is the highest level of education you have attained?

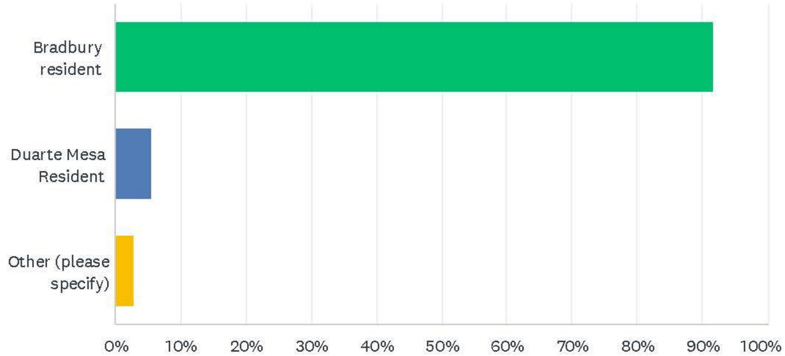
Answered: 36 Skipped: 2




| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| No high school diploma | 0.00% | 0 |
| High school diploma or equivalent (e.g., GED) | 2.78% | 1 |
| Some college but no degree | 5.56% | 2 |
| Associate degree | 11.11% | 4 |
| Bachelor degree | 22.22% | 8 |
| Graduate degree | 58.33% | 21 |
| TOTAL | | 36 |

## Q16 Which best describes you?

Answered: 36 Skipped: 2




| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| Bradbury resident | 91.67% | 33 |
| Duarte Mesa Resident | 5.56% | 2 |
| Other (please specify) | 2.78% | 1 |
| TOTAL | | 36 |

# Appendix B

## Los Angeles County Fire Department's Acceptable Plant List

# Los Angeles County Fire Department's: Acceptable Plant List by FMZ

| Botanical Name | Common Name | Zone 1 | Minimum Distance from Structure[2] |
|---|---|---|---|
| | | | |
| **Ground Cover** | | | |
| | | | |
| *Acacia redolens 'Desert Carpet'/'Low Boy'* | Desert Carpet Acacia | B | 30 |
| *Achillea tomentosa* | Woolly Yarrow | A | |
| *Ajuga reptans* | Carpet Bugle | A | |
| *Arctostaphylos (Prostrate Varieties)* | Manzanita | B | |
| *Artemisia californica (Cultivars)* | Sagebrush - Prostrate Forms | B | 30 |
| *Artemesia 'Powis Castle'* | NCN | B | |
| *Baccharis pilularis 'Pigeon Point'/'Twin Peaks'* | Prostrate Coyote Brush | B | |
| *Campanula poscharkyana* | Serbian Bellflower | A | |
| *Ceanothus gloriosus* | Point Reyes Ceanothus | B | |
| *Cerastium tomentosum* | Snow-In-Summer | A | |
| *Chamaemelum nobile* | Chamomile | A | |
| *Cistus salviifolius 'Prostratus'* | Sageleaf Rockrose | B | |
| *Coprosma kirkii* | Mirror Plant | B | |
| *Coreopsis auriculata 'Nana'* | Tickseed | A | |
| *Cotoneaster (Prostrate Varieties)* | Cotoneaster | B | |
| *Dalea greggii* | Trailing Indigo Bush | B | |
| *Delosperma alba* | White Training Ice Plant | A | |
| *Dichondra micrantha* | Dichondra | A | |
| *Drosanthemum floribundum* | Rosea Ice Plant | A | |
| *Duchesnea indica* | Indian Mock Strawberry | A | |
| *Dymondia margaretae* | NCN | A | |
| *Erigeron glaucus* | Seaside Daisy | A | |
| *E. karvinskianus* | Santa Barbara Daisy | B | |
| *Euonymus fortunei 'Colorata'* | Purple-Leaf Winter Creeper | B | |
| *Festuca cinerea(ovina'Glauca')* | Blue Fescue | A | |
| *F. rubra* | Red Fescue | A | |
| *Fragaria chiloensis* | Wild Strawberrry | A | |
| *Gazania Hybrids* | Trailing Gazania | A | |
| *Geranium incanum/sanguineum* | Cranesbill | A | |
| *Glechoma hederacea* | Ground Ivy | A | |
| *Helianthemum nummularium* | Sunrose | A | |
| *Herniaria glabra* | Green Carpet | A | |
| *Heuchera species and Cultivars* | Coral Bells | A | |
| *Hypericum calycinum/coris* | Aaron's Beard | B | |
| *Iberis sempervirens* | Evergreen Candytuft | A | |
| *Iva hayesiana* | Poverty Weed | B | 30 |

| | | | |
|---|---|---|---|
| *Juniperus (Prostrate species/cultivars)* | | B | |
| *Laurentia fluviatilis* | Blue Star Creeper | A | |
| *Lysimachia nummularia* | Moneywort | A | |
| *Liriope spicata* | Creeping Lily Turf | A | |
| *Liriope muscari* | Lily Turf | A | |
| *Mahonia repens* | Creeping Mahonia | B | |
| *Myoporum 'Pacificum' & 'Putah Creek'* | Pacific Myoporum | B | |
| *M. parvifolium* | NCN | A | |
| *Oenothera berlandieri* | Mexican Evening Primrose | B | |
| *O. stubbei* | Baja Evening Primrose | A | |
| *Ophiopogon japonicus* | Mondo Grass | A | |
| *Pachysandra terminalis* | Japanese Spurge | A | |
| *Pelargonium peltatum/tomentosum* | Ivy Geranium | A | |
| *Persicaria capitata* | Pink Clover | A | |
| *Phlox subulata* | Moss Pink | A | 10 |
| *Phyla nodiflora (Lippia repens)* | Lippia | A | |
| *Potentilla tabernaemontanii* | Spring Cinquefoil | A | |
| *Ribes viburnifolium* | Catalina Perfume | B | |
| *Rosmarinus officinalis (Prostrate Varieties)* | Prostrate Rosemary | B | 30 |
| *Scaevola 'Mauve Clusters'* | NCN | A | |
| *Salvia sonomensis* | Creeping Sage | B | |
| *Sedum species* | Stonecrops | A | |
| *Senecio mandraliscae/serpens* | Kleinia/Blue Chalksticks | A | |
| *Soleirolia soleirolii* | Baby's Tears | A | |
| *Teucrium cossonii majoricum* | Germander | A | |
| *T. X lucidrys 'Prostratum'* | Prostrate Germander | A | |
| *Thymus species* | Mother of Thyme | A | |
| *Trachelospermum jasminoides* | Star Jasmine | A | |
| *Trifolium fragiferum* | White Clover | A | |
| *Verbena species (Prostrate Varities)* | Garden Verbena | A | |
| *Vinca minor* | Dwarf Periwinkle | A | |
| *Viola odorata* | Sweet Violet | A | |
| *Wedelia trilobata* | Yellow Dot | B | |
| *Zoysia tenuifolia* | Korean Grass | A | |
| | | | |
| **Miscellaneous Perennials, Grasses, Ferns etc.** | | | |
| | | | |
| *Acorous gramineous and Cultivars* | Sweet Flag | A | |
| *Agapanthus africanus* | Lily of the Nile | A | |
| *Alstroemeria cooperi* | Peruvian Lily | A | |
| *Armeria species* | Thrifts | A | |
| *Bamboos* | Bamboo | B | 30 |
| *Bergenia cordifolia* | Heart Leaf Bergenia | A | |
| *Cycas species* | Cycads | A | |
| *Cyrtomium falcatum* | Holly Fern | A | |

| | | | |
|---|---|---|---|
| *Davalia tricomanoides* | Rabbits Foot Fern | A | |
| *Epilobium canum* | California Fuchia | B | |
| *Helictotrichon sempervirens* | Blue Oat Grass | A | 15 |
| *Hemerocallis hybrids* | Daylily | A | |
| *Iris douglassiana* | Coastal Iris | A | |
| *Iris germanica* | Bearded Iris | A | |
| *Kalanchoe species* | Kalanchoe | A | |
| *Leymus condensatus 'Canyon Prince'* | Canyon Prince Wild Rye | B | |
| *Lobelia laxiflora* | | A | 10 |
| *Pelargonium species* | Geranium | A | |
| *Penstemon species* | Beard Tongue | A | |
| *Plumeria* | Plumeria | A | |
| *Phlebodium aureum* | Rabbits Foot Fern | A | |
| *Tulbaghia violacea* | Society Garlic | A | |
| *Zephyranthes candida* | Zephyr Lily | A | |
| | | | |
| **Shrubs** | | | |
| | | | |
| *Abelia grandiflora (Prostrata)* | Glossy Abelia | A | 10 |
| *Abutilon hybridum* | Flowering Maple | A | 10 |
| *Acanthus mollis* | Bear's Breech | A | |
| *Agave species* | Agave | A | |
| *Aloe species* | Aloe | A | |
| *Alyogyne huegelii* | Blue Hibiscus | A | 10 |
| *Arbutus unedo (Dwarf Cultivars)* | Dwarf Strawberry Tree | A | 10 |
| *Arctostaphylos species* | Manzanita | B | |
| *Aucuba japonica* | Japanese Aucuba | A | |
| *Baccharis species* | Various | B | |
| *Berberis thunbergii* | Japanese Barberry | B | |
| *B. thunbergii ' prostrate cultivars'* | | A | 10 |
| *Bougainvillea sp.* | Bougainvillea | B | |
| *Buddleja davidii* | Butterfly Bush | B | |
| *Buxus microphylla japonica* | Japanese Boxwood | A | 10 |
| *Caesalpinia (Shrub Forms)* | Bird of Paradise Bush | A | 10 |
| *Camellia species* | Camellia | A | 10 |
| *Calliandra californica/eriophylla* | Baja Fairy Duster | B | |
| *Callistemon citrinus* | Lemon Bottlebrush | B | |
| *C. viminalis "Little John"* | NCN | A | 10 |
| *Calycanthus occidentalis* | Western Spice Bush | B | |
| *Carissa macrocarpa and Cultivars* | Natal Plum | A | 10 |
| *Carpenteria californica* | Bush Anemone | A | 10 |
| *Cassia artemisioides* | Feathery Cassia | A | 30 |
| *Ceanothus species* | Wild Lilac | B | 30 |
| *Cercocarpus betuiloides* | Mountain Mahogany | B | 30 |
| *Choisya ternata* | Mexican orange | B | |

| | | | |
|---|---|---|---|
| *Cistus species* | Rockrose | B | |
| *Comarostaphylis diversifolia* | Summer Holly | B | |
| *Convolvulus cneorum* | Bush Morning Glory | B | |
| *Coprosma pumila/repens* | Mirror Plant | B | |
| *Cotoneaster species & cultivars* | Cotoneaster | B | |
| *Crassula species* | NCN | A | |
| *Cuphea hyssopifolia* | False Heather | A | |
| *Cycas revoluta* | Sago Palm | A | |
| *Dasylirion quadrangulatum/wheeleri* | Mexican Grass Tree | A | 10 |
| *Dendromecon harfordii* | Island Bush Poppy | B | |
| *Dietes bicolor/irioides* | Fortnight Lily | A | |
| *Dodonaea viscosa (Purpurea)* | Hopseed Bush | B | |
| *Elaeagnus pungens & cultivars* | Silverberry | B | |
| *Encelia californica* | Coast Sunflower | A | 10 |
| *E. farinosa* | Brittle Bush | B | |
| *Erigonum giganteum* | St. Catherine's Lace | B | |
| *Escallonia species* | Escallonia | A | 10 |
| *Euonymus japonica & cultivars* | Evergreen Euonymus | A | 10 |
| *Euphorbia species* | | A | |
| *Euryops pectinatus* | NCN | A | |
| *Fatsia japonica* | Japanese Aralia | A | |
| *Fouquieria splendens* | Ocotillo | A | |
| *Fremontodendron species & cultivars* | Flannel Bush | B | |
| *Gardenia jasminoides* | Gardenia | A | |
| *Garrya elliptica* | Coast Silktassel | B | |
| *Grevillea species & cultivars* | Grevillea | B | |
| *Grewia occidentalis* | Lavender Starflower | B | |
| *Hakea suaveolens* | Sweet Hakea | B | |
| *Hebe species & cultivars* | Hebe | A | 10 |
| *Hesperaloe parviflora* | Red Yucca | A | |
| *Hibiscus rosa - sinensis* | Chinese Hibiscus | A | 10 |
| *Ilex species* | Holly | B | |
| *Juniperus species* | Juniper | B | |
| *Justicia brandegeana* | Shrimp Plant | A | 10 |
| *J. californica* | Chuparosa | B | |
| *Keckiella cordifolia* | Heart-Leaved Penstemon | B | |
| *Kniphofia uvaria* | Red-Hot Poker | A | |
| *Lantana Camara & hybrids* | Lantana | A | 10 |
| *Larrea tridentata* | Creosote Bush | B | |
| *Lavandula species* | Lavender | A | 10 |
| *Lavatera assurgentiflora/maritima* | California Tree Mallow | B | |
| *Leonotis leonrus* | Lion's Tail | B | |
| *Leptospermum scoparium & varities* | New Zealand Tea Tree | B | |
| *Leucophyllum species* | | B | |
| *Ligustrum japonicum* | Wax-leaf Privet | A | 10 |

| | | | |
|---|---|---|---|
| *Lupinus species* | Lupine | B | |
| *Mahonia aquifolium ('Compacta')* | Oregon Grape | A | 10 |
| *M. fremontii* | Desert Mahonia | B | |
| *M. 'Golden Abundance'* | NCN | B | |
| *M. lomariifolia* | Venetian Blind Mahonia | A | |
| *Malosma - See Rhus* | | | |
| *Malva species* | Mallow | A | 10 |
| *Melaleuca nesophila* | Pink Melaleuca | A | 10 |
| *Mimulus species (Diplacus)* | Monkey Flower | A | 10 |
| *Myrica californica* | *Pacific Wax Myrtle* | *B* | |
| *Myrsine africana* | *African Boxwood* | *A* | *10* |
| *Myrtus communis 'Compacta'* | Dwarf Myrtle | A | 10 |
| *Nandina domestica (including dwarf varieties)* | Heavenly Bamboo | A | |
| *Nerium oleander* | Oleander | B | |
| *N.o. 'Petite Salmon'* | NCN | A | 10 |
| *Opuntia species* | Prickly Pear, Cholla etc. | A | |
| *Phlomis fruticosa* | Jerusalem Sage | A | |
| *Phoenix roebelenii* | Pygmy Date Palm | A | |
| *Phormium tenax and Cultivars* | New Zealand Flax | A | |
| *Photinia fraseri* | Photinia | B | |
| *Pittosporum tobira ('Variegata')* | Tobira | B | |
| *P.t.'Wheeler's Dwarf'* | Dwarf Pittosporum | A | |
| *Punica granatum 'Nana'* | Dwarf Pomegranate | A | 10 |
| *Prunus ilicifolia* | Hollyleaf Cherry | B | |
| *Pyracantha species* | Firethorn | B | |
| *Rhamnus california/crocea* | Coffeeberry | B | |
| *Rhaphiolepis indica and Cultivars* | India Hawthorn | A | 10 |
| *Rhus integrifolia/laurina* | Lemonade Berry | B | 40 |
| *R. ovata* | Sugar Bush | B | 30 |
| *Ribes species* | Currant/Gooseberry | A | 10 |
| *Romneya coulteri* | Matilija Poppy | B | |
| *Rosa species (except R. californica)* | Rose | A | |
| *Rosmarinus officinalis & cultivars* | Rosemary | B | |
| *Salvia species - native varieties* | Sage | B | |
| *S. greggii/leucantha* | Autumn Sage | A | 10 |
| *Santolina chamaecyparissus/rosmarinifolius* | Lavender Cotton | A | 10 |
| *Simmondsia chinensis* | Jojoba | B | |
| *Strelitzia nicolai/regina* | Bird of Paradise | A | |
| *Tagetes lemmonii* | Copper Canyon Daisy | B | |
| *Tibouchina urvilleana* | Princess Flower | A | 10 |
| *Trichostema lanatum* | Wooly Blue Curls | B | |
| *Viburnum species* | Viburnum | A | 10 |
| *Westringia fruticosa* | Coast Rosemary | A | 10 |
| *Xylosma congestum* | Shiny Xylosma | B | |
| *X.c. 'Compacta'* | Compact Xylosma | A | 10 |

| | | | |
|---|---|---|---|
| *Yucca species* | Yucca | B | |
| | | | |
| **Trees** | **Trees** | **Trees** | **Trees** |
| | | | |
| *Acacia farnesiana* | Sweet Acacia | A | 15 |
| *A. greggii* | Catclaw Acacia | B | |
| *A. salicina* | Willow Acacia | A | 15 |
| *A. smallii* | NCN | A | 15 |
| *A. stenophylla* | Shoestring Acacia | A | 15 |
| *Acer negundo* | Box Elder | B | |
| *A. palmatum* | Japanese Maple | A | |
| *A. saccharinum* | Silver Maple | B | 30 |
| *Aesculus californica* | California Buckeye | B | |
| *Agonis flexuosa* | Peppermint Tree | B | |
| *Albizia julibrissin* | Silk Tree | B | |
| *Alnus rhombifolia* | Alder | B | |
| *Arbutus unedo ('Marina')* | Strawberry Tree | A | 15 |
| *Archontophoenix cunninghamiana* | King Palm | A | |
| *Bauhinia variegata* | Purple Orchid Tree | B | |
| *Betula pendula* | European White Birch | A | 10 |
| *Brachychiton acerifolius/populneus* | Flame Tree/Bottle Tree | B | |
| *Brahea armata/edulis* | Blue Hesper Palm | A | 10 |
| *Butia capitata* | Pindo Palm | A | 10 |
| *Callistemon citrinus* | Lemon Bottlebrush | B | |
| *C. viminalis* | Weeping Bottlebrush | A | 15 |
| *Calocedrus decurrens* | Incense Cedar | B | |
| *Calodendrum capense* | Cape Chestnut | B | |
| *Cedrus deodara* | Deodar Cedar | B | 30 |
| *Ceratonia siliqua* | Carob | B | 30 |
| *Cercidium floridum/microphyllum* | Blue Palo Verde | A | |
| *Cercis occidentalis/canadensis* | Western Redbud | A | 10 |
| *Chamaerops humilis* | Mediterranean Fan Palm | A | 10 |
| *Chilopsis linearis* | Desert Willow | A | 15 |
| *Chionanthus retusus* | Chinese Fringe Tree | A | 10 |
| *Chitalpa X tashkentensis* | Chitalpa | A | 10 |
| *Chorisia speciosa* | Floss Silk Tree | B | |
| *Cinnamomum camphora* | Camphor Tree | B | 30 |
| *Citrus species* | Citrus | A | 10 |
| *Cocculus laurifolius* | Laurel Leaf Snail Seed | B | |
| *Cordyline australis* | Giant Dracaena | A | |
| *Cyathea cooperi* | Australian Tree Fern | A | |
| *Dicksonia antarctica* | Tazmanian Tree Fern | A | |
| *Dracaena draco* | Dragon Tree | A | |
| *Eriobotrya deflexa/japonica* | Bronze Loquat/Loquat | A | 10 |
| *Erythrina species* | Coral Tree | B | |

| | | | |
|---|---|---|---|
| *Feijoa sellowiana* | Pineapple Guava | A | 10 |
| *Ficus species* | Fig | B | 50 |
| *Fraxinus species* | Ash | B | 30 |
| *Geijera parviflora* | Australian Willow | A | 15 |
| *Ginkgo biloba* | Maidenhair Tree | A | 15 |
| *Gleditsia triacanthos* | Honey Locust | A | 15 |
| *Grevillea robusta* | Silk Oak | B | |
| *Heteromeles arbutifolia* | Toyon | A | 15 |
| *Hymenosporum flavum* | Sweetshade Tree | A | 15 |
| *Jacaranda mimosifolia* | Jacaranda | B | |
| *Juglans californica* | Black Walnut | B | |
| *Koelreuteria bipinnata/paniculata* | Chinese Flame Tree | B | |
| *Lagerstroemia indica* | Crape Myrtle | A | 10 |
| *Laurus nobilis* | Sweet Bay | B | |
| *Leptospermum laevigatum* | Australian Tea Tree | A | 15 |
| *Liquidambar formosana* | Chinese Sweet Gum | A | 15 |
| *L. styraciflua* | American Sweet Gum | B | |
| *Liriodendron tulipfera* | Tulip Tree | B | |
| *Lithocarpus densiflorus* | Tanbark Oak | B | |
| *Lophpstemon confertus (Tristania)* | Brisbane Box | A | 15 |
| *Lyonothamnus floribundus* | Catalina Ironwood | A | 15 |
| *Magnolia grandiflora* | Southern Magnolia | B | |
| *M. X soulangeana* | Saucer Magnolia | A | 10 |
| *Maytenus boaria* | Mayten Tree | A | 10 |
| *Melaleuca quinquenervia* | Cajeput Tree | A | 15 |
| *Metasequoia glypstroboides* | Dawn Redwood | A | 15 |
| *Metrosideros excelsus* | New Zealand Christmas Tree | A | 10 |
| *Morus alba* | White Mulberry | B | |
| *Olea europea* | Olive - Fruitless only | A | 15 |
| *Parkinsonia aculeata* | Jerusalem Thorn | A | 10 |
| *Phoenix dactylifera* | Date Palm | B | |
| *Pinus species* | Pine | B | 75 |
| *Pistacia chinensis* | Chinese Pistache | B | |
| *Pittosporum phillyraeoides* | Willow Pittosporum | A | 10 |
| *P. rhombifolium* | Queensland Pittosporum | B | |
| *Platanus racemosa* | California Sycamore | B | |
| *Podocarpus gracilior/macrophyllus* | Fern Pine/Yew Pine | B | |
| *Populus fremontii* | Fremont Cottonwood | B | |
| *Prosopis chilensis* | Chilean Mesquite | B | |
| *P. glandulosa* | Honey Mesquite | A | 15 |
| *Prunus cerasifera 'Atropurpurea'* | Purple-leaf Plum | A | 10 |
| *Punica granatum* | Pomegranate | B | |
| *Pyrus calleryana/kawakamii* | Ornamental Pear | A | 15 |
| *Quercus species* | Oak | B | 30 |
| *Rhus lancea* | African Sumac | B | |

| | | | |
|---|---|---|---|
| *Robinia ambigua* | Locust | B | |
| *Sapium sebiferum* | Chinese Tallow Tree | B | |
| *Schefflera actinophylla* | Queensland Unbrella Tree | A | |
| *Sophora japonica* | Japanese Pagoda Tree | B | |
| *Stenocarpus sinuatus* | Firewheel Tree | A | 10 |
| *Syagrus romanzoffianum* | Queen Palm | A | |
| *Tabebuia species* | Trumpet Tree | A | 15 |
| *Tipuana tipu* | Tipu Tree | B | |
| *Tupidanthus calyptratus* | Tupidanthus | A | |
| *Trachycarpus fortunei* | Windmill Palm | A | |
| *Umbellularia californica* | California Bay | B | |
| *Washingtonia filifera* | California Fan Palm | B | 30 |
| *Zelkova serrata* | Sawleaf Zelkova | B | |

**Source**: Los Angeles County Fire Department, Fuel Modification Unit.

**Notes:**

1. The plant list above is intended to be a representative sample of which plants are appropriate in Zones A or B considering their size, moisture content, leaf litter production, and chemical composition.
2. Plants with certain physical and chemical characteristics make them more flammable and should not be planted close to structures in fire hazard areas. These trees should be spaced to allow a minimum canopy clearance at maturity from the structure as specified in the above table.
3. Landscape Designers may choose plants that are not on this list and may be acceptable if their plant characteristics are fuel modification zone appropriate.
4. Additionally, selecting regionally appropriate plants and the consideration of climate and microclimate adaptability is the responsibility of the Landscape Designer.

# Appendix C

## Los Angeles County Fire Department's Undesirable Plant List

# Los Angeles County Fire Department's: Undesirable Plant List by FMZ

| Botanical Name | Common Name | Comment[1] |
|---|---|---|
| Adenostoma fasciculatum | Chamise | F |
| Adenostoma sparsifolium | Red Shank | F |
| *Artemesia californica* | California Sagebrush | F |
| *Carpobrotus edulis* | Hottentot-fig | F, I |
| *Cortaderia spp.* | Pampas Grass | F, I |
| *Cupressus spp.* | Cypress | F |
| *Eriogonum fasciculatum* | Common Buckwheat | F |
| *Eucalyptus spp.* | Eucalyptus | F |
| *Jasminum humile* | Italian Jasmine | F |
| *Plumbago auriculata* | Cape Plumbago | F |
| *Tecoma capensis* | Cape Honeysuckle | F |

**Source**: Los Angeles County Fire Department, Fuel Modification Unit.

**Notes:**

1. F = flammable, I = Invasive
2. Certain plants are considered to be undesirable in the landscape due to characteristics that make them highly flammable. These characteristics can be either physical or chemical. Physical properties would include large amounts of dead material retained within the plant, rough or peeling bark, and the production of copious amounts of litter. Chemical properties include the presence of volatile substances such as oils, resins, wax, and pitch. Plants with these characteristics should not be planted close to structures in fire hazard areas. These species are typically referred to as "Target Species" since their complete or partial removal from the landscape is a critical part of hazard reduction. Therefore, any plant listed in the above table is not allowed as part of an acceptable Fuel Modification Plan.
3. Plants on this list that are considered invasive are a partial list of commonly found plants. There are many other plants considered invasive that should not be planted in a fuel modification zone and they can be found on The California Invasive Plant Council's Website www.cal-ipc.org/ip/inventory/index.php. Other plants not considered invasive at this time may be determined to be invasive after further study.
4. For the purpose of using this list as a guide in selecting plant material, it is stipulated that all plant material will burn under various conditions.
5. The absence of a particular plant, shrub, groundcover, or tree, from this list does not necessarily mean it is fire resistive.
6. All vegetation used in Fuel Modification Zones and elsewhere within the Chadwick Ranch Estates Project site shall be subject to approval of the L.A. County Fire Department's Fuel Modification Unit or Fire Code official.

# Appendix D

Los Angeles County Fire Department's
Repopulation Information Guide Sheet

LOS ANGELES COUNTY FIRE DEPARTMENT

# REPOPULATION GENERAL INFORMATION

This document contains important general information and resources. Specific repopulation information for the Lake Fire, when available, can be found in the *News Release/Media Advisory Section* and/or on the current *Incident Update Information Sheet*. Click here to return to the Lake Fire Status webpage when you have finished reading this information.

## REPOPULATION – GENERAL INFORMATION

**Frequently asked question: The fire is out in my area; why can't I go home?**

The Los Angeles County Fire Department recognizes that evacuation orders can cause undue strain on those eager to return home. Please understand that incident commanders are continuously evaluating both fire and infrastructure conditions so that repopulation can occur as quickly as possible, but not at the expense of your safety. **YOUR SAFETY IS OUR PRIMARY CONCERN.**

Some, but not all, of the factors that need to be considered before any evacuations can be lifted are:

- Amount of fire personnel still working in an area and the type of work being performed.
- Damage to roads/guardrails, etc. that must be repaired prior to allowing public access.
- Removal of trees or large debris impacting the roadway.
- Damage to utility infrastructure that must be repaired prior to allowing public access (e.g., clearing power lines from roadways, replacing downed power poles, etc.).
- Public health considerations.

When evacuations are lifted and repopulation begins to occur, it may sometimes include the entire evacuation area but, more likely, will affect only one portion of the evacuation area at a time. Repopulating in segments not only allows us to get some residents home as quickly as possible, but also reduces the impact on law enforcement officials who need to check for identification when these areas are reopened to residents only (which is usually the case).

When an area is repopulated, we ask those residents to please be mindful of people working in the area as essential services continue to be restored. Stay vigilant as you drive into areas that have been impacted by the fire as road crews, firefighters, and other personnel are focused on completing their assignments. As traffic flow is introduced into these areas, people may be more focused on the damage and not aware of their immediate surroundings. Please stay alert and pay attention.

LOS ANGELES COUNTY FIRE DEPARTMENT

# REPOPULATION
# GENERAL INFORMATION

As the area is repopulated, please be aware that there may be intermittent power outages and associated street closures as power is restored or equipment is repaired throughout the impacted areas.

Because there are many hazards that can exist when returning to your home after a wildfire, we urge you to take safety precautions, such as personal protective equipment (breathing protection, proper clothing, gloves, boots, and eye/face protection). Click here to learn more about how to safely re-enter areas burned by wildfire.

###

# Appendix E

City of Bradbury Water Supply Standards

CHAPTER 8. - WATER SERVICE REQUIREMENTS

Sec. 17.08.010. - Water service requirements.

(a) Minimum requirement. With respect to water service, the following water service requirements are hereby established and shall require that any new construction of habitable structures and accessory buildings over 1,000 square feet of interior additions or remodeling of habitable structures or accessory buildings which adds over 1,000 square feet within the City and for which a permit is required to be issued:

| Lot Size | Any Lot |
|---|---|
| Fire Flow Req. | 1,250 GPM |
| Duration Req. | Two Hours |
| Fire Hydrant Spacing | 500 Feet |

(b) Service. All such water service shall be connected to the existing domestic water service system.

(c) Computation of available fire flow shall be based upon a minimum of 20 pounds per square inch gauge of residual operation pressure remaining in the street main from which the flow is measured.

(d) The City Council may reduce the 1,250 GPM fire flow requirement upon the recommendation of the Planning Commission in exceptional circumstances and where the applicant proves to the satisfaction of the Council that the condition set forth in Chapter 4 of the Bradbury Zoning Code exist.

**Bradbury Municipal Code, Title IX—Development Code**

May 1, 2013 **Chapter 1—Zoning Regulations** Index Page 2

**Bradbury Municipal Code, Title XVII—Building Regulations**

(Prior Code, § 8700; Ord. No. 347U, § 9, 3-21-2017; Ord. No. 347, § 9, 6-20-2017)

# Appendix F

City of Bradbury General Plan Sections

# City of Bradbury General Plan Policies

## 1.1 Land Use Goals, Objectives, and Policies

### 1.1.1 Land Use Goals

The objectives and policies expressed throughout the General Plan shall be based on achieving and implementing the following goals:

1. Financial sustainability.
2. Independent local government.
3. Local responsive and responsible governance.
4. Quiet and peaceful living environment.
5. Safety community.
6. Compatibility between rural agriculture and residential estate development.
7. Balance the City's rural character, including agricultural opportunities, preservation of open-space and natural topography, with residential necessities such as traditional municipal services and utilities.
8. Living/housing opportunities for all ages and economic levels.
9. Services for residents that encompass and are sensitive to an aging population and cultural diversity.

- Land Use Goal No. 1. The Land Use Element maintains the existing rural residential character of the City. The element designates the general location, distribution, and extent of existing and permitted development.
- Land Use Goal No. 2. Preserve the identity, image, and environmental quality of the hillside and open space areas in perpetuity by enforcing the Hillside Development Standard.

### 1.1.2 Land Use Objectives

- Land Use Objective No. 1. To maintain the existing character of the community and to preserve those environmental resources and amenities that make the City of Bradbury a desirable place to live.

### 1.1.3 Land Use Policies

- Land Use Policy No. 1. The residential character of the community and environmental resources important to the City will be maintained.

### 1.1.4 Land Uses Implementation Programs

The City of Bradbury intends to complete the following items which address the objectives and policies of the Land Use Element of the General Plan:

- Land Use Action No. 1. Encourage as much hillside preservation as possible through the use of conservation easements, acquisition efforts by conservation organizations or preservation as natural preserves that promote the protection of natural hillsides as open-space in perpetuity.
- Land Use Action No. 2. Work with the City of Monrovia to adjust the common municipal boundaries to expand the City of Bradbury to the edge of the Wild Rose Avenue right-of-way to be consistent with the legal boundaries of the Bradbury Estates Community Services District.
- Land Use Action No. 3. Revise the City's Design Guidelines to promote sustainable building and development design alternatives.
- Land Use Action No. 4. Encourage the homeowners associations to consider the update or adoption of design guidelines for their respective jurisdictions.
- Land Use Action No. 5. Engage the community and the homeowner associations to explore the need to control development intensity including but not limited to re-examination of lot coverage definitions, relationship of setbacks and building height and the ratio of main dwelling unit footprints to the total parcel size.
- Land Use Action No. 6. Perform a biennial review of the Hillside Development Standards and update if necessary, to carry out the goals of the General Plan.

## 1.2 Health and Safety Element Goals, Objectives, and Policies

### 1.2.1 Safety Goals

- Safety Goal No. 1. To protect the citizens, their property, and public facilities from natural and man-made hazards.
- Safety Goal No. 2. To establish, maintain and develop awareness on the part of all residents of Bradbury as to how to react to protect themselves and each other, in the event of a natural or man-made hazard or disaster.

- Safety Goal No. 3. To achieve a greater sense of citizen satisfaction with the safety services within the community, through constantly monitoring the effective and efficient staffing of safety service personnel.
- Safety Goal No. 4. To minimize the risk to persons and property due to seismic activity.
- Safety Goal No. 5. To minimize the risk to lives and property due to fire hazards.
- Safety Goal No. 6. To minimize the risk to persons and property due to the use and storage of hazardous materials.
- Safety Goal No. 7. Protect the community from floods and landslides.
- Safety Goal No. 8. Assure that existing and new development addresses fire protection in a proactive and preventative way.

### 1.2.2 Safety Objectives

- Safety Objective No. 1. Prepare the community for expected or unexpected disasters resulting from natural or man-made causes.
- Safety Objective No. 2. Prepare the residents of Bradbury to be aware of potential hazards and disasters and to be prepared to be self-reliant for at least seven-days in the event of a disaster.
- Safety Objective No. 3. Communicate with Bradbury residents through all available media, that safety personnel are properly trained to provide assistance in the event of a disaster.
- Safety Objective No. 4. Implement the City's Hazard Mitigation Plan in a timely manner.
- Safety Objective No. 5. Reduce the possibility of hazardous materials becoming a health and safety issue within the community.
- Safety Objective No. 6. Assure that potential flooding and landslide hazards are reviewed during new development.
- Safety Objective No. 7. Ensure that adequate service levels of fire protection are maintained in the City.

### 1.2.3 Safety Policies

- Safety Policy No. 1. Support community programs that train volunteers to assist "First Responders" in the implementation of the Hazard Mitigation Plan programs.
- Safety Policy No. 2. Implement precautionary measures in high risk areas to reduce injury and loss of property caused by natural or manmade hazards.

- Safety Policy No. 3. Review all development proposals for compliance with established hazard avoidance criteria.
- Safety Policy No. 4. Provide adequate levels of service to ensure that the residents are protected to the best of the City's ability from natural and manmade disasters.
- Safety Policy No. 5. Cooperate with Federal, State and County agencies responsible for the enforcement of all health and safety laws and regulations.
- Safety Policy No. 6. Establish and maintain a variety of media sources to enable interactive safety awareness and preparedness educational opportunities for the residents.
- Safety Policy No. 7. Obtain materials and support the dissemination of written information to all Bradbury households regarding minimizing or avoiding hazards within the home.
- Safety Policy No. 8. Provide opportunities to continually advise and update community residents regarding actions and activities they should engage in after a significant natural or manmade disaster.
- Safety Policy No. 9. Support continuing review and updating of the City's Disaster Preparedness Program manual.
- Safety Policy No. 10. Work closely with adjacent cities, County, State and Federal agencies to inform, monitor and communicate the presence of wild animals.
- Safety Policy No. 11. Maintain and evaluate the level of safety services available to the community.
- Safety Policy No. 12. Restrict development in areas prone to seismic hazards.
- Safety Policy No. 13. Continue to support "mutual assistance" agreements between local and State firefighting agencies.
- Safety Policy No. 14. Continue to support programs to reduce fire hazards within the community.
- Safety Policy No. 15. Provide appropriate firefighting equipment, personnel, and peak load water supply.
- Safety Policy No. 16. Provide access to potable water for emergency purposes.
- Safety Policy No. 17. Regulate and monitor, to the extent possible, the delivery, use and storage of hazardous materials within the City.
- Safety Policy No. 18. Require all existing and new development to install and maintain adequate smoke detection systems.
- Safety Policy No. 19. All new development to install fire sprinkler systems.
- Safety Policy No. 20. Require that all new development incorporate sufficient measures to mitigate flood and landslide hazards including but not limited to on-site drainage systems and grading of site to minimize storm-water runoff.

### 1.2.4 Safety Implementation Program

The City of Bradbury intends to complete the following items which address the objectives and policies of the Safety Element of the General Plan:

- Safety Action No. 1. Adopt ordinances that require new development to utilize techniques and equipment that reduce consumption of renewable resources.
- Safety Action No. 2. Assure that the land use element recognizes and addresses seismic threats from development in areas of the City.
- Safety Action No. 3. Promote public education about fire safety at home.
- Safety Action No. 4. Promote public education about disaster preparedness.
- Safety Action No. 5. Update the hillside development standards which include fire prevention design measures.
- Safety Action No. 6. Continue to make emergency and disaster preparedness a community priority.
- Safety Action No. 7. Update and review the Emergency Operations Plan annually.
- Safety Action No. 8. City staff to continue to work with the LACFD on brush removal and weed abatement from April to June.
- Safety Action No. 9. Conduct public outreach on wildfire prevention awareness.
- Safety Action No. 10. Promote voluntary efforts to tree trimming and brush and weed abatement.
- Safety Action No. 11. Maintain and update the multi-hazard emergency plan for the City.
- Safety Action No. 12. Continue to support and participation with the Emergency Response Committee.

# Appendix G

## BehavePlus Fire Behavior Analysis Summary

# *BehavePlus Fire Behavior Modeling Analysis*

## 1.1 BehavePlus Fire Behavior Modeling History

Fire behavior modeling has been used by researchers for approximately 50+ years to predict how a fire will move through a given landscape (Linn 2003). The models have had varied complexities and applications throughout the years. One model has become the most widely used as the industry standard for predicting fire behavior on a given landscape. That model, known as "BEHAVE", was developed by the U. S. Government (USDA Forest Service, Rocky Mountain Research Station) and has been in use since 1984. Since that time, it has undergone continued research, improvements, and refinement. The current version, BehavePlus 6.0, includes the latest updates incorporating years of research and testing. Numerous studies have been completed testing the validity of the fire behavior models' ability to predict fire behavior given site specific inputs. One of the most successful ways the model has been improved has been through post-wildfire modeling (Brown 1972, Lawson 1972, Sneeuwjagt and Frandsen 1977, Andrews 1980, Brown 1982, Rothermel and Rinehart 1983, Bushey 1985, McAlpine and Xanthopoulos 1989, Grabner, et. al. 1994, Marsden-Smedley and Catchpole 1995, Grabner 1996, Alexander 1998, Grabner et al. 2001, Arca et al. 2005). In this type of study, Behave is used to model fire behavior based on pre-fire conditions in an area that recently burned. Real-world fire behavior, documented during the wildfire, can then be compared to the prediction results of Behave and refinements to the fuel models incorporated, retested, and so on.

Fire behavior modeling conducted on this site includes a relatively high-level of detail and analysis which results in reasonably accurate representations of how wildfire may move through available fuels on and adjacent the property. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. To objectively predict flame lengths, spread rates, and fireline intensities, this analysis incorporated predominant fuel characteristics, slope percentages, and representative fuel models observed on site. The BehavePlus fire behavior modeling system was used to analyze anticipated fire behavior within and adjacent to key areas just outside of the proposed lots. Predicting wildland fire behavior is not an exact science. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather and the limits of weather forecasting. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire prevention planning information. To be used effectively, the basic assumptions and limitations of BehavePlus must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuels less than one-quarter inch in diameter. These are the fine fuels that carry fire. Fuels greater than one inch have little effect while fuels greater than three inches have no effect on fire behavior.
- Second, the model bases calculations and descriptions on a wildfire spreading through surface fuels that are within six feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.
- Third, the software assumes that weather and topography are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
- Fourth, the BehavePlus fire behavior computer modeling system was not intended for determining sufficient fuel modification zone/defensible space widths. However, it does provide the average length of

the flames, which is a key element for determining "defensible space" distances for minimizing structure ignition.

Although BehavePlus has some limitations, it can still provide valuable fire behavior predictions which can be used as a tool in the decision-making process. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur on a site. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven fuel characteristics help define the 13 standard fire behavior fuel models[1] and the five custom fuel models developed for Southern California[2]. According to the model classifications, fuel models used in BehavePlus have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface to volume ratio. Observation of the fuels in the field (on site) determines which fuel models should be applied in BehavePlus. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models and the custom Southern California fuel models:

- Grasses — Fuel Models 1 through 3
- Brush — Fuel Models 4 through 7, SCAL 14 through 18
- Timber — Fuel Models 8 through 10
- Logging Slash — Fuel Models 11 through 13

In addition, the aforementioned fuel characteristics were utilized in the recent development of 40 new fire behavior fuel models[3] developed for use in BehavePlus modeling efforts. These new models attempt to improve the accuracy of the standard 13 fuel models outside of severe fire season conditions, and to allow for the simulation of fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the new 40 fuel models:

- Non-Burnable — Models NB1, NB2, NB3, NB8, NB9
- Grass — Models GR1 through GR9
- Grass-shrub — Models GS1 through GS4
- Shrub — Models SH1 through SH9
- Timber-understory — Models TU1 through TU5
- Timber litter — Models TL1 through TL9

1 Anderson, Hal E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. USDA Forest Service Gen. Tech. Report INT-122. Intermountain Forest and Range Experiment Station, Ogden, UT.
2 Weise, D.R. and J. Regelbrugge. 1997. Recent chaparral fuel modeling efforts. Prescribed Fire and Effects Research Unit, Riverside Fire Laboratory, Pacific Southwest Research Station. 5p.
3 Scott, Joe H. and Robert E. Burgan. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

- Slash blowdown Models SB1 through SB4

BehavePlus software was used in the development of the City of Bradbury Community Wildfire Protection Plan (CWPP) in order to evaluate potential fire behavior for the surrounding areas of the City. Existing site conditions were evaluated, and local weather data was incorporated into the BehavePlus modeling runs.

## 1.2 Fire Models

Dudek utilized the BehavePlus software package to analyze fire behavior potential for the City of Bradbury. As is customary for this type of analysis, two fire scenarios were evaluated, including one summer, onshore weather condition (northwest from the City) and two extreme fall, offshore weather condition (north and northeast of the City). Fuels and terrain at and beyond this distance can produce flying embers that may affect the more interior homes of the City. It is the fuels adjacent to and within fuel modification zones that would have the potential to affect the structures within the City from a radiant and convective heat perspective as well as from direct flame impingement. BehavePlus software requires site-specific variables for surface fire spread analysis, including fuel type, fuel moisture, wind speed, and slope data. The output variables used in this analysis include flame length (feet), rate of spread (feet/minute), fireline intensity (BTU/feet/second), and spotting distance (miles). The following provides a description of the input variables used in processing the BehavePlus models for the naturally vegetated hillsides adjacent to the City. In addition, data sources are cited and any assumptions made during the modeling process are described.

### 1.2.1 Vegetation (Fuels)

To support the fire behavior modeling efforts conducted for this CWPP, the different vegetation types observed adjacent to the City were classified into the aforementioned numeric fuel models. As is customary for this type of analysis, the terrain and fuels directly adjacent to the City and within the naturally vegetated hillsides of the San Gabriel Mountains are used for determining flame lengths and fire spread. It is these fuels that would have the potential to affect the structures throughout the City from a radiant and convective heat perspective as well as from direct flame impingement.

Vegetation types were derived from a site visit that was conducted by a Dudek Fire Protection Planner. Based on the site visit, four different fuel models were used in the fire behavior modeling effort presented herein. Fuel model attributes are summarized in Table G-1. Modeled areas include Coast live oak and western sycamore Riparian with non-native chaparral and shrub understory (Fuel Model SH4 = Timber-Shrub) occur near the base of the San Gabriel Mountains, north of the City. Mature tree canopies for coast live oak trees (*Quercus agrifolia)* and western sycamore trees (*Platanus racemosa*) are assumed to have a canopy base height ranging from 35 to 45 feet off the ground. Canopy bulk density, the weight of canopy fuels per cubic foot of volume, is assumed to be the maximum allowable value in BehavePlus to represent broadleaf trees which, given canopy density and leaf size, have more weight per area than conifer trees (the standard for this value input in BehavePlus (Heinsch and Andrews 2010)). Foliar moisture, the moisture content of canopy foliage, is assumed to be 100%, a reasonable estimate in lieu of site-specific data (Scott and Reinhardt 2001).

### Table G-1: Existing Fuel Model Characteristics

| Fuel Model | Description | Location | Fuel Bed Depth (Feet) |
|---|---|---|---|
| Sh4 | Riparian Habitat (Timber Shrub) | Riverbed that runs near the base of the San Gabriel Mountains, north of the City of Bradbury | >8.0 ft. |
| Sh5 | High Load, Dry Climate Shrub | Scrub and chaparral naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury. | >4.0 ft. |
| Gs2 | Moderate load, Dry Climate Grass-Shrub | Scrub and grasses naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury. | <3.0 ft. |
| FM4 | Chaparral | Chaparral fuel model naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury | >6.0 ft. |

## 1.2.2 Topography

Slope is a measure of angle in degrees from horizontal and can be presented in units of degrees or percent. Slope is important in fire behavior analysis as it affects the exposure of fuel beds. Additionally, fire burning uphill spreads faster than those burning on flat terrain or downhill as uphill vegetation is pre-heated and dried in advance of the flaming front, resulting in faster ignition rates. Slope values ranging from 18 to 45% were measured around the perimeter of the City from U.S. Geological Survey (USGS) topographic maps.

## 1.2.3 Weather

Historical weather data for the Bradbury region was utilized in determining appropriate fire behavior modeling inputs for the Proposed Project area fire behavior evaluations. To evaluate different scenarios, data from both the 50th and 97th percentile moisture values were derived from Remote Automated Weather Station (RAWS) and utilized in the fire behavior modeling efforts conducted in support of this report. Weather data sets from the Henninger Flats Station RAWS[4] were utilized in the fire modeling runs.

RAWS fuel moisture and wind speed data were processed utilizing the Fire Family Plus software package to determine atypical (97th percentile) and typical (50th percentile) weather conditions. Data from the RAWS was evaluated from August 1 through November 30 for each year between 1994 and 2018 (extent of available data record) for 97th percentile weather conditions and from June 1 through September 30 for each year between 1994 and 2018 for 50th percentile weather conditions.

Following analysis in Fire Family Plus, fuel moisture information was incorporated into the Initial Fuel Moisture file used as an input in BehavePlus. Wind speed data resulting from the Fire Family Plus analysis was also determined. Initial wind direction and wind speed values for the two BehavePlus runs were manually entered during the data input phase. The input wind speed and direction is roughly an average surface wind at 20 feet above the vegetation over the analysis area. Table G-2 summarizes the wind and weather input variables used in the Fire BehavePlus modeling efforts.

4 https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCHEN
Latitude: 34.1142 Longitude: -118.0536; Elevation: 2,800 ft.)

**Table G-2: Variables Used for Fire Behavior Modeling**

| Model Variable | Summer Weather (50th Percentile) | Peak Weather (97th Percentile) |
|---|---|---|
| Fuel Models | FM4, Gs2, Sh4 and Sh5 | FM4, Gs2, Sh4, and Sh5 |
| 1 h fuel moisture | 5% | 2% |
| 10 h fuel moisture | 6% | 3% |
| 100 h fuel moisture | 9% | 5% |
| Live herbaceous moisture | 39% | 30% |
| Live woody moisture | 78% | 60% |
| 20 ft. wind speed | 19 mph (sustained winds) | 18 mph (sustained winds); wind gusts of 50 mph |
| Wind Directions from north (degrees) | 200 and 290 | 0 and 80 |
| Wind adjustment factor | 0.4 | 0.4 |
| Slope (uphill) | 18 to 38% | 20 to 45% |

## 1.3 Fire Behavior Modeling Efforts

As mentioned, the BehavePlus fire behavior modeling software package was utilized in evaluating anticipated fire behavior adjacent to the Proposed Project site. Three focused analyses were completed, each assuming worst-case fire weather conditions for a fire approaching the City from the north, east, and west/northwest. The results of the modeling effort included anticipated values for surface fires (flame length (feet), rate of spread (mph), and fireline intensity (Btu/ft/s)) and crown fires (critical surface intensity (Btu/ft/s), critical surface flame length (feet), transition ratio (ratio: surface fireline intensity divided by critical surface intensity), transition to crown fire (yes or no), crown fire rate of spread (mph), critical crown rate of spread (mph), active ratio (ratio: crown fire rate of spread divided by critical crown fire rate of spread), active crown fire (yes or no), and fire type (surface, torching, conditional crown, or crowning)). The aforementioned fire behavior variables are an important component in understanding fire risk and fire agency response capabilities. Flame length, the length of the flame of a spreading surface fire within the flaming front, is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews, Bevins, and Seli 2008). Fireline intensity is a measure of heat output from the flaming front, and also affects the potential for a surface fire to transition to a crown fire. Fire spread rate represents the speed at which the fire progresses through surface fuels and is another important variable in initial attack and fire suppression efforts (Rothermel and Rinehart 1983). Spotting distance is the distance a firebrand or ember can travel down wind and ignite receptive fuel beds.

## 1.4 Fire Behavior Modeling Results

The results presented in Table G-3 values based on inputs to the BehavePlus software and are not intended to capture changing fire behavior as it moves across a landscape. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis. For planning purposes, the averaged worst-case fire behavior is the most useful information for conservative fuel modification design. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

Based on the BehavePlus analysis, worst-case fire behavior is expected in untreated, surface shrub and chaparral fuels northeast and east of the proposed Project site under Peak weather conditions (represented by Fall Weather, Scenario 3). The fire is anticipated to be a wind-driven fire from the north/northeast during the fall. Under such conditions, expected surface flame lengths reach 42 feet with wind speeds of 50+ mph. Under this scenario, fireline intensities reach 18,499 BTU/feet/second with fast spread rates of 6.2 mph and could have a spotting distance up to 2.3 miles away.

**Table G-3: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions**

| Fire Scenario | Flame Length[1] (feet) | Spread Rate[1] (mph[5]) | Fireline Intensity[1] (Btu/ft/s) | Spot Fire[1] (miles) | Surface Fire to Tree Crown Fire | Tree Crown Fire Rate of Spread (mph) | Crown Fire Flame Length (feet) |
|---|---|---|---|---|---|---|---|
| *Scenario 1: 38% slope; Summer Onshore Wind (50th percentile)* | | | | | | | |
| Riparian Habitat - Timber Shrub[2,3] (Sh4) | 10.9' | 0.9 | 1,013 | 0.5 | Crowning [4] | 0.8 | 110.8' |
| Sagebrush scrub (Sh5) | 19.5' | 1.5 | 3,599 | 0.7 | Crowning [4] | 0.8 | 116.3 |
| Moderate load grass-shrub (Gs2) | 7.8' | 2.3 | 9,509 | 0.4 | Crowning [4] | 0.8 | 109.0 |
| Chaparral (FM 4) | 30.4' | 0.7 | 500 | 1.0 | Crowning [4] | 0.8 | 123.2 |
| *Scenario 2: 43% slope; Fall Offshore, Extreme Winds (97th percentile)* | | | | | | | |
| Riparian Habitat - Timber Shrub (Sh4) | 12.8' (23.5')[6] | 1.1 (4.2) | 1,453 (5,471) | 0.5 (1.5) | Crowning [4] | 1.0 (4.1) | 133.1' |
| Sagebrush scrub (Sh5) | 25.0' (41.8') | 2.1 (6.4) | 6,184 (18,966) | 0.8 (2.3) | Crowning [4] | 1.0 (4.1) | 141.6' |
| Moderate load grass-shrub (Gs2) | 10.1' (19.1') | 1.0 (3.9) | 870 (3,450) | 0.4 (1.4) | Crowning [4] | 1.0 (4.1) | 131.0' |
| Chaparral (FM 4) | 38.1' (70.4') | 3.1 (11.9) | 15,517 (58,853) | 1.1 (3.3) | Crowning [4] | 1.0 (4.1) | 151.3' |
| *Scenario 3: 20% slope; Fall, Offshore, Extreme Winds (97th percentile)* | | | | | | | |
| Sagebrush scrub (Sh5) | 24.0' (41.3') | 1.9 (6.2) | 5,697 (18,499) | 0.8 (2.3) | No | N/A | N/A |
| Moderate load grass-shrub (Gs2) | 9.7' (18.9') | 0.9 (3.8) | 797 (3,380) | 0.4 (1.3) | No | N/A | N/A |
| Chaparral (FM 4) | 36.5' (69.6') | 2.9 (11.6) | 14,172 (57,575) | 1.1 (3.3) | No | N/A | N/A |

**Note:**

1. Wind-driven surface fire.
2. Riparian overstory torching increases fire intensity. Modeling included canopy fuel over Sh4, which represents surface fuels beneath the tree canopies.
3. A surface fire in the mixed sycamore riparian forest would transition into the tree canopies generating flame lengths higher than the average tree height (25 feet). Viable airborne embers could be carried downwind for approximately 1.0 mile and ignite receptive fuels.
4. Crowning= fire is spreading through the overstory crowns.
5. MPH=miles per hour
6. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph

The following describes the fire behavior variables (Heisch and Andrews 2010) as presented in Table G-3:

### Surface Fire:

- Flame Length (feet): The flame length of a spreading surface fire within the flaming front is measured from midway in the active flaming combustion zone to the average tip of the flames.
- Fireline Intensity (Btu/ft/s): Fireline intensity is the heat energy release per unit time from a one-foot wide section of the fuel bed extending from the front to the rear of the flaming zone. Fireline intensity is a function

of rate of spread and heat per unit area, and is directly related to flame length. Fireline intensity and the flame length are related to the heat felt by a person standing next to the flames.

- Surface Rate of Spread (mph): Surface rate of spread is the "speed" the fire travels through the surface fuels. Surface fuels include the litter, grass, brush and other dead and live vegetation within about 6 feet of the ground.

**Crown Fire:**

- Transition to Crown Fire: Indicates whether conditions for transition from surface to crown fire are likely. Calculation depends on the transition ratio. If the transition ratio is greater than or equal to 1, then transition to crown fire is Yes. If the transition ratio is less than 1, then transition to crown fire is No.
- Crown Fire Rate of Spread (mph): The forward spread rate of a crown fire. It is the overall spread for a sustained run over several hours. The spread rate includes the effects of spotting. It is calculated from 20-ft wind speed and surface fuel moisture values. It does not consider a description of the overstory.

Fire Type: Fire type is one of the following four types: surface (understory fire), torching (passive crown fire; surface fire with occasional torching trees), conditional crown (active crown fire possible if the fire transitions to the overstory), and crowning (active crown fire; fire spreading through the overstory crowns). Dependent on the variables: transition to crown fire and active crown fire.

The information in Table G-4 presents an interpretation of the outputs for five fire behavior variables as related to fire suppression efforts. The results of fire behavior modeling efforts are presented in Table G-3. Identification of modeling run locations is presented graphically in Figure 8 of the CWPP.

**Table G-4: Fire Suppression Interpretation**

| Flame Length (ft) | Fireline Intensity (Btu/ft/s) | Interpretations |
|---|---|---|
| Under 4 feet | Under 100 BTU/ft/s | Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire. |
| 4 to 8 feet | 100-500 BTU/ft/s | Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective. |
| 8 to 11 feet | 500-1000 BTU/ft/s | Fires may present serious control problems – torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective. |
| Over 11 feet | Over 1000 BTU/ft/s | Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective. |

# Appendix H

## FlamMap Fire Behavior Analysis Summary

# FlamMap Fire Behavior Modeling Analysis

## 1.1 FlamMap Fire Behavior Modeling

The FlamMap software package (Finney et al. 2015) was used to evaluate fire hazard in the City. The FlamMap software package is a publicly available resource available through the Fire, Fuel, and Smoke Science Program of the U.S. Forest Service. FlamMap uses the same fire spread equations built into the BehavePlus software package but allows for a geographical presentation of fire behavior outputs as it applies the calculations to each pixel in an associated geographic information system (GIS) landscape (Finney 1998). FlamMap is a GIS-based software package that models potential fire behavior for constant weather conditions (wind and fuel moisture) and generates map files of potential fire behavior characteristics (e.g., flame length, crown fire activity). FlamMap outputs represent fire behavior calculated for each pixel within the analysis area independently and does not calculate fire spread across a landscape. The software requires a minimum of five input variables, including elevation, slope, aspect, fuel model, and canopy cover. To use the crown fire activity model for forested land cover types, additional input variables are necessary, including stand height, canopy base height, and canopy bulk density. Wind and weather data are also critical components to FlamMap modeling efforts. The following sections present a background on fire behavior modeling and present the methods and data sources used in performing the FlamMap fire behavior modeling analysis for this CWPP.

## 1.2 Fire Behavior Modeling Background

Predicting wildland fire behavior is not an exact science due to the many variables that must be considered. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather, the limits of weather forecasting, and the weather that is often created by firestorms. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire information (Rothermel 1993). To be used effectively, the basic assumptions and limitations of fire behavior modeling applications must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuel less than 0.25 inches in diameter. These are the fine fuels that carry fire. Fuels greater than 1 inch in diameter have little effect, while fuels greater than 3 inches in diameter have no effect on fire behavior.
- Second, the model bases surface fire calculations and descriptions on a wildfire spreading through fuels that are within 6 feet of the ground and contiguous to the ground. Surface fuels are classified as grass, grass/shrub, shrub, timber litter, timber understory, or slash.
- Third, the software assumes that weather is uniform. However, because wildfires almost always burn under non-uniform conditions, creating their own weather, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
- Fourth, fire behavior computer modeling systems are not intended for determining sufficient fuel modification zone/defensible space widths. However, results can provide the average length of the flames, which is a key element for determining defensible space distances for minimizing structure ignition.

FlamMap can provide valuable fire behavior predictions, which can be used as a tool in the decision-making process. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Fuels are made up of the various components of vegetation, both live and dead, that occur in a particular landscape. The type and quantity will depend upon soil, climate, terrain, and management and disturbance (e.g., fire) history. The major fuel groups of grass, grass/shrub, shrub, trees, tree litter, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven (7) principal fuel characteristics help define the 13 standard fire behavior fuel models (Anderson 1982). According to the model classifications, fuel models used for fire behavior modeling (BehavePlus, FlamMap, FARSITE) have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface area-to-volume ratio. Observation of the fuels in the field determines which fuel models should be applied in modeling efforts. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models:

- Grasses – fuel models 1 through 3
- Brush – fuel models 4 through 7
- Timber – fuel models 8 through 10
- Logging slash – fuel models 11 through 13

In addition, the aforementioned fuel characteristics were utilized in the development of 40 newer fire behavior fuel models (plus 5 non-burnable models) (Scott and Burgan 2005) developed for use in the BehavePlus, FlamMap, and FARSITE modeling systems. These newer models attempt to improve the accuracy of the 13 standard fuel models and to allow for the simulation of fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the 40 newer fuel models:

- Non-burnable – models NB1, NB2, NB3, NB8, NB9
- Grass – models GR1 through GR9
- Grass shrub – models GS1 through GS4
- Shrub – models SH1 through SH9
- Timber understory – models TU1 through TU5
- Timber litter – models TL1 through TL9
- Slash blowdown – models SB1 through SB4

## 1.3 FlamMap Analysis

### 1.3.1 Base Mapping Data

FlamMap (version 6.0) was used for the modeling analysis. The base data for the modeling analysis was obtained from the LANDFIRE (Landscape Fire and Resource Management Planning Tools) data distribution site (LANDFIRE 2019). LANDFIRE is shared program between the wildland fire management programs of the U.S. Forest Service and U.S. Department of the Interior and provides landscape-scale GIS data layers. LANDFIRE Remap (LF 2.0.0) data file was obtained and used for the model base data set. The LF Remap represents circa 2016 ground conditions and has a data resolution of 30 meters. The LANDFIRE data was obtained in a Landscape file format, which is a composite GIS file that includes the following layers:

- **Elevation:** Necessary for adiabatic adjustment of temperature and humidity and for conversion of fire spread between horizontal and slope distances.
- **Slope:** Necessary for computing slope effects on fire spread and solar radiance.
- **Aspect:** Important in determining the solar exposure of grid cells.
- **Fuel Model:** A numerical assignment of vegetation/fuels that represent distinct distributions of fuel loadings found among surface fuel components (live and dead), size classes, and fuel types. The fuel models are described by the most common fire carrying fuel type (grass, brush, timber (tree) litter or timber understory), loading and surface area-to-volume ratio by size class and component, fuelbed depth, and moisture of extinction. The fuel model set used for this analysis was the 40-fuel model set from Scott and Burgan (2005). The models included in the analysis are summarized in Table H-1.

Table H-1. Fuel Models in Modeling Area

| Fuel Model | Description |
|---|---|
| GR1 (101) | Short, Sparse Dry Climate Grass |
| GR2 (102) | Low Load, Dry Climate Grass |
| GS1 (121) | Low load, Dry Climate Grass-Shrub |
| GS2 (122) | Moderate Load, Dry Climate Grass-Shrub |
| SH1 (141) | Low Load, Dry Climate Shrub |
| SH2 (142) | Moderate Load Dry Climate Shrub |
| SH5 (145) | High Load, Dry Climate Shrub |
| NB1 (91) | Urbane/Developed |

- **Canopy Cover:** Necessary for computing shading and wind reduction factors for all fuel models. Canopy cover is measured as the horizontal fraction of the ground that is covered directly overhead by tree canopy.
- **Stand Height:** The representation of the average height of dominant and co-dominant trees in a stand (not the tallest height or average height of all trees). Stand height is used in FlamMap for computing wind reduction to midflame height and spotting distances from torching trees. Stand height is a necessary dataset for utilizing the torching, spotting, and crown fire model in FlamMap.
- **Canopy Base Height:** A variable used for determining transition from surface fire to crown fire; represents the height to the bottom of the live tree crown. Canopy base height is a necessary dataset for utilizing the torching, spotting, and crown fire model in FlamMap.
- **Canopy Bulk Density:** Used to determine the characteristics of crown fires and describes the density of available canopy fuel in a stand. It is defined as the mass of available canopy fuel per canopy volume unit. Canopy bulk density is a necessary data set for utilizing the torching, spotting, and crown fire model in FlamMap.

The FlamMap analysis area encompassed the City of Bradbury plus a buffer of approximately 5 miles. LANDFIRE data layers were projected to the NAD 83, California State Plane, Zone 5 coordinate system. In addition to the Landscape file, wind and weather data were incorporated into the model inputs, as described below.

### 1.3.2 Wind and Fuel Moisture

In order to utilize weather and fuel moisture variables for the fire behavior modeling area, data from the Henninger Flats Remote Automated Weather Station (RAWS)[1] was analyzed. Utilization of RAWS data is necessary for fire behavior modeling as it includes data for fuel moisture, temperature, relative humidity, and wind speed. The Henninger RAWS is located approximately 16 miles to the northwest of the City. The following summarizes the location and available data ranges for the Herringer RAWS:

**Latitude:** 34.1142
**Longitude:** -118.0536
**Elevation:** 2,800 feet
**Data years:** 1994 to 2019

Wind and weather data are a required component to fire behavior modeling efforts. The Henninger RAWS data was processed with the FireFamily Plus version 5.0 (FireFamily Plus 2019) software package to determine weather conditions to be incorporated into modeling efforts. The selected weather scenario used 97th percentile conditions to mimic a fire event during Sundowner wind conditions. The analysis period for weather data analysis was May 1–December 31.

These weather values were incorporated into the Initial Fuel Moisture file used as an input in FlamMap. Wind direction and wind speed values for the FlamMap run were manually entered during the data input phase. Table H-2 presents the wind and weather values used in the FlamMap fire behavior modeling runs conducted in support of this CWPP.

Table H-2. FlamMap Weather Input Variables

| Model Variable | Value |
|---|---|
| 1-hour fuel moisture | 2% |
| 10-hour fuel moisture | 3% |
| 100-hour fuel moisture | 5% |
| Live herbaceous moisture* | 30% |
| Live woody moisture | 60% |
| 20-foot wind speed (mph) | 50 mph (maximum speed) |
| Wind direction | 80 degrees (Santa Ana) |

**Note:**
* Live herbaceous moisture values were lower than 30% so the herbaceous fuels are considered fully cured (Scott and Burgan 2005).

Finally, wind vectors were modeled within the FlamMap runs using the WindNinja tool embedded in the FlamMap software. WindNinja models the effect of topography on wind speed and direction and generates wind vector files for use in the modeling runs. The grid resolution for the WindNinja analysis was set at 60 meters.

### 1.3.3 Model Outputs

Three output grid files were generated for the FlamMap run and represent flame length, crown fire activity, and spotting potential. Flame length, the length of the flame of a spreading surface fire within the flaming front, is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews et al. 2008). It is a somewhat subjective and non-scientific measure of fire behavior but is extremely important to fireline

1 https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCHEN
Latitude: 34.1142 Longitude: -118.0536; Elevation: 2,800 ft.)

personnel in evaluating fireline intensity and is worth considering as an important fire variable (Rothermel 1993). Flame length values in the resulting grid file are in feet. Table H-3 presents an interpretation of flame length and its relationship to fireline intensity. Fireline intensity is a measure of heat output from the flaming front and also affects the potential for a surface fire to transition to a crown fire.

Table H-3. Fire Suppression Interpretation

| Flame Length | Fireline Intensity | Interpretations |
|---|---|---|
| Under 4 feet | Under 100 BTU/ft/s | Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire. |
| 4 feet to 8 feet | 100–500 BTU/ft/s | Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective. |
| 8 feet to 11 feet | 500–1,000 BTU/ft/s | Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective. |
| Over 11 feet | Over 1,000 BTU/ft/s | Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective. |

**Note:** BTU/ft/s = British thermal units per foot per second.
**Source:** Roussopoulos and Johnson 1975.

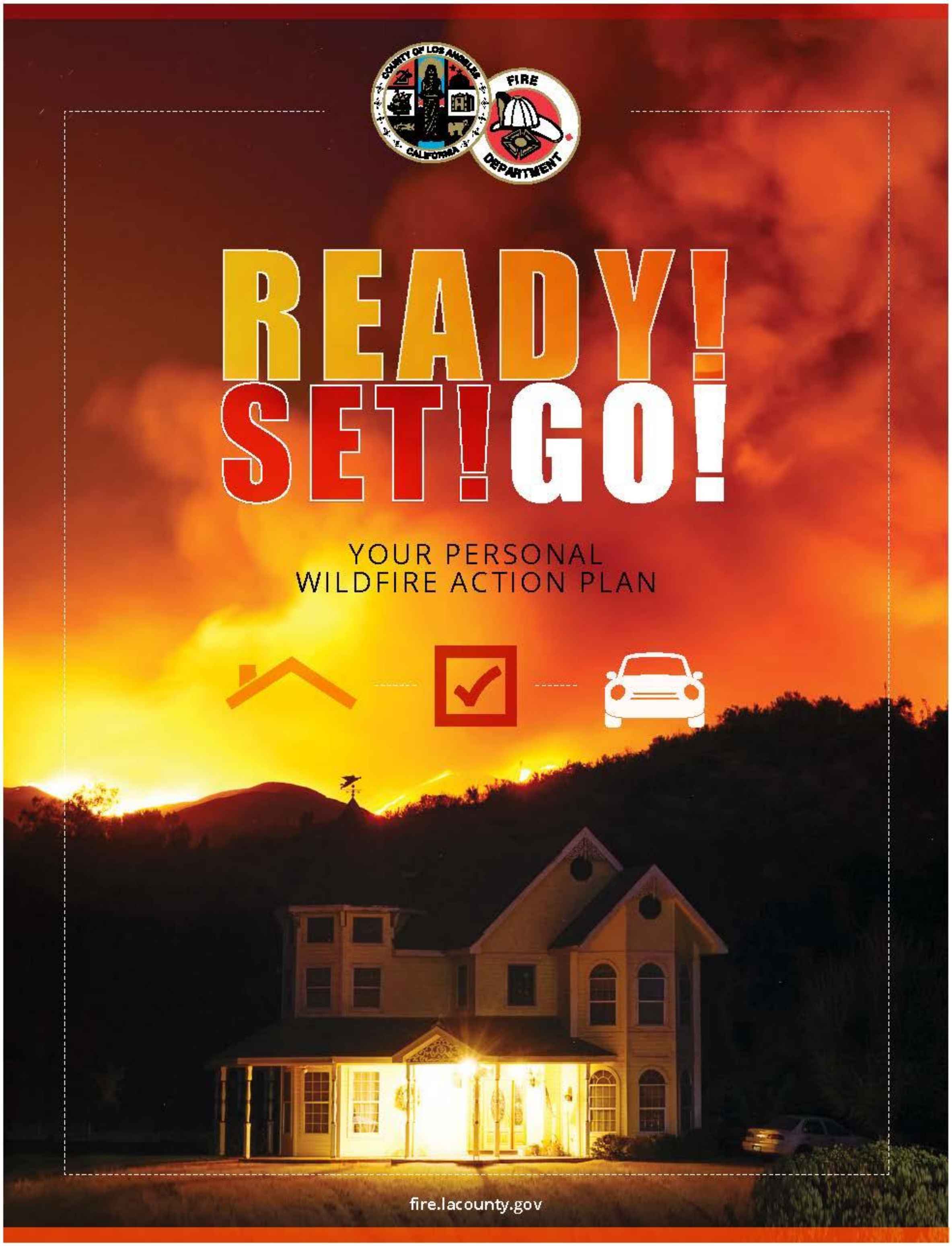
Model outputs for crown fire activity include three potential options: surface fire, passive crown fire (torching), or active crown fire. Surface fires may transition to crown fire, depending on surface fire intensity and crown characteristics. Ladder fuels facilitate ignition of crown fuels by the surface fire and then transition to some form of crown fire (Seli et al. 2015). As presented in Table H-3, crown fires present significant resistance to control and are a characteristic of extreme fire behavior.

Model outputs for spotting are the maximum spotting distance (in meters) from a crown fire. FlamMap only generates spotting potential where crown fires occur (e.g., in oak woodlands), so this analysis does not account for spotting generated in a fire burning in chaparral vegetation. FlamMap outputs generate point data set coded with the maximum spotting distance. This data set was then buffered to create a spotting potential layer, where the buffer radius equaled the maximum spotting distance. The buffering exercise represented a circular area around each spotting point, which is not an accurate representation of upwind spotting distances (as the modeling scenario utilized a Sundowner wind event). However, this analysis does give an estimate of potential fire hazard associated with spotting (embers) in the downwind area of the City.

A map depicting potential flame length values is presented in Figure 9.

# Appendix I

## Los Angeles County Fire Department's "Ready Set, GO!" Plan


READY!
SET! GO!
YOUR PERSONAL
WILDFIRE ACTION PLAN
fire.lacounty.gov

# MESSAGE FROM FIRE CHIEF DARYL L. OSBY

Dear Residents,

Los Angeles County is one of the most beautiful places to live, but for those living in "wildland urban interface areas," it does not come without risks. With a year-round fire season and ever-growing number of wildfires, firefighters and residents alike are now constantly on heightened alert for the threat of wildfires.

The Los Angeles County Fire Department, along with our partnering agencies, stand ready to quickly respond to contain wildfires, utilizing our firefighting resources from the air and ground to help protect you and your property from wildfire.

But, we can't do this without your cooperation. Preparation and prevention go hand-in-hand. This *Ready! Set! Go!* brochure was designed to provide you with critical information on creating defensible space around your home, retrofitting your home with fire-resistant materials, and preparing you to safely evacuate well ahead of a wildfire. Please protect yourself, your family, and your property from a devastating wildfire by taking the time to learn about *Ready! Set! Go!*

In Los Angeles County, wildfires will continue to be fueled by a build-up of seasonal dry vegetation and driven by dry conditions and locally strong winds, making them extremely dangerous and challenging for firefighters to control. Yet, many homeowners don't consider how a wildfire could affect them, and very few residents have properly prepared for evacuation until it is too late.

You play the most important role in protecting yourself, family, and property. Through planning and preparation, we can all be ready for the next wildfire. I hope you find the information in this brochure helpful as you prepare your home and family for a wildfire.

As always, if you need additional information about preparing for a wildfire or any other natural disaster, please contact your nearest fire station or visit us at fire.lacounty.gov.

**Daryl L. Osby**
***Los Angeles County Fire Chief***

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# INSIDE

## READY!



## SET!



## GO!



**Preparing for a wildfire starts with three simple steps:**

**READY!** ------ **SET!** ------ **GO!**

Please keep this plan on hand as a quick reference for helping your family and property be safe in the event of a wildfire.

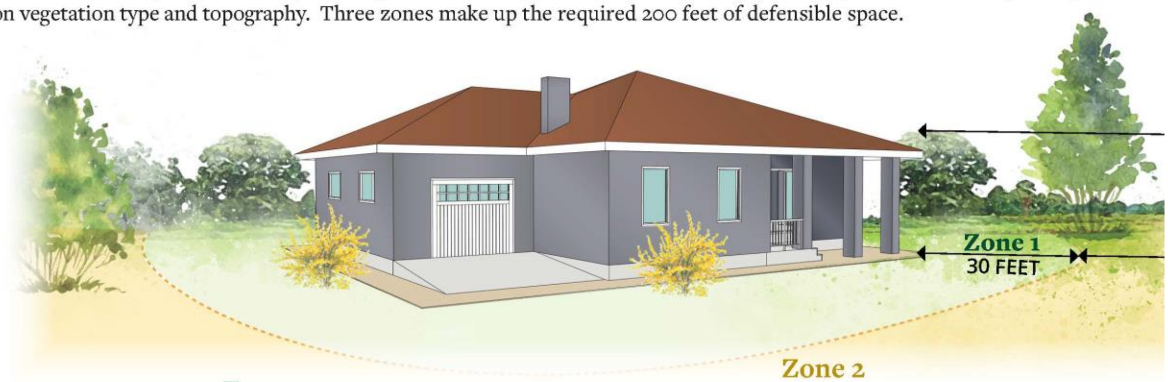
# READY!

## Living in the Wildland Urban Interface

Ready! Set! Go! begins with a house that firefighters can defend.

## Defensible Space

Creating and maintaining defensible space is essential for increasing your home's chance of surviving a wildfire. It's the buffer homeowners are required to create between their structure and the native landscape. This space slows the spread of wildfire and improves the safety of firefighters defending your home. Defensible space composition varies, depending on vegetation type and topography. Three zones make up the required 200 feet of defensible space.




### Zone 1

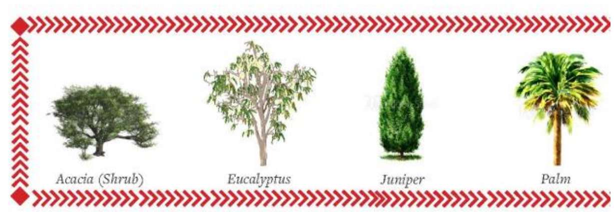
**Extends 30 feet out from the structure**

- Remove all dead or dying vegetation.
- Remove dead or dry leaves and pine needles from your yard, roof, and rain gutters.
- Trim trees regularly to keep branches a minimum of 10 feet from other trees.
- Remove dead branches hanging over your roof. And, keep branches 10 feet away from your chimney.
- Relocate exposed woodpiles outside of Zone 1 unless they are completely contained in a fire-resistant enclosure.
- Remove vines and climbing plants from combustible structures (e.g., bougainvillea, wisteria).
- Remove or prune vegetation near windows (you should be able to see out the windows).
- Remove vegetation and items around and under decks that could catch fire.
- Create separations between trees, shrubs, and items that could catch fire, such as patio furniture, swing sets, etc.
- Irrigation is recommended to maintain vegetation moisture content.

### Zone 2

**Extends from the outer edge of Zone 1 to 100 feet from the structure**

- Cut or mow annual grass down to a maximum height of three inches.
- Create vertical and horizontal spacing between trees and shrubs (the distance between trees should be three times the height).
- Remove fallen leaves, needles, twigs, bark, cones, and small branches. However, a mulch layer may be permitted to a depth of four inches, if erosion control is an issue.
- Irrigation is recommended to maintain vegetation moisture content.



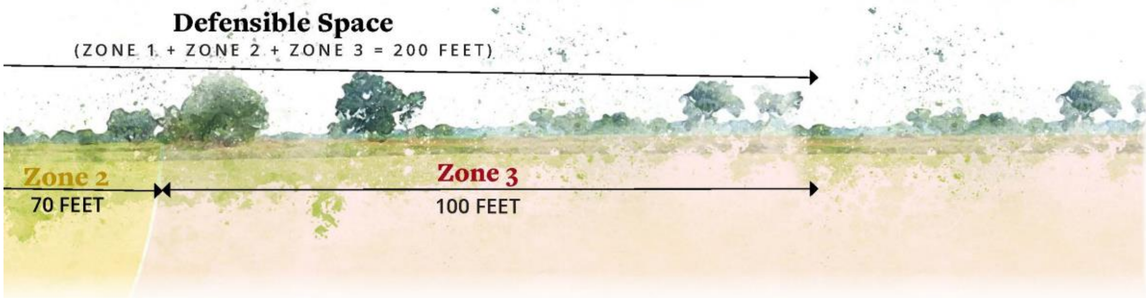
# READY!

# HAZARDOUS

## ORNAMENTAL LANDSCAPE

Preventing conditions where fire can travel from adjacent fuels, through an ornamental landscape to your structure, is the key to creating defensible space. Fire spreads through convection, conduction, radiation, or embers. Proper maintenance of ornamental vegetation reduces ember production, fire propagation, intensity, and duration of the approaching flames.

This home provides a good example of defensible space.




## Zone 3

**Extends from the outer edge of Zone 2 to 200 feet from the structure**

Zone 3 consists of mostly native plants appropriately thinned and spaced by 30 to 50 percent. The objective is to reduce vegetation density and overall fuel load. This slows the rate of fire spread, reducing flame lengths and fire intensity before it reaches irrigated zones or structures.

- Irrigation systems are not required.
- Vegetation consists of modified existing native vegetation.
- Additional ornamental shrubs and trees are generally not recommended due to water conservation goals.
- Existing native vegetation is modified by thinning and removing plants constituting a high fire risk, including, but not limited to, laurel sumac, chamise, ceanothus, sage, sage brush, buckwheat, and California juniper.
- Remove the lower ⅓ of large shrubs and all dead wood to reduce fuel loads.
- Trees should be limbed up to at least six feet above grade and a minimum of three times the height of underlying plants.
- As the distance from structures increases, native plants may be removed in reduced amounts.
- Spacing for large native shrubs or groups of native shrubs is 15 feet between the edge of their canopies.
- Spacing for existing native trees or small groups of trees is 30 feet between the edge of canopies. This depends on the species, topography, and orientation on the site.

### HIGH-HAZARD PLANTS

*Pine*

*Pampas Grass*

**Note:** Special attention should be given to the use and maintenance of ornamental plants known or thought to be high-hazard plants when used in close proximity to structures. Examples include acacia, cedar, cypress, eucalyptus, Italian cypress, juniper, palms (remove all dead fronds), pine (removal within 30 feet of structures), and pampas grass. These plantings should be properly maintained and not allowed to be in mass plantings that could transmit fire from the native growth to any structure.

# READY!

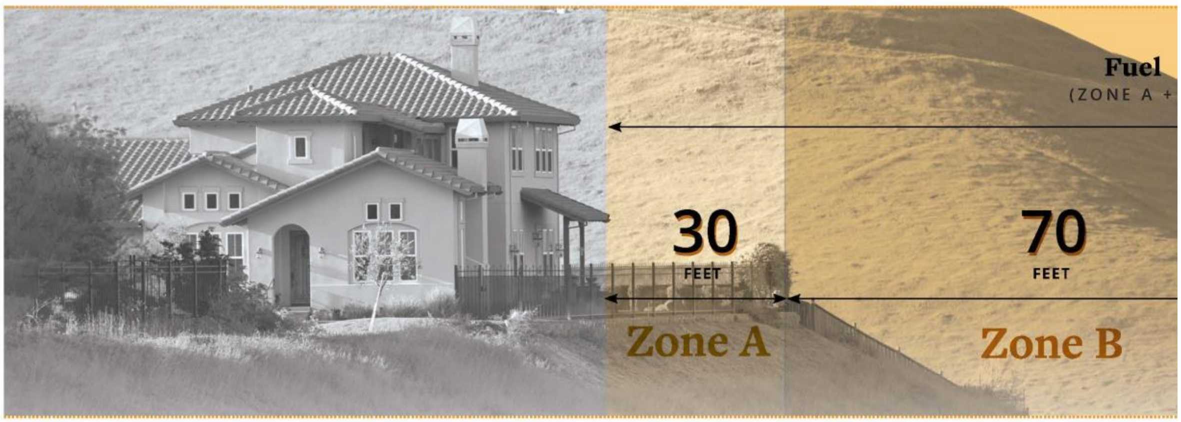
## Fuel Modification

### What Is Fuel Modification?

The Fuel Modification Plan Review Program affects new structures and developments built in fire hazard severity zones. A Fuel Modification Plan (or landscape plan) identifies defensible space zones and restricts or limits planting around structures.

**For further information, please visit** bit.ly/fuelmod or call (626) 969-5205.

## *Fuel Modification Zones*




### Zone A

**EXTENDS 30 FEET FROM THE STRUCTURE**

- Irrigated area consisting of low-growing, small herbaceous plants with high-moisture content immediately around structures.
- Hedges shall not be within five feet of any structures.
- Occasional accents of woody shrubs or small patio trees 10 feet from structures. Single plants and/or groups of plants are widely spaced (the distance between plants is three times the height).
- Cut annual grasses to three inches and remove leaf litter.
- Vines and climbing plants are not allowed on combustible structures.
- Use rock or non-combustible mulch within five feet of structures.

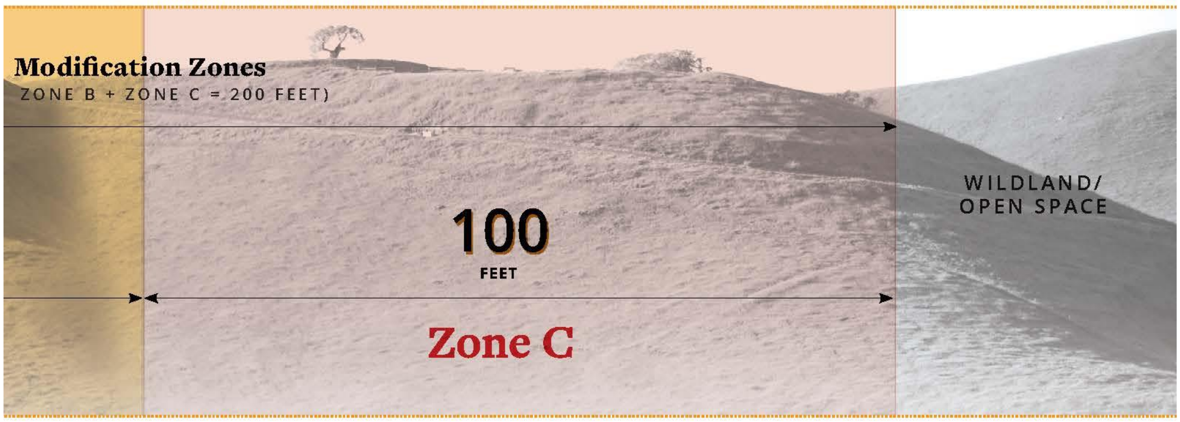
*Ideal Fuel Modification Landscape:*

Limited woody plant material, high moisture content, adequate spacing, and inorganic mulch throughout Zone A.

# READY!

## Create a Defensible Home

A home with defensible space has the greatest potential of surviving a wildfire. Defensible homes are compliant with the Los Angeles County Fire Department's brush clearance requirements. Homes built after January 1, 1996, have been through the Fire Department's Fuel Modification Program, where strict planting requirements and construction standards improve fire safety in the high and very high fire hazard severity zones.




### Zone B

**EXTENDS FROM THE OUTER EDGE OF ZONE A TO 100 FEET FROM THE STRUCTURE**

- Irrigated with slightly denser planting than Zone A. Avoid woody plants larger than three feet in height at maturity under tree canopies.
- Has zone-appropriate shade trees with adequate spacing.
- Minimize continuous canopy coverage to reduce fire transmission.
- Screening plants may be used; however, continuous hedges are discouraged as this promotes accumulation of dead litter inside the live hedge and creates a continuous fuel ladder to the structure.

### Zone C

**EXTENDS FROM THE OUTER EDGE OF ZONE B TO 200 FEET FROM THE STRUCTURE**

- Thin to remove dead vegetation and prevent overgrowth.
- Thin native species to slow the fire's progress and reduce its intensity by decreasing availability of continuous fuels.
- Native vegetation is thinned 30 to 50 percent in Zone C.

# READY!

## Safeguard or "Harden" Your Home

The ability of your home to survive a wildfire depends on the materials your home is constructed of and the quality of the "defensible space" surrounding it. Windblown embers from a wildfire will find the weak link in your home's fire protection scheme and gain the upper hand because of a small, overlooked, or seemingly inconsequential factor. However, there are measures you can take to safeguard your home from wildfire. While you may not be able to accomplish all of the measures listed below, each will increase your home's - and possibly your family's - safety and survival.


### Tour a Wildfire-Ready Home

### Address 1

- Make sure your address is clearly visible from the road. The address needs to be a contrasting color to the surface that it is mounted on, so it can be seen.

### Chimney 2

- Cover your chimney and stovepipe outlets with a non-flammable screen of ⅛-inch wire mesh or smaller to prevent embers from escaping and igniting a fire.
- Tree branches must be removed within 10 feet of any chimney (exception: oak trees).

### Deck/Patio Cover 3

- Use heavy timber or non-flammable construction material for decks and patio covers, especially within the first 10 feet of the home.
- Enclose the underside of balconies and decks with fire-resistant materials to prevent embers from blowing underneath.
- Keep your deck clear of combustible items, such as baskets, dried flower arrangements, and other debris.

### Driveways and Access Roads 4

- Driveways should be designed to allow fire and emergency vehicles and equipment to reach your home (current fire code requirement is 15 feet wide).
- Access roads should have a minimum 10-foot clearance on either side of the traveled section of the roadway and should allow for two-way traffic.
- Locked or electric gates should have a disconnect or a lock box.
- Ensure that all gates open inward and are wide enough to accommodate emergency equipment.
- Trim trees and shrubs above all roads clear to the sky, with the exception of Oak trees which only need to be cleared to a height of 13½ (or 13.5) feet.

### Garage 5

- Have a fire extinguisher and tools, such as a shovel, rake, bucket, and hoe, available for fire emergencies.
- Install a solid door with self-closing hinges between living areas and the garage. Install weather stripping around and under the doors to prevent ember intrusion.
- Store all combustibles and flammable liquids away from ignition sources.
- Keep the garage closed whenever possible.

### Home Site and Yard 6

- Ensure you have up to a 200-foot radius of defensible space (cleared vegetation) around your home. If the 200-foot distance is on adjacent property, contact your local fire station for assistance in obtaining adequate clearance.
- Cut dry weeds and grass before noon when temperatures are cooler to reduce the chance of sparking a fire when using metal tools.
- Landscape with fire-resistant plants that are low-growing with high-moisture content.
- Keep woodpiles, propane tanks, and combustible materials away from your home and other structures, such as garages, barns, and sheds (recommended 30 feet).
- Ensure trees and branches are at least four feet away from power lines. Notify your power company if this condition exists; they will complete required work.

# READY!

## Inside

- Keep a working fire extinguisher on hand and train your family how to use it. Store in an easily accessible location (check expiration date regularly).

- Install smoke alarms on each level of your home and adjacent to the bedrooms. Test them monthly and change the batteries twice a year.

## Non-Combustible Boxed-In (Soffit) Eaves

- Box-in eaves with non-combustible materials to prevent accumulation of embers.

## Non-Combustible Fencing 7

- Make sure to use non-combustible fencing to protect your home during a wildfire.

## Rain Gutters

- Screen or enclose rain gutters to prevent accumulation of plant debris.

## Roof 8

- Your roof is the most vulnerable part of your home because it can easily catch fire from windblown embers.
- Homes with wood shake or shingle roofs are at a higher risk of being destroyed during a wildfire.
- Build your roof or re-roof with fire-resistant materials that include composition, metal, or tile.
- Block any spaces between roof decking and covering to prevent ember intrusion.
- Clear pine needles, leaves, and other debris from your roof and gutters.
- Cut any tree branches within 10 feet of your roof.

## Vents

- Vents on homes are particularly vulnerable to flying embers.
- All vent openings should be covered with ⅛-inch or smaller metal mesh. Do not use fiberglass or plastic mesh because they can melt and burn.
- Attic vents in eaves or cornices should be baffled or otherwise to prevent ember intrusion (mesh is not enough).

## Walls 9

- Wood products, such as boards, panels, or shingles, are common siding materials. However, they are combustible and not good choices for fire-prone areas.
- Build or remodel with fire-resistant building materials, such as brick, cement, masonry, or stucco.
- Be sure to extend materials from foundation to roof.

## Water Supply 10

- Have multiple garden hoses that are long enough to reach any area of your home and other structures on your property.

## Windows 11

- Heat from a wildfire can cause windows to break even before the home ignites. This allows burning embers to enter and start internal fires. Single-paned and large windows are particularly vulnerable.
- Install dual-paned windows with an exterior pane of tempered glass to reduce the chance of breakage in a fire.
- Limit the size and number of windows in your home that face large areas of vegetation.

## Utilities

- Ensure that your family knows where your gas, electric, and water main shut-off controls are and how to safely shut them down in an emergency.

# ☑ SET!

## Create Your Own Wildfire Action Plan

Now that you have done everything you can to protect your home, it's time to prepare your family. **Your Wildfire Action Plan must be prepared with all members of your household well in advance of a wildfire.** Each family's plan will be different, depending on their situation. Once you finish your plan, practice it regularly with your family, and post it in a safe and accessible place for quick implementation.

### 1 Important Phone Numbers

- ☐ A family communication plan that designates an out-of-area friend or relative as a point-of-contact to act as a single source of communication among family members in case of separation.
- ☐ Maintain a list of emergency contact numbers posted near your phone and in your Emergency Supply Kit (see page 12 in this guide).

### 2 What to Take

- ☐ Assemble an Emergency Supply Kit (see page 12 in this guide).
- ☐ Keep an extra Emergency Supply Kit in your car in case you can't get to your home because of fire.
- ☐ Have a portable radio or scanner, so that you can stay updated on the fire.

### 3 Prepare to Evacuate

- ☐ Designate an emergency meeting location, outside the fire or hazard area. It is critical to determine who has safely evacuated from the affected area.
- ☐ Have several different travel routes from your home and community identified. Practice these often, so everyone in your family is familiar in case of emergency.
- ☐ Have all of the necessary supplies and/or boarding options for your pets and large animals identified and/or packed. If trailers are necessary for larger animals, have a plan that is tested and ready to implement.

Your Personal
# WILDFIRE ACTION PLAN

During High Fire Danger days in your area, monitor your local media for information on wildfires and be ready to implement your plan. Hot, dry, and windy conditions create the perfect environment for a wildfire.

## 1 IMPORTANT PHONE NUMBERS

**EMERGENCY CONTACTS**

Name

( ) Phone

Name

( ) Phone

**SCHOOLS**

Name

( ) Phone

Name

( ) Phone

**FAMILY & FRIENDS**

Name

( ) Phone

Name

( ) Phone

## 2 WHAT TO TAKE

- ○ Insurance Papers
- ○ Photos
- ○ Emergency Supply Kit
- ○ Prescriptions
- ○ Important Documents
- ○ ________

## 3 EVACUATION

**WHEN TO GO**

**WHERE TO GO**

**HOW TO GET THERE**

**DESTINATION**

**WHO TO TELL** (BEFORE AND AFTER)

**ANIMAL SHELTER**

Name

( ) Phone

**LOS ANGELES COUNTY FIRE DEPARTMENT**

**IF YOU HAVE AN EMERGENCY, CALL 9-1-1**

**Public Information Office:** (323) 881-2411

**fire.lacounty.gov**

# ☑ SET!

## Assemble Your Emergency Supply Kit

Put together your emergency supply kit long before a wildfire or other disaster occurs, and keep it easily accessible, so you can take it with you when you have to evacuate. Plan to be away from your home for an extended period of time. Each person should have a readily accessible emergency supply kit. Backpacks work great for storing these items (except for food and water) and are easy to grab. Storing food and water in a tub or chest on wheels will make it easier to transport. Keep it light to be able to easily lift it into your vehicle.

### Essential Supplies

- ☐ Three-day supply of non-perishable food and three gallons of water per person
- ☐ Map marked with at least two evacuation routes
- ☐ Prescriptions or special medications
- ☐ Change of clothing and closed-toe shoes
- ☐ Extra eyeglasses or contact lenses
- ☐ An extra set of car keys, credit cards, and cash
- ☐ First aid kit
- ☐ Flashlight
- ☐ Battery-powered radio and extra batteries
- ☐ Sanitation supplies
- ☐ Copies of important documents (e.g., birth certificates, passports, etc.)
- ☐ Don't forget food and water for your pets!

### If Time Allows

- ☐ Easy-to-carry valuables
- ☐ Family photos and other irreplaceable items
- ☐ Personal computer data on hard drives/flash drives
- ☐ Chargers for cell phones, laptops, etc.

## Pre-Evacuation Preparation Steps

When an evacuation is anticipated and if time permits, follow these checklists to give your home the best chance of surviving a wildfire:

### Animals

- ☐ Locate your pets and keep them nearby.
- ☐ Prepare large animals for transport and think about moving them to a safe location early.

### Inside

- ☐ Shut all windows and doors.
- ☐ Remove flammable window shades, lightweight curtains, and close metal shutters.
- ☐ Move flammable furniture to the center of the room, away from windows and doors.
- ☐ Leave your lights on, so firefighters can see your home under smoky conditions.
- ☐ Shut off the air conditioning.
- ☐ Shut off the gas meter and all pilot lights.

### Outside

- ☐ Gather flammable items from the exterior of the house and bring them inside (e.g., patio furniture, children's toys, doormats, etc.) or place them in your pool.
- ☐ Turn off propane tanks. Move propane BBQ appliances away from structures.
- ☐ Connect garden hoses to outside water valves or spigots for use by firefighters.
- ☐ Don't leave sprinklers on or water running. They can affect critical water pressure.
- ☐ Leave exterior lights on.
- ☐ Put your emergency supply kit in your vehicle.
- ☐ Back your loaded vehicle into the driveway with all doors and windows closed. Carry your car keys with you.
- ☐ Have a ladder available in a conspicuous location for firefighter use.
- ☐ Seal attic and ground vents with a non-combustible material or commercial seals, if time permits.
- ☐ Monitor your property and your wildfire situation. Don't wait for an evacuation order, if you feel threatened and need to, leave.
- ☐ Check on neighbors and make sure they are preparing to leave.

# GO!

## TAKE ACTION IMMEDIATELY WHEN WILDFIRE STRIKES

### Go Early

By leaving early, you will give your family the best chance of surviving a wildfire. You also help firefighters by keeping roads clear of congestion, enabling them to move more freely throughout the neighborhood and do their job.

### When to Go

Leave early enough to avoid being caught in fire, smoke, or road congestion. Don't wait to be told by authorities to leave. In an intense wildfire, they may not have time to knock on every door. If you are advised to leave, don't hesitate!

The terms "Voluntary" and "Mandatory" are used to describe evacuation orders. However, local jurisdictions may use other terminology such as "Precautionary" and "Immediate Threat." These terms are used to alert you to the significance of the danger. All evacuation instructions provided by emergency personnel should be followed immediately for your safety.

### Where to Go

Leave for a pre-determined location. It should be a low-risk area, such as a well-prepared neighbor or relative's house, a Red Cross shelter or evacuation center, motel, etc.

### How to Get There

Have several evacuation routes in case one route is blocked by the fire or by emergency vehicles and equipment. Choose an evacuation route away from the fire.

*Follow these steps as soon as possible to get ready to* GO!

- **Review your Wildfire Action Plan evacuation checklist.**


- Ensure your Emergency Supply Kit is in your vehicle.


- Cover up to protect against heat and flying embers. Wear long pants, a long-sleeve shirt, heavy shoes/boots, a cap, dry bandana (for face cover), goggles, or glasses. 100% cotton is preferable.

- Locate your pets and take them with you.

# GO!

## Survival Tips if You Become Trapped

### In Your Home

- ☐ Stay calm and keep your family together.
- ☐ Call 9-1-1 and inform authorities of your location.
- ☐ Fill sinks and tubs for an emergency water supply.
- ☐ Keep doors and windows closed, but unlocked.
- ☐ Remove curtains from the windows.
- ☐ Turn your interior and exterior lights on.
- ☐ Stay inside your home.
- ☐ Shelter away from outside walls.

### In Your Vehicle

- ☐ Stay calm.
- ☐ Park your vehicle in an area clear of vegetation.
- ☐ Close all vehicle windows and vents.
- ☐ Cover yourself with a wool or cotton blanket or jacket.
- ☐ Lie on the vehicle floor.
- ☐ Use your cell phone and call 9-1-1 to inform authorities of your location.

### On Foot

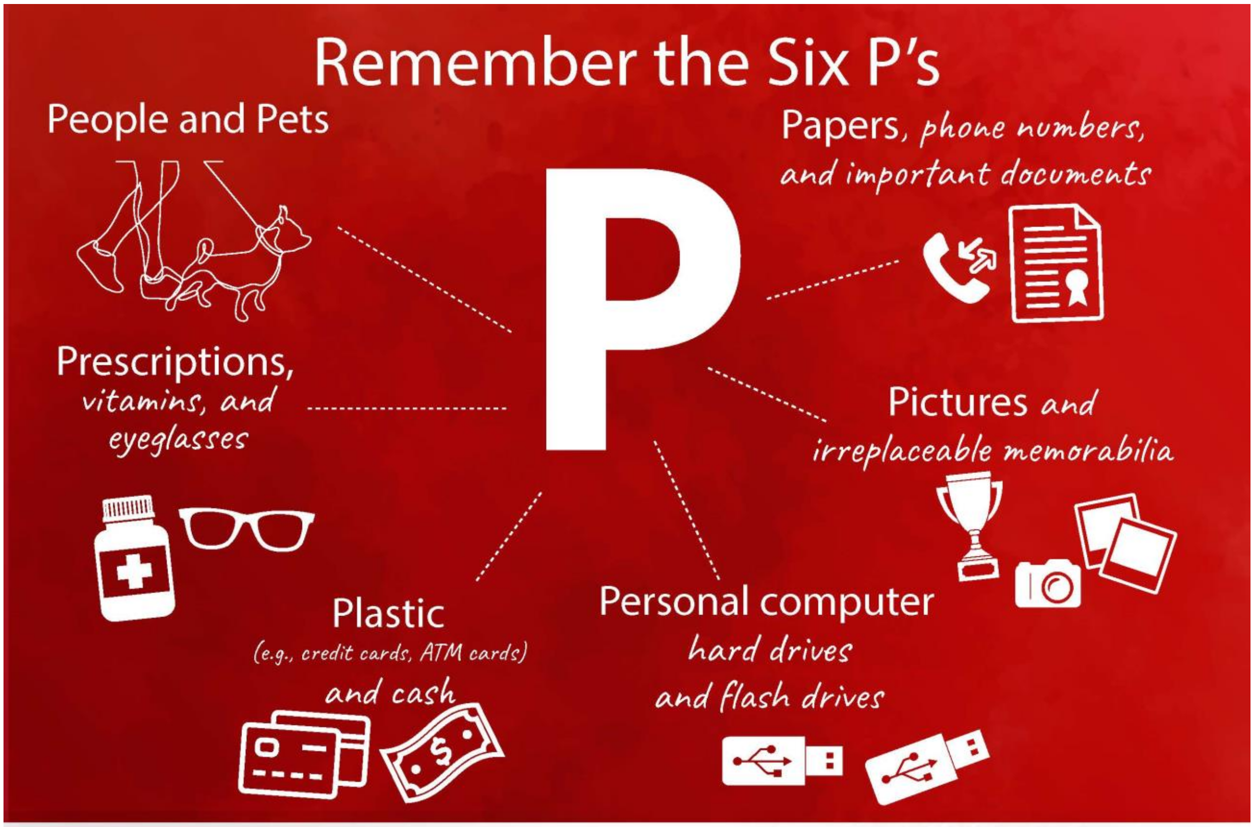
- ☐ Stay calm.
- ☐ Go to an area clear of vegetation, a ditch or depression on level ground, if possible.
- ☐ Lie face down and cover up your body.
- ☐ Use your cell phone and call 9-1-1 to inform authorities of your location.

## Returning Home After a Wildfire

**Do not return home until emergency officials determine it is safe. You will receive proper notification to do so as soon as it is possible, considering safety and accessibility.**

### When You Return Home

- ☐ Be alert for downed power lines and other hazards.
- ☐ Check propane tanks, regulators, and lines before turning gas on.
- ☐ Check your residence carefully for hidden embers or smoldering fires.

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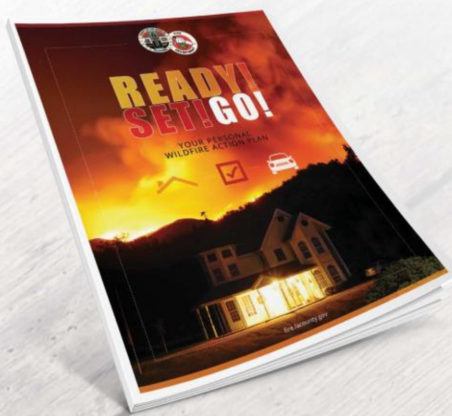


**Download the *Ready! Set! Go!* Wildfire Action Plan at fire.lacounty.gov/rsg or by scanning this QR code with your smart phone.**

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READY!
SET!
GO!
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FIRE DEPARTMENT
Public Information Office
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Produced by the Communications Section
of the Executive Support Division.
Revised April 29, 2021.
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# Appendix J

Glossary of Terms

# Glossary of Terms

***BehavePlus:*** Fire behavior prediction and fuel modeling computer program designed to model fire behavior characteristics based on fuel, weather, and topographic inputs. Model outputs include flame length values, fire spotting potential, and rate of fire spread.

***Brush:*** A collective term that refers to stands of vegetation dominated by shrubby, woody plants or low-growing trees; usually of a vegetation type undesirable for livestock or timber management.

***Brush Fire:*** A fire burning in vegetation that is predominantly shrubs, brush, and scrub growth.

***Burning Conditions***: The state of the combined factors of the environment that affect fire behavior in a specified fuel type.

***Canopy:*** The forest cover of branches and foliage formed by tree crowns. The stratum containing the crowns of the tallest vegetation present (living or dead), usually above 20 feet.

***Chipping:*** Using a mechanical chipper to chip cut vegetation into small chips.

***Closure:*** Legal restriction, but not necessarily elimination, of specified activities such as smoking, camping, or entry that might cause fires in a given area.

***Combustible:*** Any material that, in the form in which it is used and under the conditions anticipated, will ignite and burn.

***Conflagration:*** A raging, destructive fire. Often used to describe a fire burning under extreme fire weather. The term is also used when a wildland fire burns into a WUI, destroying structures.

***Crown Fire:*** A fire that advances from top-to-top of trees or shrubs more or less independent of a surface fire.

***Cured:*** The stage when herbaceous fuel moisture falls to 30% or less.

***Defensible Space:*** An area either natural or man-made where material capable of allowing a fire to spread unchecked has been treated, cleared, or modified to slow the rate and intensity of advancing wildfire. This will create an area for housing increased emergency fire equipment, for evacuating or sheltering civilians in place, and a point for fire suppression to occur.

***Duff:*** The layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles and leaves and immediately above the mineral soil.

***Exotic Pest Plant:*** A non-indigenous plant species, or one introduced to this state that either purposefully or accidentally escapes into the wild where it reproduces on its own either sexually or asexually.

***Exposure:*** (1) Property that may be endangered by a fire burning in another structure or by a wildfire; (2) direction in which a slope faces, usually with respect to cardinal directions; (3) the general surroundings of a site with special reference to its openness to winds.

***Extreme Fire Behavior:*** A level of fire behavior characteristics that ordinarily precludes methods of direct control. One or more of the following is usually involved: high rates of spread, prolific crowning and/or spotting, presence of fire whirls, a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environments and behave erratically, sometimes dangerously.

***Fine Fuels:*** Fast-drying dead fuels that are less than 0.25-inch in diameter and are generally characterized by a comparatively high surface area to volume ratio. These fuels (grass, leaves, needles, etc.) ignite readily and are consumed rapidly by fire when dry.

***Fire Behavior:*** The manner in which a fire reacts to the influences of fuel, weather, and topography.

***Fire Department:*** Any regularly organized fire department, fire protection district or fire company regularly charged with the responsibility of providing fire protection to the jurisdiction.

***Fire Front:*** That part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, it is assumed to be the leading edge of the fire perimeter.

***Fire Hazard:*** A fuel complex, defined by volume, type condition, arrangement, and location that determines the degree of ease of ignition and of resistance to control.

***Fire Hydrant:*** A valved connection on a piped water supply system having one or more outlets that is used to supply hose and fire department pumpers with water.

***Fire Ladders:*** Areas where vegetation allows fire to quickly transmit from grass to brush and then to the canopy of trees, producing a high intensity fire with less potential for fire control.

***Fire Prevention:*** Activities, including education, engineering, enforcement, and administration that are directed at reducing the number of wildfires, the costs of suppression, and fire-caused damage to resources and property.

***Fire Protection:*** The actions taken to limit the adverse environmental, social, political, and economic effects of fire. Protection is relative, not absolute.

***Fire Regime**:* Periodicity and pattern of naturally occurring fires in a particular area or vegetative type, described in terms of frequency, biological severity, and area of extent.

***Fire Retardant:*** Any substance, except plain water, that by chemical or physical action reduces flammability of fuels or slows their rate of combustion.

***Fire Season:*** (1) Period(s) of the year during which wildland fires are likely to occur, spread, and affect resource values sufficient to warrant organized fire management activities; (2) a legally enacted time during which burning activities are regulated by state or local authority.

***Fire Triangle:*** Instructional aid in which the sides of a triangle are used to represent the three factors (oxygen, heat, fuel) necessary for combustion and flame production; removal of any of the three factors causes flame production to cease.

***Fire Weather:*** Weather conditions which influence fire starts, fire behavior, or fire suppression.

***Firebrand:*** Any source of heat, natural or human made, capable of igniting wildland fuels. Flaming or glowing fuel particles that can be carried naturally by wind, convection currents, or gravity into unburned fuels. Examples include leaves, pinecones, glowing charcoal, and sparks.

***Firebreak:*** A natural or constructed barrier used to stop or check fires that may occur or to provide a control line from which to work.

***Firefighter:*** A person who is trained and proficient in the components of structural or wildland fire.

***Fireline:*** That portion of the fire upon which resources are deployed and actively engaged in suppression action. In a general sense, the working area around a fire.

***Flame:*** A mass of gas undergoing rapid combustion, generally accompanied by evolution of sensible heat and incandescence.

***Flammability:*** The relative ease with which fuels ignite and burn regardless of the quantity of the fuels.

***Fuel Break:*** An area, strategically located for fighting anticipated fires, where the previously-occurring vegetation has been permanently modified or replaced so that fires burning into it can be more easily controlled. Fuel breaks divide fire-prone areas into smaller areas for easier fire control and to provide access for firefighting.

***Fuel Loading:*** The volume of fuel in a given area generally expressed in tons per acre.

***Fuel Model:*** Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

***Fuel Modification:*** Any manipulation or removal of fuels to reduce the likelihood of ignition or the resistance to fire control.

***Fuels:*** All combustible material within the WUI or intermix, including vegetation and structures.

***Hazard:*** The degree of flammability of the fuels once a fire starts. This includes the fuel (type, arrangement, volume, and condition), topography, and weather.

***Ignition Time:*** Time between application of an ignition source and self-sustained combustion of fuel.

***Invasive Plant Species:*** A plant species that is not native to the region and has demonstrated the ability to aggressively outcompete native plant species that would normally colonize a given area.

***Ladder Fuels:*** Fuels that provide vertical continuity allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease.

***Limbing:*** To remove the lower branches from trees, brush or shrubs in an area to reduce fire ladders. The root structure of the plants is not disturbed.

***McLeod:*** A firefighting tool used for scraping soil and small roots, and grasses to construct fire line. The tool head is a large hoe approximately 12 inches wide, with one side a solid scraping blade for scraping soil and the other side with metal fingers for scraping vegetation but leaving soil.

***Mosaic:*** To reduce the total volume of vegetation within an area by removing vegetation in a cluster or mosaic pattern.

***Multicutting:*** A vegetation management method where cut vegetation is reduced in size by cutting vegetation into lengths no longer than 6 inches on length. Multicut vegetation is then left on site no greater than 12 inches in depth.

***Overstory:*** That portion of the trees in a forest that forms the upper or uppermost layer.

***Peak Fire Season:*** That period of the year during which fires are expected to ignite most readily, to burn with greater than average intensity, and to create damages at an unacceptable level.

***Pile Burn:*** A prescribed burn method where fire is ignited to individual piles within a project area. Vegetation in this method of burning is cut and piled into stacks within the project area and then burned.

***Prescribed Burn:*** A wildland fire tool that uses the knowledgeable application of fire to a specific unit of land to meet predetermined fire and resource management objectives. Specific prescriptions for burning vegetation are developed for each area based on weather, topography, and fuel type.

***Prescribed Fire:*** A fire burning within prescription. This fire may result from either planned or unplanned ignitions.

***Protected Species:*** State- and federally listed Endangered or Threated species of flora or fauna, and non-listed species otherwise protected by state and/or federal statutes.

***Pruning:*** To selectively cut dead or live branches from trees, brush, or shrubs to reduce the total volume of flammable vegetation from a plant.

***Pulaski:*** A firefighting tool used for digging out roots and soil to construct fire line. The head has one side with an axe blade and the other side with a hoe blade.

***Rate of Spread (ROS):*** The speed at which a fire extends its horizontal dimensions, expressed in terms of distance per unit area of time. Generally thought of in terms of a fire's forward movement or head fire rate of spread.

***Remote Automatic Weather Station (RAWS):*** A weather station at which the services of an observer are not required. A RAWS unit measures selected weather elements automatically and is equipped with telemetry apparatus for transmitting the electronically recorded data via radio, satellite or by a landline communication system at predetermined times on a user-requested basis.

***Red Flag Warning Conditions:*** A **Red Flag Warning** is a forecast warning issued by the United States National Weather Service to inform area firefighting and land management agencies that conditions are ideal for wildland fire ignition and propagation. After drought conditions, and when humidity is very low, and especially when high or erratic winds that may include lightning are a factor, the Red Flag Warning becomes a critical statement for firefighting agencies, which often alter their staffing and equipment resources dramatically to accommodate the forecast risk.

***Responsibility Area:*** That area for which a particular fire protection organization has the primary responsibility for attacking an uncontrolled fire and for directing the suppression action. Such responsibility may develop through law, contract, or personal interest of the fire protection agent. Several agencies or entities may have some basic responsibilities without being known as the fire organization having direct protection responsibility.

***Riparian:*** An area of land adjacent to a stream, river, lake or wetland that contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas.

***Sensitive Species:*** A plant or animal species with a special status listing from federal, state, or local regulatory agencies.

***Slope:*** The variation of terrain from the horizontal; the number of feet rise or fall per 100 feet measured horizontally, expressed as a percentage.

***Smoke:*** (1) The visible products of combustion rising above a fire; (2) term used when reporting a fire or probable fire in its initial stages.

***Spotting:*** The ignition of unburned fuels ahead of the fire front as a result of ignition by firebrands. Spotting enhances the spread of wildfires.

***Structure:*** A constructed object, usually a free-standing building above ground.

***Structure Fire:*** Fire originating in and burning any part of all of any building, shelter, or other structure.

***Suppression:*** The most aggressive fire protection strategy, it leads to the total extinguishment of a fire.

***Surface Fuel:*** Fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.

***Thinning:*** To reduce the total volume of trees, brush or shrubs within an area by completely cutting out dead and live plants from the area or to reduce the size or volume of an individual plant by cutting out dead and live branches.

***Tree Crown:*** The primary and secondary branches growing out from the main stem, together with twigs and foliage.

***Uncontrolled Fire:*** Any fire that threatens to destroy life, property, or natural resources and that (a) is not burning within the confines of firebreaks or (b) is burning with such intensity that it could not be readily extinguished with ordinary, commonly available tools.

***Understory:*** Low-growing vegetation (herbaceous, brush or reproduction) growing under a stand of trees. Also, that portion of trees in a forest stand below the overstory.

***Vegetation Management:*** The practice of reducing and/or rearranging both the green and dead biomass (vegetation) to reduce fire hazard, to reduce the potential damage associated with wildfire, and to improve environmental habitat. Vegetation management is synonymous with the term "vegetation or fuel reduction". Many different vegetation management methods may be used to reduce and/or rearrange both green and dead biomass.

***Vegetation Management Unit:*** Delineated property unit based on parcel, topography, vegetation or other features used for vegetation management planning.

***Weed:*** A plant species that interferes with a desired management objective. This term does not denote the native or non-native status of a plant species. Both native and non-native plants have the ability to interfere, depending on the objective.

***Wildfire/Wildland Fire:*** A fire occurring that burns through vegetation, either in the urban interface or undeveloped areas

***Wildland:*** An area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered.

***Wildland Urban Interface (WUI):*** The area where structures and other human developments meet or intermingle with undeveloped wildland.

**Source:** www.firewise.org, Los Angeles County Fire Department, 2020, NWCG 2020