FOOTHILL MUNICIPAL WATER DISTRICT

2026 Multi-Jurisdictional Hazard Mitigation Plan

Volume 1 Areawide Information

PUBLIC COMMENT DRAFT
JULY 2026

BLACK & VEATCH

FOOTHILL MUNICIPAL WATER DISTRICT · INCORPORATED · FMWD · JANUARY 7, 1953 · CALIFORNIA

CRESCENTA VALLEY WATER DISTRICT · CVWD

LA CAÑADA IRRIGATION DISTRICT · Est. 1924

LAS FLORES WATER CO. · INC. JUNE 1885

LAWC · LINCOLN AVENUE WATER COMPANY · ALTADENA, CA

VALLEY WATER COMPANY · INCORPORATED 1910 · LA CANADA FLINTRIDGE

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Hazard mitigation involves implementing cost-effective and sustainable measures to minimize the risk to human life, property, and infrastructure from potential hazards. Through mitigation planning, the Foothill Municipal Water District and participating member agencies developed a framework to lessen the impacts of natural disasters and increase resilience.

HAZARD MITIGATION OVERVIEW

Hazard Mitigation is defined by the Federal Emergency Management Agency (FEMA) as "*a sustained action taken to reduce or eliminate long-term risk to life and property*". A hazard mitigation plan is a long-term, community-based strategy designed to identify local disaster risks and outline specific actions to minimize future loss of life and property damage. By acting before disasters strike, these plans aim to permanently break the cycle of repeated damage and expensive reconstruction. Local governments across the country prepare local hazard mitigation plans to be better prepared to respond and recover from the bad things that can happen.

THE EATON FIRE

An example of a "bad thing that can happen" was the January 2025, Eaton Fire. The Eaton Fire in Southern California's San Gabriel Mountains, was the second most destructive wildfire in California state history. Fueled by hurricane-force Santa Ana winds, the Eaton Fire burned over 14,000 acres, killed at least 19 people, and destroyed more than 9,000 buildings and damaged over 1,000 structures across foothill communities like Altadena.

The Foothill Municipal Water District (FMWD) along with its member agencies that service the Altadena area suffered both immediate (service loss and water safety issues) and long term (infrastructure damage and financial strain) impacts from this fire. FMWD itself remained operational as a wholesaler, but its member agencies, especially in Altadena, experienced catastrophic system damage, turning the event into both a water infrastructure crisis and a long-term financial and recovery challenge. Key impacts included:

- Reservoirs:
  - Multiple reservoirs damaged; some had roofs burned and collapsed into the water
  - In Altadena alone, 7 of 23 reservoirs were damaged
- Pump stations & treatment facilities:
  - Damage to pump stations, tanks, and electrical equipment
- Distribution system:
  - Broken or melted pipes, meters, service lines, and communication systems
- Member agency impacts:
  - Three primary Altadena systems sustained "significant damage" affecting both drinking water supply and fire protection
  - Los Flores Water Company: lost ~74% of service connections
  - Lincoln Avenue Water Company: lost ~55% of service connections
  - Rubio Cañon: lost ~35% of service connections

These impacts reduced system capacity and limited the ability to deliver water for both daily use and firefighting.

One of the more critical impacts on the Altadena area was the loss of safe drinking water. The fire caused system depressurization (due to firefighting demand, leaks, and destroyed connections). This allowed contaminants like benzene and other VOCs to enter pipelines, making the water unsafe to drink. Authorities issued region wide "Do Not Drink / Do Not Boil" orders for Altadena and surrounding areas. Systems required re-pressurization, flushing, and extensive water testing before service could be restored. For FMWD and its member agencies, this meant shifting from water delivery to emergency public health response and recovery.

The 2025 Los Angeles wildfires (including the Eaton and Palisades fires) fundamentally changed how engineers, utilities, regulators, and the public view wildfire risk to water systems. Before 2025, wildfire impacts on water were often seen as secondary or localized; afterward, they are now understood as systemic, long-lasting, and high-consequence risks. This change highlights the importance of hazard mitigation planning for water utilities.

HAZARD MITIGATION PLANNING FOR FMWD

The FMWD has developed this multi-jurisdictional hazard mitigation plan (MJHMP) to continue its commitment to reducing risk of natural hazards for the residents, assets, and community lifelines. The Eaton Fire impacted the planning area 2 months into this planning process. This plan aims to safeguard the people and essential services provided throughout the planning area using lessons learned from the Eaton Fire as well as other hazard impacts within the region.

This plan includes annexes for member agencies to address the Planning Area's specific capabilities, vulnerabilities, and mitigation opportunities. The FMWD MJHMP forms the foundation for a long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repetitive damage. This plan aligns with federal and state hazard mitigation planning regulations and requirements to ensure eligibility for pre- and post-disaster mitigation funding through the Federal Emergency Management Agency (FEMA) for all agencies that participated as Planning Partners:

- Foothill Municipal Water District (initial plan)
- Crescenta Valley Water District (plan update)
- La Cañada Irrigation District (initial plan)
- Las Flores Water Company (initial plan)
- Lincoln Avenue Water Company (initial plan)
- Valley Water Company (initial plan)

BUILDING THE PLANNING TEAMS

FMWD brought together an inclusive group of individuals to participate, develop, and implement the MJHMP. A Core Planning Team, Planning Committee, and Planning Partnership oversaw the planning process and were responsible for coordinating, overseeing, and executing the planning process.

CORE PLANNING TEAM

The CPT was comprised of key personnel from the FMWD, participating agencies, and discipline leads from the FMWD's contract consultant, Black & Veatch. They were responsible for monitoring plan progress milestones and identifying input needs for the PC.

PLANNING COMMITTEE

A PC was comprised of CPT members, participating agency, and local stakeholders. They were responsible for participating throughout the process, reviewing information, providing input, informing the risk assessment, and developing mitigation strategies.

PLANNING PARTNERSHIP

The Planning Partnership included jurisdictional representatives seeking DMA 2000 compliance.
They participated throughout the process, reviewed information, provided input, informed the risk assessment, developed mitigation strategies, and adopted the MJHMP.

OUTREACH STRATEGY

The Core Planning Team (CPT) implemented a multimedia public involvement strategy that was approved by the Planning Committee (PC). The strategy included a community hazard mitigation awareness survey; a project web page; and multiple in-person events promoting hazard awareness. Additionally, the PC helped amplify public outreach efforts to their networks

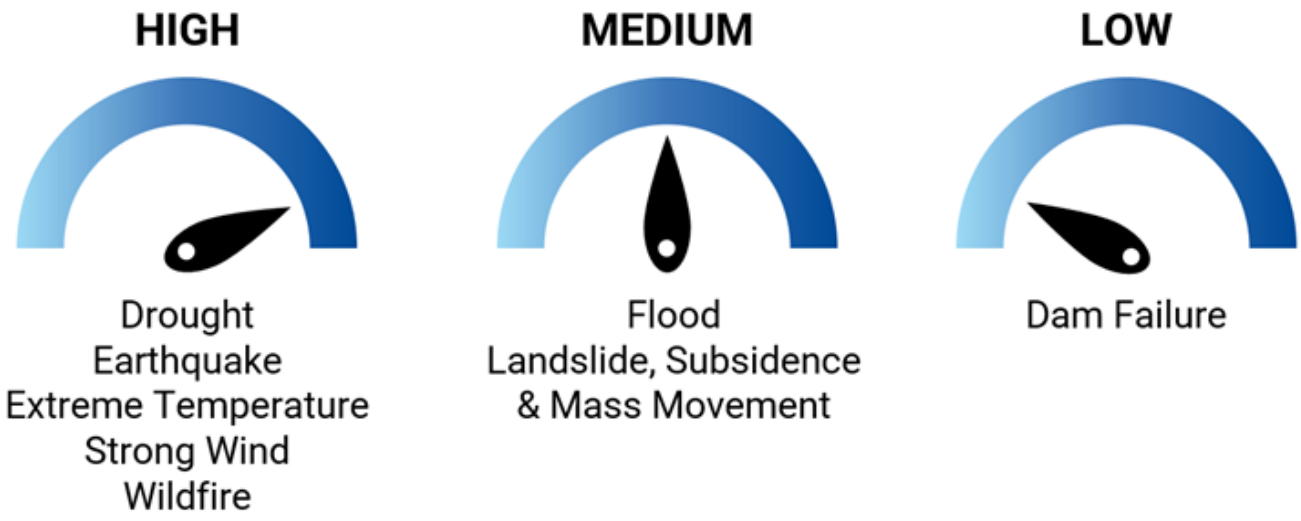
RISK ASSESSMENT

A risk assessment is the process of measuring the potential loss of life resulting from natural hazards, as well as personal injury, property damage, and environmental damage. The assessment determines a community's overall vulnerability to hazard events. The PC used the risk assessment to gauge the potential impacts of natural hazards identified as "hazards of concern" for this plan.

Risk assessment models for hazards of concern were based on current data and technologies. The assessment of each hazard of concern includes discussion of the following:

- Hazard identification and profile.
- The exposure of population, property, and the environment to the hazards.
- The estimated cost of potential damage, where applicable.

Based on the risk assessment, the hazards of concern were ranked for the risk they pose to the Planning Area. Area-wide results are as follows:



In addition to assessing the hazards of concern, this plan provides a review of "hazards of interest." The PC determined that these other hazards, though not required to be evaluated under federal guidelines for hazard mitigation plans, are important to recognize qualitatively in this plan. Brief hazard profiles, without quantitative risk assessments, are provided for the following hazards of interest:

- Cybersecurity
- Bioterrorism
- Terrorism/Mass Gathering

CAPABILITY ASSESSMENT

A robust assessment of mitigation capabilities was completed by each participating agency to identify gaps that may need to be addressed so mitigation actions can be successfully implemented. The following capability types were analyzed:

- Planning and Regulatory
- Development and Permitting
- Administrative and Technical
- National Flood Insurance Program (NFIP) Compliance
- Public Outreach
- Fiscal
- Participation in Other Programs
- Adaptive Capacity

MITIGATION STRATEGY

The PC developed mitigation goals to reflect the focus of FMWD and its participating agencies. The PC determined the following goals for this MJHMP:

- **Goal 1.** Protect the integrity of district assets from impacts to the quality of life and property.
- **Goal 2.** Maintain continuity of essential water services.
- **Goal 3.** Increase whole community awareness of the risks of loss of service.
- **Goal 4.** Facilitate partnerships with recognized stakeholders within the planning area and implement a coordination plan between the stakeholders.
- **Goal 5.** Protect water supply resources.
- **Goal 6.** Protect against environmental consequences caused by system failure initiated by natural hazards

Mitigation actions presented in this plan are designed to reduce or eliminate losses resulting from natural hazard events. The development process resulted in the identification of more than 100 mitigation actions for implementation by individual Planning Partners, as presented in the jurisdictional annexes in

Volume 2 of this MJHMP. Several of these actions are within the current capabilities of each jurisdiction, resulting in a high priority for implementation over the next 5 years.

In addition, the planning teams identified an areawide action benefitting the whole planning partnership, listed below.

Areawide Action 001 – Coordinate with municipalities in the service area to develop a pre- and post-disaster response and recovery plan for a unified interagency protocol.

IMPLEMENTING, ADOPTING, AND MAINTAINING THE PLAN

Implementing the mitigation actions in this MJHMP will take time and resources over its 5-year performance period. The CPT developed an implementation and maintenance strategy that includes the following:

- Monitoring mitigation action implementation.
- Progress reporting.
- A strategy for continued public involvement.
- Plan integration with other relevant plans and programs.

Upon FEMA Approval Pending Adoption (APA) status of the 2026 HMP, each agency will adopt the plan by resolution of local governing body.

This MJHMP is designed with an adaptive management approach that can evolve along with funding sources and state and federal mandates. The Planning Partners will assume responsibility for adopting the recommendations of this plan and committing resources toward implementation. The framework established by this plan will enable the Planning Partnership to pursue FEMA Hazard Mitigation Assistance (HMA) grant funding for feasible, eligible, cost-effective actions. The Planning Partnership developed this plan with extensive opportunities for public involvement and input. Public support of the mitigation actions identified in this MJHMP will ensure its success.

1. INTRODUCTION

1.1 WHY PREPARE THIS PLAN

Foothill Municipal Water District and its participating agencies, the Planning Partnership, prepared this Multi-Jurisdictional Hazard Mitigation Plan to better protect their customers, property, and assets throughout the planning area from the effects of natural hazards.

Hazard mitigation plays a crucial role in emergency management by working to reduce the impacts of disasters on individuals, communities, and important assets. By implementing mitigation measures, we can help prevent the same areas from being repeatedly impacted by disasters. Mitigation is part of the emergency management cycle, which is divided into four phases:

- **Preparedness** is when we develop or update activities, programs and systems before an event happens. These activities are often tested (or exercised) in non-emergency situations. This tests their effectiveness. Emergency managers also assess potential risks, hazards and vulnerabilities in this phase.

- **Response** focuses on the immediate and short-term effects of a disaster. It is usually focused on life safety and preventing immediate damage.
- **Recovery** is a long-term phase that looks to return a community to normal, or to a more resilient state, after a disaster.
- **Mitigation** focuses on building (or rebuilding) in ways that reduce the risk more permanently. It is an activity that can occur at any point in the emergency management cycle. For example, communities can undertake mitigation actions before a disaster (the preparedness phase) or while rebuilding after a disaster (the recovery phase) (FEMA 2023).

This multi-jurisdictional hazard mitigation plan (MJHMP) highlights the dedication of the Foothill Municipal Water District (FMWD) and the Planning Partnership to reduce risk from hazards, enhancing overall resilience, and providing a practical tool for decision makers to incorporate mitigation into daily operations.

1.1.1 Federal Eligibility

Disaster Mitigation Act

In an effort to reduce the nation's mounting natural disaster losses, the U.S. Congress passed the Disaster Mitigation Act of 2000 (DMA 2000), which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of DMA 2000 emphasizes the need for state and local government entities to closely coordinate on mitigation planning activities and requires a Hazard Mitigation Plan (HMP) for any local government applying for federal mitigation grant funds. These funds primary fall under the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance (HMA) program. Grant programs under HMA include the following:

Hazard mitigation is any sustained action taken to reduce or eliminate long-term risk to life and property from hazards.

FEMA defines a **Hazard Mitigation Plan** as a community-driven process to help state, local, tribal, special purpose districts, and territorial governments plan for hazard risk. By planning for risk and setting a strategy for action, governments can reduce the negative impacts of future disasters.

- Flood Mitigation Assistance (FMA)
- Hazard Mitigation Grant Program (HMGP)
- Building Resilient Infrastructure and Communities (BRIC)

Entities with an adopted and federally-approved HMP are pre-positioned to receive available mitigation funds before and after the next disaster strikes. The plan was developed to make the Planning Partnership eligible for pre- and post-disaster FEMA grants.

1.1.2 Purposes for Planning

This MJHMP highlights FMWD's dedication to reducing risk from hazards, enhancing overall resilience, and providing a practical tool for decision makers to incorporate mitigation into daily operations. FMWD prepared this DMA-compliant MJHMP to identify resources, information, and strategies for reducing risk

from natural hazards. Elements and strategies in the plan were selected because they meet a program requirement and the intent of the FMWD and the Planning Partnership, and customers to mitigate hazards. The plan will help guide mitigation activities throughout the planning area. It was developed to meet the following needs:

- Meet or exceed program requirements specified under DMA;
- Enable the FMWD and the Planning Partnership to apply for federal grant funding to reduce hazard risk through mitigation;
- Fulfill state and federal requirements for hazard mitigation planning;
- Create a risk assessment that focuses on the hazards of concern in the planning area; and
- Coordinate existing plans and programs so high-priority projects to mitigate potential disaster impacts are funded and implemented.

This MJHMP is a living document that will be used to reduce vulnerability to natural hazards. It serves as the groundwork for the long-term plan to lessen disaster impacts and establishes a framework for decision-making to mitigate harm to people, assets, and the economy from future natural disasters. Mitigation projects include a broad range of actions to help reduce vulnerability, allowing FMWD and the Planning Partnership to bounce back more quickly from disasters. This ongoing effort ensures that FMWD and the Planning Partnership have the necessary information to create and implement successful mitigation strategies, reduce the impacts of natural disasters, and enhance overall resilience.

1.2 PLAN LAYOUT

1.2.1 Initial Plan

The FMWD and the Planning Partnership demonstrate dedication to reducing disaster impacts to their customers by developing their first multi-jurisdictional hazard mitigation plan.

The 2026 Foothill Municipal Water District MJHMP is in alignment with FEMA's Local Mitigation Planning Policy Guide (April 2025), FEMA's Local Mitigation Planning Handbook (June 2025), and the State of California planning requirements.

1.2.2 Previous Plan – Crescenta Valley Water District

The Crescenta Valley Water District, a member agency to FMWD and included in this Planning Partnership, adopted a single-jurisdiction HMP in November 2021. CVWD is updating their initial plan as an annexing partner in this multi-jurisdictional planning process.

Why Update

The drivers to update CVWD's initial plan includes funding eligibility and to encompass a diverse Planning Partnership that included a unified plan for FMWD and local water agencies. Throughout the planning process, the plan was developed with a focus on assessing vulnerability caused by hazard events, evaluating capabilities and their utilization in implementing hazard mitigation measures, reviewing the prior mitigation strategies, and identifying new initiatives to enhance overall resilience.

Federal and State Requirements

In response to the requirements of the DMA 2000, which requires local governmental agencies to develop and update the HMP every 5 years, this plan serves as the 2026 update to the prior Local Hazard Mitigation Plan developed by Crescenta Valley Water District.

Changes in Hazards

The 2021 Crescenta Valley Water District HMP assessed the following six hazards of concern:

- Drought
- Earthquakes
- Flood
- Wildfire
- Landslide
- Severe Weather

The 2026 Foothill Municipal Water District MJHMP includes the hazards listed above, and three additional hazards of concern *(italicized)* that were identified by FEMA's National Risk Index as impacting the Planning Area and selected by the Planning Committee. In response to the Eaton Fire disaster, the landslide hazard was expanded to include post-fire debris flows. The hazards addressed in this plan are as follows:

- *Dam Failure*
- Drought
- Earthquake
- *Extreme Temperature*
- Flood
- Landslide, Subsidence, and Mass Movement (including Post-Fire Debris Flow)
- *Strong Wind*
- Wildfire

Changes in Development and Population

Local Plan Requirement E1—44 CFR Part 201.6(d)(3)

A local jurisdiction must review and revise its plan to reflect changes in development.

Looking at past and future growth in hazard-prone areas shows how exposure to hazards may be increasing in the community. This requirement helps ensure the mitigation strategy continues to address current and future risk and vulnerability from existing and potential development.

The Updated Plan - What Has Changed?

The overall planning process and the 2021 Crescenta Valley Water District HMP have been improved and revised for this 2026 Foothill Municipal Water District MJHMP in response to changes in community priorities, planning requirements and overall improvements. Key changes are outlined as follows:

- **Mitigation Goals** – The mitigation goals from the 2021 CVWD HMP were used as a starting point to develop the goals for this MJHMP. Goals were revised and expanded to ensure that community priorities for all participating agencies are addressed.

- **Updated Hazards of Concern** – The list of assessed hazards was updated to reflect the most current Planning Area experiences and concerns.
- **Climate Change Impacts** – The 2026 Foothill Municipal Water District MJHMP includes a dedicated subsection for each hazard of concern to the issue of climate change and its potential effects on climate-related hazards.
- **Community Outreach** – The Planning Area's priorities for community engagement have changed since CVWD developed their initial HMP during the COVID-19 pandemic. This MJHMP included outreach focused on in-person engagement in addition to print and digital outreach.

1.3 HOW TO USE THIS PLAN

The 2026 Foothill Municipal Water District MJHMP was prepared to align with FEMA's Local Mitigation Planning Policy Guide (April 2025), FEMA's Local Mitigation Planning Handbook (June 2025), and the State of California planning requirements. The MJHMP is organized into two volumes as follows:

1.3.1 Volume 1

- Executive Summary
- Part 1 - Introduction and Planning Process
- Part 2 - Risk Assessment
- Part 3 - Capability Assessment and Mitigation Strategy
- Part 4 - Maintaining the Plan
- Appendix A – Public Outreach
- Appendix B – Hazard Selection
- Appendix C – Meeting Documentation
- Appendix D – Federal and State Agencies, Programs and Regulations
- Appendix E – Plan Maintenance Agendas
- Appendix F – FEMA Approval and Planning Partner Adoption

1.3.2 Volume 2

- Federally required jurisdiction-specific elements, in annexes for each participating jurisdiction
- Description of the participation requirements confirmed by the CPT and Planning Committee

1.3.3 Planning Requirement Icons

Throughout this plan, FEMA's local hazard mitigation planning requirements and state-specific compliance are identified using the icons below. These provide a pathway to show where the MJHMP meets each requirement.

FEMA Mitigation Plan Requirement – 44 CFR Part 201.6

Used to identify the requirements met for a local hazard mitigation plan.

2. PLANNING PROCESS

Local Plan Requirement A1 – 44 CFR Part 201.6(c)(1)

The plan shall document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

2.1 INTRODUCTION

The following section describes the overall process of developing the MJHMP, including how it was prepared, who was involved, and how stakeholders and the public participated. To adhere to the requirements of the DMA 2000 and ensure that the planning process received wide and robust support from the participating jurisdictions, regional and local stakeholders, and the public, the approach to the planning process and plan documentation included the following:

- The 2026 Foothill Municipal Water District MJHMP addresses all natural hazards that could affect the FMWD service area. This meets the natural hazard requirements of DMA 2000 and Element B of FEMA's Local Mitigation Planning Policy Guide (April 2025).
- FMWD selected contract consultant, Black & Veatch, to help develop and implement the plan.
- A Core Planning Team (CPT) was created to lead the planning effort, as shown in Table 2-1.
- Foothill Municipal Water District invited its member agencies to take part in the MJHMP. Four agencies joined as part of the initial planning effort, and one joined as a plan update participant. All agreed to meet participation expectations. See Table 2-1.

The beginning of the planning process for this MJHMP was marked by the Eaton Fire disaster. The Planning Partnership was committed to continuing the planning process during disaster recovery to promote community resilience in the face of the most severe local disaster in recent years. See Figure 2-1 for an overall timeline demonstrating the adaptability and flexibility of the Planning Partnership to accommodate the needs of the impacted member agencies.

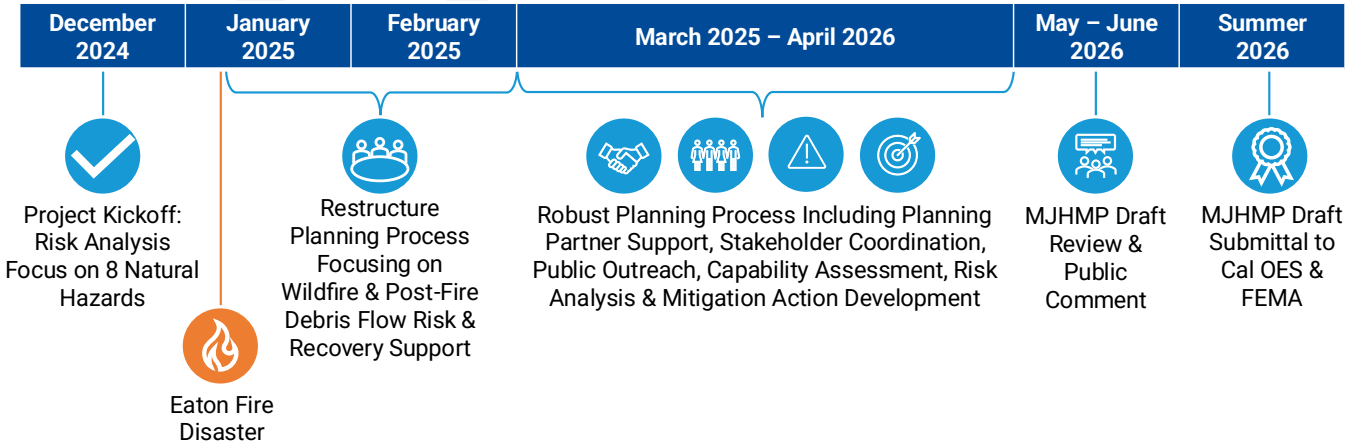
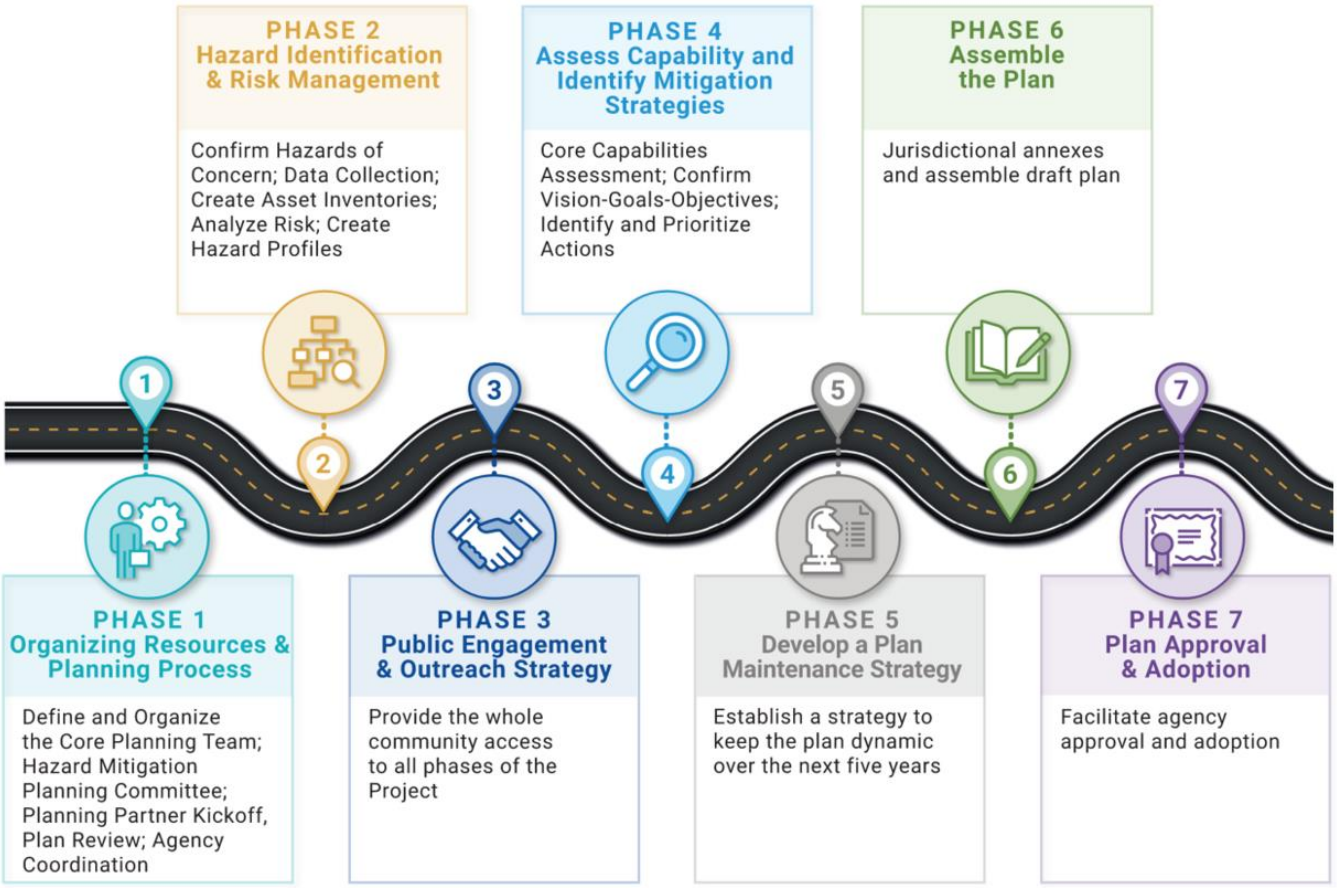


Figure 2-1. Planning Process Timeline

The overall planning process for this MJHMP, as shown below, included the following seven steps:

1. Organize Resources & Planning Process
2. Hazard Identification & Risk Management
3. Public Engagement & Outreach Strategy
4. Assess Capability and Identify Mitigation Strategies
5. Develop a Plan Maintenance Strategy
6. Assemble the Plan
7. Plan Approval & Adoption



2.2 DEFINING THE PLANNING AREA

The planning area includes the Foothill Municipal Water District service area for five of its member agencies. FMWD has two additional member agencies that developed individual HMPs and did not participate in this MJHMP. Relevant planning area characteristics are described in Chapter 3 (District Profile) and in each jurisdictional annex in Volume 2. The risk assessment for this MJHMP is performed for the planning area shown on Figure 2-2.

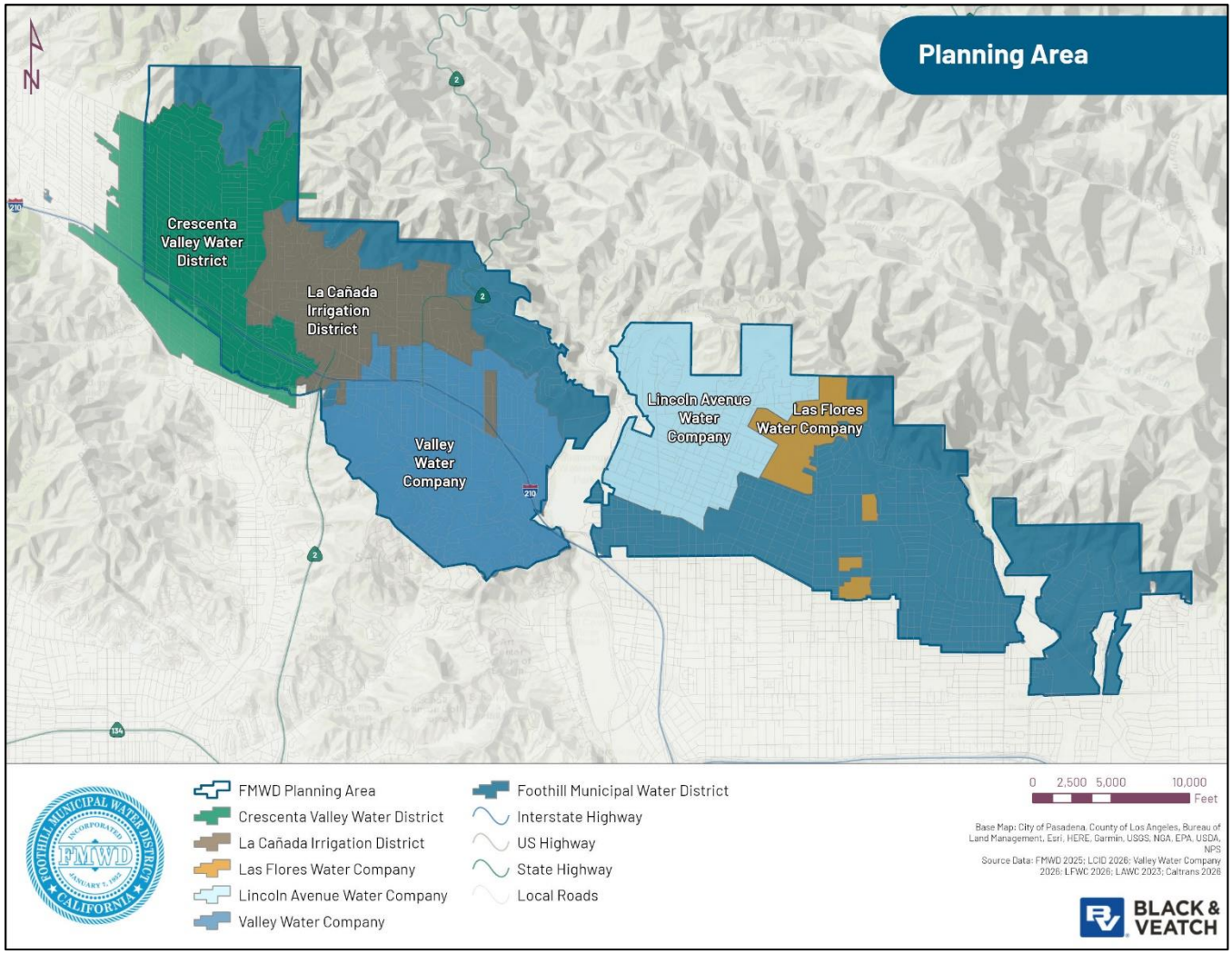


Figure 2-2. FMWD MJHMP Hazard Mitigation Planning Area

2.3 FUNDING

Funding for this MJHMP was through Cal OES HMGP DR-4683 with a local in-kind match.

2.4 FORMATION OF THE PLANNING TEAMS

A successful planning effort includes active participation and buy-in from the whole community – individuals and communities, all levels of government, private and nonprofit sectors, non-governmental establishments, community lifelines, and members of the public. Table 2-1 lists the planning team participants.

2.4.1 Core Planning Team

The **Core Planning Team** was made up of key personnel from FMWD, the Planning Partnership, and discipline leads from the contract consultant, Black & Veatch. They were responsible for monitoring plan progress milestones and identifying input needs for the Planning Partners and Planning Committee.

2.4.2 Planning Committee

The **Planning Committee** consisted of a variety of personnel from participating agencies, local jurisdictions, and stakeholders that guided the process of developing the MJHMP. They were responsible for participating throughout the process, reviewing information, providing input, informing the risk assessment, and developing mitigation strategies.

2.4.3 Planning Partnership

The **Planning Partnership** was made up of jurisdictional representatives seeking DMA 2000 compliance. They were responsible for participating throughout the process, reviewing information and providing input, informing the risk assessment, developing mitigation strategies, and adopting the MJHMP.

In mid-2024, FMWD notified its member agencies of the planning process and invited them to participate. They were asked to formally join by letter of intent to participate and to identify points of contact to represent the agency and participate throughout the planning process. The contacts each agency identified in the letter of intent to participate were informed of the planning process, attended meetings, provided direct input, and reviewed plan documents.

Jurisdictional involvement is demonstrated through the completion of an annex in Volume 2 of this plan. Local planning teams who represented their agency are listed in agency annexes in Volume 2. Each annex was developed with input gathered during the planning process and includes points of contact, risk assessments for relevant hazards, evaluation of capabilities for mitigation, identification and prioritization of mitigation measures, and ultimately, adoption of the plan through a resolution.

CORE PLANNING TEAM

The CPT was comprised of key personnel from the FMWD, participating agencies, and discipline leads from the FMWD's contract consultant, Black & Veatch. They were responsible for monitoring plan progress milestones and identifying input needs for the PC.

PLANNING COMMITTEE

A PC was comprised of CPT members, participating agency, and local stakeholders. They were responsible for participating throughout the process, reviewing information, providing input, informing the risk assessment, and developing mitigation strategies.

PLANNING PARTNERSHIP

The Planning Partnership included jurisdictional representatives seeking DMA 2000 compliance.
They participated throughout the process, reviewed information, provided input, informed the risk assessment, developed mitigation strategies, and adopted the MJHMP.

Table 2-1. FMWD Hazard Mitigation Planning Participation

Jurisdiction / Organization	Name	Core Planning Team	Planning Committee	Planning Committee Alternate	Planning Partnership	Stakeholder
Foothill Municipal Water District	Natalie Ouwersloot, AGM/District Engineer	■	■		■	
	Nina Jazmadarian, General Manager	■			■	
	Kim Wong, Engineering Aide	■			■	
	Michael Le, Water Program Technician	■	■		■	
Crescenta Valley Water District	Carla Dillon, Director of Engineering & Operations	■	■		■	
	Darlene Telles, Risk and Resilience Manager	■		■	■	
La Cañada Irrigation District	Justin Baily, General Manager	■			■	
Las Flores Water Company	Bill Kimberling, General Manager	■			■	
Lincoln Avenue Water Company	Jennifer Betancourt Torres, General Manager	■			■	
Valley Water Company	Bob Fan, General Manager	■			■	
LA County Sheriff's Office	Ethan Marquez, Lieutenant		■			■
	Dustin Wiemann, Deputy			■		■
Metropolitan Water District of Southern California	Ian Whyte, Emergency Management Program Manager		■			■
Jet Propulsion Laboratory	Ian Pinkham, Group Supervisor / Emergency Management Officer		■			■
	Maia Durant, Group Supervisor / Strategic Planning and Real Estate			■		■
Descanso Gardens	Juliann Rooke, CEO		■			■
	Laura Olhasso, Board Member			■		■
La Cañada Unified School District	Barbara Boliver, Facilities Director		■			■
	Melissa Shepherd, Assistant Superintendent			■		■
Altadena Town Council	Nic Arnzen, Town Council Chair		■			■
Public Water Agencies Group	Alix Stayton, Emergency Management Coordinator		■			■
City of La Cañada Flintridge	Dan Jordan, City Manager		■			■
	Arabo Parseghian, Assistant City Manager			■		■
Black & Veatch	Rob Flaner, Project Manager	■				
	Megan Brotherton, Lead Planner	■				
	Carol Baumann, Risk Assessment Lead	■				
	Jess Farrington, Planner	■				
	Erin Schanen, Public Outreach Lead	■				

2.5 STAKEHOLDER COORDINATION AND INVOLVEMENT

Local Plan Requirement A2 – 44 CFR Part 201.6(b)(2)

The planning process shall include an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other non-profit interests to be involved in the planning process.

Outreach to stakeholders was conducted in a timely manner and maintained throughout the planning process. Stakeholders were invited to participate in the planning process with relevance to the entire planning partnership and to all agency annexes in Volume 2 of this plan. This section outlines the stakeholders who were involved in the creation of this MJHMP and outlines their participation.

2.5.1 Types of Stakeholders

Stakeholders consist of individuals and groups that mitigation actions or policies affect. For this MJHMP, businesses, private organizations, public entities, and neighboring communities were identified and invited to participate. The Planning Partnership made conscientious efforts to ensure diverse regional, County, and local representation in the planning process.

2.5.2 Stakeholder Participation

Throughout the entire planning process, stakeholders were invited to participate via email notifications informing them of the planning effort and giving them an opportunity to get involved. Stakeholders were invited to participate as follows:

- Participate as a member of the Planning Committee and/or as a Planning Partner.
- Take a Public Hazard Awareness Survey.
- Attend Planning Committee meetings.
- Share public outreach information within their organization.
- Comment on the draft plan.

Below is a summary of the stakeholders' involvement in the planning process, demonstrating the extensive outreach efforts made by the Planning Partnership. Key elements of stakeholder outreach include the following:

- Ten stakeholders agreed to serve as members of the Planning Committee.
- The web link to the draft plan was emailed to all stakeholders and neighboring communities, inviting them to comment on the draft plan.

Federal and State Agencies

The following section lists the government agencies that were involved during the planning process.

Table 2-2 describes how federal and state agencies participated in the FMWD MJHMP planning process. Those listed in the table below were directly or indirectly involved in the process and provided crucial information to for the plan.

Table 2-2. Federal and State Agencies

Agency/Department	Federal	State	Participation
FEMA Region 9	■		FEMA provided updated planning guidance; presented preliminary regulatory flood products to agencies and the public; and conducted plan review.
FEMA National Risk Index (NRI)	■		FEMA's NRI was used as a baseline for natural hazard selection for this MJHMP.
National Centers for Environmental Information (NCEI)	■		NCEI's online tools were accessed to obtain information regarding hazard identification, hazard details, and risk assessments to incorporate into the MJHMP.
CAL FIRE		■	Provided updated maps for Local Responsibility Areas that were used in the wildfire risk assessment.
Cal OES – Mitigation Planning Division		■	Oversaw the planning process; reviewed the draft plan.

Local Stakeholders and Neighboring Communities

Area stakeholders and neighboring communities were invited to participate in the MJHMP process. Agencies and organizations provided input in a variety of ways. Those that served on the Planning Committee and as a Planning Partner are noted in Table 2-1.

Local stakeholders who were invited to participate in the planning process through outreach via email messaging, meeting invitations, and in-person outreach events are included in Table 2-3.

Table 2-3. Local Stakeholders and Neighboring Communities

Stakeholder Category	Agency or Organization Name
Agencies Involved in Hazard Mitigation	Jet Propulsion Laboratory LA County Sheriff's Office
Community-Based Organizations/Non-Profits	Public Water Agencies Group
Emergency Services	LA County Sheriff's Office
Local Businesses and Academia	Descanso Gardens La Cañada Unified School District
Neighboring Communities	Altadena Town Council

Stakeholder Category	Agency or Organization Name
	City of La Cañada Flintridge
Planning and Zoning	Altadena Town Council City of La Cañada Flintridge
Utilities	Foothill Municipal Water District Crescenta Valley Water District La Cañada Irrigation District Las Flores Water Company Lincoln Avenue Water Company Valley Water Company Metropolitan Water District of Southern California

2.5.3 Draft Plan Review

All the entities listed above were provided an opportunity to review and comment on the draft plan during the public comment period, primarily through the link on the MJHMP web page. Each entity was sent an email informing them that the draft plan was available for comment and included a link to the web page and online comment tool. Additional invitations to review the draft plan were released through social media posts.

The public draft review period extended from Month Day - Day, 2026. Number comments were received on the draft plan.

Upon completion of a public comment period, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region 9 for a review to ensure program compliance.

2.6 PUBLIC PARTICIPATION

Local Plan Requirement A3 – 44 CFR Part 201.6(b)(1)

The planning process shall include an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

An important component of the mitigation planning process involved public participation, so the outreach efforts described in this section were done on behalf of the entire Planning Partnership who developed jurisdictional annexes in Volume 2 of this plan. This coordinated approach was valuable to all planning partners, but especially to the two agencies directly impacted by the Eaton Fire with limited resources for outreach during disaster recovery. Input from the public provides the Planning Partnership with a greater understanding of local concerns and increases the likelihood of successfully implementing mitigation actions by developing community "buy-in" from those directly affected by the decisions of Planning Area officials. Public awareness is a key component of a successful mitigation strategy and is aimed at making the community safer from the potential effects of hazards.

Public involvement during the development of the MJHMP was sought using a public survey and a digital copy of the draft plan was made available on the project web page and advertised for public review and comment. Comments received were incorporated in the draft plan as applicable.

2.6.1 Hazard Mitigation Plan Web Page

At the beginning of the planning process, a hazard mitigation web page was established on the FMWD website to provide information about the process. The web page was used to keep the public informed about milestones and public participation opportunities and to solicit input.

Figure 2-3. Hazard Mitigation Web Page

2.6.2 Public Meetings

Each of the Committee meetings was open and advertised for public attendance. Refer to Section 2.8, Plan Development Milestones, for descriptions and details of the Hazard Mitigation Planning Committee meetings.

2.6.3 Public Events

Local public events promoted the MJHMP planning process including the La Cañada Community Preparedness event in September 2025, with about 300 community members in attendance (Figure 2-4).

Figure 2-4. La Cañada Community Preparedness event, September 2025

2.6.4 Public Survey

The CPT developed and posted a public survey early in the planning process. The survey was designed to capture information from members of the public. The survey was posted from April 2025 through May 2026 (Figure 2-5). A link to the survey was posted on the hazard mitigation web page and distributed through multiple social media platforms. A link to the electronic public survey was also shared with Planning Committee members, Planning Partners, and Stakeholders.

Summary of Survey Results

During the 13-month period that the survey was open, 139 members of the public completed the survey and 84 respondents provided their email address to receive additional information about natural hazard awareness. The survey and detailed results are included in Appendix A.

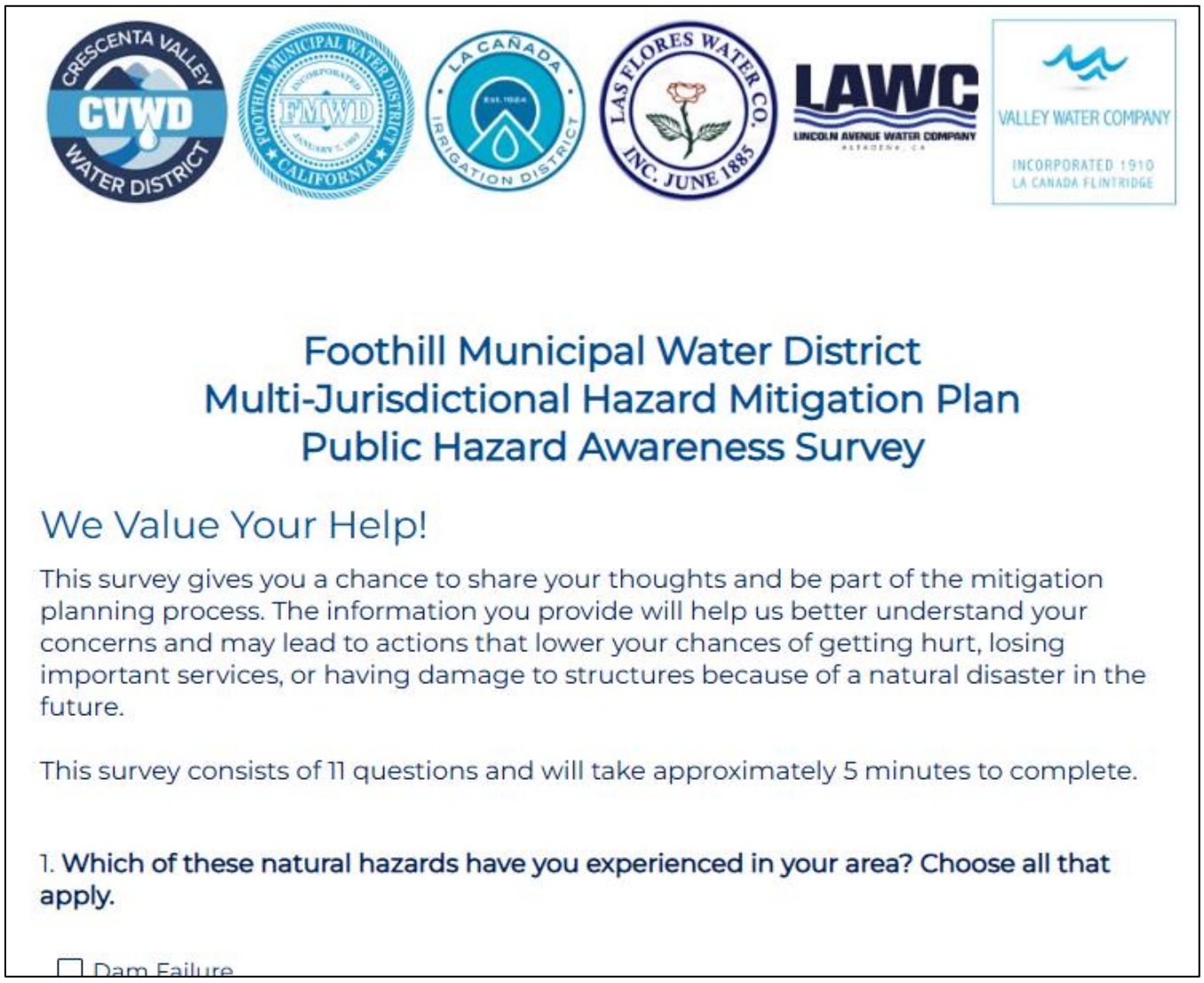


Figure 2-5. Public Survey Sample Page

Incorporation of the Public Survey Into the Hazard Mitigation Plan

Survey participants provided input to the Planning Partners to reduce risk of future hazard events. Of those suggestions, all are included in the mitigation action plan, or are existing core capabilities that the Planning Partners will continue to carry out. Refer to Table 2-4 for examples of feedback and how it was incorporated in the MJHMP.

Table 2-4. Public Survey Comment Examples and MJHMP Incorporation

Public Input	2026 MJHMP Incorporation
84 respondents provided their email address to receive additional information about natural hazard awareness	Agencies included mitigation actions to increase public outreach capabilities
Just over half of the respondents could be self-sufficient for only 1-3 days without drinking water	Agencies included mitigation actions to increase continuity of critical services after a disaster

2.6.5 Public Review Period

Members of the public were provided an opportunity to comment on the draft plan for 2 weeks in June 2026. The hazard mitigation web page included a link to the draft plan and an online tool that allowed community members to submit comments. In addition to the website, the public comment period was promoted on social media and at the publicly-facing FMWD Board meeting.

2.7 REVIEW AND INCORPORATION OF EXISTING PROGRAMS

Local Plan Requirement A4 – 44 CFR Part 201.6(b)(3)

Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

The Planning Partnership utilized the most current technical information, plans, studies, and reports during the planning process to assist in hazard profiling, risk and vulnerability assessment, reviewing mitigation capabilities, and identifying, developing, and prioritizing mitigation strategies at the local levels.

- **Overall Planning Process** – The 2025 FEMA Local Mitigation Planning Policy Guide and Handbook were reviewed and used to develop this MJHMP. The 2023 California State HMP was reviewed for alignment with mitigation goals, identified hazards, risk assessments, and mitigation actions. In addition, neighboring jurisdiction mitigation plans were reviewed for alignment with identified hazards and mitigation actions.
- **Risk Assessment** – Asset and inventory data collected was used to complete the risk assessment of the MJHMP. This included local, state, and federal hazard technical information (e.g., US Geological Survey [USGS] earthquake data, CAL FIRE wildfire data, FEMA disaster declarations). Details of the data used, along with how the data was used, is presented in Chapter 5 and throughout the hazard profiles (Chapters 6 through 13).
- **Capability Assessment** – Numerous plans, reports, regulations, codes, and technical information were obtained from the PC, and stakeholders involved in the planning process, as well as through

independent research conducted by the planning consultant. The Planning Partners were responsible for providing the inventory of their Planning and Regulatory capabilities in each jurisdictional annex in Volume 2, and noted relevant planning and regulatory documents as needed.

- **Mitigation Strategy** – The Planning Partnership developed more than 100 mitigation actions to address the results of the risk assessment and input received from the public and local stakeholders. These actions considered the current capabilities of the Planning Partners to implement each strategy.

2.8 PLAN DEVELOPMENT MILESTONES

Table 2-5 summarizes the planning process activities, efforts, and key milestones conducted to prepare the MJHMP. Meeting documentation (e.g., presentations, agendas, meeting minutes) are located in Appendix C. The table only identifies formal meetings held during the planning process; it does not reflect all planning activities conducted by individuals and groups throughout the planning process.

Table 2-5. Plan Development Milestones

Date	Event	Description	Attendance
	Support Contractor Secured		N/A
	Organize Resources	CPT formed	N/A
December 12, 2024	Project Kickoff Meeting	• Introductions • Hazard Mitigation Planning` Overview • Scope & Schedule • Core Planning Team • Planning Committee • Risk Assessment • Planning Partnership Expectations • Communication Protocols	9
January 7, 2025	Eaton Fire Disaster		
February 20, 2025	CPT Meeting #1	• Planning Partner Updates and Needs • Schedule Adjustments • Data Request • Organized the Planning Committee	9
March 6, 2025	CPT Meeting #2	• Data Request Follow-Up • Schedule Adjustments • Public Outreach • Shared File Access • Planning Committee Organization	10
March 20, 2025	CPT Meeting #3	• Data Request Follow-Up • Hazard Selection • Shared File Access • Style Guide	12

Date	Event	Description	Attendance
		• Public and Stakeholder Outreach • Planning Committee Organization	
April 3, 2025	CPT Meeting #4	• In-Kind Tracking • Dam Failure Inundation Area Discussion • Planning Committee Organization and Kick-Off Meeting Schedule • Public and Stakeholder Outreach	9
April 29, 2025	PC Meeting #1	• Welcome & Introductions • Hazard Mitigation Planning Overview • Role of the Planning Committee • Meeting Ground Rules • Participating Planning Partners • Confirm Hazards • Public Outreach Strategy	24
April 17, 2025	CPT Meeting #5	• In-Kind Tracking • Planning Committee Organization • Updated FEMA Planning Guidance • Mitigation Goals • Public Outreach Survey	8
April 21, 2025	Public Outreach	• FMWD Board Meeting Informational Presentation	N/A
April 2025	Public Outreach	• Public Survey Opens	N/A
May 1, 2025	CPT Meeting #6	• In-Kind Tracking • Planning Committee Updates • Mitigation Goals • Public Outreach • GIS Data	8
May 29, 2025	PC Meeting #2	• Welcome • Approve April Meeting Summary • Natural Hazard Scenarios • Public Outreach Update • Equity Priority Communities Discussion	15
June 12, 2025	CPT Meeting #7	• In-Kind Tracking • Planning Committee Meeting Follow-Ups • Public Outreach • Planning Partner Annex Status	10
July 9, 2025	CPT Meeting #8	• In-Kind Tracking • Public Outreach • Blue Ribbon Commission Report on Climate Action and fire-Safe Recovery Discussion	9

Date	Event	Description	Attendance
		• Planning Partner Annex Status	
July 24, 2025	CPT Meeting #9	• In-Kind Tracking • Mitigation Goals • Public Outreach Materials • GIS Coordination • Planning Committee Meeting Agenda	7
July 31, 2025	PC Meeting #3	• Approve May Meeting Summary • Public Outreach Update • Risk Analysis Update • Hazard Mitigation Goals • Best Practice Mitigation Actions	14
August 7, 2025	CPT Meeting #10	• SWOO Working Session	9
September 18, 2025	CPT Meeting #11	• In-Kind Tracking • Public Outreach Updates • Plan Maintenance Strategy • Planning Committee Meeting Agenda	7
September 25, 2025	PC Meeting #4	• Approve July Meeting Summary • Public Outreach Update • Hazard List and Risk Assessment Methodology • Planning Partner Updates • Preview Draft MJHMP Table of Contents • Review and Approve Plan Maintenance Strategy	15
October 30, 2025	CPT Meeting #12	• In-Kind Tracking • Power Outage Impacts Discussion • Public Survey Results Summary • Planning Timeline Update	7
January 15, 2026	PC Meeting #5	• Public Outreach Update • Risk Assessment Exposure Results • Planning Partner Updates	18
February 12, 2026	CPT Meeting #13	• In-Kind Tracking • Plan Development Updates • Risk Assessment Coordination • Planning Partner Annexes – Phase 2 • Project Schedule	9
February 26, 2026	CPT Meeting #14	• Mitigation Action Workshop	8
March 12, 2026	CPT Meeting #15	• Mitigation Action Brainstorming Session	8
March 26, 2026	CPT Meeting #16	• Map Template Input • Planning Partner Annexes – Phase 2 • Internal Review Draft Update	8

Date	Event	Description	Attendance
May 6, 2026	CPT Meeting #17	• Planning Partner Annexes – Phase 2 Wrap-Up • Agency Board Informational Presentations • Review Upcoming Milestone Dates	6
May 12, 2026	Public Outreach	• CVWD Board Meeting Informational Presentation	N/A
May 25, 2026	Public Outreach	• Public Survey Closes	139
June day-day, 2026	Public Outreach	• Public Comment Period	N/A
June 28, 2026	PC Meeting #6	• TBD	N/A
Month day, 2026	Plan Submittal to Cal OES	Submittal of draft plan and plan review tool to Cal OES for review and approval	N/A
Month day, 2026	Plan Submittal to FEMA Region 9	Submittal of draft plan to FEMA Region 9 by Cal OES with proof of adoption documentation	N/A
Month day, 2026	Adoption	District Board adoptions of draft plan	N/A
Month day, 2026	Approval	Final approval of the plan by FEMA Region 9	N/A

3. PLANNING AREA PROFILE

3.1 OVERVIEW

3.1.1 Historical Overview

Foothill Municipal Water District was established in 1952 in response to rapid population growth in foothill communities following World War II, when local groundwater supplies alone were no longer sufficient to meet demand.

Community leaders pursued connection to the Metropolitan Water District of Southern California (MWD) to secure imported water from the Colorado River Aqueduct (and later the State Water Project), and FMWD formally became an MWD member agency in 1953.

Since its formation, the District has evolved from a supplemental supplier into a critical regional wholesaler, now providing over half of total water demand within its service area through imported supplies, while local groundwater remains an important complementary source.

3.1.2 Member Agencies

Foothill Municipal Water District is a wholesale water provider that serves eight retail water agencies within its service area. These agencies are responsible for delivering water directly to customers (residential, commercial, and institutional).

FMWD's member agencies include:

- **Crescenta Valley Water District** – Participating in the MJHMP as an update to the 2021 single-jurisdiction HMP
- **La Cañada Irrigation District** – Participating in this MJHMP
- **Las Flores Water Company** – Participating in this MJHMP
- **Lincoln Avenue Water Company** – Participating in this MJHMP
- **Valley Water Company** – Participating in this MJHMP
- Kinneloa Irrigation District – Not part of this Planning Partnership but participated in the Public Water Agencies Group MJHMP
- Liberty Utilities – Not part of this Planning Partnership
- Rubio Cañon Land & Water Association – Not part of this Planning Partnership

3.2 GEOGRAPHY AND THE ENVIRONMENT

This section describes the geography and the natural environment of the FMWD.

3.2.1 Location

The FMWD service area is located in northeastern Los Angeles County, along the base of the San Gabriel Mountains.

It encompasses approximately 22 square miles and includes communities such as La Cañada Flintridge, La Crescenta–Montrose, and portions of Pasadena and Altadena, situated between the cities of Pasadena to the east and Glendale to the south and west.

3.2.2 Geography and Topography

The planning area is characterized by foothill and mountain terrain at the southern edge of the San Gabriel Mountains. Elevations generally rise from the relatively urbanized valley floor in Pasadena and Glendale to steeper slopes, canyons, and ridgelines to the north.

The landscape includes alluvial fans, dissected canyons, and hillside neighborhoods, reflecting the geomorphic transition between mountain and the Los Angeles Basin.

Topographic variation plays a key role in water system operations, as imported water must be pumped uphill from MWD connections near lower elevations (e.g., Pasadena/Rose Bowl area) to serve higher-elevation communities.

3.2.3 Hydrology and Hydrography

The FMWD service area lies primarily within the Upper Los Angeles River and Upper San Gabriel River watershed regions.

Local hydrology is shaped by small foothill drainages and canyon systems, including tributaries such as Eaton Canyon and Arroyo Seco, which convey runoff from the San Gabriel Mountains to downstream urban flood control channels.

In addition to surface runoff, the area overlies two important adjudicated groundwater basins—the Raymond Basin and Verdugo Basin—which supply a significant portion of local water demands and are actively managed to ensure long-term sustainability.

3.2.4 Climate

The service area experiences a Mediterranean climate typical of inland Southern California, characterized by hot, dry summers and mild, wetter winters.

Precipitation is highly seasonal, with most rainfall occurring between November and March, often delivered via Pacific storm systems. The adjacent San Gabriel Mountains create changes in airflow and weather patterns, leading to higher rainfall totals in the foothills compared to the coastal plain and increasing the potential for runoff, erosion, and post-wildfire debris flows.

Long-term climate conditions include periodic droughts, increasing temperatures, and hydrologic variability, which contribute to continued reliance on imported water supplies and regional water management strategies.

3.2.5 Land Use and Land Cover

As a water provider, FMWD has no land use authority. Such authority lies with the municipal governments that intersect the FMWD's service area. Land use within the service area is predominantly residential, reflecting the built-out suburban communities of La Cañada Flintridge, La Crescenta–Montrose, Altadena, and portions of Pasadena. The service area is a primarily residential foothill suburban landscape with localized commercial corridors and significant adjacent open space.

Zoning across the FMWD service area is governed by Los Angeles County unincorporated areas and one incorporated city, but shares common structural characteristics.

Land cover transitions from urbanized residential areas to fire-prone natural vegetation, creating a wildland–urban interface (WUI).

The combined land use, land cover, and zoning patterns create several important planning considerations as follows:

- Residential development, and therefore agency infrastructure, directly abuts fire-prone vegetation, elevating wildfire and post-fire debris flow risk.
- Steep slopes limit development intensity, but contribute to elevated landslide risk for structures and infrastructure located in those areas.
- Urban runoff from developed areas interacts with steep natural drainage systems.
- Much of the area is already built out, with growth primarily occurring through infill or corridor redevelopment.

3.3 POPULATION AND DEMOGRAPHICS

Those that live in the service area for the FMWD are one of the most important assets and this MJHMP identifies mitigation strategies to protect the ability to provide critical water services to community members.

3.3.1 General Population

The Foothill Municipal Water District service area serves an estimated population of approximately 80,000 residents across foothill communities including La Cañada Flintridge, La Crescenta-Montrose, and portions of Altadena and Pasadena through its member agencies. Refer to Planning Partner annexes in Volume 2 for details for each agency.

Future Population Projections

According to the Southern California Association of Governments (SCAG), growth projections indicate an increase of less than 0.7% each year over the next five years.

3.4 POPULATION GROWTH AND LAND USE TRENDS

3.4.1 Population Trends

Like many foothill communities, the FMWD service area has a relatively stable, long-term resident base with an increasing share of older adults, and lower rates of household turnover compared to more urban parts of Los Angeles County. Population trends in the FMWD service area reflect long-term slow growth in a built-out suburban environment, followed by a temporary post-Eaton Fire population decline and displacement. As recovery continues, projected gradual moderate growth is expected through 2030, potentially accompanied by demographic shifts.

3.4.2 Future Growth and Development

The FMWD service area is largely built out, with long-established residential neighborhoods in Altadena, La Crescenta-Montrose, and La Cañada Flintridge. Most growth since 2020 reflects incremental change rather than large-scale expansion. Growth occurs primarily through infill development, redevelopment of existing parcels, and accessory dwelling units (ADUs).

Since the 2025 Eaton Fire, land use trends, particularly in Altadena, have shifted from stable, low-density suburban patterns toward a dynamic recovery phase characterized by large-scale rebuilding, increased use of ADUs, emerging redevelopment pressures, stricter wildfire-resilient development standards, and heightened focus on displacement risks.

4. HAZARDS OF CONCERN

4.1 WHAT IS A HAZARD OF CONCERN?

Defining the hazards that present the greatest risk to the planning area is the first step in assessing overall risk to the community. The Planning Partnership and Planning Committee reviewed available information to determine what types of hazards may affect the planning area, how often they can occur, and their potential severity.

Natural hazards are eligible for FEMA HMA grant funding and generally occur because of natural processes. Some natural hazards may also be caused by humans, such as dam failure and wildfire. Human-caused hazards are not reviewed by FEMA for plan approval and are not eligible for FEMA HMA grant funding. The CPT and PC chose to include human-caused hazards in the MJHMP because of their current and potential impact on the Planning Area and to align with other local plans and programs.

4.2 FEDERAL DISASTER DECLARATIONS

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction. Federal disaster declarations, authorized by the Stafford Act, include the following three main types:

- DR (Major Disaster) for large-scale events needing extensive aid.
- EM (Emergency) for supplemental assistance to save lives and property.
- FM (Fire Management) for fires threatening destruction.

Table 4-1 summarizes the Los Angeles County federal disaster declarations between 2019 and 2026.

Table 4-1. Federal Disaster Declarations in Los Angeles County

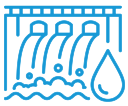
Disaster Number	Event Date Start Date	Incident Type	Title
FM-5293-CA	October 10, 2019	Fire	Saddleridge Fire
FM-5296-CA	October 24, 2019	Fire	Tick Fire
FM-5297-CA	October 28, 2019	Fire	Getty Fire
DR-4482-CA	January 20, 2020	Biological	COVID-19 Pandemic
EM-3428-CA	January 20, 2020	Biological	COVID-19
DR-4569-CA	September 4, 2020	Fire	Wildfires
FM-5374-CA	September 13, 2020	Fire	Bobcat Fire
DR-4683-CA	December 27, 2022	Flood	Severe Winter Storms, Flooding, Landslides, and Mudslides

Disaster Number	Event Date Start Date	Incident Type	Title
EM-3591-CA	January 8, 2023	Flood	Severe Winter Storms, Flooding, and Mudslides
DR-4699-CA	February 21, 2023	Severe Storm	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides
EM-3592-CA	March 9, 2023	Flood	Severe Winter Storms, Flooding, Landslides, and Mudslides
DR-4769-CA	January 31, 2024	Severe Storm	Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslides
FM-5537-CA	September 10, 2024	Fire	Bridge Fire
FM-5548-CA	December 10, 2024	Fire	Franklin Fire
FM-5551-CA	January 7, 2025	Fire	Hurst Fire
FM-5550-CA	January 7, 2025	Fire	Eaton Fire
FM-5549-CA	January 7, 2025	Fire	Palisades Fire
DR-4856-CA	January 7, 2025	Fire	Wildfires and Straight-Line Winds
FM-5605-CA	August 7, 2025	Fire	Canyon Fire

Source: (FEMA 2026)

4.3 NATURAL HAZARDS OF CONCERN AND HAZARDS OF INTEREST

Based on a review of the 2023 California State Hazard Mitigation Plan, the National Risk Index, the prior hazard mitigation plan among the Planning Partnership, and input from the Planning Committee, eight natural hazards of concern affecting the Planning Area and are addressed in this plan:


Dam Failure


Flood


Drought


Landslide, Subsidence & Mass Movement


Earthquake


Strong Wind


Extreme Temperature


Wildfire

Three hazards of interest listed below are discussed in a narrative but not fully assessed in the plan.


Bioterrorism


Cybersecurity


Terrorism/Mass Gathering

Please refer to Appendix B for a complete comparison of hazards included in the 2023 California State Hazard Mitigation Plan, the prior hazard mitigation plan from Planning Partnership, and this MJHMP.

5. RISK ASSESSMENT METHODOLOGY AND TOOLS

5.1 ASSESSING RISK

In hazard mitigation planning, risk is the potential for damage or loss when natural hazards interact with people or assets, such as buildings, infrastructure, and resources. A risk assessment is a process used to identify potential hazards and analyze what could happen if a disaster or hazard occurs. It involves a data-driven analysis to identify potential hazards, what could happen if hazards occur, and determine vulnerabilities to hazards (FEMA 2023).

The risk assessment process focuses on three main elements – hazard identification, exposure identification, and vulnerability identification and loss estimation.

5.2 RISK ASSESSMENT TOOLS

Local Plan Requirement A4 – 44 CFR Part 201.6(b)(3)

Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

For this MJHMP, geographic information system (GIS) and FEMA's Hazus software were used to conduct the risk assessment.

5.2.1 Mapping

GIS tools provide a mechanism to perform quantitative analysis. Hazards that have specified geographic boundaries permit analysis using GIS. These hazards include the following:

- Dam Failure
- Earthquake
- Flood
- Landslide
- Wildfire

5.2.2 Modeling

FEMA's Hazus Model 6.1 was used to evaluate the following hazards:

- **Dam Failure**—A Level 2 user-defined analysis was performed using the flood methodology described below. The analysis assessed the combined inundation areas for failure of six dams: Devil's Gate, Eaton Wash Debris Basin, Glenoaks 968 Reservoir, Morris S. Jones, Rubio Debris Basin, Sierra Madre Villa
- **Earthquake**—A Level 2 analysis was performed to assess earthquake exposure and vulnerability for three scenarios: Puente Hills (LA) M6.95, Sierra Madre M7.16, and Verdugo M6.90. The Hazus

methodology uses ground motion and ground failure fragility curves to estimate damage state probabilities which are then used to estimate losses at the structure level.

- **Flood**—A Level 2 user-defined analysis was performed for critical facilities and infrastructure in flood zones. The effective FEMA flood mapping for the Planning Area was used to delineate flood hazard areas and estimate potential losses from the 1 percent annual chance flood event. To estimate damage that would result from a flood, Hazus uses predefined relationships between flood depth at a structure and resulting damage, with damage given as a percent of total replacement value. Curves defining these relationships have been developed for damage to structures and for damage to typical contents within a structure. By inputting flood depth data and known property replacement cost values, dollar-value estimates of damage were generated.

Overview

FEMA developed the Hazards U.S., or Hazus, model in 1997 to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. Hazus was later expanded into a multi-hazard methodology with new models for estimating potential losses from hurricanes and floods. The use of Hazus for hazard mitigation planning offers the following numerous advantages:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates the review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a HMP throughout its implementation.

Hazus is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, community lifelines, transportation and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program can be used to map hazard data and the results of damage and economic loss estimates for buildings and infrastructure.

Level of Detail for Evaluation

Hazus provides default data for inventory, vulnerability and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out the following three levels of analysis, depending on the format and level of detail of information about the Planning Area:

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the Planning Area.

- **Level 2**—More accurate estimates of losses require more detailed information about the Planning Area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the Planning Area.

5.3 RISK ASSESSMENT APPROACH

This plan evaluated risks associated with each identified hazard for the Planning Area. Each hazard was profiled using the following steps:

- **Identify and profile each hazard** – The following information is given for each hazard of concern:
  - *Description of the Hazard:* Defining the hazard and a discussion of potential impacts.
  - *Location:* Geographic areas most affected by the hazard.
  - *Extent:* Measuring the intensity of the hazard, warning time for preparations, and the reasonable worst-case scenario.
  - *Previous Occurrences:* Summary of past events that have impacted the Planning Area.
  - *Future Occurrences:* Probability estimates, including potential frequency and intensity shifts caused by climate change and population and development trends.
- **Determine exposure to each hazard** – One of the following assessment approaches was used, depending on the type of information available for the hazard:
  - *Quantitative assessment*—Performed when numerical data are available to define risk. Available numerical hazard data may include financial impact and probability.
  - *Qualitative assessment*—Uses words to describe and categorize the likelihood and consequences of a risk when numerical data are unavailable.
- **Assess the vulnerability of exposed facilities** – Vulnerability of exposed structures and infrastructure was evaluated by estimating the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard
  - Impact on Life, Health, and Safety
  - Impact on General Building Stock
  - Impact on Community Lifelines
  - Impact on the Economy
  - Impact on Historic and Cultural Resources
  - Impact on Natural Resources
  - Change in Vulnerability Since the Previous HMPs
- **Identify potential mitigation opportunities** – A range of potential opportunities for mitigating each hazard is included for jurisdictions to consider during the development of their mitigation strategies.
  - Community: Mitigation actions that can be implemented by the general public.
  - Organizational: Mitigation actions that can be implemented by businesses and nonprofits.
  - Government: Mitigation actions that can be implemented by local governments.

5.4 SOURCES OF DATA USED IN HAZUS MODELING

5.4.1 Facilities and Infrastructure Cost Data

Replacement cost values and detailed structure information were derived from data provided by the Planning Partners on their system facilities and infrastructure. The exposure of the facilities and infrastructure to the hazards was analyzed using GIS overlays. Hazus was used to determine damage to pipelines and to the following facilities: pump stations, water treatment plants, tanks, and buildings.

The Hazus earthquake module calculates the economic loss to pipelines using the number of leaks and the number of breaks multiplied by cost to repair each leak or break. Default cost-to-repair Hazus default values for pipeline restoration time also were revised with information provided by the agencies.

- Cost to repair a pipeline leak: $5,000
    - Cost to repair a pipeline break: $15,000

These values are understated for Foothill Municipal Water District and its member agencies and the loss estimations made using these values should be viewed as conservative, lower-bound estimates.

Table 5-1. Data Source Summary

Data	Source	Date(s)	Format(s)
TBD	TBD	TBD	TBD
TBD	TBD	TBD	TBD

5.5 DATA LIMITATIONS

Loss estimates, exposure assessments and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic, or economic parameter data
- The unique nature, geographic extent and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. Over the long term, the Planning Partners will collect additional data to assist in estimating potential losses associated with other hazards.

6. DAM FAILURE

6.1 HAZARD PROFILE

6.1.1 Description of the Hazard

Definition and Classification of Dams

A dam is an artificial barrier that can store water, wastewater, or liquid-borne materials for many reasons—flood control, human water supply, irrigation, livestock water supply, energy generation, containment of mine tailings, recreation, or pollution control. Many dams fulfill a combination of these functions. They are an important resource in the United States. (City of Los Angeles 2024) In California, dams are regulated by the State of California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) (California Department of Water Resources n.d.). Additional regulatory oversight of dams is cited in Appendix C (Federal & State Agencies, Programs & Regulations).

The California Water Code (Division 3) defines a dam as any artificial barrier, together with appurtenant works, that does or may impound or divert water, and that either:

- Has a height of more than 6 feet and it impounds 50 acre-feet or more of water, or
- Has a height of 25 feet or higher and impounds more than 15 acre-feet of water.

Dams can be classified according to their purpose, the construction material or methods used, their slope or cross section, the way they resist the force of the water pressure, or the means used for controlling seepage. Materials used to construct dams include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, plastic, rubber, and combinations of these. (City of Los Angeles 2024)

Regulatory Oversight of Dams

Potential for catastrophic flooding caused by dam failures led to enactment of the National Dam Safety Act (Public Law 92-367), which for 30 years has protected Americans from dam failures. The National Dam Safety Program (NDSP) is a partnership among states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under FEMA's leadership, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchases of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most dams in the United States (FEMA n.d.).

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers (USACE) is responsible for safety inspections of some federal and nonfederal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state's and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety (USACE 2021).

Cause of the Hazard

Partial or full failure of dams has the potential to cause massive destruction to the ecosystems and communities located downstream. Partial or full failure can occur because of one or a combination of the following reasons (City of Los Angeles 2024).

- Overtopping caused by floods that exceed the dam capacity (inadequate spillway capacity).
- Prolonged periods of rainfall and flooding.
- Deliberate acts of sabotage (terrorism).
- Structural failure of materials used in dam construction.
- Movement and/or failure of the foundation supporting the dam.
- Settlement and cracking of concrete or embankment dams.
- Piping and internal erosion of soil in embankment dams.
- Inadequate or negligent operation, maintenance, and upkeep.
- Failure of upstream dams on the same waterway.
- Earthquake (liquefaction/landslides).

Planning Requirements

State of California

All dams whose inundation areas may impact the planning area have emergency action plans (EAPs) on file. The EAPs must include the following (Cal OES 2021):

- Emergency notification flow charts.
- Information on a four-step response process.
- Description of agencies' roles and actions in response to an emergency incident.
- Description of actions to be taken in advance of an emergency.
- Inundation maps.
- Additional information such as revision records and distribution lists.

After the EAPs are approved by the state, the law requires dam owners to send the approved EAPs to relevant stakeholders. Local public agencies can then adopt emergency procedures that incorporate the information in the EAP in a manner that conforms to local needs and includes methods and procedures for alerting and warning the public and other response and preparedness related items (Cal OES 2021).

Federal Energy Regulatory Commission

Dams that fall under the jurisdiction of the Federal Energy Regulatory Commission (FERC) also have specified planning requirements. FERC has the largest dam safety program in the United States. It cooperates with a large number of federal and state agencies to ensure and promote dam safety and, more recently, homeland security. FERC requires licensees to prepare EAPs and conducts training sessions on how to develop and test these plans. The plans are designed to serve as an early warning system if there is a potential for, or a sudden release of water from, a dam failure or accident to the dam. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows and procedures for notifying affected residents and agencies responsible

for emergency management. These plans are frequently updated and tested to ensure that in emergency situations everyone knows what to do, thus saving lives and minimizing property damage (City of Los Angeles 2024).

FEMA Guidance for Flood Mapping

FEMA's Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures is part of the National Dam Safety Program, a partnership of states, federal agencies, and other stakeholders formed to encourage individual and community responsibility for dam safety. Under this program, states are responsible for regulating non-federal dams. The guidelines provide information for federal and state agencies, local governments, dam owners, and emergency management officials to use for reducing flood hazards and the resulting potential for economic damage and loss of life. It is a resource for developing state-specific guidelines for dam safety and as a reference manual for mapping dam breach inundation zones (FEMA 2023).

Rehabilitation of High Hazard Potential Dams

FEMA's Rehabilitation of High Hazard Potential Dams grant program provides assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness. For the purposes of the HHPD program, the term "rehabilitation" means the repair, replacement, reconstruction, or removal of a dam that is carried out to meet applicable state dam safety and security standards (FEMA 2020).

Summary of Potential Impacts

Dam failure can be catastrophic to all life and property downstream. Flooding is the most common effect of dam failure. Failure of dams could have catastrophic and compounding impacts in the inundation area including:

- **Economy** - the cost of recovery and removal of debris; the financial impact on residents; and any livestock and property losses.
- **Environmental** - the destruction of plants, trees, and earth; the need to remediate areas inundated by flood waters; the removal of natural debris; the secondary risk of land and mudslides following a dam failure until the earth has been sufficiently stabilized.
- **Infrastructure** - the need to repair damage to the dam and to affected infrastructure such as buildings, critical facilities, energy generation facilities, and transportation routes.
- **Population** - the displacement of residents and removal of victims.

Cascading Hazard Impacts

Dam failure can cause cascading hazards such as Landslide, Subsidence, and Mass Movement, bank erosion, and destruction of downstream habitat. Dam failure may worsen the severity of a Drought by releasing water that might have been used as a potable water source. Other notable cascading impacts from dam failures include:

- Potential to impact multiple downstream jurisdictions.
- Loss of power associated with facilities that provide hydropower.

- Damage to agricultural lands.
- Impacts on multiple jurisdictions (CalOES 2023).

6.1.2 Location

According to the National Inventory of Dams, there are 103 dams in Los Angeles County – 91 are state regulated and 15 are federally regulated. Three dams within Los Angeles County have potential impacts on the Planning Area as shown in Table 6-1.

A dam breach inundation map shown in Figure 6-1 shows flooding that could result from a combined failure of the assessed dams or their critical appurtenant structure. In 2017, the California Legislature passed a law requiring all State jurisdictional dam owners, except for owners of low-hazard dams, to develop inundation maps approved by DSOD and emergency action plans approved by Cal OES. At the time of the drafting of this plan in mid-2026, Eaton Wash Debris Basin and Rubio Debris Basin pose the highest hazard concern for the Planning area. Devils Gate Dam touches the planning area though poses minimal risk.

Table 6-1. Dams in Los Angeles County with Potential to Impact the Planning Area

Name	Hazard Class[1]	Water Course	Owner	Year Built	Dam Type	Crest Length (feet)	Height (feet)	Storage Capacity (acre-feet)	Drainage Area (sq. mi.)
Rubio Debris Basin	High	Rubio Creek	Los Angeles County Department of Public Works	1944	Earth	-	64	44	1.71
Description	The Rubio Debris Basin is located in Altadena, California and was completed in 1944. This dam serves to control debris and reduce flood risk along Rubio Creek. The dam is the only one to fall entirely within the Planning Area and sits within the Rubio Canon Land-Water Association. According to the California Department of Water Resources Division of Safety Dams (DOSD), the downstream hazard is high.								
Devils Gate	High	Arroyo Seco	Los Angeles County Department of Public Works	1920	Gravity	-	108	2,600	29.7
Description	The Devils Gate Dam is located in Pasadena, California and was completed in 1920. This dam was the first flood control dam constructed in Los Angeles County. FMWD's pump station is in Devil's Gate Dam area. The dam sits at the narrowest part on the Arroyo Seco. The downstream hazard risk of this dam is extremely high, though much of the inundation area is just outside of the Planning Area and follows along the Brookside Golf Course.								
Eaton Wash Debris Basin	High	Eaton Wash	Los Angeles County Department of Public Works	1936	Earth	-	63	721	9.47
Description	The Eaton Wash Debris Basin is located in Pasadena, California and was completed in 1936. This dam serves as both flood risk reduction and debris control. The dam sits at the narrowest part on the Arroyo Seco. The downstream hazard risk of this dam is extremely high.								

Source: (National Inventory of Dams n.d.)

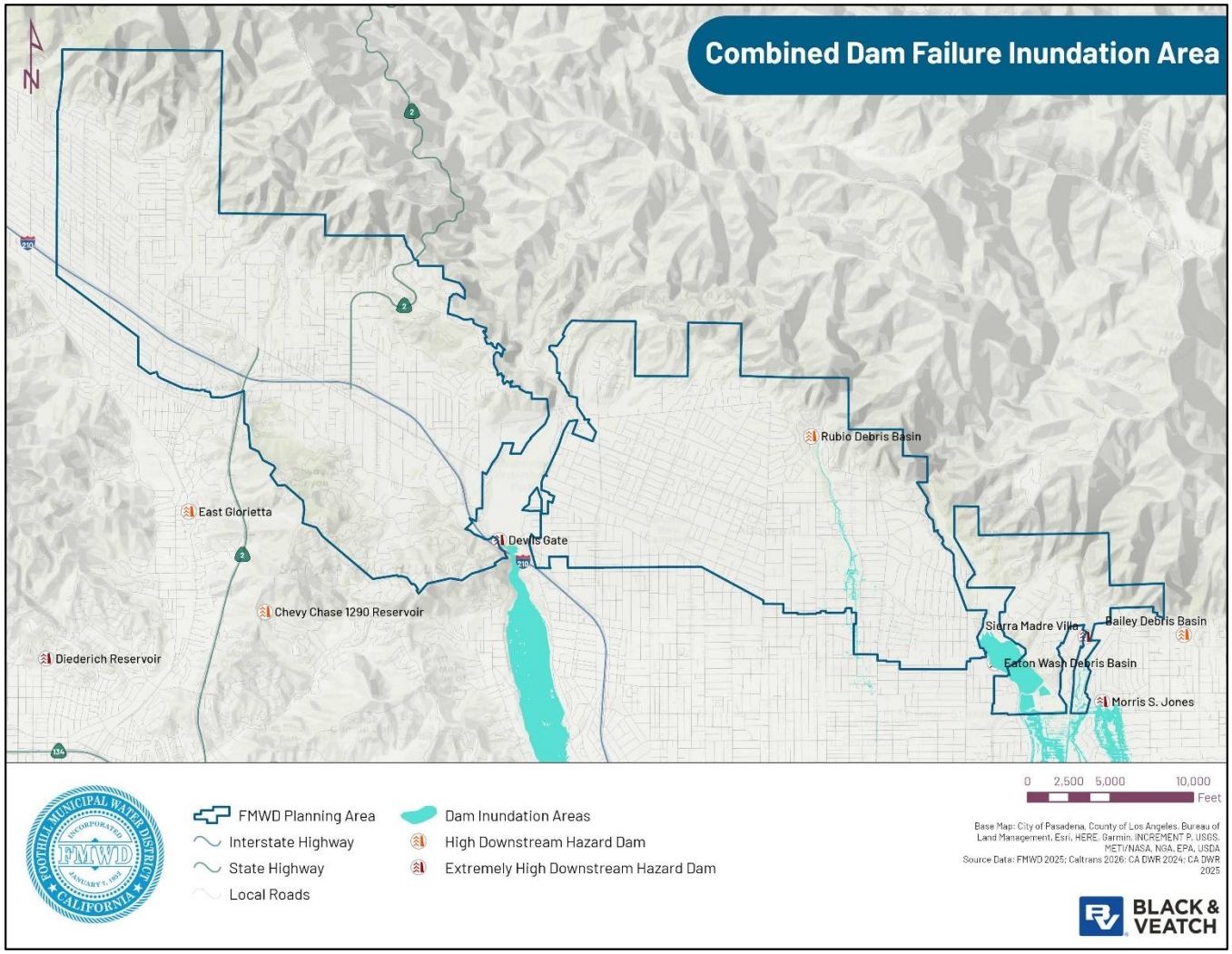


Figure 6-1. Combined Dam Failure Inundation Area

6.1.3 Extent

Measuring Intensity

California's Division of Safety of Dams has developed a hazard potential classification system for state-jurisdiction dams, as shown in Table 6-3. Condition Assessment Ratings. This system is modified from federal guidelines, which recommend a three-tier classification. The California system adds a fourth hazard classification of "extremely high." Dams classified as extremely high hazard may impact highly populated areas or critical infrastructure or have short evacuation warning times.

The DWR DSOD assigns a downstream hazard classification and condition assessment rating to jurisdictional dams (dams that are over six feet tall that impound 50-acre feet or more of water or dams that are over 25 feet tall and impound more than 15 feet of water) within the State. The downstream hazard is based solely on potential downstream impacts to life and property should the dam fail when operating with a full reservoir. This hazard is not related to the condition of the dam or its appurtenant

structures. Table 6-2 outlines the potential classifications for downstream hazard (California Department of Water Resources n.d.).

Table 6-2. Downstream Hazard Categories

Downstream Hazard Potential Classifications	Description Potential Downstream Impacts to Life and Property
Low	No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner's property.
Significant	No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.
High	Expected to cause loss of at least one human life.
Extremely High	Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more.

Source: (DWR 2021)

DSOD uses NID's condition rating definitions (updated 2021) as a guideline in assigning condition assessments. A dam safety deficiency is defined as a load capacity limit or other issue that can result in a failure of the dam or appurtenant structure. It is a characteristic or condition that does not meet the applicable minimum regulatory criteria. Condition assessment definitions are shown in Table 6-3. Condition Assessment Ratings

Table 6-3. Condition Assessment Ratings

Ratings	Definitions from the National Inventory of Dams
Satisfactory	No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the minimum applicable state or federal regulatory criteria or tolerable risk guidelines.
Fair	No existing dam safety deficiencies are recognized for normal operating conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action. Note: Rare or extreme event is defined by the regulatory agency based on their minimum applicable state or federal criteria.
Poor	A dam safety deficiency is recognized for normal operating conditions which may realistically occur. Remedial action is necessary. Poor may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Investigations and studies are necessary.
Unsatisfactory	A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.
Not Rated	The dam has not been inspected, is not under state jurisdiction, or has been inspected but, for whatever reason, has not been rated.

Source: (FEMA 2024)

Warning Time

Warning time for dam failure depends on the cause of the failure. In events of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, it is possible that there would be no warning time. The USGS Earthquake Hazards Program has several dam-safety related earthquake programs, including dam-specific earthquake monitoring programs in California to help monitor safety concerns following seismic events.

A dam's structural type affects warning time. Earthen dams do not tend to fail completely or instantaneously. Once a breach is initiated, discharging water erodes the breach until the reservoir is empty or the erosion stops. Concrete dams also tend to begin with a partial breach. The time of breach formation ranges from a few minutes to a few hours (USACE 2021).

Worst Case Scenario

A worst-case scenario for dam failure would be multiple high hazard dams failing at the same time. As dam failures are rare, such an event would likely be triggered by a major earthquake or catastrophic flood levels.

6.1.4 Previous Occurrences

The following sections provide a review of previous dam failure occurrences in the Planning Area.

Declarations

Federal Disaster Declarations

Between 1954 and 2025, the Planning Area experienced one dam failure. Dam failure-related disasters (DR) or emergencies (EM) are at the County level, and while the Planning Area was not directly impacted, indirect impacts were likely.

Table 6-4. Federal Disaster Declarations

Title	Event Date(s)	Disaster Number	Declaration Date
Flood Due to Broken Dam	December 21, 1963	D-161	December 21, 1963

Source: (FEMA 2025)

State Declarations

Between 2012 and 2025, California declared no disasters related to dam failure in the Planning Area (Cal OES 2025).

USDA Declarations

Between 2012 and 2025, the USDA declared no disasters related to dam failure in the Planning Area (U.S. Department of Agriculture 2025).

Summary of Significant Events

Los Angeles County was the scene of one of the worst dam failures in United States history. The St. Francis Dam was built in San Francisquito Canyon, approximately 40 miles northwest of downtown Los Angeles, in 1924. On the night of March 12-13, 1928, the dam catastrophically failed, releasing approximately 12.4 billion gallons of water. Approximately 600 were killed. Subsequent investigations determined that the dam failed as a result of defective foundations that had been built upon an unstable rock formation. As a result of the disaster, the State of California increased dam safety legislation and oversight and created a state Board of Registration for civil engineers to regulate the industry.

Recent Events

There have been no recent events of dam failure in the Planning Area since 1883.

6.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections that follow.

Probability

Dam failure events are infrequent and usually coincide with the events that cause them, such as earthquakes, landslides and excessive rainfall and snowmelt. The probability of future occurrence can be reduced through proper design, construction, and maintenance measures. Without proper maintenance, the age of a dam can increase the potential for failures.

All dams face a "residual risk" of failure, which represents the risk that conditions may exceed those for which the dam was designed. For example, dams may be designed to withstand a probable maximum precipitation, defined as "the maximum depth of precipitation at a location for a given duration that is meteorologically possible" (Sarkar 2020). The chance of a precipitation event of a greater magnitude than that represents residual risk for such dams. This represents a theoretical probability of future occurrence for a dam failure event, though the probability of an event exceeding the assumed maximum is not generally calculated as part of dam design.

Climate Change

Cal-Adapt mapping indicates a shift of precipitation events away from southern and inland regions toward central and northern regions. However, decreases in annual precipitation in southern and inland regions may not be accompanied by a reduction in flooding. An increase in climate variance may result in these regions experiencing heavier, more intense episodic rainfall and flooding events due to the transport of warmer, moisture-laden air from the ocean (CalOES 2023).

Dam failures may become more frequent and severe as climate change exacerbates extreme weather events such as flooding. More rapid snowmelt, warmer temperatures, and flash floods may weaken already aging infrastructure and increase the risk of catastrophic failure. These dams were not engineered with climate change in mind. In 2016, Climate-Safe Infrastructure Bill (Assembly Bill [AB] 2800) became law and "established the Climate-Safe Infrastructure Working Group to develop recommendations to the California legislature on how to build and design our infrastructure to be safer for Californians in the face of growing climate extremes." The Working Group's 2018 report identified nearly 700 High hazard dams in California needing repairs and upgrades.

Potential Future Impacts

The Eaton Fire wiped out Altadena's small-town commercial district and many single-family homes, temporarily reducing the number of homes at risk of flooding from dam failure. The community is in the process of rebuilding and redeveloping which will increase exposure. Post-fire development will look different in Altadena, as officials seek to reduce wildfire exposure.

Today, La Cañada Flintridge is largely built-out and the City's adopted policy is to retain the community's natural hillsides and semi-rural character. In addition, the presence of environmental and infrastructure constraints (e.g., hillside topography, wildfire hazards, lack of public sanitary sewers or acceptable

percolation rates for septic) on the few remaining vacant parcels in the city precludes extensive development. The population of the city has been relatively stable since 1980 with only minor fluctuations. (The City of La Cañada Flintridge 2023).

The planning area is not at high risk for dam failure, though Los Angeles County and neighboring Counties are home to many dams that need repair.

6.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

6.2.1 Summary of Vulnerability

To assess the Planning Area's vulnerability to the dam failure hazard, dams rated as high hazard with mapped inundation areas were combined into a single inundation area. A Hazus vulnerability assessment was conducted, and summary findings are outlined below. See individual risk assessment results in each Planning Partner annex (Volume 2).

6.2.2 Impact on Assets and the Economy

Las Flores Water Company is the only agency with assets exposed to the dam failure hazard with 0.02 miles (106 feet) of pipeline exposed. The FMWD service area includes dam failure impact areas, but these do not intersect with District-owned assets. Economic impacts would be minor considering the limited exposure.

6.2.3 Change in Vulnerability Since Prior HMP

The only participating jurisdiction that has a prior HMP is Crescenta Valley Water District. Refer to the CVWD annex in Volume 2.

6.3 MITIGATION OPPORTUNITIES

A range of potential opportunities for mitigating the dam failure hazard have been identified and considered by plan participants:

Table 6-5 presents a range of potential opportunities for mitigating the dam failure hazard.

Table 6-5. Potential Opportunities to Mitigate the Dam Failure Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• None	• Remove dams • Harden dams	• Remove dams • Harden dams

Community Scale	Organizational Scale	Government Scale
Reduce Exposure and Vulnerability		
• Relocate out of dam failure inundation areas • Elevate home to appropriate levels	• Replace or rehabilitate dams with deficiencies • Flood-proof facilities within dam failure inundation areas	• Replace earthen dams with hardened structures • Relocate critical facilities out of dam failure inundation areas • Consider open space land use in designated dam failure inundation areas • Adopt higher floodplain standards in mapped dam failure inundation areas • Retrofit critical facilities within dam failure inundation areas
Build Local Capacity		
• Learn about risk reduction for the dam failure hazard • Learn the evacuation routes for a dam failure event • Become educated about early warning systems and the dissemination of warnings	• Educate employees on the probable impacts of a dam failure • Develop a continuity of operations plan	• Map dam failure inundation areas • Enhance emergency operations plan to include a dam failure component • Institute monthly communications checks with dam operators • Inform the public on risk reduction techniques • Adopt real-estate disclosure requirements for the re-sale of property located within dam failure inundation areas • Consider the probable impacts of climate change in assessing the risk associated with the dam failure hazard • Establish early warning capability downstream of listed high-hazard dams • Consider the residual risk associated with protection provided by dams in future land use decisions
Nature-based Opportunities		
• Restore and reconnect floodplains that intersect dam failure inundation areas that have been degraded by development and structural flood control • Use soft approaches for stream bank restoration and hardening. Soft approaches can include but are not limited to the introduction of large woody debris into a system • Set back levees on systems that rely on levee protection to allow the river channel to meander, which reduces erosion and scour potential • Acquire property within dam failure inundation areas, remove or relocate structures, and preserve these areas as open space in perpetuity • Preserve floodplain storage capacity by limiting or prohibiting the use of fill within the floodplain		

7. DROUGHT

7.1 HAZARD PROFILE

7.1.1 Hazard Description

Defining the Hazard

Drought is defined as the deficiency in precipitation over an extended period, resulting in a water shortage ((NOAA n.d.)). The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location to the affected area.

The occurrence of drought is a normal phase in the climate cycle of most regions, originating from a deficiency of precipitation over an extended period of time, usually a season or more. This leads to a water shortage for some activity, group, or environmental sector. Drought can be characterized based on the following:

- Meteorological measurements such as rainfall deficit compared to normal or expected rainfall.
- Agricultural impacts due to reduced rainfall and water supply (e.g., crop loss, herd culling, etc.).
- Hydrological measurements of stream flows, groundwater, and reservoir levels relative to normal conditions.
- Direct and indirect socio-economic impacts on society and the economy (e.g., increased unemployment due to failure of an industry because of drought).

Cause of the Hazard

Droughts are climatic patterns that occur over long periods of time as the result of many causes. Global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast result in warm, dry air and reduced precipitation. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depend on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of global weather systems (NASA n.d.).

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple of months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered long-term. It is possible for a region to experience a long-term pattern that produces drought, and to have short-term changes that result in wet spells within the long-term pattern. Likewise, it is possible for a long-term wet pattern to be interrupted by weather spells that result in short-term drought (National Drought Mitigation Center n.d.).

Summary of Potential Impacts

Drought can have a widespread impact on the environment and the economy, although it typically does not result in loss of life or damage to structures, as do other natural disasters.

The National Drought Mitigation Center uses three categories to describe likely drought impacts (National Drought Mitigation Center n.d.):

- **Economic Impacts**—These impacts of drought cost people (or businesses) money. Farmers' crops are destroyed; low water supply necessitates spending on irrigation or drilling of new wells; water-related businesses (such as sales of boats and fishing equipment) may experience reduced revenue.
- **Environmental Impacts**—Plants and animals depend on water. When a drought occurs, their food supply can shrink, and their habitat can be damaged.
- **Social Impacts**—Social impacts include public safety, health, conflicts between people when there is not enough water to go around, and changes in lifestyle.

The demand that society places on water systems and supplies—such as expanding populations, irrigation, and environmental needs—contributes to drought impacts. Drought can lead to difficult decisions regarding the allocation of water, as well as stringent water use restrictions, water quality problems, and inadequate water supplies for fire suppression. There are also issues such as growing conflicts between agricultural uses of surface water and in-stream uses, surface water and groundwater interrelationships, and the effects of growing water demand on uses of water.

Vulnerability of an activity to drought depends on its water demand and the water supplies available to meet the demand. The impacts of drought vary between sectors of the community in both timing and severity (EPA n.d.):

- **Water supply**—The water supply sector encompasses urban and rural drinking water systems that are affected when a drought depletes groundwater supplies due to reduced recharge from rainfall.
- **Agriculture and commerce**—Impacts on the agriculture and commerce sectors include the reduction of crop yield and livestock sizes due to insufficient water supply for crop irrigation and maintenance of ground cover for grazing.
- **Environment, public health, and safety**—The environmental, public health, and safety sector focuses on wildfires that are both detrimental to the forest ecosystem and hazardous to the public. It also includes the impact of desiccating streams, such as the reduction of in-stream habitats for native species.

Cascading Hazard Impacts

The cascading impact most commonly associated with drought is Wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. Utility failure may result from loss of potable water supply or loss of hydroelectric power. Crop failure may also occur which increases the likelihood of mudslides and landslides on steep slopes if vegetation is lost due to drought.

Drought is also often accompanied by Extreme Heat, exposing people to the risk of sunstroke, heat cramps, and heat exhaustion. Pets and livestock are also vulnerable to heat-related injuries.

7.1.2 Location

A drought is a regional event that is not confined to geographic boundaries; it can affect several areas at once and range in severity across those areas. Drought that affects the Planning Area would affect the entirety of the area simultaneously and has the potential to impact every person, directly or indirectly, in the Planning Area, as well as adversely affect the local economy.

7.1.3 Extent

The severity of any given drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts.

Measuring Intensity

Droughts are dynamic, and locations of the State susceptible to drought can change monthly. The U.S. Drought Monitor is a map that is updated weekly to show the location and intensity of drought across the country. Other drought monitoring indices include the Standardized Precipitation Index (SPI) and the Palmer Drought Severity Index (PDSI). The drought monitor uses the five-category system shown in Table 7-1.

Table 7-1. U.S. Drought Monitor Categories

Category	Description	Possible Impacts
D0	Abnormally Dry	• Short-term dryness slowing planting, growth of crops • Some lingering water deficits • Pastures or crops not fully recovered
D1	Moderate Drought	• Some damage to crops, pastures • Some water shortages developing • Voluntary water-use restrictions requested
D2	Severe Drought	• Crop or pasture loss likely • Water shortages common • Water restrictions imposed
D3	Extreme Drought	• Major crop/pasture losses • Widespread water shortages or restrictions
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water creating water emergencies

Source: ***(FEMA 2025, NOAA National Weather Service n.d.)***

Warning Time

Droughts are climatic patterns that occur over long periods of time. Only generalized warnings can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions (NASA n.d.). No official watch or warning system is in place (CalOES 2023).

Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature; these include global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation (NOAA 2024).

At this time, scientists do not know how to predict drought more than a month in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades.

Worst Case Scenario

An extreme multi-year drought can impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years. Intensified by such conditions, extreme wildfires could break out throughout Los Angeles County, as seen in 2025 with the Palisades and Eaton Fires, increasing the need for water. Surrounding communities, also in drought conditions, could increase their demand for water supplies relied upon in the Planning Area, causing social and political conflicts. If such conditions persisted for several years, the economy of Los Angeles County and the Planning Area could experience setbacks, especially in water dependent industries.

7.1.4 Previous Occurrences

The following sections provide a review of previous drought occurrences in the Planning Area.

Declarations

Federal Disaster Declarations

There have been no federal declarations for drought for Los Angeles County (FEMA 2025).

State Declarations

Between 1954 and 2025, California included Los Angeles County in three state-proclaimed drought disasters **(Cal OES 2025)**.

Table 7-2. State Drought Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
-	1976	February 9, 1976; February 13, 1976	1976 Drought
2014-03	2014	September 18, 2014	Drinking Water Shortage
2015-05	2015	October 30, 2015	Tree Mortality

Source: (Cal OES 2025)

USDA Declarations

Between 2012 and 2025, USDA included Los Angeles County in 22 declarations relating to drought.

Table 7-3. USDA Drought Disaster Designations

Designation Number	Declaration Date	Event Type
S3268	July 12, 2012	Drought-Fast Track
S3452	December 19, 2012	Drought
S3491	February 27, 2013	Drought-Fast Track
S3542	June 19, 2013	Drought-Fast Track
S3558	July 31, 2013	Drought-Fast Track
S3626	January 15, 2014	Drought-Fast Track
S3637	January 23, 2014	Drought-Fast Track
S3626	January 15, 2014	Drought-Fast Track
S3637	January 23, 2014	Drought-Fast Track

Designation Number	Declaration Date	Event Type
S3743	September 17, 2014	Drought
S3797	February 25, 2014	Drought
S3784	February 4, 2015	Drought-Fast Track
S3943	December 23, 2015	Drought
S3952	February 17, 2016	Drought-Fast Track
S4144	February 23, 2017	Drought-Fast Track
S4460	March 20, 2019	Drought-Fast Track
S4467	March 22, 2019	Drought-Fast Track
S4467	March 22, 2019	Drought-Fast Track
S4647	March 11, 2020	Drought-Fast Track
S5146	April 8, 2022	Drought-Fast Track
S5371	March 17, 2023	Drought-Fast Track
S5943	March 25, 2025	Drought-Fast Track

Source: (U.S. Department of Agriculture 2025)

Summary of Significant Events

Drought is an ongoing hazard that has shaped California's history. In the mid-1800s, the Great Drought contributed to the demise of the cattle rancho system. Then in the 1920s and 1930s, dry conditions were prevalent in California and throughout the nation during the Great Depression and Dust Bowl. Later in the 20th century, significant droughts impacting water supplies occurred in the mid-1970s and mid- to early-1990s. Recent multi-year droughts occurred in 2007 to 2009, 2012 to 2016, and 2020 to early 2023. Drought conditions rose again in Los Angeles County in December 2024 and continued into 2025.

Recent Events

From January 2000 to December 2024, some part of Los Angeles County experienced a USDM rating of D0 or higher in 861 out of 1,318 weeks—nearly two-thirds of the weeks (refer to Table 7-1 and Table 7-3).

Table 7-4. Previous Events

Incident Period	Event Type	Description
2007 to 2009	Drought	This was California's first statewide proclamation of drought emergency, and the first drought in more than 70 years where water shortage was directly linked to social services impacts (California Department of Water Resources 2010). Several California counties were also included in a state disaster proclamation, but Los Angeles County was only included in the emergency proclamation.
2012 to 2014	Drought	Calendar year 2013 set minimum annual precipitation records for many communities.
2012 to 2016	Drought	The driest 3 consecutive years for statewide precipitation were between.
2020 to 2023	Drought	A new record was set during this multi-year drought, with 2022 becoming the driest year in California since official drought records began in 1895. All 58 counties in California were impacted as USDA disaster-designated

Incident Period	Event Type	Description
		areas. This included residents in Los Angeles County.
December 2024 to Present	Drought	As of November 2025, U.S. Drought Monitor statistics indicate that the County is experiencing moderate drought.

Source: (U.S. Department of Agriculture 2025), (National Drought Mitigation Center n.d.)

7.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

Probability

Drought has a high probability of occurrence in the Planning Area. The Planning Area has also been included in USDA drought disaster declarations (Los Angeles County) in 11 of the last 13 years (U.S. Department of Agriculture 2025). Historical drought data for Los Angeles County indicate there have been four significant multi-year droughts in the last 35 years (1987 to 2024), amounting to a severe drought every 9 years on average (National Drought Mitigation Center n.d.).

Climate Change

Future impacts of climate change are expected to influence future drought occurrences for the planning area.

With a warmer climate, droughts could become more frequent, more severe, and longer lasting. The Fourth National Climate Assessment Report for the United States indicates that "rising air and water temperatures and changes in precipitation are intensifying droughts. Changes in the relative amounts and timing of snow and rainfall are leading to mismatches between water availability and needs in some regions. Groundwater depletion is exacerbating drought risk." (USGCRP 2018).

Because changes in precipitation patterns are still uncertain, the potential impacts and likelihood of drought are uncertain. Department of Water Resources (DWR) has noted impacts of climate change on statewide water resources by charting changes in snowpack, sea level, and river flow. As temperatures rise and more precipitation comes in the form of rain instead of snow, these changes will likely continue or grow even more significantly. DWR estimates that parts of the state will experience a 48 to 65 percent loss in snowpack by the end of the century compared to historical averages. Both 2020 and 2021 broke records for statewide average temperatures (DWR 2021). Increasing temperatures may also increase net evaporation from reservoirs. The planning area's water supply is derived from groundwater. Increased incidence of drought may cause a drawdown in groundwater resources without allowing for the opportunity for aquifer recharge.

Potential Future Impacts

The Foothill Municipal Water District is composed of eight water/irrigation districts that individually have strategic and water system plans that are intended to address future water supply needs and protect

future development from the impacts of drought. Deficiencies identified by this review can be addressed by mitigation actions to increase the capability to deal with future trends in development.

While the Planning Area is largely built out, any additional population growth will place additional strains on the water supply.

7.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

7.2.1 Summary of Vulnerability

Water management plans address strategies for maintaining agency water supplies during water shortages, including programs to address drought through throughout the Planning Area. While such planning does assist in limiting vulnerability, it is still present. The entire Planning Area is vulnerable to drought. Structures are not affected, but landscapes can be impacted significantly.

Drought can affect a wide range of economic, environmental, and social activities. Its impact can span many sectors of the economy because water is integral to the ability to produce goods and provide services. The impacts can reach well beyond the area undergoing physical drought. Vulnerability of an activity to drought depends on its water demand and the water supplies available to meet the demand.

7.2.2 Impact on Assets and the Economy

A prolonged drought can have a serious economic impact on the Planning Area. Drought affects water supply. As drought conditions persist, the availability of water becomes increasingly limited. Local and state agencies may impose water restrictions. These restrictions may include placing limitations on when or how frequently lawns can be watered or any other recreational/commercial outdoor use of water supplies.

Industries that rely on water, such as nurseries, landscaping services, and tourism, may experience reduced demand or be forced to scale back.

7.2.3 Change in Vulnerability Since Prior HMP

The only participating jurisdiction that has a prior HMP is Crescenta Valley Water District. Refer to the CVWD annex in Volume 2.

7.3 MITIGATION OPPORTUNITIES

Table 7-5 presents a range of potential opportunities considered by the Planning Partnership for mitigating the drought hazard.

Table 7-5. Potential Opportunities to Mitigate the Drought Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• None	• None	• Stormwater management • Identify alternative water sources
Reduce Exposure and Vulnerability		
• Drought-resistant landscapes • Reduce water system losses • Modify plumbing systems (through water saving kits)	• Drought-resistant landscapes • Reduce private water system losses	• Water use conflict regulations • Reduce water system losses • Distribute water saving kits • Implement/expand water reuse projects
Build Local Capacity		
• Practice active water conservation	• Practice active water conservation	• Public education on drought resistance • Develop or expand recycled water network • Identify alternative water supplies for times of drought; mutual aid agreements with alternative suppliers • Develop drought contingency plan • Develop criteria “triggers” for drought-related actions • Improve accuracy of water supply forecasts • Modify rate structure to influence active water conservation techniques • Increase emergency storage capacity
Nature-based Opportunities		
• Promote and use reclaimed water supplies • Increase capacity for stored surface water to create habitats and ecosystems for aquatic species • Promote and use active groundwater recharge		

8. EARTHQUAKE

8.1 HAZARD PROFILE

8.1.1 Hazard Description

Defining the Hazard

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds (USGS n.d.).

According to the USGS Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect people's normal activities. This includes the following (USGS n.d.):

- **Surface Faulting**—Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
- **Ground Motion** (shaking)—The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
- **Landslide**—A movement of surface material down a slope.
- **Liquefaction**—A process by which water-saturated sediment temporarily loses strength and acts as a fluid. Earthquake shaking can cause this effect.
- **Tectonic Deformation**—A change in the original shape of a material due to strain.
- **Damaged Infrastructure** – Cracking of infrastructure, falling buildings, shattered glass.

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter (USGS n.d.).

A direct relationship exists between a fault's length and location and its ability to generate damaging ground motion at a given site. Small, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant in areas close to the fault. Large regional faults can generate earthquakes of great magnitudes but, because of their distance and depth, they may result in only moderate shaking in an area.

Cause of the Hazard

Tectonic Plates

The Earth's crust, which is the rigid outermost shell of the planet, is broken into seven or eight major tectonic plates (depending on how they are defined) and many minor plates. Where the plates meet, they move in one of three ways along their mutual boundary: convergent (two plates moving together), divergent (two plates moving apart), or transform (two plates moving parallel to one another). Earthquakes, volcanic activity, mountain-building, and oceanic trench formation occur along these plate boundaries. Subduction is a geological process that takes place at convergent boundaries of tectonic plate, in which one plate moves under another. Regions where this process occurs are known as subduction zones, and they have the potential to generate highly damaging earthquakes (USGS n.d.)

Seismic Fault Lines

Geologists have found that earthquakes reoccur along faults, which are zones of weakness in the earth's crust. When a fault experiences an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake can still occur. In fact, relieving stress along one part of a fault may increase it in another part (USGS n.d.).

Faults are more likely to have future earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve the accumulating tectonic stresses. Geologists classify faults by their relative hazards. "Active" faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). "Potentially active" faults are those that displaced layers of rock from the Quaternary period (the last 1,600,000 years) (USGS 2022).

Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. The majority of the seismic hazards are on well-known active faults. However, inactive faults, where no displacements have been recorded, also have the potential to reactivate or experience displacement along a branch sometime in the future.

Summary of Potential Impacts

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the central and western states.

Cascading Hazard Impacts

Earthquakes can cause large and sometimes disastrous Landslide, Subsidence, and Mass Movement. Building and road foundations can lose load-bearing strength and may sink into what was previously solid ground. Earthen dams and levees are highly susceptible to seismic events, and the impacts of Dam Failure can be considered secondary risks for earthquakes. Utility failure due to damaged infrastructure is another cascading impact.

Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Hazardous materials releases can occur during an earthquake from fixed facilities or transportation-related incidents. During an earthquake, structures storing these materials

could rupture and leak into the surrounding rea or an adjacent waterway, having a disastrous effect on the environment. Transportation corridors can be disrupted during an earthquake, leading to the release of materials to the surrounding environment.

8.1.2 Location

California is seismically active because of movement of the North American Plate, east of the San Andreas Fault, and the Pacific Plate to the west, which includes the state's coastal communities. The transform (parallel) movement of these tectonic plates against one another creates stresses that build as the rocks are gradually deformed. The rock deformation, or strain, is stored in the rocks as elastic strain energy. When the strength of the rock is exceeded, rupture occurs along a fault. The rocks on opposite sides of the fault slide past each other as they spring back into a relaxed position. The strain energy is released partly as heat and partly as elastic waves called seismic waves. The passage of these seismic waves produces the ground shaking in earthquakes (LibreTexts Geosciences n.d.).

An example of a fault zone that has been reactivated is the Foothills Fault Zone. The zone was considered inactive until evidence of an earthquake (approximately 1.6 million years ago) was found near Spenceville, California. Then, in 1975, an earthquake occurred on another branch of the zone near Oroville, California (now known as the Cleveland Hills Fault). The State Division of Mines and Geology indicates that increased earthquake activity throughout California may cause tectonic movement along currently inactive fault systems (Governor's Office of Land Use and Climate Innovation n.d.).

According to the USGS, Southern California has the highest level of earthquake risk in the United States, with half of the expected financial losses from earthquakes in the Nation expected to occur in southern California. Sitting astride the Pacific - North American plate boundary at the Big Bend of the San Andreas Fault, Southern California has over 300 faults capable of producing magnitude 6 and larger earthquakes. Affecting the more than 20 million inhabitants of the Los Angeles and San Diego metropolitan areas, this complex set of faults presents the greatest urban risk in the United States.

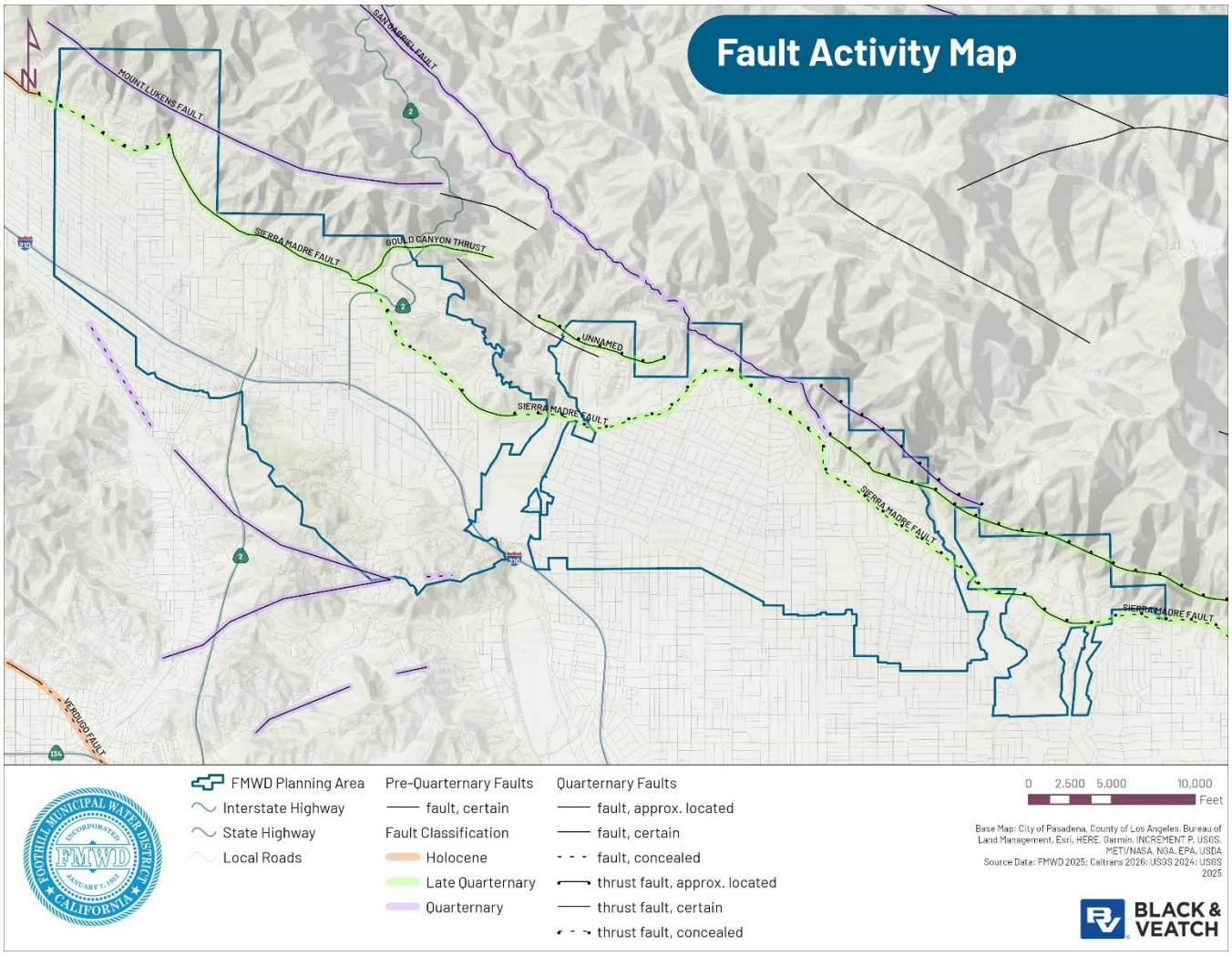


Figure 8-2 shows the know faults within close proximity to the planning area.

8.1.3 Extent

Measuring Intensity

Earthquakes are typically classified in one of two ways: By the amount of energy released, measured as magnitude; or by the impact on people and structures, measured as intensity.

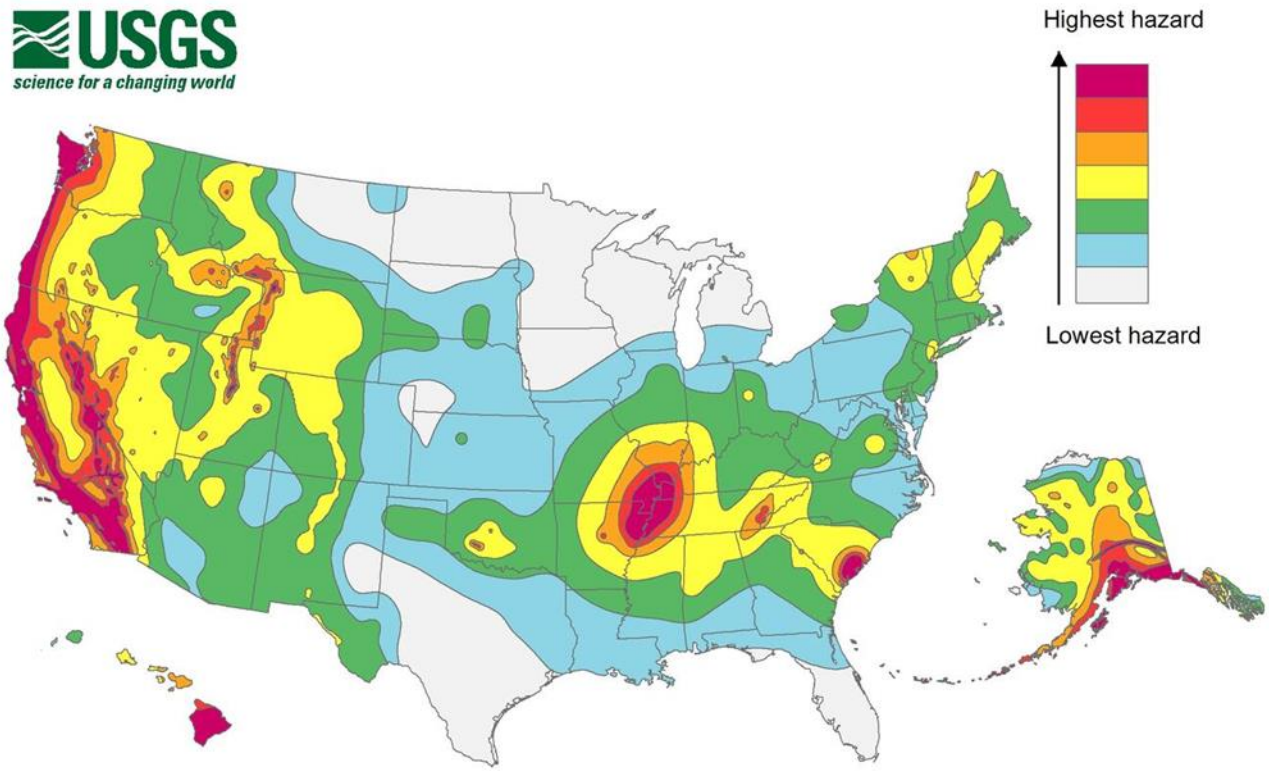
Magnitude

An earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude is commonly expressed by ratings on the moment magnitude scale (Mw), the most common scale used today. This scale is based on the total moment release of the earthquake (the product of the distance a fault moved, and the force required to move it). The scale is as follows (USGS n.d.):

Table 8-1. Moment Magnitude Scale

Earthquake Magnitude Classes	
Modified Mercalli Scale	**Class**
Mw > 8	Great
Mw = 7.0 – 7.9	Major
Mw = 6.0 – 6.9	Strong
Mw = 5.0 – 5.9	Moderate
Mw = 4.0 – 4.9	Light
Mw = 3.0 - 3.9	Minor
Mw<3	Micro

Figure 8-1. USGS National Seismic Hazard Map



Source: (USGS 2018)

Intensity

The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale as well as the perceived shaking and damage potential for structures are shown in Table 8-2. The modified Mercalli intensity scale is generally represented visually using a USGS product called a ShakeMap, which shows the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust.

Table 8-2. Mercalli Scale and Peak Ground Acceleration Comparison

Potential Structure Damage				
Modified Mercalli Scale	Perceived Shaking	Residential Buildings	Vulnerable Buildings	Estimated PGA a (%)
I	Not felt	None	None	<0.17%
II	Weak	None	None	0.17%-1.4%
IV	Light	None	None	1.4%-3.9%
V	Moderate	Very Light	Light	3.9%-9.2%
VI	Strong	Light	Moderate	9.2%-18%
VII	Very Strong	Moderate	Moderate/Heavy	18%-34%
VIII	Severe	Moderate/Heavy	Heavy	34%-65%
IX	Violent	Heavy	Very Heavy	65%-124%
X-XII	Extreme	Very Heavy	Very Heavy	>124%

[a] PGA measure in percent of g, where g is the acceleration of gravity

Source: (USGS 2011) (USGS 2025)

Ground Motion

Earthquake hazard assessment is based on expected ground motion. During an earthquake when the ground is shaking, it also experiences acceleration. The peak acceleration is the largest increase in velocity recorded by a particular station during an earthquake. Estimates are developed of the annual probability that certain ground motion accelerations will be exceeded; the annual probabilities can then be summed over a time period of interest.

The most commonly mapped ground motion parameters are horizontal and vertical peak ground accelerations (PGA) for a given soil type. PGA is a measure of how hard the earth shakes, or accelerates, in a given geographic area. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. PGA is measured in g (the acceleration due to gravity) or expressed as a percent acceleration force of gravity (%g). These readings are recorded by state and federal agencies that monitor and predict seismic activity.

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage “short period structures” (e.g., single-family dwellings). Longer period response components determine the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). Table 8-2 also lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

ShakeMaps

The USGS Earthquake Hazards Program produces maps called ShakeMaps that map ground motion and shaking intensity following significant earthquakes. ShakeMaps focus on the ground shaking caused by the earthquake, rather than on characteristics of the earthquake source, such as magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground

shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust (USGS n.d.).

A ShakeMap shows the extent and variation of ground shaking immediately across the surrounding region following significant earthquakes. Such mapping is derived from peak ground motion amplitudes recorded on seismic sensors, with interpolation where data are lacking based on estimated amplitudes. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. In addition to the maps of recorded events, the USGS creates the following (USGS n.d.):

- **Scenario ShakeMaps** of hypothetical earthquakes of an assumed magnitude on known faults.
- **Probabilistic ShakeMaps**, based on predicted shaking from all possible earthquakes over a 10,000-year period. In a probabilistic map, information from millions of scenario maps is combined to make a forecast for the future. The maps indicate the ground motion at any given point that has a given probability of being exceeded in a given timeframe, such as a 100-year (1 percent annual chance) event.

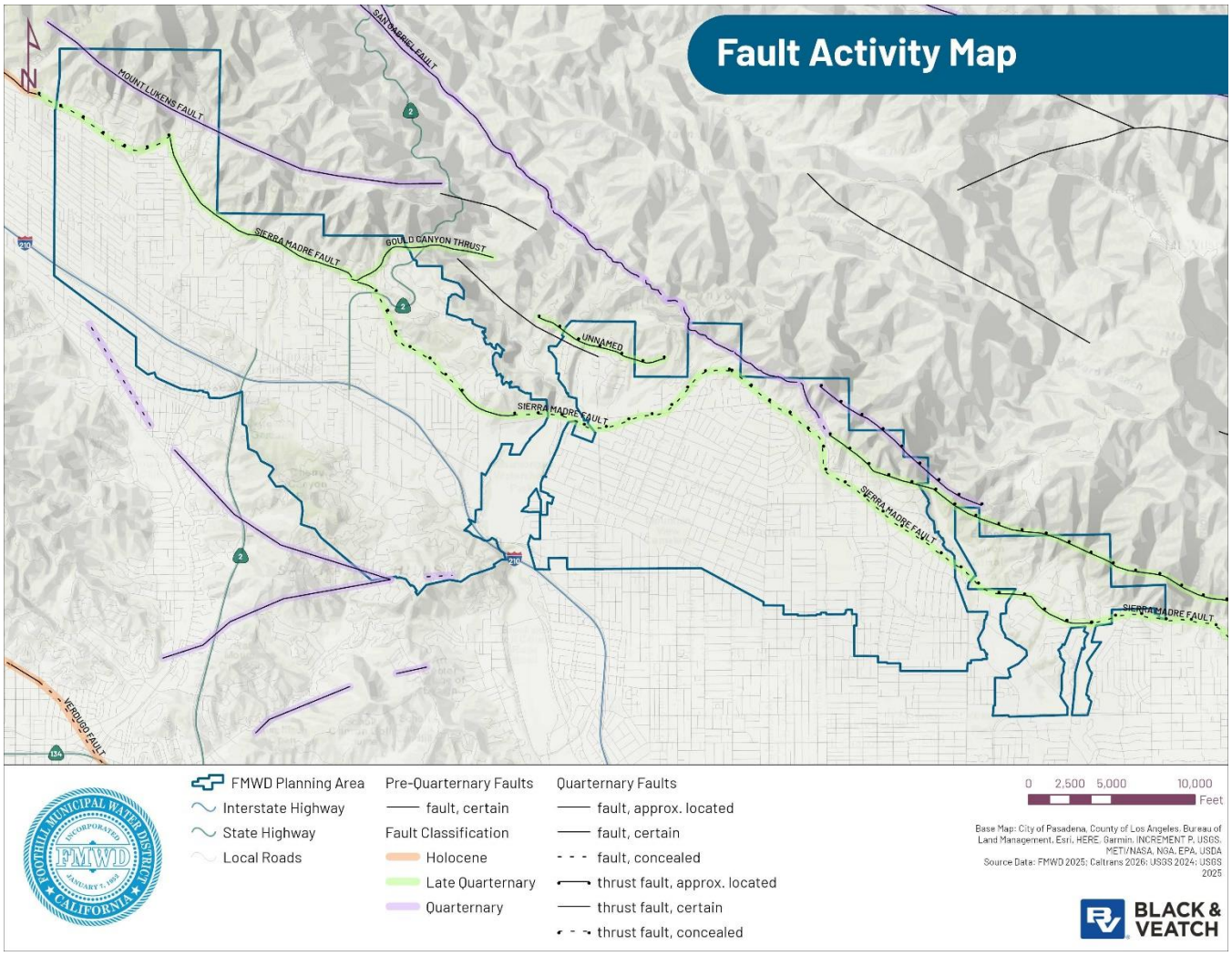


Figure 8-2. Fault Activity Map

National Seismic Hazard Map

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown, et al. 2001). The USGS updated the National Seismic Hazard Maps in 2018. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps.

Liquefaction and Soil Types

Soil liquefaction occurs when water-saturated sands, silts or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into the ground (USGS n.d.) .

The NEHRP creates maps based on soil characteristics to help identify locations subject to liquefaction. NEHRP soil types define the locations that will be significantly impacted by an earthquake. Table 8-3 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E, and F. In general, these areas are also most susceptible to liquefaction (NEHRP n.d.).

Table 8-3. NEHRP Soil Classification System

NEHRP Soil Type	Description	Mean Shear Velocity to 30 m (m/s)
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	<180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays > 36 m thick)	-

Source: (NEHRP n.d.)

Warning Time

There is no current reliable way to predict the day or month that an earthquake will occur at any given location. In 2019, Governor Gavin Newsom announced the launch of the country's first statewide Earthquake Early Warning System. The California Earthquake Early Warning System uses ground motion sensors from across the state to detect earthquakes before humans can feel them. Notifications provide within tens of seconds for Californians to take protective action and stay safe during the earthquake. As of April 2025, over 4 million users have downloaded California's MyShake App (CalOES 2025).

Worst Case Scenario

With the abundance of fault exposure in southern California, the potential scenarios for earthquake activity are many. Any earthquake above a magnitude of 5.0 or greater on faults near the Planning Area would have significant impacts. With the added factor of the liquefaction potential throughout the entire Planning Area, structural failure of buildings, damage to utilities such as water pipes and wells, and sources of power are inevitable. Potential warning systems could give approximately 40 seconds notice that a major earthquake is about to occur but would not provide enough warning other than to duck, cover and hold on for personal safety (CalOES n.d.).

8.1.4 Previous Occurrences

The following sections provide a review of previous earthquake occurrences in the Planning Area.

Declarations

Federal Disaster Declarations

Past federal disaster declarations for earthquakes in Los Angeles County have included the 1994 Northridge Earthquake (DR-1008), the 1987 Whittier Narrows Earthquake (DR-799), and the 1971 San

Fernando Earthquake (DR-299, but no declarations have been made in the past 5 years since the last mitigation plan updates for Planning Area (FEMA 2025).

Disaster Number	Incident Period	Declaration Date	Description
DR-299-CA	February 9, 1971	February 9, 1971	San Fernando Earthquake
DR-799-CA	October 1, 1987 – November 20, 1987	October 7, 1987	Earthquakes and Aftershocks
DR-1008-CA	January 17, 1994 – November 30, 1994	January 17, 1994	Brush & Timber Fires

Source: (FEMA 2025)

State Declarations

In the past 5 years, California has not declared disasters related to earthquakes in Los Angeles County (Cal OES 2025).

USDA Declarations

Between 2019 and 2025, the USDA has not declared disasters related to earthquakes in Los Angeles County (U.S. Department of Agriculture 2025).

Summary of Significant Events

The 1971 San Fernando earthquake

The 1971 San Fernando earthquake (also known as the 1971 Sylmar earthquake) occurred in the early morning of February 9 in the foothills of the San Gabriel Mountains in Southern California. The origin of faulting was located 5 miles north of the San Fernando Valley. The unanticipated thrust earthquake had a magnitude of 6.5 on the Ms scale and 6.6 on the Mw scale, and a maximum Mercalli intensity of XI. Damage was locally severe in the northern San Fernando Valley and surface faulting was extensive to the south of the epicenter in the mountains, as well as urban settings along city streets and neighborhoods. Uplift and other effects affected private homes and businesses. The shaking surpassed building code requirements and exceeded what engineers had prepared for, and although most dwellings in the valley had been built in the prior two decades, even modern earthquake-resistant structures sustained serious damage (FEMA n.d.).

1994 Northridge Earthquake

The 1994 Northridge Earthquake was the costliest seismic event in California since the 1906 San Francisco Earthquake. The infrastructure of the metropolitan area was severely disrupted. Freeways collapsed, power systems for the city and linked communities as far away as Oregon were temporarily blacked out, and communications were disrupted. The California State HMP reports that the Northridge Earthquake caused over $40 billion of disaster losses, 57 deaths, and 11,846 injuries (Chief Executive Office of Los Angeles County n.d.). Officially lasting approximately 30 seconds, and with a magnitude of 6.7, this earthquake caused significant damage to buildings. Of 57 fatalities attributed to this quake, 16 were a result of the collapse of a single structure—the Northridge Meadows apartment building. The ground motion was measured throughout Southern California, including intensity readings of 1.82 g near the Ventura Freeway in the Tarzana area. Ground motions as strong as 1.21 g were measured as far

away as Inglewood (approximately 25 miles from Northridge). One "g" of ground motion is enough to make unsecured buildings move off their foundations.

According to the USGS and the Southern California Earthquake Center, the Northridge Earthquake raised nearby mountains by as much as 70 centimeters. The fault, which was previously unknown, appears to be truncated by the fault that broke in the similarly sized 1971 San Fernando Earthquake, the two faults abutting at a depth of 5 miles. The Northridge Earthquake caused many times more damage than the 1971 event, primarily because its fault is directly under the densely populated valley, whereas the 1971 fault lies under the mountains.

Recent Events

No recent events have occurred in the area since 2015 (USGS n.d.)

8.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

Probability

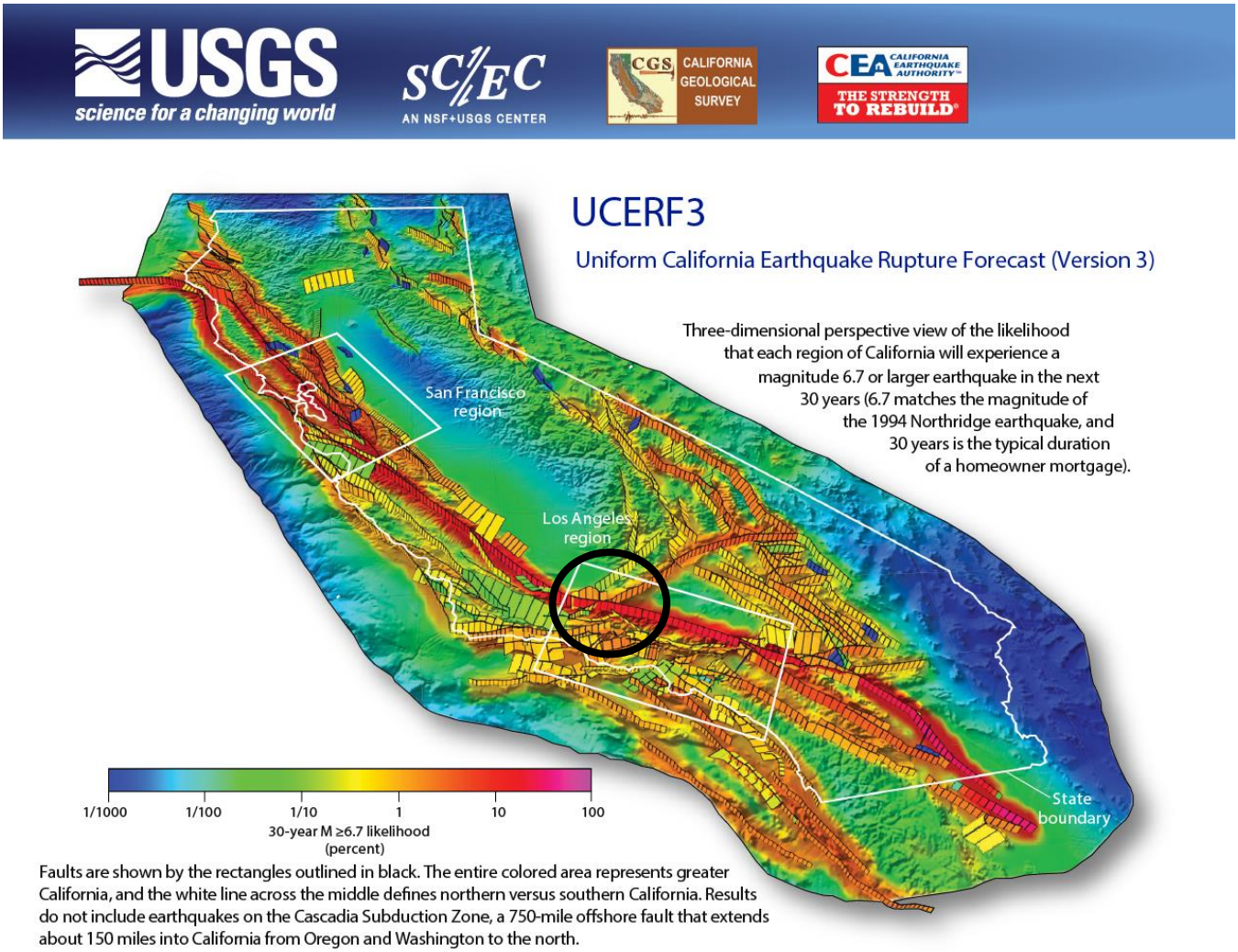
California experiences hundreds of earthquakes each year, most with magnitudes below 3.0 and minimal damage. Earthquakes that cause moderate damage to structures occur several times a year. According to the USGS, a strong earthquake measuring greater than Magnitude 5.0 occurs statewide every 2 to 3 years, and major earthquakes of more than Magnitude 7.0 occur once a decade. The San Andreas Fault has the potential for experiencing major to great events (USGS n.d.).

Based on the most recent earthquake forecast model for California, scientists estimate that in the next 30 years the Los Angeles region has a 60 percent probability of an earthquake of Magnitude 6.7 or greater, a 46 percent probability of an earthquake of Magnitude 7 or greater, and a 31 percent probability of an earthquake of Magnitude 7.5 (USGS n.d.).

The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3) predicts the probability of an earthquake of Magnitude 6.7 or greater over the next 30 years as shown on Figure 8-3. The UCERF3 also defined the following recurrence intervals for the deterministic earthquake scenarios used for the risk assessment in this LHMP (USGS n.d.):

- Puente Hills (LA) M6.95: 3 to 7% 30-year probability
- Sierra Madre M7.16: 5 to 15% 30-year probability
- Verdugo M6.90: 2 to 5% 30-year probability

Figure 8-3. UCERF3 Earthquake Probability



Source: (USGS n.d.)

Climate Change

It is unknown whether climate change has a direct impact on earthquake probability or severity. However, cascading hazards related to earthquakes are exacerbated by climate change. Increasing air temperatures and extreme weather events can affect soil integrity and affect erosion, sedimentation, and landslide occurrence associated with earthquakes.

Potential of Future Impacts

Since all of the planning area is located within earthquake hazard zones, all future development will, to some extent, be exposed to the earthquake hazard. The planning area is largely build out, but any additional development will increase exposure. The Cities in the Planning Area will strictly enforce all seismic building codes and design standards to prevent loss of life and property from earthquakes.

Public education, cooperation with the development community, and individual preparedness are essential.

8.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

8.2.1 Summary of Vulnerability

The entire Planning Area is exposed to the earthquake hazard, so an earthquake has the potential to affect all structures and infrastructure in the Planning Area. A Hazus vulnerability assessment was conducted, and summary findings are outlined below. See individual risk assessment results in each Planning Partner annex (Volume 2).

8.2.2 Impact on Assets and the Economy

The following table summarizes economic impacts from each earthquake scenario for all water agencies.

Table 8-4. Estimated Planning Area Pipe Leaks and Breaks from Earthquake Hazard

Scenario	Number of Leaks	Number of Breaks	Total Number of Repairs	Hours to Repair Leaks	Hours to Repair Breaks	Total Hours to Repair	Economic Loss
Puente Hills M6.95	91.6	23	114.7	436.3	218	654.3	$961,875
Sierra Madre M7.16	214.5	53.7	268.2	1,012.6	508.6	1,521.2	$2,229,324
Verdugo M6.90	179.1	44.8	224	833.6	422.8	1,256.4	$1,898,640

8.2.3 Change in Vulnerability Since Prior HMP

The only participating jurisdiction that has a prior HMP is Crescenta Valley Water District. Refer to the CVWD annex in Volume 2.

8.3 MITIGATION OPPORTUNITIES

Table 8-5 presents a range of potential opportunities considered by the Planning Partnership for mitigating the earthquake hazard.

Table 8-5. Potential Opportunities to Mitigate the Earthquake Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• None	• None	• None
Reduce Exposure and Vulnerability		
• Locate outside of hazard area (off soft soils) • Retrofit structure (anchor house structure to foundation) • Secure household items that can cause injury or damage (such as water heaters, bookcases, and other appliances) • Build to higher design	• Locate or relocate critical functions outside hazard area where possible • Build redundancy for critical functions and facilities • Retrofit critical buildings and areas housing critical functions	• Locate critical facilities or functions outside hazard area where possible • Harden infrastructure • Provide redundancy for critical functions • Adopt higher regulatory standards • Perform seismic retrofits for vulnerable critical buildings and areas
Build Local Capacity		
• Practice “drop, cover, and hold” • Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 72-hour self-sufficiency during an event • Keep cash reserves for reconstruction • Become informed on the hazard and risk reduction alternatives available • Develop a post-disaster action plan for your household • Sign up for early warning systems • Sign up for MyShake	• Adopt higher standard for new construction; consider “performance-based design” when building new structures • Keep cash reserves for reconstruction • Inform your employees on the possible impacts of earthquakes and how to deal with them at your work facility. • Develop a continuity of operations plan	• Provide better hazard maps • Provide technical information and guidance • Enact tools to help manage development in hazard areas (e.g., tax incentives, information) • Include retrofitting and replacement of critical system elements in capital improvement plan • Develop strategies to take advantage of post-disaster opportunities • Warehouse critical infrastructure components such as pipe fittings, valves, pumps, power line, and road repair materials • Solidify supplemental power supply to tanks and pump stations (generator program) • Develop and adopt a continuity of operations plan • Initiate triggers guiding improvements (such as <50% substantial damage or improvements) • Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities • Develop a post-disaster action plan that includes grant funding and debris removal components
Nature-based Opportunities		
• None identified		

9. EXTREME TEMPERATURE

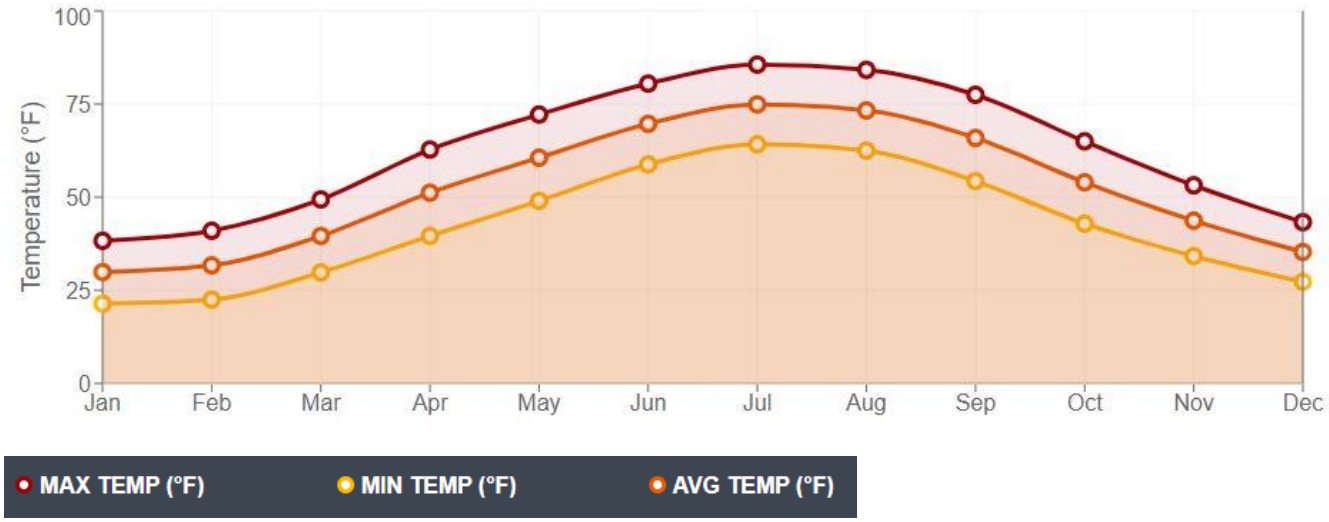
9.1 HAZARD PROFILE

9.1.1 Hazard Description

Defining the Hazard

Extreme temperature includes both heat and cold events that have significant direct impacts to human health and commercial/agricultural businesses and primary and secondar effects on infrastructure. (e.g., burst pipes and power failure). Distinguishing characteristics of "extreme cold" or "extreme heat" vary by location, based on the conditions to which the population is accustomed. Figure 9-1 shows the average, low, and high temperatures each month at the Pasadena, CA NOAA Station in Altadena near the Planning Area based on the latest 30-year period (1991-2020) (NOAA 2024).

Figure 9-1. Average Temperatures at the Pasadena, CA NOAA Station



Source: (NOAA n.d.)

Extreme Cold

Extreme cold events refer to a prolonged period of time with extremely cold temperatures. Further, what is considered an extreme cold event will vary by region. Extreme cold events are when temperatures drop well below the temperatures that are normal in an area. Depending on what is normal, this may mean temperatures around the freezing point (32 ºF) or below 0 ºF. Freeze events are when temperatures remain below freezing for a sustained period. Temperatures below freezing in Southern California's generally warm and mild weather regions are rare, but their occurrence can cause life loss and health risks to vulnerable populations (CISA n.d.).

Extreme Heat

In most of the United States, extreme heat is a long period (2 to 3 days) of high heat and humidity with temperatures above 90° Fahrenheit (F); in California, it is 3 days over 100° F (FEMA Preparedness Community 2024).

Extreme heat often results in the highest number of annual deaths among all weather-related hazards. Older adults, children, and sick or overweight individuals are at greater risk from extreme heat. According to the California Climate Adaptation Strategy, heat waves have claimed more lives in California than all other declared disaster events combined (State of Claifornia n.d.). It can take several days of oppressive heat for a heat wave to have a significant or quantifiable impact. Heat waves do not strike victims immediately, but their cumulative effects slowly cause harm to vulnerable populations.

Cause of the Hazard

Extreme Cold

Extreme cold events are often amplified or caused by a variety of factors, one being polar vortexes. Polar vortexes are a large area of low pressure and cold air surrounding both the earth's poles. It's a counterclockwise flow of air that keeps colder air near the poles. Cold air damming may occur, in which low-level cold air mass is trapped topographically. Often, this cold air is entrenched on the east side of mountainous terrain and often implies that the trapped cold air mass is influencing the dynamics of the overlying air mass (CISA n.d.).

Unseasonal cold snaps may occur due to atmospheric phenomena such as disruptions in the polar vortex or shifts in the jet stream, which can occasionally direct Arctic air masses into Southern California. These events can lead to sudden drops in temperature, particularly affecting communities in higher elevations or inland valleys.

Extreme Heat

Events of extreme heat, or heat waves, are usually a result of both high temperatures and high relative humidity. Temperature is the measure of how hot or cold something is, and humidity is the amount of water vapor in the air. The higher the relative humidity or the more moisture in the air, the less likely that evaporation will take place. This becomes significant when high relative humidity is coupled with soaring temperatures, posing significant risk to human health (NIHHIS n.d.).

Extreme heat events are often intensified in dense developments of the city. As these urban areas develop and change, so does the landscape. Buildings, roads, and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas. This forms an 'island' of higher temperatures (US EPA 2025).

Similar to the occurrence of drought, extreme temperature is a regional phenomenon. Extreme temperature events could affect the entirety of the area simultaneously or only a portion of it. It has the potential to impact every person directly or indirectly in the Planning Area as well as adversely affect the

local economy. Although the Planning Area typically experiences a mild to hot year-round climate, the region is not immune to temperature extremes.

Summary of Potential Impacts

Extreme Cold

Freezing temperatures and frost events can also severely affect the agriculture industry. Freezing temperatures occurring during winter and spring growing seasons can cause extensive crop damage. Secondary impacts of freeze events can include major economic impacts on farmers, farm workers, packers, and shippers of agricultural products. Freezes can also cause significant increases in food prices to the consumer because of shortages, disruption of global agricultural, and food supply chain issues (Masters 2024).

Extreme Heat

Excessive heat is the primary weather-related cause of death in the United States, claiming over 100 lives each year. In a 30-year record of weather fatalities across the nation (1992 to 2021), excessive heat claimed more lives each year than floods, lightning, tornados, and hurricanes (Erdman 2023). Extreme heat events do not typically impact buildings; however, losses may be associated with the urban heat island effect and overheating of heating, ventilation, and air conditioning systems.

Cascading Hazard Impacts

A cascading impact of extreme heat is poor air quality, which can occur during summer, when stagnant atmospheric conditions trap humid air and pollutants near the ground and closer to residents. Ozone, a major component of smog, is created in the presence of sunlight via reactions between chemicals in gasoline vapors and industrial smokestacks. Hot weather can increase ozone levels. High ozone levels often cause or worsen respiratory problems (EPA n.d.).

Extreme heat contributes to more severe Wildfire in a longer wildfire season and increases the health and safety risk experienced by wildland firefighters and populations near wildfires due to additional reductions in air quality. Wildfire can also further exacerbate worsening air quality caused by extreme heat, placing all vulnerable populations at risk of new or worsened respiratory conditions.

Noted in the Drought chapter, extreme heat is also often associated with drought events. The prolonged exposure to extreme heat increases the risk of sunstroke, heat cramps and heat exhaustion to people and animals. Both extreme heat and extreme cold tend to increase electricity demand leading to brownouts and utility failures.

9.1.2 Location

The term ‘heat island’ describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with more than one million people can be between 1.8 ºF and 5.4ºF warmer than

its surrounding areas. In the evening, the difference in air temperatures can be as high as 22ºF. Heat islands occur on the surface and in the atmosphere. On a hot, sunny day, the sun can heat dry, exposed urban surfaces to temperatures 50ºF to 90ºF hotter than the air. Heat islands can affect communities by increasing peak energy demand during the summer, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality degradation (US EPA 2025).

As urban areas develop and change, so does the landscape. Buildings, roads, and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas. This forms an 'island' of higher temperatures (EPA 2024).

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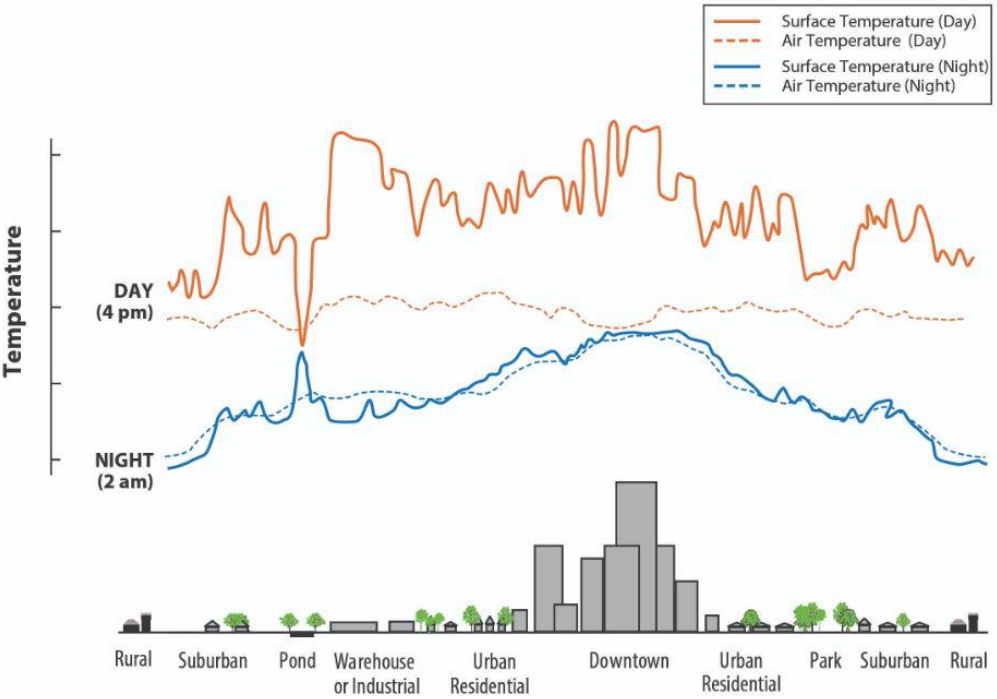
Figure 9-2. Urban Heat Island Profile below illustrates an urban heat island profile. The graphic demonstrates that heat islands are typically most intense over dense urban areas. Further, vegetation and parks within a downtown area may help reduce heat islands (EPA 2024).

Figure 9-2. Urban Heat Island Profile



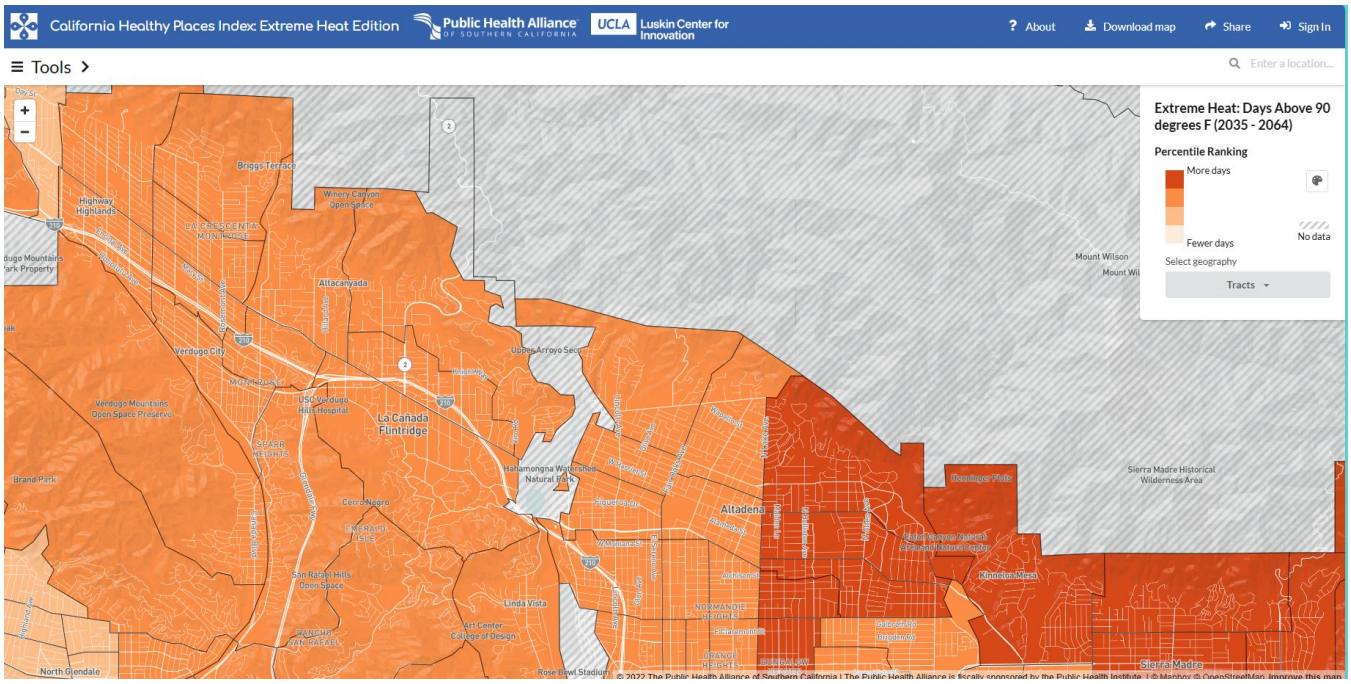
The California Healthy Places Index (HPI): Extreme Heat Edition is a tool developed by the Public Health Alliance in partnership with the UCLA Luskin Center for Innovation. The tool provides datasets on projected heat exposure for California, place-based indicators measuring community conditions, and sensitive populations. It also provides a list of resources and funding opportunities that can be used to address extreme heat.

The tool can be used to:

- Understand the underlying heat vulnerability and resilience characteristics of a community.
- Identify resources to mitigate the adverse effects of extreme heat.
- Prioritize public and private investments, resources, and programs.

The HPI combines 25 community characteristics, based on the social determinants of health, into a single score for each California census tract. Neighborhood-by-neighborhood, the HPI maps data on social conditions that drive health — like education, job opportunities, and clean air and water. The HPI tool evaluates the relationship between 23 identified key drivers of health and life expectancy at birth — which can vary dramatically by neighborhood. Based on that analysis, it produces a score ranking from 1 to 99 that shows the relative impact of conditions in a selected area compared to all other such places in the state. The HPI scores and compares geographies across the state, now with the ability to view data neighborhood-by-neighborhood, providing an even more granular view of community wellbeing. Figure 9-3 shows the HPI Extreme Heat Edition data generated for the Planning Area (California Healthy Places Index n.d.).

Figure 9-3. HPI Extreme Heat Edition Data Outputs for the Planning Area



Source: (California Healthy Places Index n.d.)

9.1.3 Extent

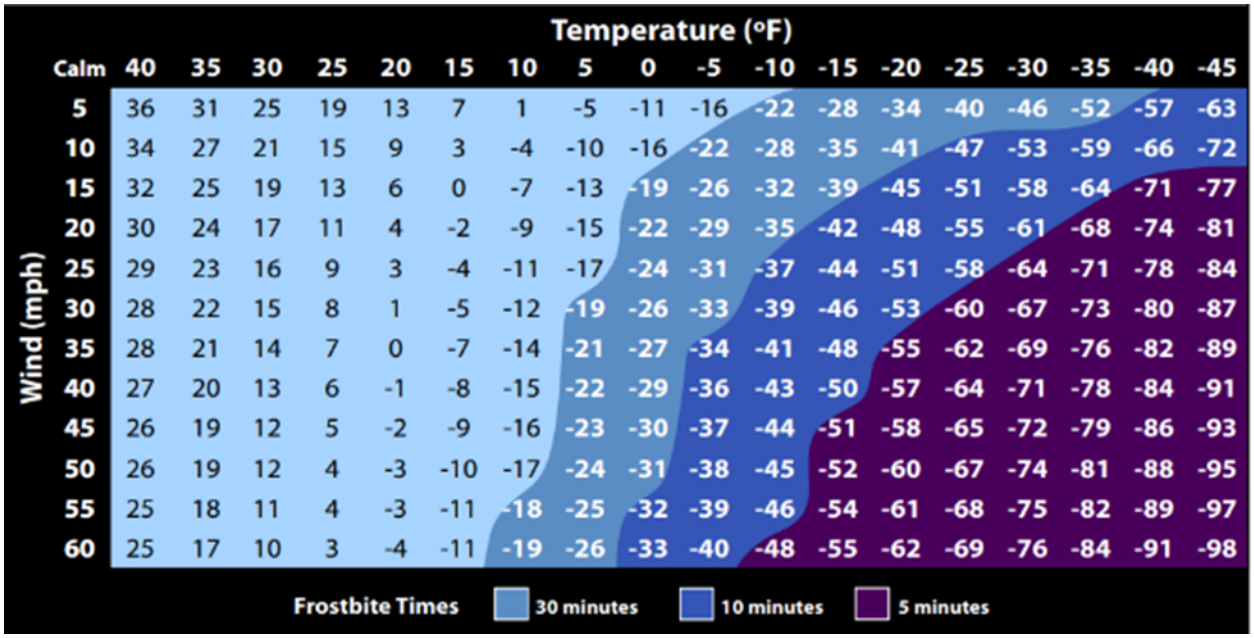
The severity of extreme cold and extreme heat events can be defined with record lows and highs and in terms of economic losses incurred.

Measuring Intensity

Extreme Cold

Wind chill can also make cold temperatures feel even colder. The Wind Chill Index (Figure 9-2) is a measure of the rate of heat loss from exposed skin caused by the combined effects of wind and cold (NWS n.d.)The NWS chart shows the "Wind Chill Index" as it corresponds to various temperatures and wind speeds, illustrating the conditions where temperature, wind speed, and exposure time will produce frostbite to humans.

Figure 9-4. NWS Wind Chill Index Figure

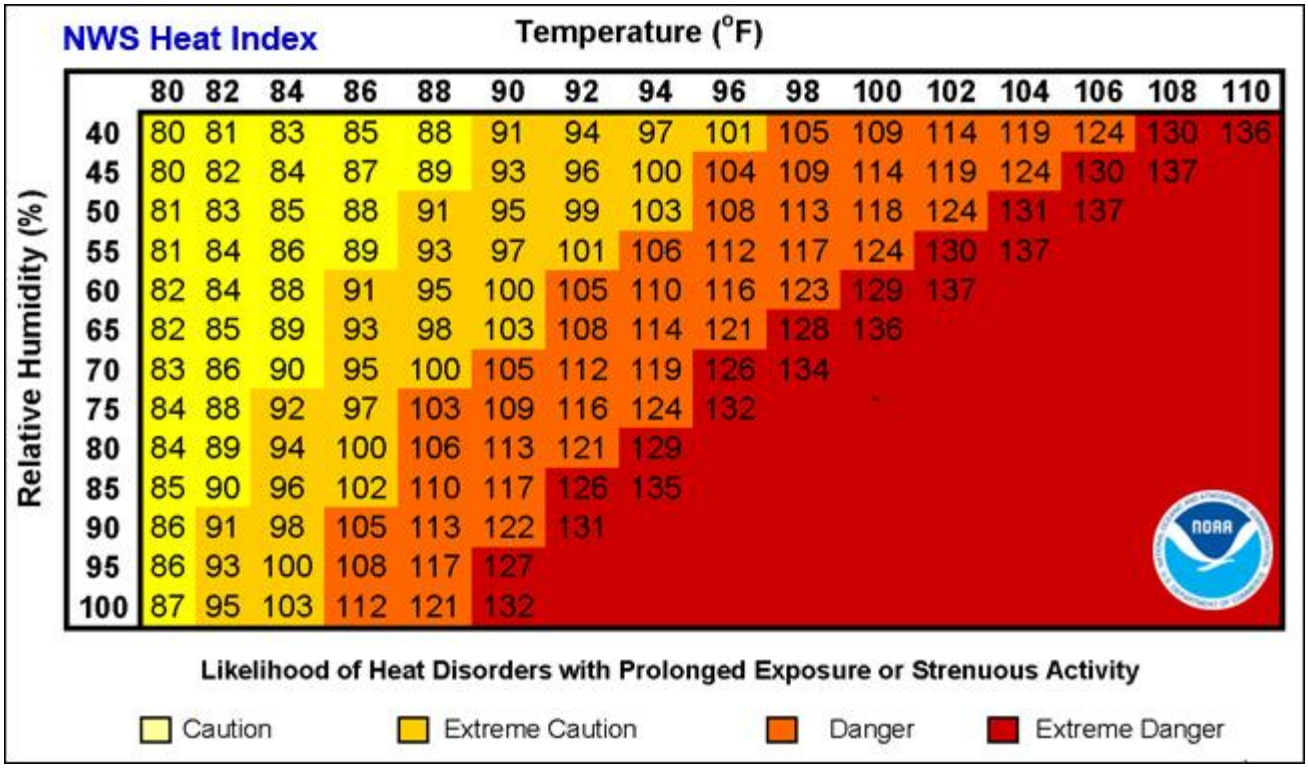


Source: (NWS n.d.)

Extreme Heat

In an effort to raise the public's awareness of the hazards of extreme heat, the NOAA and National Weather Service (NWS) has devised the "Heat Index." The Heat Index chart, shown on Figure 9-5., uses air temperature and humidity to determine the heat index or apparent temperature. In addition, information regarding the likelihood of health dangers by heat index is presented (NWS 2024).

Figure 9-5. NOAA and NWS Heat Index



Source: (NWS 2024)

Legislation was introduced in California in 2021 to create and implement a statewide extreme heat ranking system. Heat-wave ranking would include the projected health impact and meteorological data, such as maximum and minimum temperatures, as well as how long a heat wave is anticipated to persist (California Department of Insurance 2022). The categorization would help communities take measures to reduce the number of heat-related fatalities (Washington Post 2021).

Warning Time

Meteorologists can accurately forecast the timing and severity of extreme temperature events with several days' lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations.

Currently, the only way to headline very cold temperatures is with the use of the NWS-designated Wind Chill Advisory or Warning products. When actual temperatures reach Wind Chill Warning criteria with little to no wind, extreme cold warnings may be issued (NWS n.d.)

The NWS Heat Risk forecast provides a quick view of heat risk potential over the upcoming 7 days. The heat risk is portrayed in a numeric (0 – 4) and color (green, yellow, orange, red, magenta) scale, which is similar in approach to the Air Quality Index or the UV Index. It provides one value each day that indicates the approximate level of heat risk concern for any location, along with identifying the groups who are most at risk.

Figure 9-4. NWS Heat Risk

Category	Level	Meaning
Green	0	No Elevated Risk
Yellow	1	Low Risk for those extremely sensitive to heat, especially those without effective cooling and/or adequate hydration
Orange	2	Moderate Risk for those who are sensitive to heat, especially those without effective cooling and/or adequate hydration
Red	3	High Risk for much of the population, especially those who are heat sensitive and those without effective cooling and/or adequate hydration
Magenta	4	Very High Risk for entire population due to long duration heat, with little to no relief overnight

Source: (NOAA NWS 2024)

The NWS issues excessive heat watches, excessive heat warnings, and heat advisories to warn of extreme heat events within the next 36 hours. If NWS forecasters predict an excessive heat event beyond 36 hours, then the NWS will issue messaging in the form of a special weather statement, emails, and social media in the 3 to 7 day timeframe. The NWS issues the following types of heat-related advisories (National Weather Service 2023):

- Heat Advisory—HeatRisk category is on the orange/red (Level 2-3) thresholds.
- Excessive Heat Watch—HeatRisk category is on the red/magenta (Level 3-4) thresholds. An Excessive Heat Watch is a way to give the public and emergency officials a warning that extreme temperatures are expected. The NWS issues an excessive heat watch generally 2 to 3 days in advance.
- Excessive Heat Warning—HeatRisk category is forecast for 24 to 28 hours on the red/magenta (Level 3-4) thresholds. An excessive heat warning indicates that extreme heat has either arrived or is expected soon.

Worst Case Scenario

A level 4, magenta heat risk event is the worst-case scenario. This scenario would include rare and long duration extreme heat with little to no overnight relief. Anyone without adequate hydration or access to effective cooling is at risk. An extreme, multi-year drought associated with record-breaking rates of low precipitation and extreme heat may accompany the extreme heat event and compound the negative cascading effects.

An extreme cold worst-case scenario would involve an unprecedented temperature drop combined with high winds/winter storms, bringing sustained freezing temperatures and intense wind chills. For a region unaccustomed to harsh extreme cold conditions, these conditions could overwhelm energy infrastructure, leading to widespread and sustained power outages due to grid failures, and surging heating demands. Water distribution systems could also freeze, cutting off water supplies and potentially leading to damaging burst pipe events.

9.1.4 Previous Occurrences

The following sections provide a review of previous extreme temperature occurrences in the Planning Area.

Declarations

Federal Disaster Declarations

Historically, FEMA has denied requests and subsequent appeals for federal disaster declarations related to extreme heat events, stating that the cascading impacts of heat-related events, such as wildfires, cause the damage for which states seek assistance (Congressional Research Service 2024). However, extreme cold events are still recognized. Table 9-1 below outlines two extreme temperature events since 1990.

Table 9-1. Federal Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-894-CA	December 19, 1990 – January 3, 1991	February 11, 1991	Severe Freeze
DR-1689-CA	January 11, 2007 – January 17, 2007	March 13, 2007	Severe Freeze

Source: (FEMA 2025)

State Declarations

California has made two disaster declarations related to extreme temperature (freeze). One in 1991 and another in 2007.

Table 9-2. State Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Disaster Name
DR-894	December 19, 1990 – January 3, 1991	February 11, 1991	1990 Freeze
2007-02	January 11, 2007 – January 17, 2007	March 13, 2007	2007 Severe Freeze

Source: **(Cal OES 2025)**

USDA Declarations

One USDA declaration has been issued regarding extreme temperature (freeze).

Table 9-3. USDA Proclamations

Event Description	Designation Number	Proclamation Date
Freezing temperatures, high winds, excessive rain	S3255	June 19, 2012
Drought-FAST TRACK	S3268	July 12, 2012
Drought-FAST TRACK	S3491	February 27, 2013
Drought-FAST TRACK	S3542	June 19, 2013
Drought-FAST TRACK	S3558	July 31, 2013
Drought-FAST TRACK	S3784	February 4, 2015
Drought-FAST TRACK	S3952	February 17, 2016

Source: (U.S. Department of Agriculture 2025)

Summary of Significant Events

The December 1990 Freeze set records for low temperatures over an extended period. $3.4 Billion in direct and indirect economic losses including damage to public buildings, utilities, crop damage, and residential pipe bursts. Agricultural damage was extensive (Western Regional Climate Center n.d.).

Summary of Recent Events

The NOAA NCEI Storm Events Database did not report events in the Planning Area for extreme cold/wind chill, frost/freeze, or winter weather. Four winter storm events were reported for the eastern range of the San Gabriel Mountain between 2020 and 2025 and are presented in Table 9-3. The NOAA NCEI Storm Events Database did not report events in the Planning Area for extreme heat.

Table 9-23. Significant Extreme Temperature Events (2012 – 2025)

Date(s) of Events	Declaration Number	Planning Area Included	Description
March 29, 2023	1091211	East San Gabriel Mountains	Winter storm conditions developed across the eastern range of the San Gabriel Mountains. Above 5000 feet, snowfall totals of 6 to 12 inches were reported. Additionally, southerly winds, gusting up to 67 MPH, were reported.
July - August 2023	-	Statewide	Between July 11 and August 2, daytime temperatures only dipped below 90° F one day
February 1, 2024	1164871	East San Gabriel Mountains	Winter storm conditions impacted the eastern range of the San Gabriel Mountains. Snowfall totals up to 3 inches were reported along with wind gusts up to 69 MPH.
February 4, 2024	1164887	East San Gabriel Mountains	Winter storm conditions impacted the eastern range of the San Gabriel Mountains in Los Angeles County. Snowfall totals of 1 to 3 feet were reported above 6000 feet along with wind gusts up to 83 MPH.
March 31, 2024	1207154	East San Gabriel Mountains	Significant, late-season, winter storm conditions developed across the eastern range of the San Gabriel Mountains. Mountain High reported 12-16 inches of snowfall while Mount Baldy reported 12-14 inches of snowfall. Along with the snow, southerly winds, gusting in excess of 40 MPH, were reported.

Date(s) of Events	Declaration Number	Planning Area Included	Description
July 2024	-	Statewide	A weeklong extreme heat event occurred with temperatures between 90° F to 97° F. The state experienced wildfires during this time.
September 2024	-	Statewide	An extreme heat wave impacted southern California the first week of the month, with daytime temperatures 10° to 20° above normal for that time of year. Persistent triple-digit temperatures drove a spike in emergency room visits for heat-related illnesses. Three fires burning in the eastern part of Los Angeles County exploded in intensity during this time period, impacting communities with smoke and short-notice evacuations.

Source: (NOAA NCEI 2025)

9.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

Probability

With temperatures expected to increase in the service area because of changing climatic conditions, it is possible that the frequency of extreme cold/freeze events will decline in the future. Cold waves as defined in the NRI dataset do not occur in the Planning Area; however, winter weather is reported using these considerations, the annual probability assigned to the extreme cold/freeze hazard is likely low (FEMA n.d.).

The Planning Area regularly experiences temperatures in the “danger” and “extreme danger” categories on the NWS the “danger” and “extreme danger” categories on the NWS Heat Index Chart (above 98°F). Climate models, completed by the County of Los Angeles, project that by mid-century, Los Angeles County will experience an average of 9 days of extreme heat per year, growing to 12 days per year by the final decades of the century (LAO 2021). Based on historic events and projected conditions, there is a high probability of occurrence of extreme heat for the Planning Area (FEMA n.d.).

Climate Change

Data projections from Cal-Adapt, a tool provided by the California Energy Commission, were utilized to obtain localized climate change projections as it relates to the hazard of extreme temperature (Cal Adapt 2025). Data suggests that climatic changes may intensify the severity and frequency of extreme temperature events in the Planning Area. The increase in average surface temperatures can also lead to more intense heat waves that can be exacerbated in the Planning Area. When comparing average annual temperatures from 1901–1960 to those of 1986–2016, most of California has experienced increases exceeding 1°F, with some areas exceeding 2° (NASA n.d.). This general warming trend has the potential to reduce the occurrence and range of anticipated intensities of extreme cold or freezing events in the future while increasing the intensities of extreme heat events.

Cascading Impacts

Grid vulnerabilities to potential future heat waves described by climate change projections were assessed throughout Los Angeles County (LAC). It is crucial to understand how future temperature change might impact the power system, as previous failures and strains have occurred, to ensure continued reliable operation. Potential increases in peak demand, resource adequacy requirements, and component over-loadings were forecast for ranges of scenarios from 2021 to 2060.

Extreme cold events, though less frequent, also present significant risks to grid reliability. During cold snaps, the demand for heating surges, often relying heavily on natural gas, which is a primary fuel source for electricity generation. A shortage of natural gas during such events could severely limit power generation capacity, leading to blackouts.

While the Planning Area is largely built out, the County is projected to continue to grow, which will strain regional resources (LAEDC n.d.)

9.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

9.2.1 Summary of Vulnerability

The entire planning area is exposed to the extreme temperature hazard, so an event has the potential to affect the entire Planning Area. Extreme heat generally does not impact buildings, but all buildings in the planning area will have an increased energy demand for cooling. All of the planning area's identified critical facilities are vulnerable to the extreme heat hazard. Agency staff working in the field should also be considered vulnerable.

9.2.2 Impact on Assets and the Economy

Domestic water networks, including water pipes, meters, and mains are most at-risk, as lines are continuously filled with water to maintain pressure and are more likely to burst when frozen. Irrigation lines, sewer lines, and stormwater pipes also have the potential to freeze and/or burst.

Most of the impacts to the Planning Area from extreme heat are not caused by direct damages to assets though they are possible. Assets with motors and electrical components, such as booster stations, lift stations, and buildings, face increased vulnerability given potential impacts due to power outages caused by extreme heat events.

9.2.3 Change in Vulnerability Since Prior HMP

The only participating jurisdiction that has a prior HMP is Crescenta Valley Water District. Refer to the CVWD annex in Volume 2.

9.3 MITIGATION OPPORTUNITIES

Table 9-4 presents a range of potential opportunities considered by the Planning Partnership for mitigating the extreme heat hazard.

Table 9-4. Potential Opportunities to Mitigate the Extreme Temperature Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• Plant trees to create shade in urban areas • Remove concrete and other hard surfaces and replace them with native vegetation	• Plant trees in urban areas experience urban heat island effects or with below average tree canopy coverage • Remove concrete and other hard surfaces and replace them with native vegetation	• Plant trees in urban areas experience urban heat island effects or with below average tree canopy coverage • Remove concrete and other hard surfaces and replace them with native vegetation
Reduce Exposure and Vulnerability		
• Insulate structures to provide greater thermal efficiency • Provide redundant power sources • Install air conditioning	• Relocate critical infrastructure underground • Provide cooling centers for employees • Install “cool roofs” and “green roofs”	• Relocate critical infrastructure underground • Trim trees away from power lines • Install “cool roofs” and “green roofs” • Establish and promote accessible cooling centers in the community • Use the best available technology to enhance the warning systems for extreme heat events
Build Local Capacity		
• Promote 72-hour self-sufficiency • Obtain a NOAA weather radio • Obtain an emergency generator	• Provide safety training and resources for employees that work primarily outside and at field locations • Create redundancy in power supply • Equip facilities with a NOAA weather radio • Equip vital facilities with emergency backup power	• Enhance public awareness and outreach to address actions to take during extreme heat events • Coordinate severe weather warning capabilities and the dissemination of warning among agencies with the highest degree of capability • Modify land use and environmental regulations to

Community Scale	Organizational Scale	Government Scale
		support vegetation management activities that improve reliability in utility corridors • Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines • Provide NOAA weather radios to the public • Review and update heat response plan to account for climate change projections • Promote programs that support community-scale microgrids • Evaluate and revise building codes to address and mitigate extreme heat impacts on residents
Nature-based Opportunities		
• Manage invasive species that thrive in warmer temperatures • Incorporate nature-based heat-reduction measures with plantings in green spaces, trail areas, and community parks		

10. FLOOD

10.1 HAZARD PROFILE

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.

10.1.1 Hazard Description

Defining the Hazard

Flooding occurs when water overflows onto land that is normally dry. They can happen during heavy rains, rapid snow melt, or when dams or levees break (NOAA National Severe Storms Laboratory 2023). Floods are one of the most frequent and costly natural disasters in the United States and the State of California. The Foothill Municipal Water District is typically exposed to the following flood types, with each further described below:

- Riverine flooding
- Flash flooding
- Urban flooding

Riverine Flooding

Riverine flooding, or fluvial flooding, is when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land. This occurs when the flow of a river exceeds the bank sides and causes damage or obstruction to a nearby floodplain. Riverine flooding can turn into a flash flood if the river is at or above its flood stage and if the soil is saturated (FEMA 2019).

Flash Flooding

A flash flood is a rapid inundation of low-lying areas caused by heavy rain associated with severe thunderstorms, tropical systems, or melting water from ice or snow. Flash flooding also occurs far away from water bodies when a large volume of water cannot be absorbed by the soil or storm water systems and travels overland unimpeded (NWS 2019).

Urban Flooding

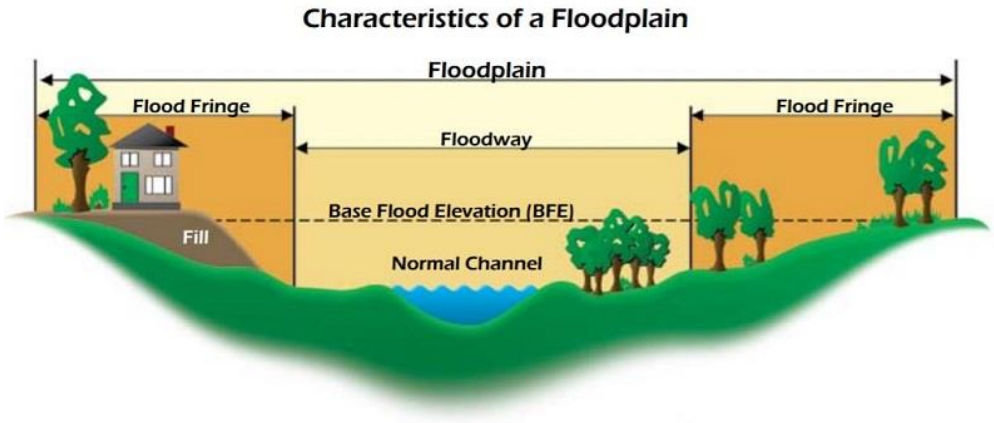
Local (urban) drainage systems collect groundwater from heavy rainfall in developed areas. Water that does not evaporate or become absorbed by the ground is carried by conduits to waterways such as creeks, rivers, or the ocean. These systems have two purposes: 1) to control storm water runoff during periods of heavy rainfall; and 2) to minimize disruption of activity from more frequently occurring, less significant storms. Flooding occurs when runoff exceeds system capacity, or because systems are blocked from lack of maintenance. Flooding which results from poorly designed or blocked drainage systems is categorized as urban/stormwater flooding (NOAA 2022).

Floodplains

In natural settings, floods typically take place within a floodplain. A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. The floodplain describes the area inundated by the "100-year" flood, or a flood that has a 1-percent chance in any given year of being equaled or exceeded. A floodplain is designated when floodwater exceeds the capacity of the main channel, or water escapes the channel through bank erosion. **Figure 10-1** depicts the flood hazard area, the flood fringe, and the floodway areas of a floodplain.

The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques.

Figure 10-1. Characteristics of a Floodplain



Source: (FEMA 2009)

Flood hazard areas are identified as Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled to or exceeded in any given year. The 1- percent annual chance flood is also referred to as the base flood or 100-year flood. A 100-year floodplain is not a flood that will occur once every 100 years; the designation indicates a flood that has a 1-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. Similarly, the moderate flood hazard area (500-year floodplain) will not occur every 500 years but is an event with a 0.2-percent chance of being equaled or exceeded each year). The 1-percent annual chance floodplain establishes the area that has flood insurance and floodplain management requirements. The following are additional definitions relating to flood maps (FEMA 2025):

- Flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA).
- SFHA = the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year.

- 1-percent annual chance flood = the base flood or 100-year flood.
- SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.
- Zone B or Zone X (shaded) = Moderate flood hazard areas and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood.
- Zone C or Zone X (unshaded) = Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled.

Cause of the Hazard

Flooding typically occurs when prolonged rain falls over several days, when intense rain falls over a short period of time, or when a debris jam causes a river or stream to overflow onto the surrounding area. The most common cause of flooding is water due to rain and/or snowmelt that accumulates faster than soils can absorb it or rivers can carry it away (NWS n.d.).

Summary of Potential Impacts

Flooding in the Foothill Municipal Water District can have significant impacts on the people, structures, infrastructure, and natural environment. Roads, bridges, and buildings can be severely damaged or destroyed, making transportation difficult and disrupting daily life and emergency response efforts. Hydrostatic pressures and flowing floodwaters can easily cause structures to collapse or float away. This can lead to costly repairs and loss of property value, impacting homeowners and businesses. Floodwaters can contaminate drinking water and lead to the spread of contaminants and diseases. During severe flood events, residents may need to evacuate their homes, which can lead to displaced residents and the potential increased risk of drowning during evacuation efforts. Flooding can result in scouring and erosion of sediment in areas with flow or wave action.

Cascading Hazard Impacts

Flooding often initiates a series of cascading hazards that extend beyond direct inundation caused by a flood event. One of the most significant secondary impacts is erosion. In many cases, the threat and effects of erosion are worse than actual flooding. This is particularly evident along steep canyons where fast-moving floodwaters may recede quickly but aggressively scour banks and slopes, destabilizing land and progressively encroaching on adjacent properties.

Prolonged soil saturation from high flows can also trigger landslides and slope failures, especially in areas with steep terrain or pre-existing instability. In addition, floodwaters can mobilize hazardous materials when storage tanks or containment systems fail, allowing pollutants to enter waterways or drainage systems.

10.1.2 Location

Riverine and flash flooding can occur along the waterways in the Planning Area, including the steep canyon channels.

10.1.3 Extent

The severity of a flood depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to manage this water. The size of rivers and streams in an area and infiltration rates are significant factors. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration rates decrease and any more water that accumulates must flow as runoff (Harris 2001).

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1-percent chance of being equaled or exceeded in any given year. The “annual flood” is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used by the NFIP as the standard for floodplain management and to determine the need for flood insurance, as well as the regulatory flood boundary by many agencies. Also referred to as the Special Flood Hazard Area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the water elevation resulting from a given discharge level, which is one of the most important factors used in estimating flood damage. A structure located within a SFHA shown on an NFIP map has a 26-percent chance of suffering flood damage during the term of a 30-year mortgage.

The term “500-year flood” is the flood that has a 0.2-percent chance of being equaled or exceeded each year. The 500-year flood could occur more than once in a relatively short period of time. Statistically, the 0.2-percent (500-year) flood has a 6-percent chance of occurring during a 30-year period of time, the length of many mortgages. The 500-year floodplain is referred to as Zone X500 for insurance purposes on FIRMs. Base flood elevations or depths are not shown within this zone and insurance purchase is not required in this zone (FEMA 2022).

Measuring Intensity

In the case of riverine flood hazard, once a river reaches flood stage, the flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat:

- Minor Flooding - minimal or no property damage, but possibly some public threat or inconvenience.
- Moderate Flooding - some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.

- Major Flooding - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (NOAA 2021).

Currently, there is no measurement used to further define the frequency and severity of stormwater/urban flooding.

Warning Time

Most floods are preceded by a warning period that allows emergency managers to communicate the need to prepare for the event. A flood may last from minutes to days (O'Connor, Grant and Costa 2002). Warnings issued through official sources, such as the National Weather Service (NWS) and the Storm Prediction Center, provide the most reliable and timely preparedness information, but the exact flood location and depth depends on the amount, duration, and location of rainfall.

The NWS uses the following advisory, watch, and warnings when flooding conditions are anticipated (NWS 2025):

- **Flood Advisory:** Issued when flooding is forecast to occur, generally within the next 6 hours, but is not expected to substantially threaten life and property.
- **Flood Watch:** A Flood Watch is issued when conditions are favorable for flooding. It does not mean flooding will occur, but it is possible.
- **Flash Flood Warning:** Issued when flash flooding is imminent, generally within the next 6 hours. This is usually issued based on observed heavy rainfall (measured or radar estimated) for dangerous small stream or urban flooding, but may also be issued for significant dam or levee failures that have occurred or are imminent.
- **Areal Flood Warning:** Issued when widespread general flooding is forecast to occur throughout an identifiable geographic area.
- **Flood Warning for River Forecast Point:** Issued when a river gauge is forecast to exceed a predetermined flood stage.

Worst Case Scenario

A worst case scenario for flood would likely involve a strong, slow-moving storm that drops heavy rainfall combined with heavy predecessor rainfall events that limit the availability of the natural systems to absorb rainfall. An event of this magnitude could result in widespread flooding.

10.1.4 Previous Occurrences

The following sections provide a review of previous flood occurrences in the Planning area.

Declarations

Federal Declarations

Between 2019 and 2025, the Planning Area experienced five major disaster (DR) or emergency declarations (EM) related to a flood hazard.

Table 10-1. Federal Flood Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-4683-CA	December 27, 2022 – January 31, 2023	January 14, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides
EM-3591-CA	January 8 – January 31, 2023	January 9, 2023	Severe Winter Storms, Flooding, and Mudslides
DR-4699-CA	February 21 – July 10, 2023	April 3, 2023	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides
EM-3592-CA	March 9 – July 10, 2023	March 10, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides
DR-4769-CA	January 31– February 9, 2024	April 13, 2024	Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslides

Source: OpenFEMA Datasets (OpenFEMA Data Sets | FEMA.gov)

State Proclamations

Between 2019 and 2025, California included Los Angeles County in 10 state-proclaimed flood disasters.

Table 10-2. State Landslide Disaster Declarations

Disaster Number	Declaration Date	Description
-	November 17, 2021	January 2021 Winter Storms
-	September 16, 2022	Tropical Storm Kay
N-1-23, N-2-23, N-10-23	January 4, 2023	December 2022 to January 2023 Storms
CA23-1	January 4, 2023	Late December 2022 Storms
CA23-3	March 1, 2023	Late February-Early March 2023 Winter Storms
CA23-3	June 16, 2023	February 2023 Winter Storms
-	August 19, 2023	Tropical Storm Hilary
-	February 4, 2024	Early February 2024 Storms
-	March 3, 2024	March 2024 Storms
-	June 21, 2024	January 2024 Winter Storms

Source: (Cal OES 2025)

USDA Declarations

Between 2019 and 2025, the USDA declared that Los Angeles County experienced one disaster relating to flood.

Table 10-3. USDA Drought Disaster Declarations

Designation Number	Event Begin Date	Description
S5658	August 9, 2023	Tropical Storm Hillary

Source: (U.S. Department of Agriculture 2025)

Summary of Significant Events

Significant and damaging atmospheric river flood event that occurred in the winters of 2022-2023 which caused and resulted in land movement in the fall of 2023 and early 2024 in the Planning Area.

Recent Events

The NOAA NCEI Storm Events Database reported 75 flood events impacting Los Angeles County forecast zones from 2019 through 2025, three of which impacted areas adjacent to the Planning Area (NOAA NCEI 2025). The Planning Area experienced the atmospheric river that occurred in the winter of 2023-2024, delivering short-duration rainfall events that resulted in flash flooding warnings from February 1 – February 5, 2024. Table 10-4 shows a summary of significant flood events impacting the Planning Area (NOAA NCEI 2025).

Table 10-4. Recent Flood Hazard Events

Date (s) of Event	Event Type	FEMA / State Declaration Number (if applicable)	Los Angeles County included in declaration?	Description
January 9 – January 14, 2023	Flood/Severe Winter Storm	DR-4683-CA	Yes	Heavy rainfall across Los Angeles County resulting in flash flooding, landslides, and impact to transportation.
January 9, 2023	Flood/Severe Winter Storm	EM-3591-CA	Yes	Heavy rainfall generated flash flooding and significant mud and debris flows.
April 3, 2023	Flood/Severe Winter Storm	DR-4699-CA	Yes	Heavy rainfall generated flash flooding and significant mud and debris flows across Los Angeles County.
March 10, 2023	Flood/Severe Winter Storm	EM-3592-CA	Yes	Winter storm conditions developed across the mountains of Los Angeles County with heavy precipitation and resulting landslides.
August 9, 2023	Tropical Storm	NA	NA	Tropical Storm Hilary delivered record August rainfall for Los Angeles County and widespread flooding/debris flows across Southern California.
February 1 – February 5, 2024	Flood/Flash Flood	NA	NA	Flash Flood Warning covering the Planning Area.
April 13, 2024	Flood/Severe Winter Storm	DR-4769-CA	Yes	A powerful winter storm impacted all of Southwestern California including tornadoes, flooding, landslides, and mudslides.

Source: (NOAA NCEI 2025); (FEMA 2025)

10.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

Probability

The chance of heavy flooding and flash flooding is greatest during California's rainy season from November to April. However, the diversity of climate patterns in California makes flooding more than a seasonal risk. The following are some of the weather and climate conditions that have a significant impact on the occurrence of flooding (CalOES 2023):

- El Niño conditions
- La Niña conditions
- Desert monsoons
- Tropical storms
- Gulf of Alaska storms
- Atmospheric river patterns

The number of years between floods of any given size varies because of the natural variations in climate and weather events. FEMA conducts flood studies that use historical records to determine the probability of occurrence for different flood levels in a community. FEMA FIRMs identify the flood hazard area as the area that would be inundated by a flood with a 1 percent chance of occurring in any given year (the 1% annual chance flood). FIRMs also typically show the extent of the flood with a 0.2 percent chance of occurring in any given year (0.2% annual chance flood). These measurements reflect statistical averages only, and it is possible for two or more floods with a 1% annual chance to occur in a short time period (USGS n.d.). Table 10-5 summarizes the concept of recurrence intervals and probabilities.

Table 10-5. Recurrence Intervals and Probabilities of Occurrence

Recurrence Interval (in years)	Probability of Being Equaled or	Recurrence Interval (in years)
100	1 in 100	1%
50	1 in 50	2%
25	1 in 25	4%
10	1 in 10	10%
5	1 in 5	20%
2	1 in 2	50%

Source: (USGS n.d.)

Flooding is common in California and can take place any time of the year. Based on historical flood events, the State has a high probability of future riverine, flash, localized, and alluvial fan flood events. The frequency and severity of fluvial flooding for river systems are based on "discharge probability." The discharge probability is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for different discharge levels. These measurements reflect statistical averages only; it is possible for multiple floods with a low probability of occurrence (such as a 1 percent annual chance flood) to occur

in a short time period. A single flood event can have flows at different points on a river or stream that correspond to different probabilities of occurrence.

Climate Change

Climate change plays a significant role in the increasing frequency and intensity of extreme weather events, particularly floods. According to scientific reports, as global temperatures rise, the hydrological cycle becomes more dynamic and unpredictable. Warmer air holds more moisture, which often leads to heavier and more intense rainfall. This accelerates the risk of flooding, as seen in numerous impactful events around the world. Additionally, the shift in weather patterns caused by climate change contributes to prolonged periods of drought in some regions, further exacerbating water-related challenges.

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Scientists project greater storm intensity with climate change, resulting in more direct runoff and flooding. High frequency flood events in particular will likely increase with a changing climate. What is currently considered a 1 percent annual chance also may strike more often, leaving many communities at greater risk. Going forward, model calibration must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted.

Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness and emergency response.

Climate change will also increase other hazards that contribute to flood risk, most notably wildfires. According to California's Fourth Climate Change Assessment, continued increases in greenhouse gas emissions are expected to drive a substantial rise in large wildfires, with a projected 50 percent increase in fires over 25,000 acres and a 77 percent increase in average area burned by 2100. Post-fire landscapes are highly vulnerable: vegetation loss and soil damage make it easier for rain to trigger destructive debris flows and mudflows. When storms pass over recently burned areas, runoff can carry ash, sediment, and debris downslope, dramatically intensifying flood impacts and causing significant damage (Cal OES 2023).

Potential Future Impacts

The Planning Area municipalities are well-equipped to manage growth in floodplains with flood damage prevention ordinances, its building codes, and the Safety Element of the municipal General Plans. The Planning Partners adhere to local land use regulations when building structures and infrastructure.

10.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

10.2.1 Summary of Vulnerability

Valley Water Company and Las Flores are the only agencies with assets exposed to the mapped flood hazard. See individual agency results in Volume 2.

10.2.2 Impact on Assets and the Economy

A total of 3.1 miles of pipeline in the Planning Area is exposed to the mapped flood hazard. Economic impacts would be minor considering the limited exposure.

10.2.3 Change in Vulnerability Since Prior HMP

The only participating jurisdiction that has a prior HMP is Crescenta Valley Water District. Refer to the CVWD annex in Volume 2.

10.3 MITIGATION OPPORTUNITIES

Table 10-6 presents a range of potential opportunities considered by the Planning Partnership for mitigating the flood hazard.

Table 10-6. Potential Opportunities to Mitigate the Flood Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• Clear storm drains and culverts • Use low-impact development techniques	• Clear storm drains and culverts • Use low-impact development techniques	• Maintain drainage systems • Institute low-impact development techniques on property • Structural flood control, levees, channelization, or revetments • Stormwater management regulations and master planning

Community Scale	Organizational Scale	Government Scale
		• Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff
Reduce Exposure and Vulnerability		
• Locate outside of hazard area • Elevate utilities above base flood elevation • Use low-impact development techniques • Raise structures above base flood elevation • Elevate items within house above base flood elevation • Build new homes above base flood elevation • Flood-proof structures	• Locate outside of hazard area • Use low-impact development techniques • Build critical function redundancy or retrofit critical buildings • Provide floodproofing when new critical infrastructure must be located in floodplains	• Locate or relocate critical facilities outside of hazard area • Acquire or relocate identified repetitive loss properties • Promote open space uses in identified high hazard areas via techniques such as planned unit developments, easements, setbacks, greenways, sensitive area tracks • Adopt land development criteria such as planned unit developments, density transfers, clustering Institute low impact development techniques on property • Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff • Harden infrastructure, bridge replacement program • Provide redundancy for critical functions and infrastructure • Adopt regulatory standards such as freeboard standards, cumulative substantial improvement or damage, lower substantial damage threshold, compensatory storage, non-conversion deed restrictions • Stormwater management regulations and master planning • Adopt “no-adverse impact” floodplain management policies that strive to not increase the flood risk on downstream communities • Improve unpaved roads to reduce their likelihood to fail due to flooding
Build Local Capacity		
• Buy flood insurance • Develop household plan, such as retrofit savings, communication with outside, 72 hour self-sufficiency during and after an event	• Keep cash reserves for reconstruction • Support and implement hazard disclosure for sale of property in risk zones • Solicit cost-sharing through partnerships on	• Produce better hazard maps • Provide technical information and guidance • Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) • Incorporate retrofitting or replacement of critical system elements in capital improvement plan

Community Scale	Organizational Scale	Government Scale
	projects with multiple benefits	• Develop strategy to take advantage of post-disaster opportunities • Warehouse critical infrastructure components • Develop and adopt a continuity of operations plan • Consider participation in the Community Rating System • Maintain and collect data to define risks and vulnerability • Train emergency responders • Create an elevation inventory of structures in the floodplain • Develop and implement a public information strategy • Charge a hazard mitigation fee • Integrate floodplain management policies into other planning mechanisms within the Planning Area. • Consider impacts of climate change on the risk associated with the flood hazard • Consider the residual risk associated with structural flood control in future land use decisions • Enforce National Flood Insurance Program • Adopt a Stormwater Management Master Plan
Nature-based Opportunities		
• Restore and reconnect floodplains that have been degraded by development and structural flood control • Use soft approaches for stream bank restoration and hardening • Set back levees on systems that rely on levee protection to allow the channel to meander, which reduces erosion and scour potential • Preserve floodplain storage capacity by limiting or prohibiting the use of fill in the floodplain • Incorporated green infrastructure into stormwater management facilities • Protect and/or restore riparian buffers		

11. LANDSLIDE, SUBSIDENCE, AND MASS MOVEMENT

11.1 HAZARD PROFILE

11.1.1 Hazard Description

Defining the Hazard

A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation driven by gravity. Both natural and human-induced changes in the environment can trigger landslides. The following are the several types of landslides (USGS n.d.):

- **Rock falls** are rapid movements of bedrock, which result in bouncing or rolling.
- **Topple** is a section or block of rock that rotates or tilts before falling to the slope below.
- **Slides** are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material.
- **Mudflows**, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or "slurry."
- **Slurry** can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing larger as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.
- **Creep** is the imperceptibly slow downward movement of slope forming rock or soil that can be accelerated during wet weather events or earthquakes.
- **Land subsidence** is the gradual lowering of land-surface elevation due to changes in the soil or sediment. In California, subsidence has been documented for over a century and is a growing issue that impacts water infrastructure and communities (California Department of Water Resources 2025).

Cause of the Hazard

Landslides are caused by a combination of geological and climate conditions and the influence of urbanization. They can be initiated by storms, earthquakes, fires, volcanic eruptions, or human modification of the land. Vulnerable natural conditions are affected by human development and the infrastructure that supports it. In some cases, irrigation increases the landslide potential. The following factors can contribute to slide formation (USGS n.d.):

- Change in slope of the terrain
- Increased load on the land
- Shocks and vibrations
- Change in water content
- Groundwater movement
- Frost action
- Weathering of rocks
- Removing or changing

- The type of vegetation covering slopes

Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach-field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past, relatively flat-lying areas away from sudden changes in slope, and areas at the top or along ridges set back from the tops of slopes (USGS n.d.).

While small landslides are frequently a result of human activity, the largest landslides are often naturally occurring phenomena with little or no human contribution. The sites of large landslides are typically areas of previous landslide movement that are periodically reactivated by significant precipitation or seismic events (USGS n.d.).

Subsidence is caused by various factors including groundwater pumping, oil extraction, and geological processes (California Department of Water Resources n.d.). The main cause of subsidence in California is groundwater pumping, in which excessive groundwater pumping causes the empty spaces between soil particles to collapse and compact the earth. Specifically in the Greater Los Angeles Metropolitan Area, causes of subsidence is due to tectonic deformation, oil field operations, and groundwater extraction and injection occur in overlapping proximity. There have also been separate cases of subsidence have been attributed to groundwater pumping, oil extraction, and tectonic movement (Borchers and Carpenter 2014).

Summary of Potential Impacts

Landslides in hillside terrain can pose serious hazard to downslope property and structures. They can disrupt roadways and other infrastructure lifelines and destroy private property. A slide can move rapidly down slopes or through channels and can strike with little or no warning. It can travel miles from its source, growing as it descends, picking up trees, boulders, cars, and anything else in its path. Although slides behave as fluids, they convey many times the hydraulic force of water due to the mass of material they carry.

Cascading Hazard Impacts

Landslides that block rivers or streams can form unstable natural dams, trapping water and creating temporary lakes. These impoundments pose a serious risk of sudden failure, which can create destructive flash flooding downstream. Saturated soils from these events can likely destabilize nearby slopes, triggering additional landslides and cause cascading effects such as damaged infrastructure and roads, isolating rural communities, disrupting emergency services, and contaminating water sources (USGS n.d.).

11.1.2 Location

In 2011, the California Geological Survey conducted a statewide analysis using a combination of regional rock strength and slope data to create classes of susceptibility to deep-seated landslides. The analysis assumed, in general, that susceptibility to deep-seated landslides is low on very low slopes in all rock materials and increases with slope and in weak rocks. The analysis also factored in locations of past landslides.

Landslides are more likely during the late winter when the water table is high. After heavy rains from November to December, soils become saturated with water. As water seeps downward through upper soils that may consist of permeable sands and gravels and as it accumulates on impermeable silt, it will weaken and destabilize the slope. A short intense storm could cause saturated soil to move, resulting in landslides. As rains continue, the groundwater table rises, adding to the weakening of the slope. Gravity, poor drainage, a rising groundwater table, and poor soil exacerbate hazardous conditions.

11.1.3 Extent

Measuring Intensity

Landslides are typically a function of soil type and steepness of slope. Soil type is a key indicator for landslide potential and is used by geologist and geotechnical engineers to determine soil stability for construction standards. In general, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following (USGS n.d.):

- A slope greater than 33 percent.
- Post-wildfire areas.
- A history of landslide activity or movement during the last 10,000 years.
- Stream or wave activity, which has caused erosion, undercut a bank or cut into a bank to cause the surrounding land to be unstable.
- The presence or potential for snow avalanches.
- The presence of an alluvial fan, indicating vulnerability to the flow of debris or sediments.
- The presence of impermeable soils, such as silt or clay, mixed with granular soils, such as sand or gravel.

The best predictor of where slides might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years. Most landslides recognizable in this fashion range from a few acres to several square miles. Most show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges. The recognition of ancient dormant landslide sites is important in the identification of areas susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Also, because they consist of broken materials and frequently involve disruption of groundwater flow, these dormant sites are vulnerable to construction-triggered sliding (USGS n.d.).

Warning Time

Landslides can occur suddenly or slowly. The velocity of slide may range from a slow creep of inches per year to many feet per second, depending on slope angle, material, and water content. Generally accepted warning signs for landslide activity include the following (USGS n.d.):

- Springs, seeps, or saturated ground in areas that have not typically been wet before.
- New cracks or unusual bulges in the ground, street pavements, or sidewalks.
- Soil moving away from foundations.

- Ancillary structures such as decks and patios tilting or moving relative to the main house.
- Tilting or cracking of concrete floors and foundations.
- Broken water lines and other underground utilities.
- Leaning telephone poles, trees, retaining walls or fences.
- Offset fence lines.
- Sunken or down-dropped road beds.
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content).
- Sudden decrease in creek water levels though rain is still falling or just recently stopped.
- Sticking doors and windows and visible open spaces indicating frames out of plumb.
- A faint rumbling sound that increases in volume as the landslide nears.
- Unusual sounds, such as trees cracking or boulders knocking together.

Some methods used to monitor landslides can provide an idea of the type of slide and the amount of time prior to failure. Assessing the geology, vegetation, and amount of predicted precipitation for an area can help in predictions of what areas are at risk during general time periods. Currently, there is no practical warning system for individual landslides, however. The standard operating procedure is to monitor situations on a case-by-case basis and respond after an event has occurred (USGS 2018).

Worst Case Scenario

The worst-case scenario for landslide hazards in the planning area would generally correspond to a severe storm with heavy rain that caused flooding in an area that had been burned by fire. Landslides are more likely during the late winter when the water table is high. After heavy rains from November to December, soils become saturated with water. As water seeps downward through upper soils that may consist of permeable sands and gravels and as it accumulates on impermeable silt, it will weaken and destabilize the slope. A short intense storm could cause saturated soil to move, resulting in landslides. As rains continue, the groundwater table rises, adding to the weakening of the slope. Gravity, poor drainage, a rising groundwater table, and poor soil exacerbate hazardous conditions.

11.1.4 Previous Occurrences

The following sections provide a review of previous landslide occurrences in Planning Area.

Declarations

Federal Disaster Declarations

There have been 20 federal disaster declarations including landslides, mudslides, or debris flows since 1978.

Table 11-1. Federal Disaster Declarations for Landslide

Event Name	Disaster Number	Declaration Date
Coastal Storms, Mudslides and Flooding	DR-547-CA	January 15, 1978
Severe Storms, Mudslides and Flooding	DR-615-CA	February 21, 1980
Coastal Storms, Floods, Slides and Tornadoes	DR-677-CA	January 9, 1983
Rain/Snow/Windstorms, Flooding, Mudslides	DR-935-CA	February 25, 1992
Severe Winter Storm, Mud & Land Slides, and Flooding	DR-979-CA	February 3, 1993

Event Name	Disaster Number	Declaration Date
Fires, Mud/Landslides, Flooding, Soil Erosion	DR-1005-CA	October 28, 1993
Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1044-CA	January 10, 1995
Severe Winter Storms, Flooding Landslides, Mud Flow	DR-1046-CA	March 12, 1995
Wildfires, Flooding, Mudflow and Debris Flow Directly Related	DR-1498-CA	October 27, 2003
Severe Storms, Flooding, Debris Flows, and Mudslides	DR-1577-CA	February 4, 2005
Severe Storms, Flooding, Landslides, and Mud and Debris Flows	DR-1585-CA	April 4, 2005
Wildfires, Flooding, Mud Flows, and Debris Flows	DR-1731-CA	October 24, 2007
Severe Winter Storms, Flooding, and Debris and Mud Flows	DR-1884-CA	March 8, 2010
Severe Winter Storms, Flooding, and Mudslides	DR-4305-CA	March 16, 2017
Wildfires, Flooding, Mudflows, and Debris Flows	DR-4353-CA	January 2, 2018
Severe Winter Storms, Flooding, and Mudslides	EM-3591-CA	January 9, 2023
Severe Winter Storms, Flooding, Landslides, and Mudslides	DR-4683-CA	January 14, 2023
Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides	DR-4699-CA	April 3, 2023
Severe Winter Storms, Flooding, Landslides, and Mudslides	EM-3592-CA	March 10, 2023
Severe Winter Storms, Tornadoes, Flooding, Landslides, And Mudslides	DR-4769-CA	April 13, 2024

Source: (FEMA 2025)

State Proclamations

Between 1954 and 2024, California included Los Angeles County in six state-proclaimed landslide disasters.

Table 11-2. State Disaster Declarations for Landslide

Event Name	Disaster Number	Declaration Date
Flooding and Landslides	-	January 5, 1965
1965 Landslides	-	January 21, 1965
1970 Landslide (Los Angeles)	-	March 10, 1970
Tropical Storm Kay	-	September 16, 2022
January 2024 Winter Storms	-	June 21, 2024
Early February 2024 Storms	-	February 4, 2024

Source: (Cal OES 2025)

USDA Declarations

Between 2012 and 2025, there have been no USDA agricultural disaster declaration related to landslide for Los Angeles County (U.S. Department of Agriculture 2025).

Summary of Significant Events

In December of 2009, a strong winter storm brought flash flooding to the foothill areas that caused mud and debris flows near the Station Fire burn, affecting the communities of La Crescenta and La Canada-Flintridge. Numerous streets were closed.

Recent Events

February 2025 Storms

One month after the Eaton Fire burned through the foothills near Altadena in January 2025, heavy rain fell on the burn-scarred land and triggered mud and debris flows, forcing people to evacuate (NOAA n.d.)

11.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

Probability

Mass movements are often triggered by other natural hazards such as earthquakes, heavy rain, floods, or wildfires, so their frequency is often related to the frequency of the precipitating hazards. In Los Angeles County landslides occur occasionally and usually during and after severe storms, so the potential for landslides largely coincides with the potential for sequential severe storms that saturate steep, vulnerable soils. Most weather-induced landslides occur in the winter after the water table has risen. Landslides that result from Earthquakes can occur at any time.

Climate Change

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. An increase in global temperature is likely to affect the snowpack and its ability to hold and store water. DWR estimates that parts of the state will experience a 48 to 65 percent loss in snowpack by the end of the century compared to historical averages. Both 2020 and 2021 broke records for statewide average temperatures (DWR 2021). Increasing temperatures may also increase net evaporation from reservoirs. Warming temperatures could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. Each these factors would increase the probability of landslides.

Potential Future Impacts

The planning area may become infringed upon by increasing numbers of landslides originating along the foothills of the San Gabriel Mountains. This includes primarily residential and recreational areas that are near the base of the mountain range. While the Planning Area is primarily built out, any development that occurs will increase exposure.

11.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

11.2.1 Summary of Vulnerability

Much of the Planning Area is exposed to the landslide hazard, so a landslide has the potential to affect structures and infrastructure in the Planning Area. An exposure analysis was conducted, and summary findings are outlined below. See individual risk assessment results in each Planning Partner annex (Volume 2).

11.2.2 Impact on Assets and the Economy

More than 250 miles of pipeline in the Planning Area is exposed to the very high and high landslide susceptibility zones.

11.2.3 Change in Vulnerability Since Prior HMP

The only participating jurisdiction that has a prior HMP is Crescenta Valley Water District. Refer to the CVWD annex in Volume 2.

11.3 MITIGATION OPPORTUNITIES

Table 11-1 presents a range of potential opportunities considered by the Planning Partnership for mitigating the landslide/mass movement hazard.

Table 11-1. Potential Opportunities to Mitigate the Landslide/Mass Movement Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• Stabilize slope • Reduce weight on top of slope • Minimize vegetation removal and the addition of impervious surfaces	• Stabilize slope • Filling in fissures and lining canyons to minimize water infiltrating the ground and water table	• Stabilize slope • Filling in fissures and lining canyons to minimize water infiltrating the ground and water table • Reduce weight on top of slope
Reduce Exposure and Vulnerability		
• Locate structures outside of hazard area	• Locate structures outside of hazard area	• Armor/retrofit critical infrastructure against the impact of landslides • Support transition of high hazard areas to open space

Community Scale	Organizational Scale	Government Scale
Build Local Capacity		
• Subscribe to warning systems, and develop evacuation plan • Keep cash reserves for reconstruction • Educate yourself on risk reduction techniques for landslide hazards	• Institute warning system, and develop evacuation plan • Keep cash reserves for reconstruction • Develop a continuity of operations plan • Educate employees on the potential exposure to landslide hazards and emergency response protocol	• Provide public with information on landslide hazard and appropriate risk reduction alternatives
Nature-based Opportunities		
• Replace or restore native vegetation known to stabilize steep slopes • Hybrid solutions that combine engineering with a nature-based approach using appropriate vegetation		

12. STRONG WIND

12.1 HAZARD PROFILE

12.1.1 Hazard Description

Defining the Hazard

Windstorms are generally short-duration events involving straight-line winds or gusts of over 50 miles per hour (mph), strong enough to cause property damage. Windstorms are especially dangerous in areas with significant tree stands and areas with exposed property, poorly constructed buildings, mobile homes (manufactured housing units), major infrastructure, and above-ground utility lines. A windstorm can topple trees and power lines, cause damage to residential, commercial, and critical facilities, and leave tons of debris in its wake. There are seven primary types of damaging winds (NOAA National Severe Storms Laboratory n.d.):

- **Straight-line winds—**Any thunderstorm wind that is not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft.
- **Downdrafts—**A small-scale column of air that rapidly sinks toward the ground.
- **Downbursts—**A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.
- **Microbursts—**A small, concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only 5 to 10 minutes, with maximum wind speeds that can exceed 100 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.
- **Gust front—**A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
- **Derecho—**A derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word “derecho” is of Spanish origin and means “straight ahead.” Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area (National Weather Service n.d.).

- **Bow echo—**A bow echo is a linear wind front bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last for several hours, and produce extensive damage at the ground (National Oceanic Atmospheric Association 2023).

In addition to the seven primary types of damaging winds, Southern California also experiences a localized phenomenon known as Santa Ana Winds. These strong, dry, gusty downslope winds known as Santa Ana winds form when air from a region of high pressure over the desert region of the southwestern United States flows westward toward low-pressure areas off the California coast (Figure 12-1) (Sosnowski 2021). As the wind flows over the Sierra Nevada and Santa Ana mountains, it drops from high elevation to sea level. The air becomes compressed and heats up as it sinks, and its relative humidity drops. Gaps in mountains form wind tunnels that strengthen these winds as they pour warm air east to west through the canyons. These winds play a major role in increasing wildfire risk in the region because of the dryness of the winds and the speed with which they can cause a fire to spread, complicating containment efforts (National Weather Service n.d.).

Southern California also experiences tornadoes, a violently rotating column of air extending from the base of a thunderstorm down to the ground. Tornadoes are capable of completely destroying well-made structures, uprooting trees, and hurling objects through the air like deadly missiles. Tornadoes can occur at any time of day or night and at any time of the year. Although tornadoes are most common in the Central Plains and the southeastern United States, they have been reported in all 50 states (National Weather Service n.d.).

Figure 12-1. Santa Ana Winds

Source: (Sosnowski 2021)

Cause of the Hazard

Longer-period windstorms have two main causes: (1) large differences in atmospheric pressure across a region and (2) strong jet stream winds overhead. Horizontal pressure differences may accelerate the surface winds substantially as air travels from a region of higher atmospheric pressure to one of lower pressure (Pielke 2025).

Santa Ana winds may occur year-round, but are most common during the cooler months, typically from September through March. A Santa Ana wind event can yield sustained winds of 40 miles per hour; isolated wind gusts of over 90 miles per hour have been recorded. Most Santa Ana wind events peak for a 12 to 24 hour period but can persist for a few days (National Weather Service n.d.).

Summary of Potential Impacts

Windstorms can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights and parks, and other damage. Wind speeds as low as 32 mph can cause structural damage, and winds of 100 mph can destroy wood-frame structures. High winds can also cause direct losses to buildings, people, and vital equipment. There are direct consequences to the local economy resulting from windstorms related to both physical damage and interrupted services.

Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing winds can create lift and suction forces that act to pull building components and surfaces outward. As positive and negative forces impact a building's doors, windows, and walls, the result can be roof or building component failures and considerable structural damage. The effects of winds are magnified in the upper levels of multi-story structures.

Debris carried along by extreme winds can contribute directly to loss of life and indirectly to the failure of protective building envelopes. Falling trees and branches can damage buildings, power lines, and other property and infrastructure. Tree limbs breaking in winds of only 45 mph can be thrown over 75 feet, so overhead power lines can be damaged even in relatively minor windstorm events. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds. Utility lines brought down by summer thunderstorms have also been known to cause fires, which start in dry roadside vegetation. Electric power lines falling down to the pavement create the possibility of lethal electric shock.

Downed trees and power lines, and damaged property also can be major hindrances to emergency response and disaster recovery. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted. Industry and commerce can suffer losses from interruptions in electric service and from extended road closures.

Cascading Hazard Impacts

High winds can quickly cause or spread wildfires, inundating nearby areas with heavy smoke. For additional information, refer to Section 13 Wildfire.

12.1.2 Location

Strong winds can impact the entirety of the Planning Area. Areas with sudden elevation changes such as communities in close proximity to the San Gabriel Mountains are especially impacted by strong winds given their exposure to Santa Ana and other downslope winds.

12.1.3 Extent

Measuring Intensity

Damage from strong winds accounts for half of all severe weather reports in the lower 48 states. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles. The Beaufort Wind Chart in Table 12-1 provides terminology and a description of potential wind impacts at different levels (California State Water Resources Control Board n.d.).

Table 12-1. Land Based Beaufort Scale

Beaufort Number	Range (mph)	Terminology	Description
0	0	Calm	Clam. Smoke rises vertically.
1	1-3	Light Air	Wind motion visible with smoke.
2	4-7	Light breeze	Wind felt on exposed skin. Leave rustle.
3	8-12	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19-24	Fresh breeze	Smaller trees sway.
6	25-31	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use is difficult.
7	32-38	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	Gale	Twigs broken from trees. Car veer on road.
9	47-54	Severe gale	Light structure damage
10	55-63	Storm	Trees uprooted. Considerable structural damage.
11	64-73	Violent Storm	Widespread structural damage.
12	74-95	Hurricane	Considerable and widespread damage.

Source: California State Water Resources Control Board (Beaufort Wind Force Scale)

Warning Time

NOAA issues watch, warning, and advisory information for high winds. Weather stations and media outlets can then warn residents of upcoming storms so they may prepare and plan accordingly. NOAA's watch, warning, and advisory categories and timeframes are listed below (National Weather Service 2011).

- **High Wind Warning: Take Action!** Sustained, strong winds with even stronger gusts are happening. Seek shelter. If you are driving, keep both hands on the wheels and slow down. NWS offices issue this product based on local criteria.
- **High Wind Watch: Be Prepared!** Sustained, strong winds are possible. Secure loose outdoor items and adjust plans as necessary so you're not caught outside. NWS offices issue this product based on local criteria.

- **Wind Advisory: Take Action!** Strong winds are occurring but are not so strong as to warrant a High Wind Warning. Objects that are outdoors should be secured and caution should be taken if driving. NWS offices issue this product based on local criteria.
- **Dust Storm Warning: Take Action!** A Dust Storm Warning is issued when visibility of 1/2 mile or less due to blowing dust or sand, and wind speeds of 30 miles an hour or more
- **Severe Thunderstorm Watch: Be Prepared!** A Severe Thunderstorm Watch is issued when severe thunderstorms are *possible* in and near the watch area. Winds 58 mph or higher and/or hail 1inch or larger are possible in a severe thunderstorm. Secure items outdoors that may blow around in high winds. Stay informed and be ready to take action.
- **Severe Thunderstorm Warning: Take Action!** A Severe Thunderstorm Warning is issued when severe thunderstorms is happening or is imminent in the warning area. Severe thunderstorms have wind 58 mph or higher and/or hail 1 inch or larger. Seek shelter inside a sturdy building, away from windows.
- **Gale Warning: Take Action!** Gale Warnings are issued for locations along the water when one or both of the following conditions is expected to begin within 36 hours and is not directly associated with a tropical cyclone: sustained winds of 34 to 47 knots (39 to 55 mph) or frequent gusts (duration of two or more hours) between 34 knots and 47 knots. Make sure your vessel is secure in port.
- **Hurricane Force Wind Warning:** Hurricane Force Wind Warnings are issued for locations along the water when one or both of the following conditions is expected to begin within 36 hours and not directly associated with a tropical cyclone: sustained winds of 64 knots or greater or frequent gusts (duration of two or more hours) of 64 knots (74 mph) or greater. Make sure your vessel is secure in port.

Worst Case Scenario

In January 2025, the worst-case scenario for strong wind occurred in Los Angeles County when the Palisades and Eaton Fires were spread by hurricane-force Santa Ana winds. This occurred after an extended dry period in which vegetation was particularly vulnerable to burning. The State of California, Los Angeles County, and several local organizations are collaborating to assist communities through the rebuilding process.

12.1.4 Previous Occurrences

The following sections provide a review of previous strong wind occurrences in the Foothill Municipal Water District.

Declarations

Federal Disaster Declarations

Between 1954 and 2025, Los Angeles County experienced four strong wind-related major disaster (DR) or emergency declarations (EM) (FEMA 2025).

Table 12-2. Federal Strong Wind Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-935-CA	February 10 – 12, 1992	February 25, 1992	Rain/Snow/Wind Storms, Flooding, Mudslides
DR-4699-CA	February 21 – July 10, 2023	April 3, 2023	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides
DR-4769-CA	January 31– February 9, 2024	April 13, 2024	Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslide
DR-4856-CA	January 7-31, 2025	January 8, 2025	Wildfires and Straight-Line Winds

Source: OpenFEMA Datasets (OpenFEMA Data Sets | FEMA.gov)

State Declarations

Between 1954 and 2025, California declared that Los Angeles County experienced seven disasters relating to strong wind (Cal OES 2025).

Table 12-3. State Strong Wind Disaster Declarations

Disaster Name	Declaration Date	Disaster Number
Tropical Storm Kay	September 16, 2022	-
December 2022 to January 2023 Storms	January 4, 2023	N-1-23, N-2-23, N-10-23
February to March 2023 Storms	March 1, 2023	N-6-23, N-7-23, N-9-23, N-10-23
Tropical Storm Hilary	August 19, 2023	-
January 2024 Winter Storms	June 21, 2024	-
Early February 2024 Storms	February 4, 2024	-
Los Angeles County Fires and Windstorm Event	January 7, 2025	N-2-25 through N-24-25

Source: (Cal OES 2025)

USDA Declarations

Between 1954 and 2025, there were no USDA declarations for Los Angeles County relating to strong wind (U.S. Department of Agriculture 2025).

Summary of Significant Events

Due to its geographic conditions, southern California and Los Angeles County have an extensive history dealing with strong winds. California's all-time record for wind gusts was experienced in Los Angeles County on March 25, 1975, when wind gusts of 101 mph were recorded in the Community of Sandberg. (NWS 2025). Beyond then, Santa Ana winds have seasonally affected Los Angeles County, especially in the San Gabriel and San Bernardino Mountain regions, often reaching above 60 mph (NWS 2025).

The January 2025 high wind events throughout Los Angeles County led to some of the most significant wildfire events in California history. See Chapter 14 Wildfire for additional details.

Recent Events

Between 2019 and 2025, there were four strong wind events in the Planning Area.

Table 12-4. NOAA NCEI Strong Wind Event Declarations

Incident Period	Event Type	Description
October 4, 2021	Thunderstorm Wind	Strong thunderstorms generated strong outflow winds across sections of Southern California. Wind gusts up to 78 MPH were reported by observation sites within the local mesonet. No significant damage was observed.
February 20, 2024	Strong Wind	A third, powerful, winter storm brought significant impacts to Southwestern California. Rainfall totals ranged between 2 and 12 inches with the highest totals across southern Santa Barbara County and western Ventura County. With the heavy rainfall, numerous reports of flooding and mud/debris flows were reported. Also, some gusty winds were reported.
March 7, 2026	Strong Wind	A late-season, storm brought significant rainfall to the area along with strong thunderstorms. Rainfall totals across the area ranged from 0.50 to 1.50 inches across San Luis Obispo and Santa Barbara counties to 1 to 2 inches across Ventura and Los Angeles counties. Unstable air, associated with the storm, brought scattered strong thunderstorms to the area, producing gusty winds, large hail and even some flash flooding.
February 13, 2025	Thunderstorm Wind	A powerful winter storm impacted all of Southwestern California. The storm generated strong southerly winds, gusting up to 87 MPH. The storm also produced very heavy rainfall with totals up to 8 inches reported in the mountains along with numerous reports of flooding. Also, thunderstorms associated with the winter storm produced a weak tornado.

12.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

Probability

The Foothill Municipal Water District regularly experiences strong wind events, especially during the fall and winter months when the Santa Ana winds occur (National Weather Service n.d.). Based on historic events and projected conditions, there is a high probability of occurrence of strong wind events in the planning area. In the entire State of California, more than 500 windstorms and 466 tornadoes occurred from 1950-2022. It is predicted that more than 7 windstorms and about 7 tornadoes will occur per year in the State's future (CalOES 2023).

Climate Change

It is uncertain whether strong wind events are becoming more or less frequent under a changing climate (CalOES 2023). However, impacts from climate change are increasing the intensity and frequence of wildfires which can be spread by strong winds (Lindsey 2025).

Potential Future Impacts

The Foothill Municipal Water District is located in California's most densely populated and developed County. It is surrounded by other incorporated cities so anticipated future growth will be managed through redevelopment, which creates an opportunity to build to a higher code. The Planning Area will be well-equipped to manage development with its building code, and the Safety Element of its General Plan.

12.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

12.2.1 Summary of Vulnerability

The entire Planning Area is vulnerable to strong wind, so the hazard has the potential to affect structures and infrastructure across the Planning Area. Critical infrastructure that lacks backup power is especially vulnerable. Facilities located near trees or power lines that are likely to fall are vulnerable.

12.2.2 Change in Vulnerability Since Prior HMP

The only participating jurisdiction that has a prior HMP is Crescenta Valley Water District. Refer to the CVWD annex in Volume 2.

12.3 MITIGATION OPPORTUNITIES

Table 12-5 presents a range of potential opportunities considered by the Planning Partnership for mitigating the strong wind hazard.

Table 12-5. Potential Opportunities to Mitigate the Strong Wind Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• None	• None	• None
Reduce Exposure and Vulnerability		
• Provide redundant power • Plant appropriate trees near home and power	• Relocate critical infrastructure (such as power lines) underground	• Harden infrastructure such as locating utilities underground • Trim trees back from power lines

Community Scale	Organizational Scale	Government Scale
lines ("Right tree, right place" National Arbor Day Foundation Program)	• Reinforce or relocate critical infrastructure such as power lines to meet performance expectations • Install tree wire	
Build Local Capacity		
• Trim or remove trees that could affect power lines • Promote 72 hour self-sufficiency • Obtain a NOAA weather radio • Obtain an emergency generator	• Trim or remove trees that could affect power lines • Create redundancy • Equip facilities with a NOAA weather radio • Equip vital facilities with emergency power sources	• Support programs such as "Tree Watch" that proactively manage problem areas through use of selective removal of hazardous trees, tree replacement, etc. • Increase communication alternatives • Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. • Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines. • Provide NOAA weather radios to the public
Nature-based Opportunities		
• None identified		

13. WILDFIRE

13.1 HAZARD PROFILE

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.

13.1.1 Hazard Description

Defining the Hazard

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. In general, the following three characteristics define a wildfire (CalOES 2023):

- A free-burning (unplanned) vegetative fire
- Started by an unplanned ignition that may be either natural (e.g., lightning) or human-caused (e.g., power lines, mechanical equipment, discarded cigarettes, escaped prescribed fires, or intentionally set fires) (National Wildfire Coordinating Group 2025)
- With a management objective of full suppression

Wildfires generally spread in three ways (NPS 2025):

- **Ground fires** consume the organic material beneath the surface litter ground, such as a peat or coal seam fire. Tree roots burning could also be classified as ground fire. In peat or coal seams, ground fires may burn for decades and are notoriously difficult to put out as they can move underground.
- **Surface fires** burn loose debris on the surface, which includes dead branches, leaves, and low vegetation.
- **Crown fires** advance from the tops of trees or shrubs more or less independent of a surface fire. Crown fires are sometimes referred to as running or dependent to show that it is either dependent (connected) or independent (not connected) to the surface fire. Crown fires can be passive, active (dependent), or independent. Passive crown fires torch trees but do not pass from tree to tree. Active crown fires are where the surface and crown fire are linked and spreading. Independent crown fires are capable of carrying fire through the trees with no link to a surface fire.

Cause of the Hazard

Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson (CalOES 2023). Fire behavior is based on factors such as the following (CAL FIRE 2025):

- Fuel—Fuel may include living and dead vegetation on the ground, along the surface as brush and small trees, and above the ground in tree canopies. Lighter fuels such as *Arundo donax* and other grasses, leaves, and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs, and trunks take longer to warm and ignite. Trees killed or defoliated by forest insects and diseases are more susceptible to wildfire.

- Weather—Relevant weather conditions include temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere. Conditions are very favorable for extensive and severe wildfires when the temperature is high, relative humidity is low, wind speed is increasing and coming from the east (offshore flow), and there has been little or no precipitation, so vegetation is dry. These conditions occur more frequently inland where temperatures are higher, and fog is less prevalent.
- Terrain—The slope and elevation of a region influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind; potential barriers to fire spread, such as highways and lakes; and elevation and slope of landforms (fire spreads more easily uphill than downhill).

Summary of Potential Impacts

Fire hazards present a considerable risk to vegetation and wildlife habitats. Wildfires can have a significant impact on air quality, especially with prolonged periods of burning combined with climatic conditions. The potential for significant damage to life and property exists in areas designated as "wildland-urban interface areas," where development is adjacent to densely vegetated areas (Volker C. Radeloff 2018). Short-term loss caused by a wildfire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure.

Cascading Hazard Impacts

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Wildfires strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, thus increasing the imperviousness of the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding (CalOES 2023). For more information on landslides and floods, see Section 10: Flood and Section 11: Landslide, Subsidence, and Mass Movement.

13.1.2 Location

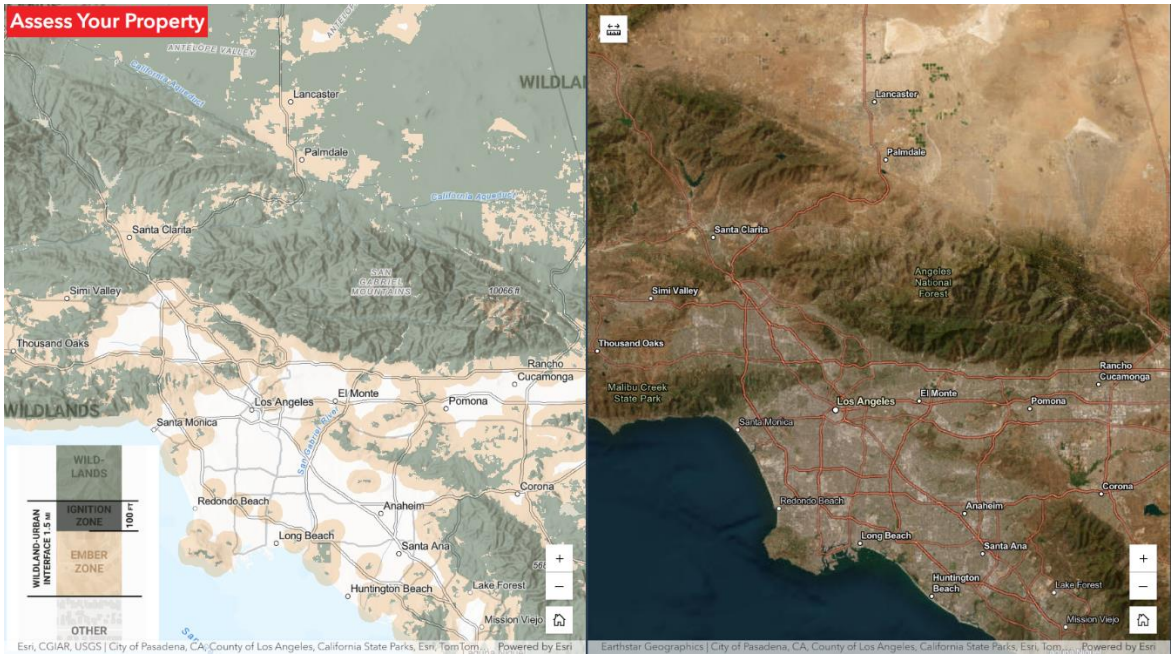
The entirety of the planning area is vulnerable to wildfire. CAL FIRE's Fire and Resource Assessment Program has modeled and mapped wildfire hazard zones using a science-based and field-tested computer model that assigns a fire hazard severity zone (FHSZ) of moderate, high, or very high (CAL FIRE 2025). The FHSZ model is built from existing CAL FIRE data and hazard information based on fuel, weather, terrain, probability of future occurrence, and other factors.

Through the FHSZ model, residents can view where their exact address lies in the different zones. Much of Los Angeles County and the Planning Area are located in the moderate to very high severity zones. Fires in Wildland-Urban Interfaces (WUIs) pose a unique risk due to proximity to human settlements and the type of material being burned (NOAA 2025). The Wildland-Urban Interface (WUI) is the zone of

transition between unoccupied land and human development. It is the line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels (U.S. Fire Administration 2022). Due to the level of urbanization in Los Angeles County,

The WUI Fire Property Awareness Explorer is a mapping tool provided by FEMA through the U.S. Fire Administration that users to search addresses or communities to gain a contextual understanding of their area relative to the WUI and vegetative fuels. The application also includes an assessment of a location's structure density and proximity - important factors to consider for creating fire-adapted communities in the WUI and for developing mitigation plans and outreach campaigns (U.S. Fire Administration 2025). Within the application, areas are split into four categories: Wildlands, Ignition Zone, Ember Zone, and Other. Residents can examine regions or individual addresses using the mapping tool.

Figure 13-1. WUI Fire Property Awareness Explorer View of Los Angeles County.



Source: [WUI Fire Property Awareness Explorer]

The WUI Fire Community Awareness Explorer is an additional tool provided by FEMA through the U.S. Fire Administration. This application provides a quick snapshot of counties or places in the US and potential exposure to wildfire hazards for structures in the WUI. Users interested in building fire-adapted communities and resilience can quickly identify vulnerable structures or areas in the WUI to help inform community risk reduction planning and targeted outreach efforts. Within the application, individual structures can be identified as being in the Wildland Zone, Ember Zone, or Ignition Zone (U.S. Fire Administration 2025).

13.1.3 Extent

Measuring Intensity

The National Fire Danger Rating System allows fire managers to estimate daily fire danger for a given area. Based on the level of fire danger, managers may impose restrictions or closures to public lands, plan for or pre-position staff and equipment to fight new fires and make decisions whether to suppress or allow fires to burn under prescribed conditions (National Park Service 2023).

Five rating levels are used to describe danger levels in public information releases and fire prevention signing (USFS n.d.):

- **Fire Danger Level: Low**—When the fire danger is "low," it means that fuels do not ignite easily from small embers, but a more intense heat source, such as lightning, may start fires in duff or dry rotten wood. Fires in open, dry grasslands may burn easily a few hours after a rain, but most wood fires will spread slowly, creeping or smoldering. Control of fires is generally easy.
- **Fire Danger Level: Moderate**—When the fire danger is "moderate," it means that fires can start from most accidental causes, but the number of fire starts is usually pretty low. If a fire does start in an open, dry grassland, it will burn and spread quickly on windy days. Most wood fires will spread slowly to moderately. Average fire intensity will be moderate except in heavy concentrations of fuel, which may burn hot. Fires are still not likely to become serious and are often easy to control.
- **Fire Danger Level: High**—When the fire danger is "high," fires can start easily from most causes, and small fuels (such as grasses and needles) will ignite readily. Unattended campfires and brush fires are likely to escape. Fires will spread easily, with some areas of high-intensity burning on slopes or concentrated fuels. Fires can become serious and difficult to control unless they are put out while they are still small.
- **Fire Danger Level: Very High**—When the fire danger is "very high," fires will start easily from most causes. The fires will spread rapidly and have a quick increase in intensity, right after ignition. Small fires can quickly become large fires and exhibit extreme fire intensity, such as long-distance spotting and fire whirls. These fires can be difficult to control and will often become much larger and longer-lasting fires.
- **Fire Danger Level: Extreme**—When the fire danger is "extreme," fires of all types start quickly and burn intensely. All fires are potentially serious and can spread very quickly with intense burning. Small fires become big fires much faster than at the "very high" level. Spot fires are probable, with long-distance spotting likely. These fires are very difficult to fight and may become very dangerous and often last for several days.

Warning Time

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when a human-caused wildfire might break out. Since fireworks often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest (CalOES 2023). Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildfires. Adverse weather can be predicted, so special attention can be paid during weather events that may include

lightning. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm (NOAA NWS 2025).

A fire that breaks out and spreads rapidly can require evacuation within days or hours. A fire's peak burning period generally is between 1 p.m. and 6 p.m. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications and social media in recent years has further contributed to a significant improvement in warning time (CalOES 2023).

Worst Case Scenario

The worst-case scenario would include an active fire season throughout the American west, spreading resources thin. Firefighting teams would be exhausted or unavailable. Many federal assets would be responding to other fires that started earlier in the season. While local fire districts would be extremely useful in the urban interface areas, they have limited wildfire capabilities or experience, and they would have a difficult time responding to the ignition zones. Even though the existence and spread of a wildfire might be known, it might not be possible to respond to it adequately, so an initially manageable fire can become out of control before resources are dispatched. Additionally, unpredictable factors like strong winds can rapidly spread wildfires, as seen in the January 2025 Los Angeles fires. For more information on strong winds, see Chapter 12.

13.1.4 Previous Occurrences

Declarations

Federal Disaster Declarations

Between 2019 and 2025, Los Angeles County experienced 12 wildfire-related major disasters (DR) or emergency declarations (EM).

Table 13-1. Federal Wildfire Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
FM-5293-CA	October 10 – October 22, 2019	October 11, 2019	Saddleridge Fire
FM-5296-CA	October 24 – October 29, 2019	October 24, 2019	Tick Fire
FM-5297-CA	October 28 – November 2, 2019	October 28, 2019	Getty Fire
DR-4569-CA	September 4 – November 17, 2020	October 16, 2020	Wildfires
FM-5374-CA	September 13, 2020	September 13, 2020	Bobcat Fire
FM-5537-CA	September 10 – September 24, 2024	September 11, 2024	Bridge Fire
FM-5548-CA	December 10 – December 18, 2024	December 10, 2024	Franklin Fire
FM-5551-CA	January 7, 2025	January 8, 2025	Hurst Fire
FM-5550-CA	January 7, 2025	January 8, 2025	*See Narrative below
FM-5549-CA	January 7, 2025	January 7, 2025	Palisades Fire
DR-4856-CA	January 7 – January 31, 2025	January 8, 2025	Wildfires And Straight-Line Winds

Disaster Number	Incident Period	Declaration Date	Description
FM-5605-CA	August 7, 2025	August 8, 2025	Canyon Fire

Source: (FEMA 2025)

State Declarations

Between 2019 and 2025, California included Los Angeles County in four state-proclaimed wildfire disasters.

Table 13-2. State Wildfire Disaster Declarations

Disaster Number	Declaration Date	Description
N-22-21 (statewide)	August 18, 2020	Fires - River, Jones, LNU Lightning Complex, Weather Conditions
N-81-20	September 25, 2020	Fire - Slater, Bobcat, Oak
N-4-24	September 11, 2024	Airport and Bridge Fires
Multiple	January 7, 2025	Los Angeles County Fires and Windstorm Event

Source: (Cal OES 2025)

USDA Declaration

There were no USDA declarations related to wildfire for Los Angeles County between 2019 and 2025 (U.S. Department of Agriculture 2025).

Summary of Significant Events

The following are significant events involving wildfire in Los Angeles County (Los Angeles Regional Fire Safe Council 2025) .

On July 20, 1960 the Johnstone Fire started in the Angeles National Forest and spread rapidly over dry chaparral vegetation. Overall, 23,170 acres of land burned and forest research facilities and cabins were destroyed. Recovery efforts included the introduction of non-native grass species to replace fire-prone chaparral grasses.

The Canyon Inn Fire (also called Canyon Fire) started on August 23, 1968, due to Santa Ana winds in the mountains adjacent to Azusa, California. The fire burned rapidly over 22,197 acres of land, including onto the Angeles National Forest. Four juvenile firefighters were trapped in the blaze, which triggered a re-evaluation of the LA County juvenile fire program (Wildland Fire Lessons Learned Center n.d.).

The Palisades fire started on January 7, 2025 and burned 23,448 acres, including many homes and businesses in Pacific Palisades. Concurrently, the Eaton fire started on January 7, 2025 around the community of Altadena, affecting many homes and businesses in neighborhoods adjacent to the NASA Jet Propulsion Laboratory (JPL). The Eaton fire burned a total of 14,021 acres (NASA 2025).

Recent Events

The following are wildfire events that affected Los Angeles County from 2020 to 2025 (NOAA NCEI 2025).

Table 13-3. NOAA NCEI Wildfire Disaster Declarations

Incident Period	Event Name	Description
July 1 – 5, 2020	Rowher Fire	The Rowher fire scorched 648 acres in the Angeles National Forest, north of the community of Aqua Dulce.
July 5 – 10, 2020	Soledad Fire	The Soledad Fire scorched 1,525 acres in the Angeles National Forest, near the community of Aqua Dulce.
July 27, 2020	Ridge Fire	The Ridge Fire scorched 310 acres in the mountains of Los Angeles County, near Highway 138. One home was destroyed by the fire.
August 12 – 31, 2020	Lake Fire	The Lake Fire burned 31,089 acres in the Angeles National Forest, northeast of the community of Azusa. In total, twelve structures were destroyed and another three were damaged. Four firefighter injuries were reported.
August 13 – 28, 2020	Ranch 2 Fire	The Ranch 2 Fire burned 4,237 acres in the Angeles National Forest. No structures were destroyed, but eight firefighter injuries were reported.
September 6 – 28, 2020	Bobcat Fire	The Bobcat Fire burned 115,796 acres in the mountains of Los Angeles County as well as the foothills of the Antelope Valley and San Gabriel Valleys. The combination of hot temperatures, very dry vegetation and some offshore winds allowed the fire to grow significantly. Overall, 87 homes were destroyed and 28 more homes were damaged.
June 15 – 26, 2024	Post Fire	The Post Fire burned 15,563 acres across the Interstate 5 Corridor in far northeastern Ventura County and far northwestern Los Angeles county. Two structures were destroyed.
September 8 – 27, 2024	Bridge Fire	The Bridge Fire burned 54,878 acres of the Angeles National Forecast in the Eastern San Gabriel Mountains. In the fire, 81 structures were destroyed and another 17 were damaged.
January 7 – 31, 2025	Palisades Fire	The Palisades Fire burned 23,707 acres across the Santa Monica Mountains and the Malibu coastal strip. The wildfire ignited during an extreme fire weather event with PDS Red Flag Warnings in effect. The combination of wind gusts in excess of 80 MPH and critically dry vegetation allowed the fire to grow explosively. The fire completed destroyed the community of Pacific Palisades and part of the community of Malibu. Throughout the fire, 6,837 structures were destroyed and another 973 structures were damaged, including many residences. Twelve civilian deaths, three civilian injuries and one firefighter injury were reported.
January 7 – 31, 2025	Eaton Fire	* See narrative below.

Incident Period	Event Name	Description
January 7 – 16, 2025	Hurst Fire	The Hurst Fire burned 799 acres in the foothills of the Western San Fernando Valley.
January 9 – 12, 2025	Kenneth Fire	The Kenneth Fire burned 1.052 acres in the valley foothills of Ventura and Los Angeles counties.

Source: (Cal OES 2025), (FEMA 2025), (NOAA NCEI 2025)

The Eaton Fire, January 2025

The wildfire having the biggest impact on the FMWD service area was the Eaton Fire that occurred in January of 2025. The Eaton Fire in Southern California's San Gabriel Mountains, was the second most destructive wildfire in California state history. Fueled by hurricane-force Santa Ana winds, the Eaton Fire burned over 14,000 acres, killed at least 19 people, and destroyed more than 9,000 buildings and damaged over 1,000 structures across foothill communities like Altadena.

The Foothill Municipal Water District (FMWD) along with its member agencies that service the Altadena area suffered both immediate (service loss and water safety issues) and long term (infrastructure damage and financial strain) impacts from this fire. FMWD itself remained operational as a wholesaler, but its member agencies, especially in Altadena, experienced catastrophic system damage, turning the event into both a water infrastructure crisis and a long-term financial and recovery challenge. Key impacts included:

- Reservoirs:
  - Multiple reservoirs damaged; some had roofs burned and collapsed into the water
  - In Altadena alone, 7 of 23 reservoirs were damaged
- Pump stations & treatment facilities:
  - Damage to pump stations, tanks, and electrical equipment
- Distribution system:
  - Broken or melted pipes, meters, service lines, and communication systems
- Member agency impacts:
  - Three primary Altadena systems sustained “significant damage” affecting both drinking water supply and fire protection
  - Los Flores Water Company: lost ~74% of service connections
  - Lincoln Avenue Water Company: lost ~55% of service connections
  - Rubio Cañon: lost ~35% of service connections

These impacts reduced system capacity and limited the ability to deliver water for both daily use and firefighting.

One of the more critical impacts on the Altadena area was the loss of safe drinking water. The fire caused system depressurization (due to firefighting demand, leaks, and destroyed connections). This allowed contaminants like benzene and other VOCs to enter pipelines, making the water unsafe to drink. Authorities issued region wide “Do Not Drink / Do Not Boil” orders for Altadena and surrounding

areas. Systems required re-pressurization, flushing, and extensive water testing before service could be restored. For FMWD and its member agencies, this meant shifting from water delivery to emergency public health response and recovery.

The 2025 Los Angeles wildfires (including the Eaton and Palisades fires) fundamentally changed how engineers, utilities, regulators, and the public view wildfire risk to water systems. Before 2025, wildfire impacts on water were often seen as secondary or localized; afterward, they are now understood as systemic, long-lasting, and high-consequence risks. This change highlights the importance of hazard mitigation planning for water utilities.

13.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

Probability

In Southern California, high grass fuel loads and drying conditions have raised the risk for large fires across fuel types, including timber and coastal grasses (CAL FIRE 2025). Additionally, a lengthened fire season; removal of older, larger trees; and massive tree die-offs may cause fires in mixed-conifer forests to continue to grow in both size and intensity (CalOES 2023).

According to CAL FIRE, the State of California has experienced 7,689 wildland fire events from January to early November 2025. The five-year average is 6,881 wildfires per year. In addition to providing annual statistics, CAL FIRE also provides a yearly fire season outlook for the northern and southern regions of the State. According to this outlook, fire potential across California is expected to increase steadily through summer, driven in Southern California by persistent drought, high grass loads, and weakening coastal moisture (CAL FIRE 2025).

Climate Change

According to California's Fourth Climate Change Assessment, if GHG emissions continue to rise, California is likely to see a 50 percent increase in fires larger than 25,000 acres and a 77 percent increase in average area burned by 2100 (CA 2018). Numerous climactic drivers will influence wildfire risk differently between California regions:

- Increasing Temperatures: Wildfire risk in the San Francisco Bay Area is rising in tandem with increasing temperatures. Further upstate, in the Sacramento, Sierra Nevada, and North Coast regions, forests that experience drought are also more susceptible to wildfire. High heat not only influences fire risk directly but can also produce indirect impacts. For instance, in the San Joaquin Valley, where fire hazard is typically low, warming temperatures will likely worsen air quality due to extended agriculture fallowing. This, in turn, can exacerbate health impacts from wildfire smoke (CalOES 2023).
- Shifting Wind Patterns: The Santa Ana, Sundowner, and Diablo winds will continue to shape wildfire activity across Southern, Central, and Northern California, respectively. Modelers are still working to determine how these wind events will be impacted by climate change (CA 2018).

- Shifting Water Patterns: Climate change will cause shifting water patterns that can impact wildfire risk across the State. In the inland desert, the potential weakening of the North American Monsoon signal could reduce the threat of fire starts due to lightning. Changing patterns of rainfall will impact plant growth in the desert, thereby altering the amount of fuel for fires. Mediterranean ecosystems along the central coast have a similar response to water availability since they are situated in a transition zone. In Southern California and San Diego, meanwhile, changing precipitation will factor heavily into post-fire risk assessments since these landscapes are especially vulnerable to post-fire flooding and landslides (CalOES 2023).
- Shifting Insect Habitat: Bark beetle infestations are rising in response to the changing climate, increasing tree mortality—particularly in the southern Sierra Nevada —and reducing carbon storage (CalOES 2023).
- Human Impacts: Across all of California's landscapes human factors, such as development patterns and risk mitigation strategies, will have a direct impact on communities' ability to mitigate and adapt to the impacts of climate change. Local decisions are a large factor in determining the future health of a community (CalOES 2023).

Potential Future Impacts

Due to climate change and pre-existing risk for wildfire, the Foothill Municipal Water District will likely continue to face significant wildfire risk through the foreseeable future. This risk is expected to increase as development increases, increasing the surface area of WUI in the Planning Area. Preventative measures such as vegetation management and fireproofing buildings in public spaces as well as increasing public education on safety procedures in the event of a wildfire will be essential to guaranteeing public health and safety in the future.

13.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

13.2.1 Summary of Vulnerability

For the vulnerability assessment of this hazard, the entire Planning Area has been considered to be exposed to wildfire impacts, either by direct impacts, or cascading impacts from wildfires within the region. There are currently no models available to measure direct impacts from wildfire risks, therefore, for this qualitative assessment on vulnerability has been associated with exposure to the mapped wildfire hazard severity zones.

13.2.2 Impact on the Economy

All community lifelines located in the FHSZ are exposed and vulnerable to the wildfire hazard and are likely to experience functional downtime following wildfire events that could increase the overall impact of such events. Wildfires can have an impact on water supplies because of residual pollutants like char or debris landing in water resources which can clog wastewater pipes, culverts, etc.

See Volume 2 for estimated exposure of each Planning Partner to the wildfire hazard.

13.2.3 Change in Vulnerability Since Prior HMP

The only participating jurisdiction that has a prior HMP is Crescenta Valley Water District. Refer to the CVWD annex in Volume 2.

13.3 MITIGATION OPPORTUNITIES

Table 13-4 presents a range of potential opportunities considered by the Planning Partnership for mitigating the wildfire hazard.

Table 13-4. Potential Opportunities to Mitigate the Wildfire Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• Clear potential fuels on property such as dry overgrown underbrush and diseased trees	• Clear potential fuels on property such as dry overgrown underbrush and diseased trees	• Clear potential fuels on property such as dry overgrown underbrush and diseased trees • Implement best management practices on public lands
Reduce Exposure and Vulnerability		
• Create and maintain defensible space around structures and provide water on site • Locate outside of hazard area • Maintain trimmed trees and grass • Use fire-resistant building materials	• Create and maintain defensible space around structures and infrastructure and provide water on site • Locate outside of hazard area • Use fire-resistant building materials • Use fire-resistant plantings in buffer areas of high wildfire threat	• Create and maintain defensible space around structures and infrastructure • Locate outside of hazard area • Enhance building code to include use of fire-resistant materials in high hazard area • Use fire-resistant plantings in buffer areas of high wildfire threat • Consider higher regulatory standards (such as Class A roofing) • Establish biomass reclamation activities • In high-risk areas, use heat-resistant materials like welded

Community Scale	Organizational Scale	Government Scale
		steel, and avoid heat-susceptible materials like polyvinyl chloride and high-density polyethylene
Build Local Capacity		
• Employ techniques from the National Fire Protection Association's Firewise Communities program to safeguard home • Identify alternative water supplies for firefighting • Install/replace roofing material with non-combustible roofing materials	• Support Firewise community initiatives • Create/establish stored water supplies to be utilized for firefighting	• More public outreach and education efforts, including an active Firewise program • Identify fire response and alternative evacuation routes • Seek alternative water supplies • Become a Firewise community • Use academia to study impacts/solutions to wildfire risk • Establish/maintain mutual aid agreements between fire service agencies • Develop, adopt, and implement integrated plans for mitigating wildfire impacts in wildland areas bordering on development • Consider the probable impacts of climate change on the risk associated with the wildfire hazard in future land use decisions • Provide incentives for existing structures to be hardened against wildfire • Use tools to detect, forecast, and take action ahead of wildfire
Nature-based Opportunities		
• Manage invasive species that are susceptible to increased wildfire risk • Create riparian corridors in wildfire hazard areas as fire breaks • Incorporate nature-based wildfire risk reduction buffers into existing ecosystem-friendly land uses (e.g., green space, trains, or parks)		

14. OTHER HAZARDS OF INTEREST

After reviewing the existing local plans and considering options for other hazards of interest to address, the SC selected a limited number of hazards of interest to include in the MJHMP.

The sections below provide short profiles of each hazard of interest, including a qualitative discussion of their potential impact in the Planning Area. No formal risk assessment was performed, no mitigation actions have been developed to address them, and the hazards are not included in the risk ranking. However, all Planning Partners for this plan should be aware of these hazards and take steps to reduce the risks they present whenever it is practical to do so.

14.1 CYBERSECURITY

14.1.1 Overview

A cyberattack is an intentional and malicious crime that compromises the digital infrastructure of a person or organization. Generally, attacks last minutes to days, but large-scale events and their impacts can last much longer. As information technology continues to grow in capability and interconnectivity, cyberattacks become increasingly frequent and destructive.

Cyberattacks can lead to loss of money, theft of personal information, and damage to personal reputation and safety. Motives range from the pursuit of financial gain to political or social aims. Attack types include using viruses to erase entire systems, breaking into systems and altering files, using someone's personal computer to attack others, or stealing confidential information. Such threats having a wide range of effects on individuals, communities, and organizations.

Computer systems can experience a variety of cyberattacks, from blanket malware infection to targeted attacks on system capabilities. Cyberattacks seek to breach information technology security measures designed to protect an individual or organization. Organizations are prone to different types of attacks that can be either automated or targeted.

14.1.2 Identified Cybersecurity Hazards

Table 14-1 describes the most common cyberattack mechanisms faced by organizations today.

Table 14-1. Common Types of Cybersecurity Attacks

Type	Description
Cross-Site Scripting	An attack that sends malicious scripts into content from reliable websites.
Denial of Service Attack	An attack that focuses on disrupting service to a network in which attackers send high volumes of data until the network becomes overloaded and can no longer function.
Internet of Things Attacks	Internet connectivity across commonly used devices presents a growing number of access points for attackers to exploit. The interconnectedness of things makes it possible for attackers to breach an entry point and use it as a gate to exploit other devices in the network.
Malware	"Malware" refers to various types of attacks, including spyware, viruses, and worms. Malware uses a vulnerability to breach a network when a user clicks a planted

Type	Description
	dangerous link or email attachment, which is used to install malicious software inside the system.
Man in the Middle	Man-in-the-middle attacks mirror victims and endpoints for online information exchange. In this type of attack, the attacker communicates with the victims, who believe they are interacting with a legitimate endpoint website. The attacker is also communicating with the actual endpoint website by impersonating the victim. As the process goes through, the attacker obtains entered and received information from both the victim and endpoint.
Password Attacks	Passwords are the most widespread method of authenticating access to a secure information system, making them an attractive target for cyber attackers. By accessing a person's password, an attacker can gain entry to confidential or critical data and systems, including the ability to manipulate and control them.
Phishing	Malicious email messages that ask users to click a link or download a program. Phishing attacks may appear as legitimate emails from trusted third parties.
Rootkits	Rootkits are installed inside legitimate software, where they can gain remote control and administration-level access over a system. The attacker then uses the rootkit to steal passwords, keys, and credentials and retrieve critical data.
SQL Injection	This occurs when an attacker inserts malicious code into a server using server query language (SQL), forcing the server to deliver protected information. This type of attack usually involves submitting malicious code into an unprotected website comment or search box.
Zero-day Exploit	A zero-day exploit refers to exploiting a network vulnerability when it is new and recently announced—before a patch is released and/or implemented.

14.1.3 Past Events

While no publicly documented cybersecurity incidents were identified specific to the Foothill Municipal Water District or its member agencies, recent events across Los Angeles County and comparable California utilities, such as the 2024 Los Angeles municipal cyberattack and ransomware incidents affecting regional water districts, demonstrate that water infrastructure is an increasingly frequent target of cyber threats. These events highlight vulnerabilities in customer service systems, operational technology, and third-party vendors that are directly applicable to the FMWD service area.

14.1.4 Location and Extent

This hazard is not geography-based. Attacks can originate from any computer to affect any other computer in the world. If a system is connected to the Internet or operating on a wireless frequency, it is susceptible to exploitation. Cybersecurity concerns have risen in recent years with the large number of people working remotely. Targets of cyberattacks can be individual computers, networks, organizations, business sectors, or governments. Financial institutions and retailers are often targeted to extract personal and financial data that can be used to steal money from individuals and banks. The most affected sectors are finance, energy and utilities, and defense and aerospace, as well as communication, retail, and health care. Both public and private operations are threatened on a near-daily basis by the engineered cyberattacks developed to automatically seek technological vulnerabilities.

Cybercrimes inflict damages in the trillions of dollars each year globally, which is much larger than the annual damage from natural disasters.

14.2 BIOTERRORISM

14.2.1 Overview

Bioterrorism is the intentional release of biological agents, such as bacteria, viruses, or toxin, to cause illness, death, or disruption in human, animal, or plant populations.

Within a water utility context, the primary concern is the intentional contamination of drinking water sources, treatment systems, storage facilities, or distribution networks. While large-scale contamination is technically challenging due to treatment and monitoring systems, even limited incidents can cause significant public fear, service disruption, and economic impacts.

14.2.2 Identified Bioterrorism Hazards

Bioterrorism threats are typically categorized by the CDC into three tiers based on severity, transmissibility, and impact:

- Category A (Highest Severity)—Easily disseminated and high mortality rates. Examples include anthrax (bacillus anthracis), botulism toxin, plague (yersinia pestis), smallpox, and viral hemorrhagic fevers (e.g., Ebola).
- Category B (Moderate Severity)—Moderately easy to disseminate, lower mortality. Examples include waterborne pathogens such as vibrio cholerae (cholera), salmonella, e. coli, shigella, and cryptosporidium.
- Category C (Emerging Threats)—Emerging pathogens that could be engineered for mass dissemination. Examples include Nipah virus, hantavirus, and novel influenza strains.

14.2.3 Past Events

There are no documented instances of bioterrorism affecting the Foothill Municipal Water District service area. While isolated incidents of bioterrorism have occurred in the United States, these events have not involved municipal drinking water systems. However, cybersecurity incidents and disaster-related contamination events demonstrate that water infrastructure remains a potential target and could experience similar impacts if intentionally compromised. As such, bioterrorism remains a low-probability but high-consequence hazard in the Planning Area.

14.2.4 Location

There exists potential (though unlikely) contamination of water supplies or aerosols near infrastructure including reservoirs, storage tanks, and distribution system access points.

14.3 TERRORISM/MASS GATHERING

14.3.1 Overview

Terrorism related to mass gatherings involves intentional acts of violence targeting large crowds at public or semi-public events such as sporting events, festivals, concerts, and civic celebrations. These events are considered "soft targets" because they are often open, accessible, and difficult to fully secure.

Federal guidance indicates that large public gatherings remain attractive targets for violent extremists due to their potential for mass casualties, economic disruption, and high media attention.

Mass gathering hazards also include secondary effects, such as panic, crowd crushes, and strain on emergency services, even if an attack is limited in scope.

14.3.2 Identified Terrorism/Mass Gathering Hazards

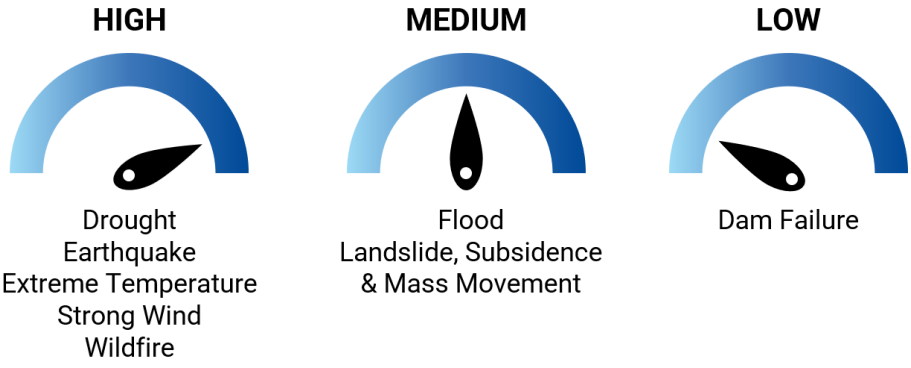
The Foothill Municipal Water District planning area is exposed to terrorism risks associated with mass gatherings, particularly due to its proximity to major regional venues such as the Rose Bowl Stadium in Pasadena. Large public events present attractive targets for violent actors due to high attendance, visibility, and limited security in surrounding areas. The most likely attack methods include vehicle-based attacks, firearms, and small-scale explosive devices. Although the likelihood of occurrence is low to moderate, the potential consequences, particularly in terms of life safety, economic disruption, and cascading impacts to critical infrastructure, are high.

14.3.3 Past Events

There are no documented successful terrorism attacks affecting mass gatherings within the FMWD Planning Area. However, there was a recent near-miss incidents when a driver attempted to run a vehicle into spectators along the 2024 Rose Parade route in Pasadena.

15. HAZARD RANKING

The prioritization of natural hazards in the Planning Area is based on the Priority Risk Index (PRI), a tool used to measure relative risk. The PRI helps the Planning Partnership identify which hazards pose the greatest threat. Results are shown below.



The PRI assigns a numerical score to each hazard, allowing them to be compared and ranked (higher values indicate greater risk). Scores are calculated using five categories: probability, impact, spatial extent, warning time, and climate change. Each category is assigned a risk value (1 to 4) and a weighting factor.

The PRI is calculated as follows:

PRI = (Probability × 0.30) + (Impact × 0.30) + (Spatial Extent × 0.20) + (Warning Time × 0.10) + (Climate Change × 0.10)

The maximum possible PRI score is 4.0. Table 15-1 shows the weighting schemes for each category. Weighting factors are typical for hazard mitigation planning, though Planning Partners may adjust them as needed. Final hazard rankings for each Planning Partner are included in the jurisdictional annexes (Volume 2). This approach enables consistent comparison of hazards across the planning area.

Many PRI categories are described in the hazard profiles. Hazards are assigned rankings based on their resulting PRI scores as outlined below:

- PRI Value 1 to 1.9 = Low Hazard Risk Ranking
- PRI Value 2.0 to 2.9 = Medium Hazard Risk Ranking
- PRI Value 3.0 to 4.0 = High Hazard Risk Ranking

The final PRI results for each hazard in the Planning Area are in

Table 15-2.

Table 15-1. Priority Risk Index Scoring Criteria

	Degree of Risk	

PRI Category	Level	Criteria	Index Value	Assigned Weighting Factor
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 90% annual probability	3	
	Highly Likely	90%+ annual probability	4	
Impact	Minor	Between 1 and 10% of service area population and/or assets impacted	1	30%
	Limited	Between 10 and 30% of service area population and/or assets impacted	2	
	Critical	Between 30 and 50% of service area population and/or assets impacted	3	
	Catastrophic	More than 50% of service area population and/or assets impacted	4	
Spatial Extent	Negligible	Limited to one specific area.	1	20%
	Small	Small areas affected.	2	
	Moderate	Large areas affected.	3	
	Large	All areas affected.	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Climate Change	Decreasing Risk	Climate change is likely to result in a decrease in the frequency and/or severity of hazard events.	1	10%
	No Impact	Climate change is not expected to impact frequency and/or severity of hazard events.	2	
	Risk Unknown	Not enough data currently exists to make accurate projections on the impact of climate change on hazard events.	3	
	Increasing Risk	Climate change is likely to result in an increase in the frequency/severity of hazard events.	4	

Table 15-2. Planning Area Hazard Risk Ranking Summary

Hazard	Weighted Risk Factors					PRI	Risk Ranking
	Probability	Impact	Spatial Extent	Warning Time	Climate Change		
Dam Failure	.3	.3	.4	.1	.3	1.4	Low
Drought	1.2	1.2	.8	.1	.4	3.7	High
Earthquake	1.2	1.2	.8	.4	.3	3.9	High
Extreme Temperature	1.2	1.2	.8	.1	.4	3.7	High
Flood	1.2	.3	..4	.1	.4	2.4	Medium
Landslide, Subsidence & Mass Movement	.6	1.2	.4	.1	.3	2.6	Medium
Strong Wind	1.2	1.2	.8	.1	.4	3.7	High
Wildfire	1.2	1.2	.8	.1	.4	3.7	High

16. MITIGATION STRATEGY

16.1 REVIEW OF PREVIOUS MITIGATION ACTIONS

Local Plan Requirement E2 – 44 CFR Part 201.6(d)(3)

The plan must document how the plan was reviewed and revised to document changes in development, progress in mitigation efforts, and changes in priorities.

The 2026 FMWD MJHMP is an initial planning effort for all the Planning Partners except Crescenta Valley Water District (CVWD). Please see CVWD's annex in Volume 2 of this plan for a review of previous mitigation actions and a status update.

Actions that were in progress or had no progress were evaluated to determine whether they should be discontinued or carried forward into the 2026 MJHMP. Actions may be discontinued if they are duplicative, unfeasible, or if the original problem no longer exists. Actions retained in the updated mitigation strategy were evaluated and revised, as needed, to reflect new information identified during the plan update (e.g., changes in risk, capabilities, or funding sources).

16.2 MITIGATION GOALS

Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(i)

The mitigation strategy must include a description of mitigation goals to reduce or avoid long-term vulnerabilities to identified hazards.

Mitigation goals are broad statements that align with the hazards identified in the MJHMP and achieved through specific mitigation actions. The PC developed mitigation goals using the 2021 CVWD HMP as a foundation and refined to reflect the priorities of the Planning Partnership. The resulting goals for this MJHMP are outlined below:

- **Goal 1.** Protect the integrity of district assets from impacts to the quality of life and property.
- **Goal 2.** Maintain continuity of essential water services.
- **Goal 3.** Increase whole community awareness of the risks of loss of service.
- **Goal 4.** Facilitate partnerships with recognized stakeholders within the planning area and implement a coordination plan between the stakeholders.
- **Goal 5.** Protect water supply resources.
- **Goal 6.** Protect against environmental consequences caused by system failure initiated by natural hazards

Goals are directly linked to the mitigation actions identified in each jurisdictional annex in Volume 2.

16.3 MITIGATION ALTERNATIVES

Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(ii)
The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effect of each hazard, with particular emphasis on new and existing buildings and infrastructure.

A range of potential mitigation opportunities is included in each hazard risk assessment (refer to Chapters 6 through 13). The potential actions are categorized by:

- Who may implement the action:
  - Community scale (individuals or groups)
  - Organizational scale (businesses, non-profits, community-based organizations)
  - Government scale (any government agency that has permit authorities and police powers within the planning area)
- What the alternative would do:
  - Manipulate the hazard (actions to prevent hazard events from occurring)
  - Reduce exposure and vulnerability (actions to safeguard people, property, and the environment from the impacts of the hazard)
  - Build local capacity (actions to improve abilities to mitigate and respond to hazard events)
  - Use nature-based solutions (actions that use green solutions to mitigate the hazard and provide additional environmental services)

16.4 DEVELOPING MITIGATION ACTIONS

Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(ii)	Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(iii)
The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effect of each hazard, with particular emphasis on new and existing buildings and infrastructure.	*The hazard mitigation strategy shall include an action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction.*

Each jurisdiction reviewed the results of the risk and capability assessments, previous mitigation strategy, mitigation goals, catalogs of mitigation alternatives and selected actions to be included in their mitigation strategy in their jurisdictional annexes.

16.5 PRIORITIZING MITIGATION ACTIONS

Local Plan Requirement E2 – 44 CFR Part 201.6(d)(3)	Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(iii)
The plan must document how the plan was reviewed and revised to document changes in development, progress in mitigation efforts, and changes in priorities.	*The hazard mitigation strategy shall include an action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction.*

The Planning Partnership followed the same prioritization method used in the 2023 California State HMP as described in Volume 2 of this plan.

16.6 MITIGATION ACTION CATEGORIZATION

The identified mitigation actions are classified by the following action types.

- **Local Plans and Regulations**—Government, administrative or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. Includes planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Emergency Services**—Actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, and the protection of essential facilities.
- **Structure and Infrastructure Projects**—Modification of buildings or structures to protect them from a hazard or removal of structures from a hazard area. Includes acquisition, elevation, relocation, and structural retrofit.
- **Education and Awareness Programs**—Actions to inform residents and elected officials about hazards and ways to mitigate them. Includes outreach projects, real estate disclosure, hazard information centers, and school-age and adult education.
- **Natural Systems Protection**—Actions that minimize hazard loss and preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, wetland restoration and preservation, and green infrastructure.
- **Climate Resiliency**—Actions that incorporate methods to mitigate and/or adapt to the impacts of climate change. Includes aquifer storage and recovery activities, incorporating future conditions projections in project design or planning, or actions that specifically address jurisdiction-specific climate change risks, such as sea-level rise or urban heat island effects.
- **Community Capacity Building**—Actions that increase or enhance local capabilities to adjust to potential damage, to take advantage of opportunities to build capacity, or to respond to consequences of insufficient capacity. Includes staff training, memorandums of understanding, development of plans and studies, and monitoring programs.

17. ADOPTING AND MAINTAINING THE MITIGATION PLAN

17.1 PLAN ADOPTION

Local Plan Requirement F1 – 44 CFR Part 201.6(c)(5)

The plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan.

DMA compliance and its benefits can only be achieved after the Plan is adopted. For multi-jurisdictional plans, each jurisdiction requesting approval must document that has been formally adopted. District Board adopt this plan after receiving a letter of approval pending adoption from FEMA Region 9. Copies of the FEMA approval and Planning Partner resolutions adopting this plan can be found in Appendix F of this volume.

17.2 PLAN MAINTENANCE

This section describes a formal plan maintenance process to ensure that the hazard mitigation plan remains an active and relevant document. Foothill Municipal Water District will take the lead on monitoring, evaluating, and updating the MJHMP over the 5-year performance period. Table 17-1 summarizes this plan maintenance strategy. The sections below further describe each element.

Table 17-1. Plan Maintenance Matrix

Approach	Timeline	Lead Responsibility
Plan Monitoring		
Track the implementation of plan actions	Continuous	All Planning Partners will report annually or in alignment with potential grant opportunities to the Foothill Municipal Water District AGM/District Engineer on action implementation. Points of contact are listed in Volume 2.
Plan Evaluation		
Review the status of previous actions; assess changes in risk; evaluate success of integration	Upon initiation of hazard mitigation plan update, comprehensive General Plan update, or major disaster	All Planning Partners
Grant Notification		
FMWD will notify Planning Partners of grant funding opportunities to fund actions identified in this plan	Continuous, as grants become available	Foothill Municipal Water District AGM/District Engineer
Plan Update		
Initiate the process to comprehensively update the plan at least every 5 years.	At the end of year 3, coordinate with the Planning Partners, and work to identify grant funding opportunity for update. Obtain grant funding by the end of year 4.	Foothill Municipal Water District will lead the plan update. All Planning Partners will support the effort.

Approach	Timeline	Lead Responsibility
Integration into Other Planning Mechanisms		
Create a linkage between the hazard mitigation plan and individual agency's plans identified in the core capability assessments	Continuous	All Planning Partners
Continuing Public Involvement		
Maintain and update FMWD's website with relevant hazard mitigation information and public participation opportunities.	Continuous	Foothill Municipal Water District AGM/District Engineer will lead continuing public participation. All Planning Partners will support the effort.

17.2.1 Integrating the Plan

Local Plan Requirement D3 – 44 CFR Part 201.6(c)(4)(ii)

The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

The Planning Partners will integrate this MJHMP into relevant decision-making processes, plans, or mechanisms, where feasible. This includes integrating the requirements of the MJHMP into other planning documents, processes, or mechanisms, such as strategic planning initiatives, master plans, local capital improvement plans, stormwater plans, emergency operation plans, and other future plans. Opportunities to integrate the requirements of this plan into other planning mechanisms shall continue to be identified through future planning efforts. The Planning Partnership outlined the following mechanisms underway and under consideration:

- Ensuring that the goals and mitigation actions of new and updated local planning documents are consistent, or do not conflict with, the goals and actions of the hazard mitigation plan, and will not contribute to increased hazard vulnerability in the planning area.
- Integration of the hazard mitigation plan will be considered on a case-by-case basis and identified at the onset of plan development.
- Integration of the hazard mitigation plan into the capital improvement program scoring criteria (e.g., does the project advance mitigation) will be implemented if deemed feasible.

17.2.2 Implementing the Hazard Mitigation Plan Through Existing Programs

To successfully reduce future losses, implementing the actions within this plan is highly recommended. The Planning Partners involved a wide range of staff in the plan development process and many departments, divisions, or other partners participating in the Plan are responsible for implementing specific mitigation actions identified by each jurisdiction. Every proposed action listed in the mitigation action plan is assigned to a specific "lead" department or partner in order to assign responsibility and accountability and increase the likelihood of implementation.

In addition to the assignment of a local lead department or partner, an implementation time period or a specific implementation date has been assigned in order to assess whether actions are being implemented in a timely fashion. The Planning Partners will seek outside funding sources to implement

mitigation projects in both the pre-disaster and post-disaster environments. When applicable, specific potential funding sources have been identified for proposed actions listed in the mitigation action plan.

The Planning Partnership will meet once annually during the five-year performance period of this Plan. This frequency of meeting will also assist in implementation tracking, as meetings will be coordinated with the strategic planning process. A key agenda item will be to determine which actions are being implemented by members of the Planning Partnership and potentially where technical assistance may be needed to advance action implementation.

17.2.3 Ongoing Public Involvement

Local Plan Requirement D1 – 44 CFR Part 201.6(c)(4)(iii)

The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

Public participation is an integral component to the mitigation planning process and will continue to be essential as this plan evolves over time. Public involvement procedures were reviewed as part of the 2026 MJHMP development process. Significant changes or amendments to the plan shall require an opportunity for public comment prior to any adoption procedures by the Planning Partners. In addition, the Planning Partners intend to regularly post information about hazard and risk assessment on their communication channels (e.g., social media, webpages, etc.). These efforts are led by the Foothill Municipal Water District AGM/District Engineer. The County also maintains a hazard mitigation planning website that can be used to provide updates and post the most current version of the plan:

https://www.fmwd.com/hazard-mitigation-plan

By keeping the plan available on the District website with an invitation and instructions on providing feedback, public access and awareness will be maintained on a continuous basis. Public comment opportunities will be provided during any process to revise or update the plan, prior to jurisdictional approval and/or adoption. Other efforts to involve the public in the maintenance, monitoring, evaluation, and revision process will be made as necessary. These efforts may include the following:

- Posting minutes from Planning Partnership meetings to the District hazard mitigation website
- Utilizing available Planning Partner communication channels to update the public on any maintenance and/or periodic review activities taking place
- Keeping a current version on the hazard mitigation plan at Planning Partner facilities and on the District webpage

Additionally, continued public involvement will be accomplished through implementation of mitigation actions. This includes locally identified mitigation actions to enhance and expand outreach.

17.2.4 Monitoring the Plan

Local Plan Requirement D2 – 44 CFR Part 201.6(c)(4)(i)

The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a 5-year-cycle.

Periodic revisions and updates of the Plan are required to ensure that the goals of the Plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance with applicable federal and state regulations. Periodic monitoring and evaluation of the plan will also ensure that specific mitigation actions are being reviewed and carried out according to the mitigation action plan. Monitoring refers to tracking the implementation of the plan over time. Evaluating refers to assessing the overall effectiveness of the plan intent and goals.

The Planning Partnership shall meet once annually to monitor and evaluate the progress attained and to revise, where needed, the activities set forth in the plan. The Foothill Municipal Water District AGM/District Engineer will be responsible for reconvening the Planning Partnership for these reviews. Plan maintenance meeting agenda templates are included in Appendix E.

The annual meetings provide the Planning Partnership with an opportunity to perform the following:

- Review plan goals.
- Document hazard occurrences that occurred during the prior year and their impacts on the Planning Area.
- Document mitigation action implementation or status.
- Evaluate the mitigation actions that have been successful.
- Discuss why mitigation actions were not completed.
- Revise the action plan if new timelines need to be established for projects (e.g., changing a long-term project to a short-term project because of funding availability).
- Consider recommendations for new mitigation projects.
- Review new funding options, including grant opportunities, and determine if contract grant-writing support is needed to pursue the opportunities.
- Document potential losses avoided due to the implementation of specific mitigation measures or other planning programs, if feasible.
- Identify any new or additional vulnerabilities that may be faced by the Planning Partnership and may need to be addressed in a future update of this plan.
- Update the hazard mapping and impact tool to reflect new or revised hazard data.

Any findings or recommendations made during the annual review shall be documented in the form of a memo that can be shared with the governing bodies of the participating jurisdictions and interested stakeholders, including the public, through the website. Further, mitigation action progress can be monitored (i.e., tracked) in an Excel version of the mitigation action plan. The Planning Partnership will also meet following any disaster event warranting a reexamination of the mitigation actions being

implemented or proposed for future implementation. This will ensure that the plan is continuously updated to reflect changing conditions and needs within the Planning Area.

17.2.5 Updating the Plan

Local Plan Requirement D2 – 44 CFR Part 201.6(c)(4)(i)

The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a 5-year cycle.

The Foothill Municipal Water District MJHMP will be thoroughly reviewed by the Planning Partnership every five years in alignment with federal regulations to ensure its consistency with these requirements. This update is also used to determine whether there have been any significant changes in the planning area that may, in turn, necessitate changes in the types of mitigation actions proposed, goals, or priorities. New development in identified hazard areas, an increased exposure to hazards, an increase or decrease in capability to address hazards, and changes to federal or state legislation are examples of factors that may affect the necessary content of the plan. The Foothill Municipal Water District AGM/District Engineer will be responsible for reconvening the Planning Partnership and conducting the five-year review. In general, the plan update development process begins approximately two years prior to plan expiration. First, resources to develop the plan must be obtained, such as obtaining a planning grant. This will be followed by the plan update process, led by the Core Planning Team and Planning Committee. Upon completion of the review and update/amendment process, the Foothill Municipal Water District Hazard Mitigation Plan will be submitted to the State Hazard Mitigation Officer at Cal OES for a compliance review in accordance with 44 CFR 201. The plan will then be reviewed by FEMA Region 9. Once an “approved pending adoption” status has been issued by FEMA Region 9, the Planning Partnership can then review, approve, and adopt the plan. The Planning Partnership review consists of final approval by each planning partner’s governing body during a public meeting.

Disaster Declaration

Following a federal disaster declaration, the Foothill Municipal Water District Hazard Mitigation Plan may be revised as necessary to reflect lessons learned, or to address specific issues and circumstances arising from the event. It will be the responsibility of the Foothill Municipal Water District AGM/District Engineer to reconvene the Planning Partnership and ensure the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

Plan Amendment Process

Unique circumstances, such as availability of critical data or an omission, may necessitate a plan amendment. Upon the initiation of the amendment process, the Foothill Municipal Water District AGM/District Engineer will forward information on the proposed change(s) to all interested parties including, but not limited to, all directly affected departments, community partners, and customers. Information will also be forwarded to Cal OES and FEMA. This information will be disseminated in order to seek input on the proposed amendment(s) for no less than a 45-day review and comment period (unless circumstances necessitate a shorter review). At the end of the 45-day review and comment

period, the proposed amendment(s) and all comments will be forwarded to the Planning Partnership for final consideration. The Planning Partnership will review the proposed amendment along with the comments received from other parties, and if acceptable, the Planning Partnership will submit a recommendation for the approval and adoption of changes to the plan. In determining whether to recommend approval or denial of a plan amendment request, the following factors may be considered by the Planning Partnership:

- There are major errors, inaccuracies, or omissions made in the identification of issues or needs in the Plan
- New or previously unknown issues or needs have been identified which are not adequately addressed in the Plan
- There has been a change in information, data, or assumptions from those on which the Plan is based

If the Planning Partnership opts to move forward with the amendment, the revised plan must be reviewed and approved by Cal OES and FEMA. The Planning Partners will also need to approve the revised plan. Prior to adoption, the District shall post the updated plan to the Foothill Municipal Water District website for public comment. Each participating jurisdiction will review the recommendation from the Planning Partnership (including the factors listed above) and comments received from the public. Following that review, the governing bodies will take one of the following actions:

- Adopt the proposed amendments as presented
- Adopt the proposed amendments with modifications
- Refer the amendments request back to the Planning Partnership for further revision
- Defer the amendment request back to the Planning Partnership for further consideration and/or additional hearings