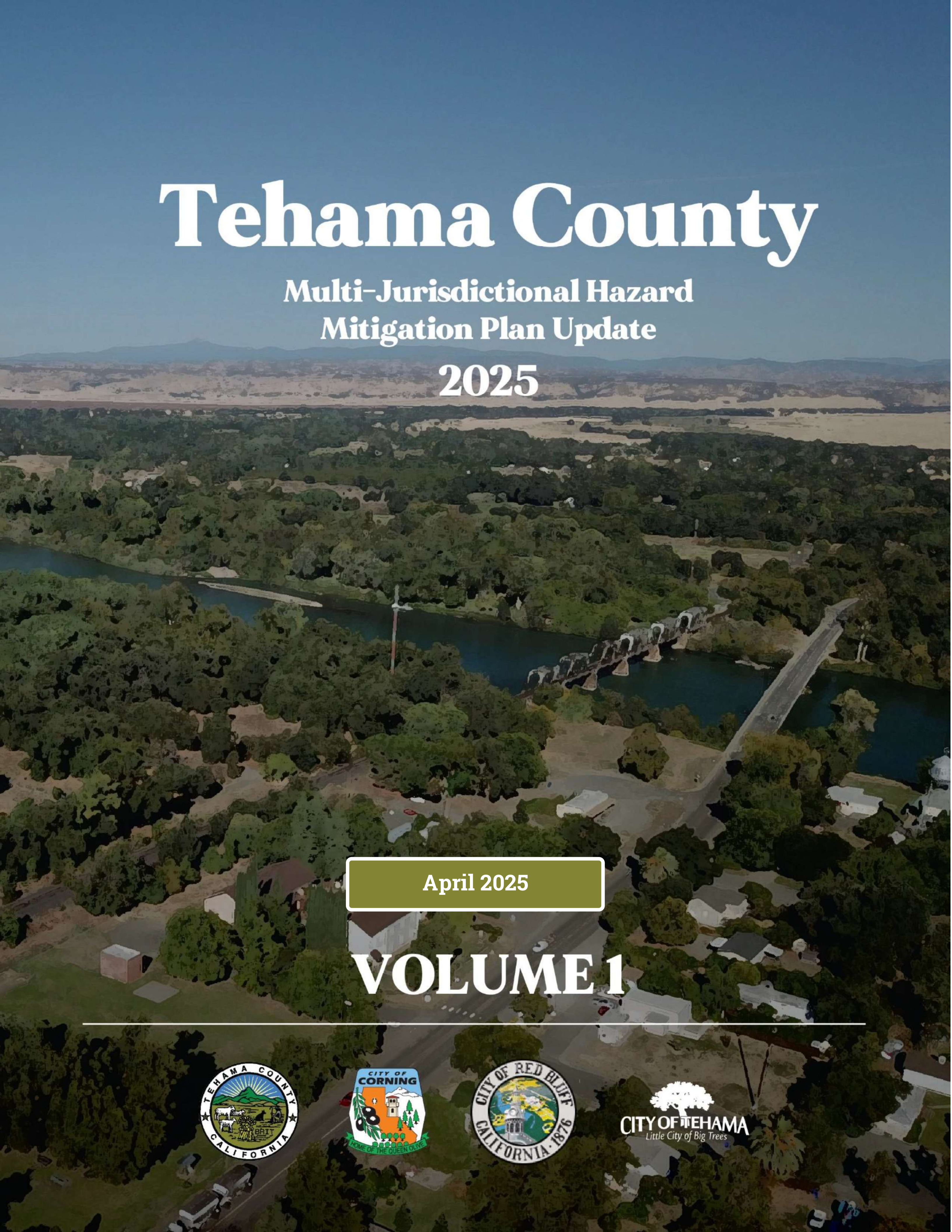

Tehama County

Multi-Jurisdictional Hazard Mitigation Plan Update

2025

April 2025

VOLUME 1

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Tehama County

Multi-Jurisdictional Hazard Mitigation Plan

Volume 1

Planning-Area-Wide Elements

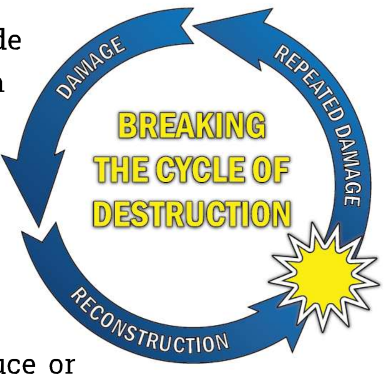
List of Figures

List of Tables

Executive Summary

TEHAMA COUNTY
MULTI-JURISDICTIONAL
HAZARD MITIGATION PLAN

Introduction



This Multi-Jurisdictional Hazard Mitigation Plan has been prepared to guide county officials, and officials from other participating jurisdictions, in protecting the people and property within Tehama County from the effects of natural disasters and hazard events. This plan demonstrates the county's commitment to reducing risk from natural hazards through mitigation and serves as a tool to direct available administrative, technical, and financial resources to achieve optimum results.

The term **"hazard mitigation"** refers to actions or strategies that can reduce or eliminate long-term risks caused by natural hazards. Mitigation activities can be developed, planned, and implemented before or after a disaster occurs. After disasters, repairs and reconstruction often are completed in such a way as to simply restore damaged property to pre-disaster conditions. These efforts may return property and infrastructure to "the norm," but the replication of pre-disaster conditions may result in a repetitive cycle of damage and reconstruction. Hazard mitigation planning in Tehama County can break this repetitive cycle by reducing vulnerability to hazards through smart construction and proper planning of future development and critical infrastructure. Hazard mitigation activities can be conducted through a wide variety of mitigation strategies, such as constructing regional flood control projects, implementing fuel reduction around buildings within high wildfire risk areas, conducting retrofits of homes or structures to increase resistance to seismic damage, or increasing urban tree cover to reduce ground temperatures during extreme heat events.

What is a hazard mitigation plan?

This Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) provides a detailed description of hazards which have the potential to affect the county or its planning area within multiple jurisdictions. This plan identifies vulnerabilities to people, property, and infrastructure based on social and geographic relationships to different hazards. Most importantly, the mitigation strategy presented in this MJHMP responds to the identified vulnerabilities within the community and provides prescriptions or actions to achieve the greatest risk reduction based on available resources. The County and the other participating jurisdictions intend to save lives, reduce injuries, reduce property damage, and protect natural resources for future generations through the mitigation activities identified and described herein.

Why have a hazard mitigation plan?

An up-to-date MJHMP can support county efforts to prevent and reduce property damage, injuries, and even deaths when hazard events strike. Hazard mitigation can also help reduce recovery time and impacts from loss of critical services and lifelines within communities. The purpose of this MJHMP is twofold. First, it provides resources for the county and its residents wishing to conduct hazard mitigation efforts by identifying areas of extreme risk and providing financial and technical mitigation resources based on current gaps.

Second, it provides the County with continued access to grant funding from the Federal Emergency Management Agency (FEMA) to conduct hazard mitigation activities. The passage of the Disaster Mitigation Act in 2000 (DMA 2000) requires proactive mitigation planning as a condition of receiving certain federal financial assistance under the Robert T. Stafford Act. DMA 2000 encourages state and local authorities to work together on pre-disaster planning to assist local governments in accurately assessing mitigation needs, resulting in faster allocation of funding and more cost-effective risk reduction projects under FEMA's Hazard Mitigation Assistance (HMA) program.

Why is the plan updated so often?

Local jurisdictions must have an active, approved hazard mitigation plan in order to pursue funding under the Robert T. Stafford Act. As a DMA 2000 requirement, the plan must be updated every five years to remain in compliance with federal mitigation grant conditions. Federal regulations require hazard mitigation plans to include a plan for monitoring, evaluating, and updating the plan. An update process provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there are needed changes in the focus of mitigation strategies over time. Grant compliance is contingent on meeting the plan update requirements that are contained in the Code of Federal Regulations (CFR).

Who participated in this plan?

The Tehama County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) covers all municipalities within the county and geographically covers the entire area within Tehama County (the "planning area"). Any local government or agency with the ability to regulate building or infrastructure development or maintenance may participate in the planning process for an MJHMP; however, to obtain FEMA approval, a participating jurisdiction must also meet the FEMA planning requirements outlined in 44 CFR § 201.6 *et seq*. Participating jurisdictions for the Tehama County MJHMP include **Tehama County, City of Tehama, City of Corning, and City of Red Bluff.**

A Hazard Mitigation Plan stakeholder group was formed to develop and steer content in this plan, including the goals, objectives, mitigation strategies, and implementation methods to reduce risk. Stakeholders included representatives from the County and other participating jurisdictions, as well as local agencies, businesses, citizens, and non-governmental organizations.

The public also participated in development of the MJHMP, through an online survey to residents and through public review of the draft plan. Community feedback played a key role in prioritizing future mitigation goals, actions, and implementation steps in the plan.

Plan Development & Update Methods

Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies identified. This MJHMP documents the hazard mitigation planning process Tehama County and participating jurisdictions used to increase natural hazard resiliency in the community. The County and all participating jurisdictions followed the recommended FEMA four-step process to develop this 2024 plan update. In this way, the plan update is a complete revamp and all-inclusive planning process. The update provides clear delineation of jurisdictional information, development of a new risk assessment, revaluation of goals and objectives, development of new mitigation actions, new enhancements for implementing mitigation actions, updates to all sections of the 2018 plan, and a new project website for stakeholder involvement and public information located at mitigatehazards.com.

Risk Assessment

The risk assessment measures the potential for loss of life, personal injury, economic injury, and property or infrastructure damage resulting from natural hazards in order to determine vulnerability. For this update, the risk assessment used new data and technologies where available since the previous county MJHMP update in 2018. The County and participating jurisdictions then used risk assessment information to rank risks and gauge potential impacts of each hazard of concern in the planning area. The risk assessment included:

- Hazard identification and profiling;
- Assessment of the impact of hazards on physical, social, and economic assets;
- Identification of particular areas of vulnerability;
- Additional impacts of each hazard due to climate change; and
- Estimates of the cost of potential damage.

As a result of the risk assessment, the following natural hazard threats were identified and profiled as county-wide priority hazards:

Wildfire
SECTION 4.5.1

Earthquake
SECTION 4.5.3

Drought
SECTION 4.5.5

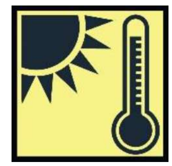
Dam Failure
SECTION 4.5.8

Flood
SECTION 4.5.1

Extreme Weather
SECTION 4.5.4

Slope Failure
SECTION 4.5.6

Extreme Heat
SECTION 4.5.7



In addition, participating jurisdictions individually assessed risks applicable to their specific planning areas, and many identified fewer relevant hazards than those identified county-wide. These jurisdiction-specific profiles are included in Volume 2 of this MJHMP.

Hazard Exposure & Damage Estimation

Some natural hazards, such as wildfire and flooding, are distributed unequally across a landscape. Others, like extreme heat, have widespread impacts not always associated with a particular geographic area. In Tehama County, wildfire, flood, earthquake, slope failure, and dam failure hazards have known geographic extents and corresponding spatial information, which make exposure and damage estimation possible. To describe vulnerability for each hazard, it is important to understand the total population and total assets at risk. This provides the estimated damage and expected losses during a "worst case scenario" event as simulated. Figure ES-1 provides a summary of how and what data sources are used to provide exposure and damage estimation results. More detail on the risk assessment analysis is provided in Section 4.4 and Appendix A. Exposure and damage estimation analysis is briefly described in later sections.

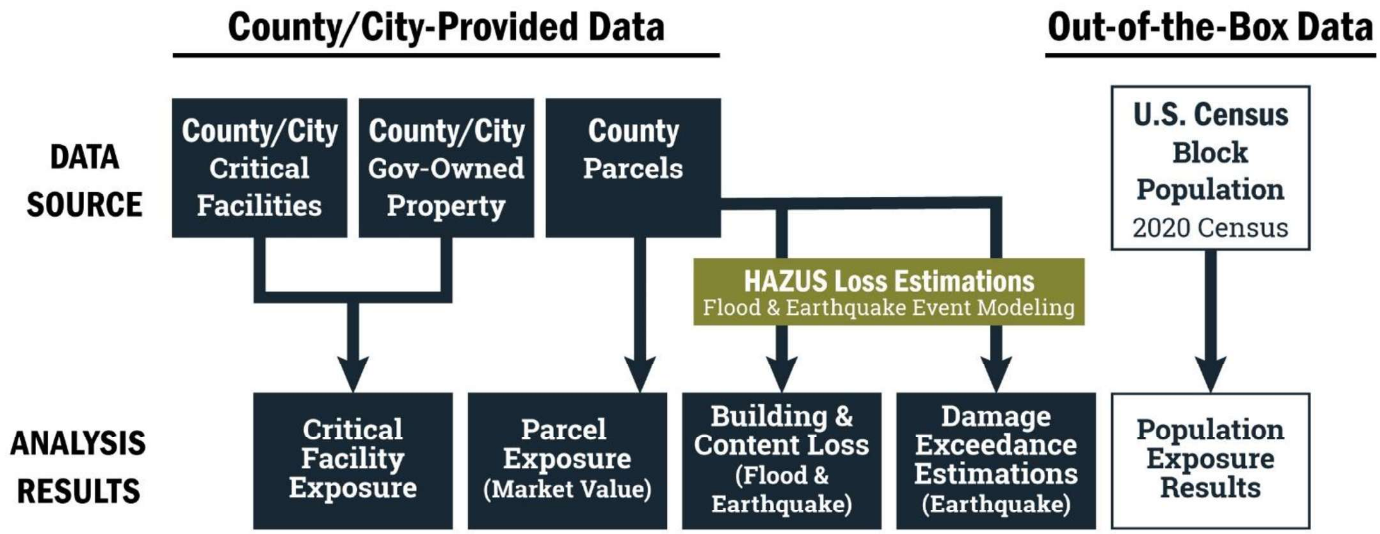


Figure ES-1: Risk Assessment Methodology Summary

Population & Asset Exposure

The total counts of properties, people, facilities, and assets, along with the sum of values, which could be exposed to a natural hazard event within the planning area is referred to as "exposure" in this plan. A mapping overlay was developed to reflect the combination of many known natural hazard spatial footprints. The spatial overlay of hazards method enables summarization of total building values, parcel counts, population, and critical facility exposure within a hazard's geographic extents (see Figure ES-2 exposure example). This method has been used to evaluate exposure to dam inundation, earthquake, landslide, flooding, and wildfire. For a more detailed explanation on risk assessment methods, see Section 4.4 and Appendix A.

Figure ES-2: Hazard Exposure Example

Damage Assessments

FEMA's Hazus software was used to conduct a detailed loss estimation for simulated natural hazard scenarios. Hazus is a nationally applicable, standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes using Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters. For this planning effort, Hazus was used to generate damage estimations due to modeled floods and earthquakes. The estimated damage and losses presented by the Hazus software are based on a "worst case scenario" event and provide the ability to understand possible widescale damage to buildings and facilities.

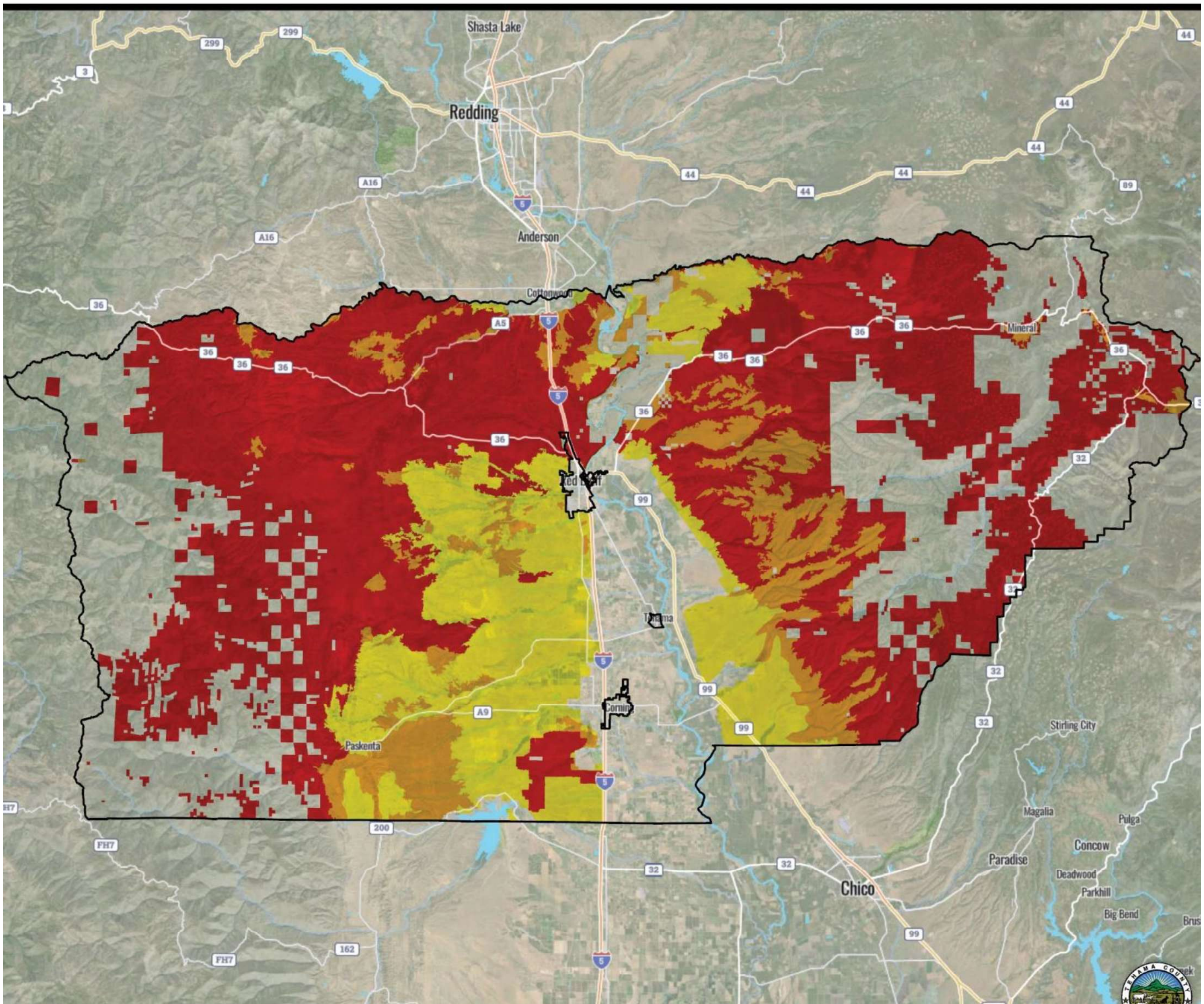
In the hypothetical map in Figure ES-3, even though both structures are exposed to flooding, it is predicted that the structure with a first-floor height below the expected depth of flooding will receive significantly more damage than the structure with a first-floor height above the water depth. For a more detailed explanation on risk assessment methods, see Section 4.4 and Appendix A.

Figure ES-3: Hazus Damage Estimation Example

Summary of Vulnerable Assets: People, Property Value & Infrastructure

Hazards with spatial boundaries can be analyzed to demonstrate the total population, assets, and properties within each hazard's footprint. At-risk populations, critical facilities and infrastructure, improved parcels of land, and estimated losses for each hazard category are provided in summary tables throughout this plan to quantify the number of assets exposed to different types of hazards. The side-by-side comparison allows public officials to evaluate the impacts of potential hazards to prioritize which hazards and exposed areas to direct energy and financial resources toward mitigation activities. For detailed vulnerability assessment information, see the individual hazard-specific profiles presented in Section 4.5. This Executive Summary provides exposure summaries for each of the profiled hazards in Figure ES-4 through Figure ES- 8

WILDFIRE RISK EXPOSURE — **TEHAMA COUNTY**



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
11,809	28%

Count Includes: VERY HIGH

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
5,570	30%

Count Includes: VERY HIGH

PARCEL VALUE IN HAZARD AREA

	Value	Exp. Rate**
Sum of Improvement Value	$2,361,995,330	30%
Sum of Content Value	$1,273,282,973	28%

Count Includes: VERY HIGH

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**
Essential Facilities	6	27%
Hazmat	20	13%
High Potential Loss	28	20%
Transportation & Lifeline	146	22%

Count/Sum Includes: VERY HIGH

Sum of Transportation & Lifeline Linear Mileage: 2,708 44%

MAP LEGEND

- MODERATE
- HIGH
- VERY HIGH

*Exposure summaries include very high risk areas. Hazard data source: Cal Fire.
**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

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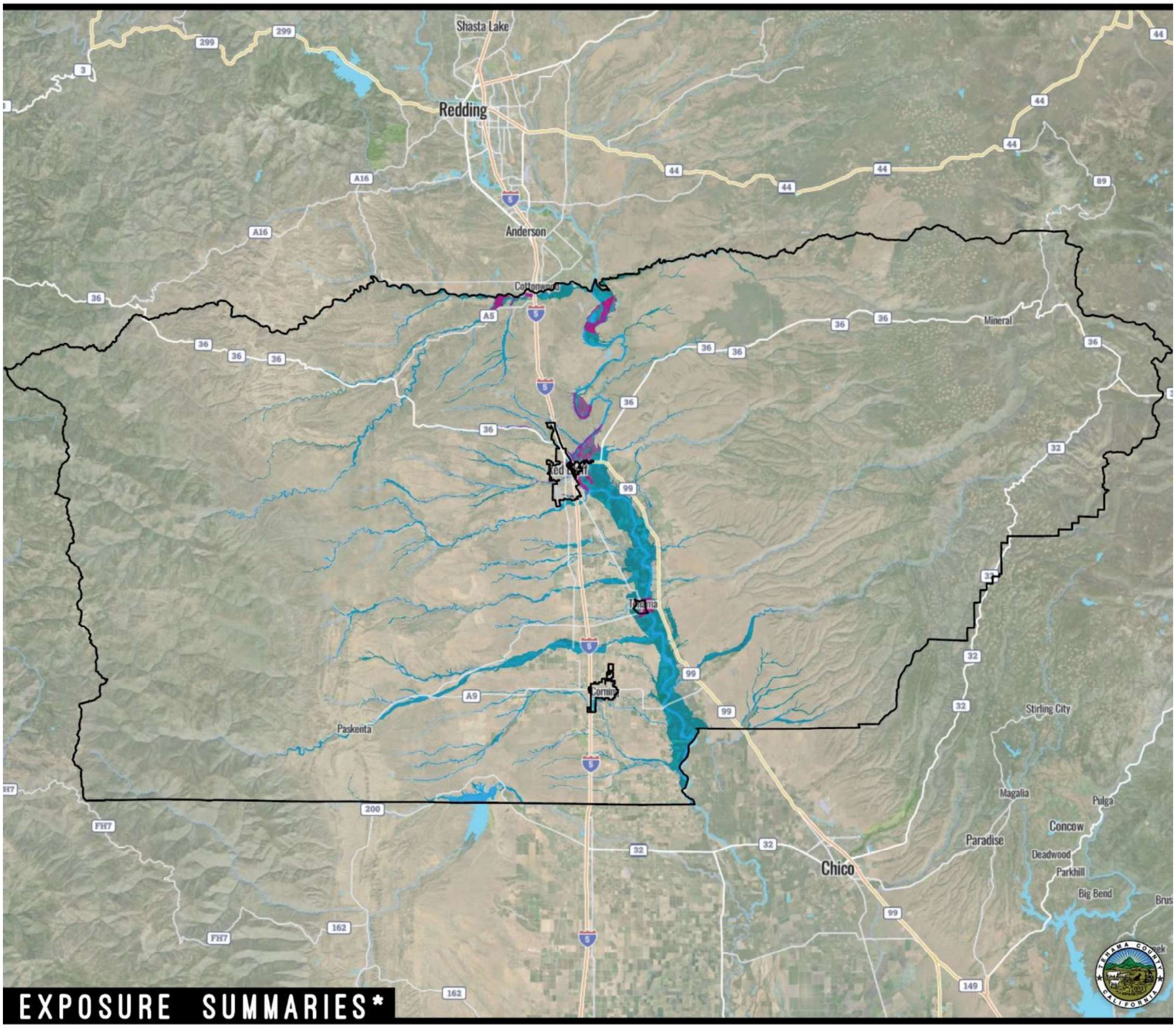
Figure ES-4: Wildfire Risk Exposure Summary

FEMA FLOOD RISK EXPOSURE

TEHAMA COUNTY



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
8,945	21%
Count Includes:	100 + 500

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
3,126	17%
Count Includes:	100 + 500

PARCEL VALUE IN HAZARD AREA

	Exp. Rate**
Sum of Improvement Value	
$1,476,234,613	19%
Sum of Content Value	
$847,995,106	19%
Count Includes:	100 + 500

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**	Count/Sum Includes:
Essential Facilities	2	9%	100 + 500
Hazmat	20	13%	
High Potential Loss	34	24%	*Sum of Transportation & Lifeline Linear Mileage*
Transportation & Lifeline	232	35%	304 5%

MAP LEGEND

100-YR | FLOODWAY | 500-YR

*Exposure summaries include 100-year and 500-year flood zone areas. Hazard data source: FEMA.
**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

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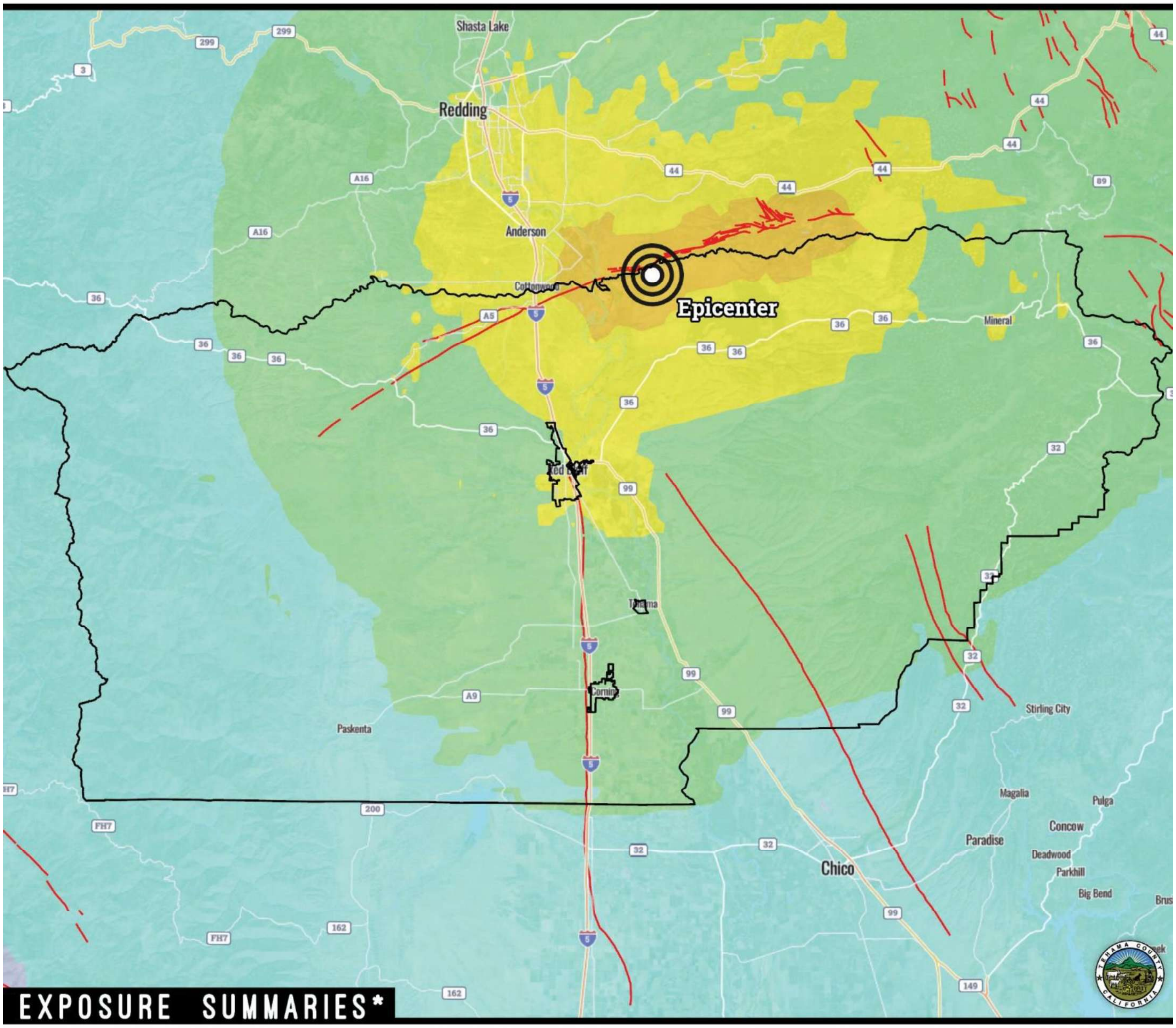
Figure ES-5: Flood Risk Exposure Summary

RAYMOND EARTHQUAKE SCENARIO (M6.8) **TEHAMA COUNTY**



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
18,087	43%

Count Includes: VI VII

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
7,352	40%

Count Includes: VI VII

PARCEL VALUE IN HAZARD AREA

		Exp. Rate**
Sum of Improvement Value	$3,705,521,725	48%
Sum of Content Value	$2,054,621,153	45%

Count Includes: VI VII

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**
Essential Facilities	12	55%
Hazmat	58	36%
High Potential Loss	61	44%
Transportation & Lifeline	213	32%

Count/Sum Includes: VI VII

Sum of Transportation & Lifeline Linear Mileage: 1,309 21%

MAP LEGEND

III	IV	V	VI	VII	VIII	IX	X
WEAK	LIGHT	MODERATE	STRONG	VERY STRONG	SEVERE	VIOLENT	EXTREME

MMI

*Exposure summaries include very strong and strong MMI classes. Hazard data source: USGS.
**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

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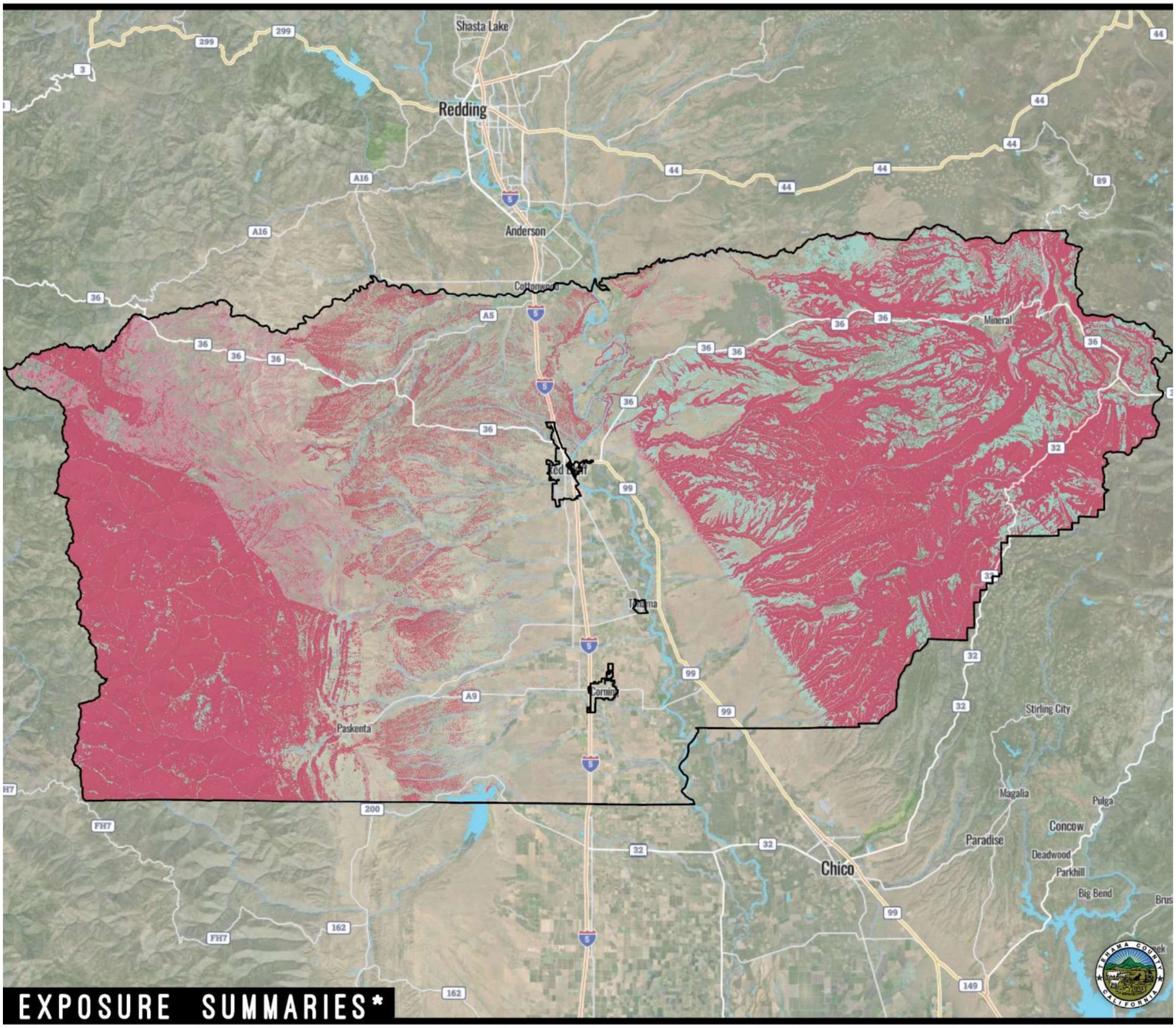
Figure ES-6: Battle Creek Earthquake Risk Exposure Summary

LANDSLIDE RISK EXPOSURE — TEHAMA COUNTY



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
3,386	8%
Count Includes:	HIGH

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
1,392	8%
Count Includes:	HIGH

PARCEL VALUE IN HAZARD AREA

	Exp. Rate**
Sum of Improvement Value: $517,183,917	7%
Sum of Content Value: $278,565,003	6%
Count Includes:	HIGH

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**	Count/Sum Includes:
Essential Facilities	1	5%	HIGH
Hazmat	5	3%	
High Potential Loss	2	1%	Sum of Transportation & Lifeline Linear Mileage
Transportation & Lifeline	50	7%	1,415 23%

MAP LEGEND

- LOW
- MODERATE
- HIGH

*Exposure summaries include high susceptibility only. Hazard data source: CGS.
**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

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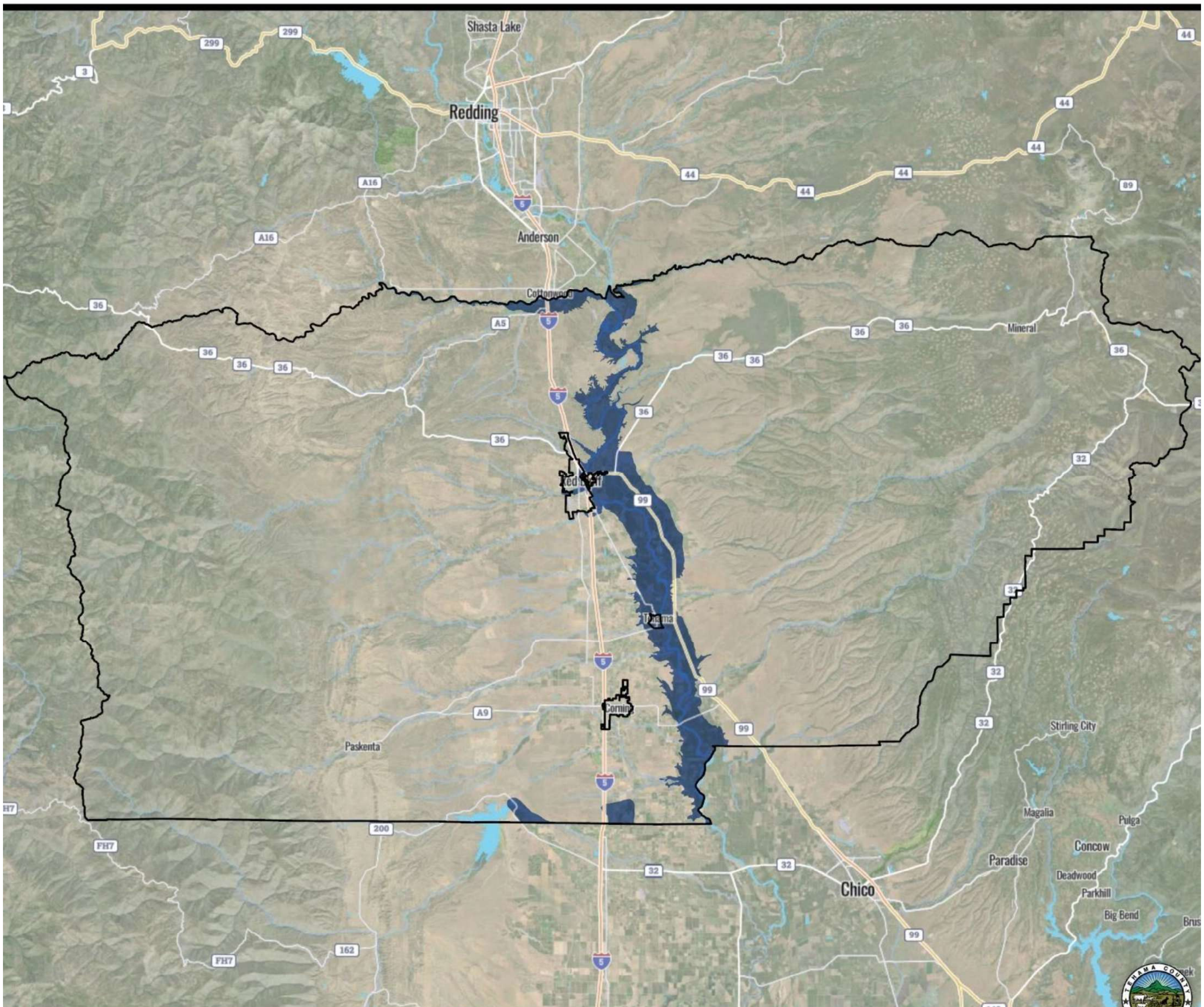
Figure ES-7: Landslide Risk Exposure Summary

DAM INUNDATION EXPOSURE — **TEHAMA COUNTY**



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
13,654	32%

Count Includes: INUNDATION

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
4,909	27%

Count Includes: INUNDATION

PARCEL VALUE IN HAZARD AREA

	Exp. Rate**
Sum of Improvement Value: $2,210,083,917	28%
Sum of Content Value: $1,282,430,474	28%

Count Includes: INUNDATION

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**	Count/Sum Includes:
Essential Facilities	4	18%	INUNDATION
Hazmat	42	26%	
High Potential Loss	58	41%	*Sum of Transportation & Lifeline Linear Mileage*
Transportation & Lifeline	120	18%	389 6%

MAP LEGEND

INUNDATION ZONE

*Exposure summaries include dam inundation areas. Hazard data source: DWR, Cal OES.
**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

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Figure ES- 8: Dam Failure Risk Exposure Summary

Mitigation Goals

The Hazard Mitigation Planning Stakeholders created a set of goals for the Tehama County MJHMP based on review of Tehama County's 2018 MJHMP and the 2023 California State Hazard Mitigation Plan. The hazard mitigation plan stakeholders elected to closely align with California's State Hazard Mitigation Plan. These updated goals guided the hazard mitigation plan stakeholders in selecting actions contained in this plan.

Figure 1-1: Mitigation Goals

Mitigation Strategy

The mitigation strategies and activities designed to reduce or eliminate losses resulting from natural hazards are the centerpiece of the mitigation planning process. Mitigation actions are designed to address identified exposure and vulnerabilities and to confer community benefits, including both indirect governmental benefits to protect the overall community and public benefits that will directly support residents, landowners, business owners, and other community members.

By implementing the mitigation actions identified and described herein, participating jurisdictions will become more resilient to disasters. These actions may or may not be geared toward grant funding under HMA; rather, the focus was on the effectiveness in achieving plan goals within each jurisdiction's capabilities. Participating jurisdictions individually selected a range of appropriate mitigation actions to work toward achieving the MJHMP's goals, compiled in Volume 2 of the plan. In addition, the hazard mitigation plan stakeholders identified county-wide mitigation actions with far-reaching benefits, as listed in Table 5-6 Pending and ongoing mitigation actions from jurisdictions' previous MJHMPs that are still relevant are also provided in Section 2 and their respective annexes in Volume 2.

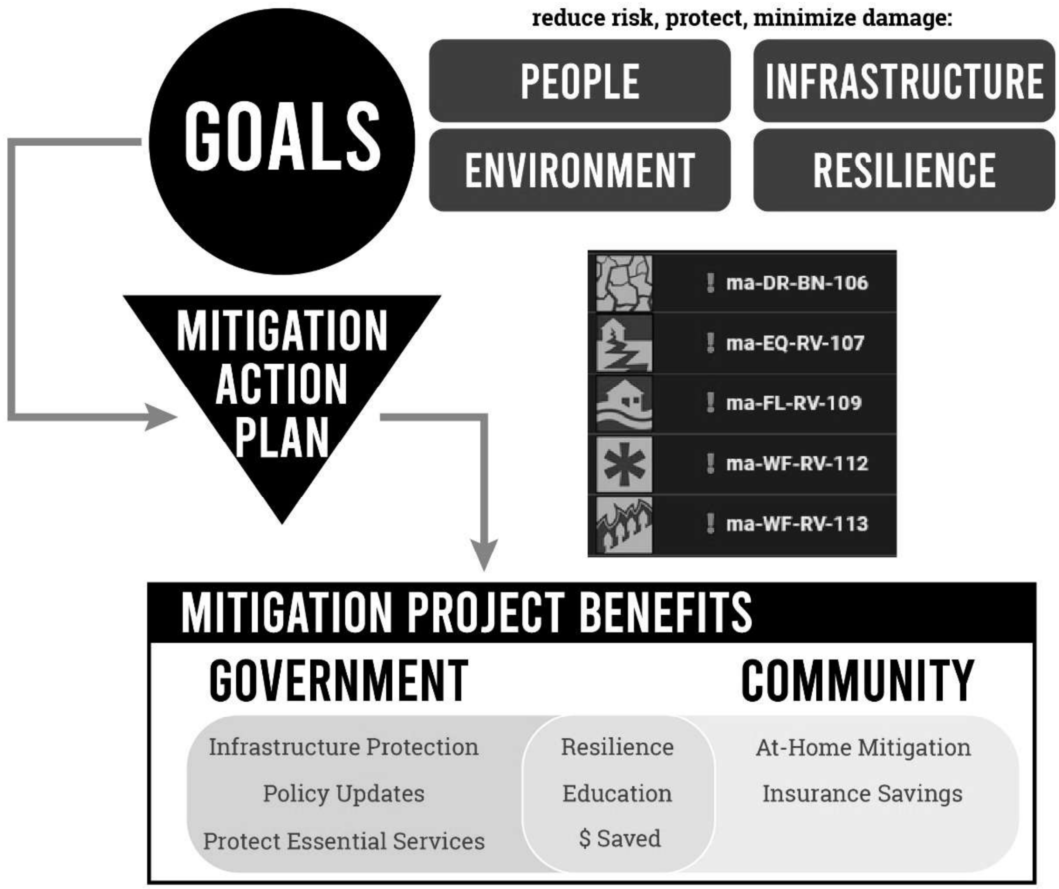

Figure ES-1: Process for Conferring Mitigation Project Benefits

County-Wide Mitigation Actions

A total of 33 county-wide mitigation actions were identified for Tehama County's 2024 MJHMP update, 31 of which were carried over from previous plans and 2 were developed specifically for the 2024 plan update to address newly identified hazards, exposure, and vulnerabilities based on more recent and better data. An overview of the county-wide Mitigation Action Plan is provided in Table ES-1, and more detailed information is provided in Table 5-6 of this MJHMP.

Table ES-1: County-Wide Mitigation Action Plan Overview

Mitigation No.	Hazard Type	Year	Title/Description	Priority
ma-DF-TC-22	Dam Failure	2018	Integrate dam inundation zones into reverse 911 / Everbridge / Tehama Alert system.	Medium
ma-DF-TC-23	Dam Failure	2018	Develop Emergency Action Plans for non-regulated dams.	High
ma-DR-TC-24	Drought	2018	Continue to develop and promote water conservation programs.	Low
ma-DR-TC-25	Drought	2018	Construct passive aquifer recharge facilities / infrastructure	High
ma-DR-TC-26	Drought	2018	Construct additional monitoring wells for ground water monitoring	Medium
ma-DR-TC-27	Drought	2018	Provide more information to residents on ground water and the effects of wells on water futures.	Low
ma-DR-TC-30	Drought	2018	Identify communities that may have water shortages in drought years and identify potential solutions.	Medium
ma-EQ-TC-114	Earthquake	2024	Retrofit Unreinforced Masonry Buildings	High
ma-EW-TC-18	Extreme Weather	2018	High Wind, Heavy Rain: Construct Back Up power infrastructure for Critical Facilities including Public Works and shelters identified on County Sheltering Plan	Medium
ma-EW-TC-19	Extreme Weather	2018	High Wind, Heavy Rain: Construct / enhance communication and networking at Red Bluff Community Center.	Medium
ma-EW-TC-28	Extreme Weather	2018	High Wind: Educate residents on the possibilities of high winds when substantial improvements are conducted.	High
ma-EW-TC-31	Extreme Weather	2018	High Wind, Heavy Rain: Assist Residential Care Facilities to have staff trained on evacuation procedures.	Medium
ma-FL-TC-10	Flood	2018	Formally survey high water marks to establish historic flooding depths.	Low
ma-FL-TC-11	Flood	2018	Inform Residents of impacts that could be caused by re-routing drainage features and importing fill into floodplains. I.e. No Adverse Impact concept for neighbors and other adjacent properties.	Medium
ma-FL-TC-115	Flood	2024	Amend Section 15.52.230 of the County Floodplain Management Regulations to adopt the currently effective FIRMs and FIS reports and all subsequent amendments, as well as best available data from other sources.	Medium
ma-FL-TC-12	Flood	2018	Continue to encourage residents to clear vegetation and maintain drainage / tributaries.	Medium
ma-FL-TC-13	Flood	2018	Provide assistance to residents for flood proofing wellheads in areas of known flood risk.	Low
ma-FL-TC-14	Flood	2018	Construct or improve flood control infrastructure to protect residents and property surrounding Salt Creek.	Medium
ma-FL-TC-16	Flood	2018	Construct flood control infrastructure to protect residents and property surrounding Antelope Creek in the Dairyville Area.	High
ma-FL-TC-17	Flood	2018	Conduct drainage improvements to Jewett Creek between Kirkwood and Margarette Road.	Medium

Mitigation No.	Hazard Type	Year	Title/Description	Priority
ma-FL-TC-21	Flood	2018	Install gauges on flashy and creeks and provide real-time data to county website.	Low
ma-FL-TC-5	Flood	2018	Make gauge information readily available on water levels and educate public on readings i.e. what does gauge elevations mean in a localized area.	Low
ma-FL-TC-6	Flood	2018	Continue outreach program to provide information needed to increase awareness and modify actions to reduce flood damage, encourage flood insurance coverage and protect natural functions of floodplains.	Low
ma-FL-TC-7	Flood	2018	Develop flood hazard areas beyond FEMA regulatory flood zones.	Low
ma-FL-TC-9	Flood	2018	Rehab and improve Deer Creek and Elder Creek levees to provide 100-YR flood protection.	Medium
ma-HH-TC-105	High Heat	2021	Increase public awareness and education surrounding the signs / symptoms of heat related illness, individual risk factors, treatment, and preventative strategies.	Medium
ma-HH-TC-106	High Heat	2021	Secure backup power facilities for community-based Cooling Centers.	High
ma-SF-TC-110	Slope Failure	2024	Conduct Community Outreach Campaign for Slope Failure Along the Sacramento River	Medium
ma-WF-TC-1	Wildfire	2018	Continue to review and implement CWPP Mitigation Actions with HMGP.	Medium
ma-WF-TC-2	Wildfire	2018	Implement fuel reduction measures around Critical Facilities such as schools and other gathering facilities.	Low
ma-WF-TC-29	Wildfire	2018	Increased or enhanced real estate disclosures for wildfire risk in Tehama County	Low
ma-WF-TC-3	Wildfire	2018	Develop defensible space program for disabled / unable residents.	High
ma-WF-TC-4	Wildfire	2018	Construct / expand water supply for hydrants in rural residential areas.	Medium
ma-WF-TC-99	Wildfire	2018	Conduct fuel reduction efforts on Railroad property.	Medium

Mitigation Action Implementation

No amount of planning or mitigation can prevent disasters from occurring or eliminate all risks and impacts from such events. Hazard events will continue to occur, and the County and participating jurisdictions will continue to take actions to reduce the risks these hazards pose to life, property, the environment, and economic prosperity. While this MJHMP identifies opportunities for reasonable mitigation actions by the County, participating jurisdictions, and allied agencies, individuals also have responsibilities to be aware of the potential hazards where they live and to reduce vulnerability within their own household.

Tehama County's ability to carry out mitigation is limited to those facilities over which it has authority, and the same is true for other participating jurisdictions; there is limited or no direct authority over schools; water, sanitation, and irrigation districts; private gas, electric, and communication utilities; state and federal highways and facilities, private hospitals, or neighboring jurisdictions and tribes. As such, all participating jurisdictions will focus on actions within their authority while seeking to cooperatively work with other entities in addressing areas of mutual vulnerability and interdependence.

The full implementation and success of this plan's recommendations will require time and resources, with success measured by effective coordination and resource sharing within Tehama County and sustaining these achievements over time. Working collaboratively to secure financial assistance from state and federal sources will be essential to launch projects that rely on alternative funding. This plan was developed through the strong leadership of a multi-disciplinary stakeholder group and a process that incorporated public input and support.

Adoption Records

To comply with DMA 2000, the Tehama County Board of Supervisors officially adopted this 2024 Tehama County Multi-Jurisdictional Hazard Mitigation Plan on **DATE TBD**. Similarly, other participating jurisdictions adopted Volume 1 of the plan as well as their respective annex in Volume 2 on the dates identified in Table ES-2. The adoption of the plan in its entirety recognizes each participating jurisdictions' commitment to reducing the impacts of natural hazards within the planning area. Adoption records for each jurisdiction are attached.

Table ES-2: Adoption Record Log

Jurisdiction	Adoption Record Information	Date of Adoption
Tehama County	Resolution No. 2024-05	3/16/2022
City of Corning	Reception No. 499622	3/22/2022
City of Red Bluff	Resolution No. 2024-05	3/1/2022
City of Tehama	Resolution No. 2024-05	6/14/2022

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Volume 1

TEHAMA COUNTY
MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

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Section 1. Introduction

1.1 Purpose & Scope

The purpose of this 2024 Tehama County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) is to guide hazard mitigation planning to better protect the people, properties, infrastructure, and assets within Tehama County from the effects of hazard events. This plan demonstrates the commitment of the County toward reducing risks from hazards and serves as a tool to help decision-makers direct mitigation activities and resources. This MJHMP was also developed to ensure Tehama County's continued eligibility for federal disaster assistance, specifically including Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance (HMA) grants such as those available under the Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC) program, and Flood Mitigation Assistance (FMA) program.

Tehama County last updated its hazard mitigation plan (MJHMP) in 2018, and it was approved by FEMA and officially adopted in 2018. The plan in its current form reflects a comprehensive update in 2024, incorporating the latest 2023 FEMA Hazard Mitigation Planning Guidance to ensure alignment with federal standards and best practices for effective disaster resilience and risk reduction. In addition to data analysis and public input, a multi-disciplined Hazard Mitigation Plan Stakeholder Group was formed to develop and steer content in this plan.

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters because additional expenses incurred by insurance companies and non-governmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be reduced or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities has demonstrated that mitigation activities are highly cost-effective. According to this study, on average, each dollar spent on mitigation can save society six dollars in avoided future losses, in addition to saving lives and preventing injuries. (NIBS, 2018)

1.2 Participating Jurisdictions

This MJHMP covers Tehama County and all municipalities within the county, referred to as "participating jurisdictions," who collaborated to create the goals, objectives, mitigation strategies, and implementation actions to reduce hazard risks within the planning area. Participating jurisdictions for the 2024 Tehama County MJHMP are listed in Table 1-1.

Any local government or agency with the ability to regulate building or infrastructure development or maintenance may participate in the planning process for an MJHMP; however, to obtain FEMA approval, a participating jurisdiction must also meet the FEMA planning requirements outlined in the Code of Federal Regulations (CFR) (44 CFR § 201.6 *et seq.*). In developing this plan, all participating jurisdictions followed the recommended FEMA process and met the requirements for FEMA approval, as outlined in Volume 1 and in the individual jurisdiction annexes of Volume 2.

Table 1-1: Participating Jurisdictions

Jurisdiction	Approx. Population
Tehama County (Unincorporated)	65,345
City of Corning	8,156
City of Red Bluff	14,557
City of Tehama	483

1.3 Planning Area

The 2024 Tehama County MJHMP geographically covers the entire 2,949.14-square-mile area within the county's boundaries (the "planning area") and includes all municipalities within the county. Figure 1-1 provides an overview of the planning area and participating jurisdictions. By encompassing the entire county and its municipalities, the MJHMP ensures a coordinated and unified approach to hazard mitigation, aiming to protect lives, property, and critical infrastructure while promoting sustainable community resilience.

Given Tehama County's diverse topography and climatic conditions, the MJHMP considers specific local vulnerabilities, such as the elevated risk of wildfires in forested areas and foothills, flooding in low-lying regions adjacent to rivers and streams, and the potential for seismic activity due to proximity to fault lines. Additionally, the plan takes into account historical data, climate change impacts, and community input to develop tailored mitigation strategies.

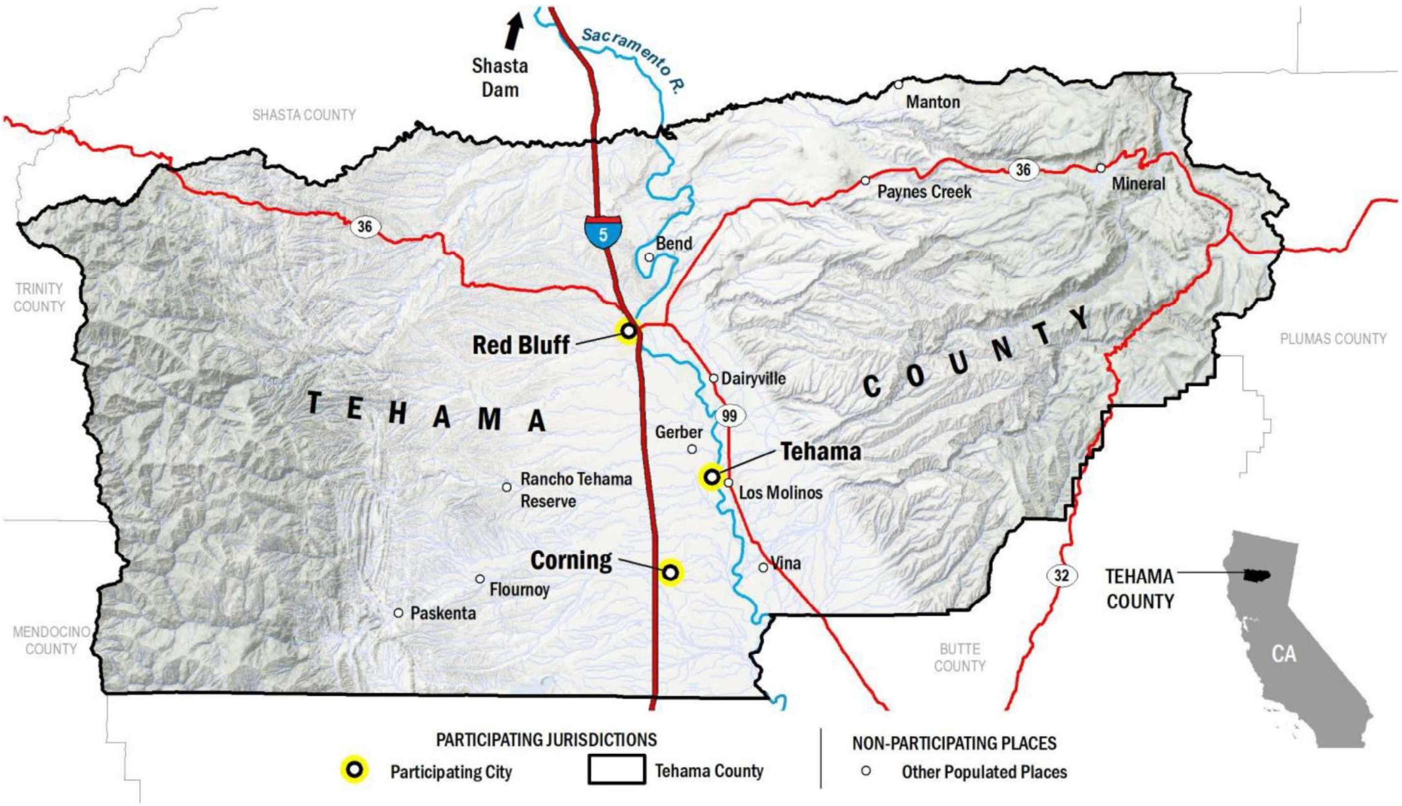

Figure 1-1 Planning Area Overview

1.4 Why Update the Plan?

Hazard mitigation is a way to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster through long- and short-term strategies. It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. The responsibility for hazard mitigation lies with many, including private property owners, businesses and industries, and local, state, and federal governments.

As codified in Public Law (Pub. L.) No. 106-390 of the United States Code (USC), the Federal Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop hazard mitigation plans as a condition of federal disaster grant assistance. (Pub. L. No. 106-390; 42 USC § 5121 *et seq.*) Prior to 2000, federal disaster funding focused on disaster relief and recovery, with limited funding for hazard mitigation planning. DMA 2000 increased the emphasis on planning for disasters before they occur.

DMA 2000 encourages state and local authorities to work together on pre-disaster planning and promotes sustainability. Sustainable hazard mitigation includes the sound management of natural resources and recognition that hazards, and mitigation must be understood in the broadest possible social and economic context. The enhanced and collaborative planning network called for by DMA 2000 helps local governments articulate accurate mitigation needs, resulting in faster allocation of funding and more cost-effective risk reduction projects.

1.4.1 Purposes for Planning

Tehama County initiated this planning effort for several key purposes. The planning area has significant exposure to numerous hazards that have caused millions of dollars in past damage, and the County and other participating jurisdictions want to be proactive in preparing for the probable impacts of future hazard events. Limited local resources make it difficult to implement proactive risk-reduction measures; thus, federal and state financial assistance is paramount to successful hazard mitigation.

The elements and strategies presented in this plan were selected because they best meet the needs of Tehama County and its community members. The plan was developed to meet the following objectives:

- Comply with or exceed the requirements of the DMA 2000 and California Senate Bill (SB) 379, which mandates the integration of climate adaptation strategies into hazard mitigation planning.
- Enable the county and participating jurisdictions to continue accessing federal grant funding for risk reduction through mitigation efforts.
- Satisfy both state and federal requirements for mitigation planning while addressing the specific needs of the county.
- Develop a risk assessment that concentrates on the county's primary hazards of concern.
- Coordinate existing plans and programs to ensure that high-priority initiatives and projects aimed at mitigating potential disaster impacts are funded and executed efficiently.

1.5 Who Will Benefit from the Plan?

Tehama County residents and businesses are the primary beneficiaries of this MJHMP. The plan aims to reduce risk for everyone who lives, works, and visits the county by providing a comprehensive framework to address all foreseeable hazards impacting the area. Public input and stakeholder participation were integral in ensuring that the plan's outcomes are beneficial for government entities, residents, and business owners alike.

The plan places a strong emphasis on protecting critical lifelines and essential government services, ensuring that key infrastructure and public utilities remain operational during and after hazard events. This includes maintaining transportation routes, communication systems, energy supplies, water and wastewater systems, and healthcare facilities.

Volume 1 of the plan contains resources and background information that are relevant county-wide, while Volume 2 includes additional details specific to individual participating jurisdictions. The plan's goals and recommendations establish a foundation for developing and implementing local mitigation activities and fostering partnerships, ensuring that lifelines and government services are resilient and capable of supporting the community in times of need.

1.6 How to Use the Plan

The 2024 Tehama County MJHMP is set up in two volumes to separate elements that apply to the whole planning area (Volume 1) from those that are jurisdiction-specific (Volume 2). The plan includes the following main pieces:

- **Volume 1:** Volume 1 covers all federally required elements of an MJHMP that apply to the entire planning area. This volume includes the description of the planning process, public involvement strategy, goals and objectives, county-wide hazard risk assessment, county-wide mitigation initiatives, and a plan maintenance strategy. Also included in Volume 1 are the following appendices:
  - **Appendix A:** Analysis Methodology
  - **Appendix B:** Planning Process Documentation
- **Volume 2:** Volume 2 includes jurisdiction-specific elements for each participating jurisdiction. All participating jurisdictions have adopted Volume 1 in its entirety in addition to their specific annex in Volume 2.

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Section 2. What's New

Section 2 includes background information on the previous MJHMP for the planning area and this 2024 update. Mitigation actions from the county's 2018 plan, as well as those from other jurisdictions' previous plans, were reviewed and have been changed, updated, and revised to reflect new priorities in this MJHMP; only the information and data still valid from the old plans were carried forward in the update.

The sections below describe the review and update process. The updated 2024 Tehama County MJHMP profiles the following nine county-wide hazards: wildfire, flood, earthquake, extreme weather, drought, slope failure, extreme heat, dam failure, and climate change.

2.1 Background: 2018 v. 2025

In 2018, the county met all approval requirements from DMA 2000 and officially adopted its 2018 MJHMP, which was updated from the 2012 Tehama County MJHMP. With guidance from the hazard mitigation stakeholders, the participating jurisdictions instituted a series of improvements for this 2025 update, including:

- **Digital Mapping of the Risk Assessment Data:** The results of hazard mitigation risk assessment models provide complex outputs that are summarized throughout the plan. In order to increase transparency and utility of the results, development of the Risk Assessment Mapping Platform (RAMP) application during the planning process update was completed, enabling plan participants to intuitively navigate these complex datasets in a simplified manner.

  By leveraging RAMP's intuitive interface and rich data discovery features, stakeholders were able to explore areas of risk across the county and individually for each participating jurisdiction. The 2024 data visualization tools empowered stakeholders to become informed decision-makers. RAMP users were able to filter data based on its position in relation to various hazards and jurisdictional boundaries. This tool was integral to the planning process and meetings, aiding in the development of mitigation strategies for the 2024 planning process.

- **Climate Change and FEMA HMP Planning Guidance:** The planning effort for the 2024 MJHMP update was meticulously aligned with the new FEMA Hazard Mitigation Planning (HMP) Guidelines, which emphasize the importance of integrating climate change considerations into hazard mitigation planning. Recognizing the increasing impact of climate change on natural hazards, the updated plan includes comprehensive strategies to address these evolving risks.

  By incorporating the latest FEMA HMP Planning Guidance, the plan ensures that climate adaptation and resilience measures are prioritized. This includes assessing the potential impacts of climate change on the frequency and intensity of hazards such as wildfires, floods, and severe storms. The plan also identifies vulnerable populations and critical infrastructure that may be disproportionately affected by climate-related events.

Through the use of advanced risk assessment tools and stakeholder collaboration, the planning effort has produced a robust framework for mitigating the effects of climate change on Tehama County. The integration of these guidelines ensures that the county is better prepared to face future challenges, safeguarding the community and its resources.

2.1.1 Changes in Participating Jurisdictions

Three municipalities within Tehama County participated in this 2025 MJHMP. Table 2-1 identifies each jurisdiction that participated in this update and changes to their role from the previous county MJHMP. Note that no changes in the participating jurisdictions are indicated between planning periods.

Table 2-1: Participating Jurisdictions, 2018 v. 2025

Jurisdiction	Role in 2018 County MJHMP	Role in 2025 Update
Tehama County (Unincorporated)	Lead Jurisdiction	Lead Jurisdiction
City of Corning	Participating Jurisdiction	Participating Jurisdiction
City of Red Bluff	Participating Jurisdiction	Participating Jurisdiction
City of Tehama	Participating Jurisdiction	Participating Jurisdiction

2.2 Mitigation Actions

During the 2025 update process, all of the mitigation actions from the previous MJHMPs were examined for relevancy and the potential for future implementation and then evaluated for potential follow-up. Some mitigation actions developed during past efforts are an inherent part of the MJHMP update process or were not detailed enough for implementation at a local level; thus, they were not included in this update. Further, significant changes have been made to other previous mitigation actions because of the updated risk assessment, to include more detail, or based on updates to the implementation strategy with current practices.

Table 2-2 provides a record of county-wide mitigation actions that were **cancelled** with an explanation for why they are no longer relevant. Actions that are **ongoing** or **pending** from previous MJHMPs and are still relevant are included with newly identified actions in the Mitigation Action Plan (Table 5-6). Information on mitigation actions unique to individual participating jurisdictions are included in each jurisdiction's annex in Volume 2.

Table 2-2: Cancelled County-Wide Mitigation Actions from Previous MJHMPs

Mitigation No.	Hazard Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Reason Cancelled
ma-EQ-TC-32	Earthquake	Cancelled	2018	Tehama County	Conduct liquefaction mapping efforts to enhance seismic risk assessments.	Tehama County Public Works	The State has a database for liquefaction run by the Department of Conservation.
ma-FL-TC-8	Flood	Cancelled	2018	Tehama County	Map RL Properties and conduct RL Area Analysis	Tehama County Flood Control and Water Resources	In 2018 the County voted to not participate in CRS.

2.3 New Analysis & Risk Assessment Methodology

Tehama County strengthened this plan by using new research methods and web-based information systems. Most important to the risk assessment was the development of a web-based and interactive Risk Assessment Mapping Platform (RAMP), which allows interactive discovery of risk, vulnerability, and exposure data developed especially for the planning area. In addition to RAMP, Geographic Information Systems (GIS) mapping and analysis provided the county with the tools and data to develop more comprehensive data sets than those in the previous MJHMPs. A platform called the Mitigation Action Support Tool (MAST) was also used to record, update, and track described vulnerabilities (referred to herein as "problem statements" or "areas of concern") and to create associated mitigation actions.

Problem statements were developed based on the quantitative risk assessment and lengthy discussions about unmapped vulnerabilities. Mitigation actions were either updated from the previous MJHMPs or newly developed to specifically address identified vulnerabilities and areas of concern.

2.4 Successful Mitigation Activities

The guiding principles and many of the goals, objectives, and mitigation actions from participating jurisdictions' previous MJHMPs have been implemented through various on-going projects, plans, and programs. Through these successful mitigation activities, improvements have been made toward reducing hazard risks to life and property, with significant risk reduction efforts for overall emergency response capacity and seismic resilience. Exemplary county-wide policies, programs, and projects with significant risk reduction are summarized in this section. Completed mitigation actions from previous MJHMPs are summarized in Table 2-3.

Table 2-3: Completed County-Wide Mitigation Actions from Previous MJHMPs

Mitigation No.	Hazard Type	Status	Year	Primary Agency	Title/Description	Responsible Party
ma-EW-TC-20	Extreme Weather	Completed	2018	Tehama County	Provide isolated populations with evacuation and emergency plans online.	Tehama County Planning Department
ma-FL-TC-15	Flood	Completed	2018	Tehama County	Construct HWY 36 as an armored levee to remove flood risk from neighborhood on east side of 36.	Tehama County Flood Control and Water Resources
ma-FL-TC-33	Flood	Completed	2018	Tehama County	Install permanent "Turn Around, Don't Drown" signs along Saron Fruit Colony Road and Jellys Ferry Road.	Tehama County Public Works

2.4.1 Success Stories

In addition to the completed mitigation actions presented in Table 2-3, this section highlights projects that have provided the planning area with significant risk reduction. These mitigation success stories are examples of county departments, partners, and stakeholders making Tehama County more resilient to hazards within the planning area.

Tehama Alert

Since the last MJHMP, Tehama County, along with jurisdictions within the county, instituted the Tehama Alert emergency system. The system enables agencies within Tehama County to quickly provide critical emergency and hazard information to the community. This effort completed a previous mitigation action and provided a higher level of communication throughout the county during recent hazard events. The County hopes to continue this momentum into the 2024 MJHMP through mitigation actions for evacuation planning and to add sirens to the communication system.

Tehama Alert can also be used to broadcast information, including photographs, regarding lost, missing, wanted, or potentially dangerous persons. Tehama Alert is a free service that residents can sign up for through the Tehama County Sheriff’s Office.

Tehama County 2025 Community Wildfire Protection Plan (CWPP)

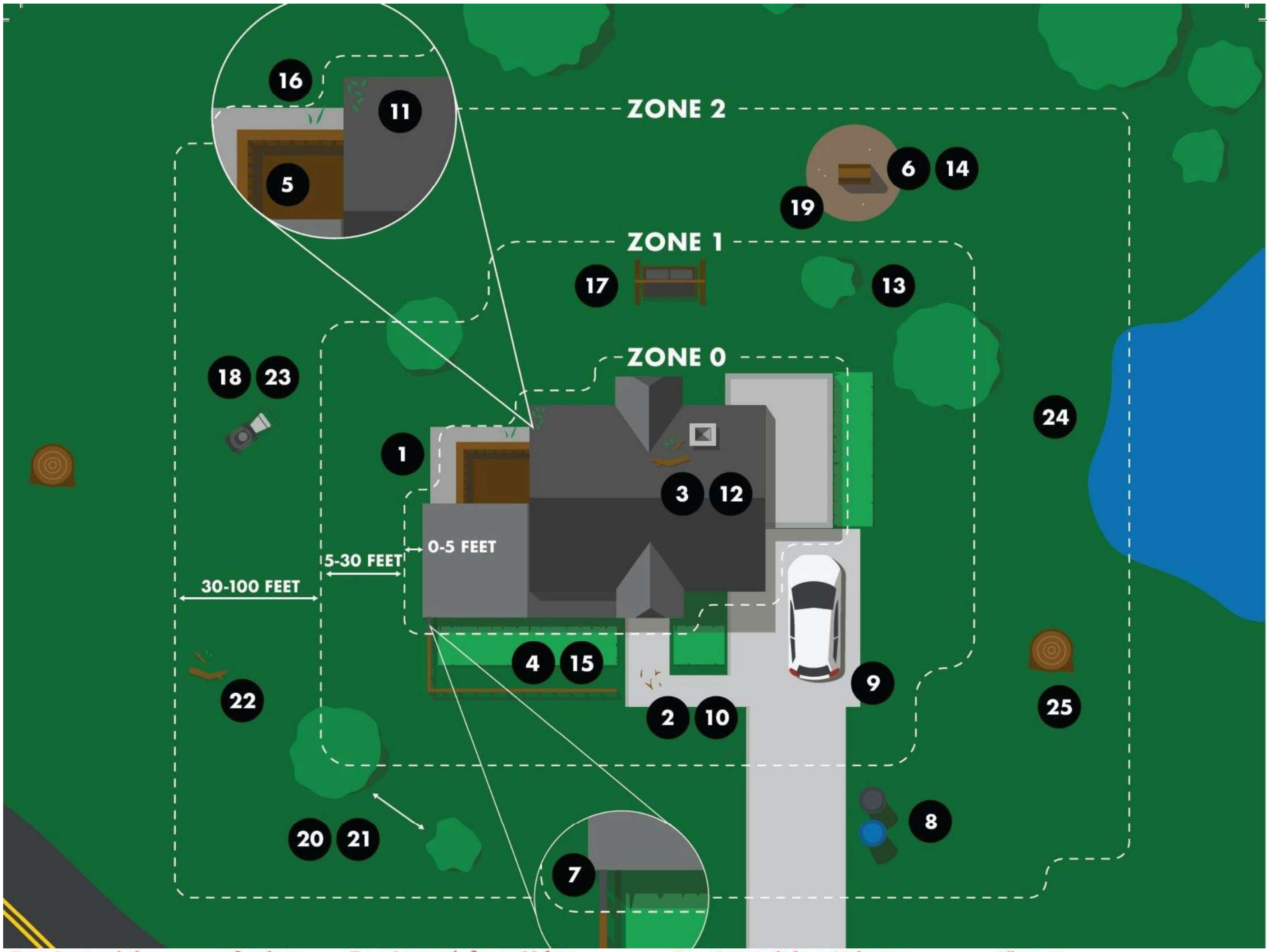
In 2023, the USDA Forest Service awarded the Resource Conservation District of Tehama County (RCDTC) $102,038 through the Community Wildfire Defense Grant program to update the 2017 Tehama East/Tehama West CWPP. Through anticipated input from over 60 collaborators and the public, improvements in the CWPP planning process and document, and project development based on fuel management strategies and objectives discussed in various State and national planning documents, the Tehama County CWPP Update will support local entities' efforts to reduce wildfire risk to communities and local resources. Defensible Space Assistance Program

TinderSmart Tehama Defensible Space Assistance Program

As part of the RCDTC's work to strengthen community wildfire preparedness, the TinderSmart Tehama Defensible Space Assistance Program offers no-cost defensible space assistance to residents within Tehama County's State Responsibility Area (SRA), Local Responsibility Area (LRA), and Wildland-Urban Interface (WUI) zones.

The services provided through this program are performed by RCDTC qualified conservation technicians. To help landowners establish the 100 feet of defensible space required by law, conservation technicians may operate a chipper, masticator, and/or hand tools to address hazardous vegetation. Treatments may include thinning brush, limbing branches, felling small diameter trees, and/or weed-eating. All post-treatment materials remains on the property in the form of wood chips or firewood.

For more information on this successful mitigation program visit: https://www.tehamacountyrcd.org



Zone 0 extends from zero to five feet from buildings, structures, decks, etc.

1. Use hardscape like gravel, pavers, concrete, and other noncombustible mulch materials. No combustible bark or mulch.
2. Remove all dead and dying weeds, grass, branches, and vegetative debris. Check your roofs, gutters, decks, porches, stairways, etc.
3. Remove all branches within 10 feet of any chimney or stovepipe outlet.
4. Limit combustible items (outdoor furniture, planters, etc.) on top of decks.
5. Relocate firewood and lumber to Zone 2.
6. Replace combustible fencing, gates, and arbors attached to the home with noncombustible alternatives.
7. Consider relocating garbage and recycling containers outside this zone.
8. Consider relocating boats, RVs, vehicles, and other combustible items outside this zone.

Zone 1 extends five to 30 feet from buildings, decks, and other structures.

9. Remove all dead plants, grass, and weeds (vegetation).
10. Remove dead or dry leaves and pine needles from your yard, roof, and rain gutters.
11. Remove branches that hang over your roof and keep dead branches 10 feet away from your chimney or stovepipe outlet.
12. Trim trees regularly to keep branches a minimum of 10 feet from other trees.
13. Relocate exposed wood piles outside of Zone 1.
14. Remove or prune flammable plants and shrubs near windows.
15. Remove vegetation and items that could catch fire from around and under decks.
16. Create a separation between trees, shrubs, and items that could catch fire, such as patio furniture, wood piles, swing sets, etc.

Zone 2 extends from 30 feet to 100 feet from buildings, structures, decks, etc.

17. Cut or mow annual grasses to a maximum height of four inches.
18. All exposed wood piles must have a minimum of 10 feet clearance around them, down to bare mineral soil, in all directions.
19. Create horizontal space between shrubs and trees. (See diagram on page 9)
20. Create vertical space between grass, shrubs, and trees. (See diagram on page 9)
21. Remove fallen leaves, needles, twigs, bark, cones, and small branches. However, they may be permitted to a depth of three inches.

All zones

22. Mow before 10 a.m., but never when it's windy or excessively dry.
23. Protect water quality. Do not clear vegetation near waterways to bare soil. Vegetation removal can cause soil erosion—especially on steep slopes.
24. Logs or stumps embedded in the soil must be removed in Zone 0. In Zones 1 and 2 they need to be removed or isolated from other vegetation.

Figure 2-1: TinderSmart Assistance Program

2.5 Incorporation into Other Planning Mechanisms

Over the past several years, previous hazard mitigation plans were incorporated into other planning mechanisms as a demonstration of progress in local hazard mitigation efforts. Various aspects of the 2018 MJHMP have been used to inform, develop, and update planning mechanisms used by the county and other jurisdictions, such as capabilities assessments and hazard background information, peculiarities, risk mapping, and exposure data. For Tehama County, specifically, the following are examples of planning mechanisms into which the 2018 MJHMP was incorporated and of what plan components were used:

- **2024 Tehama County Safey, Secondary Access, Community Planning and Evacuation Planning Study:** hazard-specific warning time and evacuation information, capabilities assessment, and dam failure hazard profile
- **2023 Tehama County Emergency Operations Plan:** hazards, risk assessment, vulnerabilities and potential impacts, and mitigation strategy
- **2020 Tehama East/Tehama West Community Wildfire Protection Plan:** wildfire hazards risk assessment, vulnerabilities and potential impacts, and mitigation strategy

This 2025 Tehama County MJHMP will be similarly incorporated into local and regional planning documents, such as the general and capital improvement plans for participating jurisdictions. For example, the plan will be referenced in and used to help update the Tehama County General Plan Safety Element as well as the Tehama County Integrated Regional Water Management Plan. Sections 5.4 and 6.3.2.4 in Volume 1 outline planning mechanisms that have been and will be integrated with the MJHMP and the process for such integration in more detail. Each jurisdictional annex in Volume 2 also describes which planning mechanisms that jurisdiction has been integrating and will integrate with the updated plan, as part of the capabilities assessment.

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Section 3. Planning Process

This section describes each stage of the planning process used to develop the MJHMP. The planning process provides a framework for document development and follows FEMA's four recommended hazard mitigation planning steps.

Figure 3-1: Four Major Planning Steps

It is important to remember that the MJHMP is a living document, driven by community participation. The participatory planning process itself is as important as the resulting plan because it informs community members and encourages the integration of mitigation efforts with day-to-day decision making.

The Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by DMA 2000 (42 USC § 5165), is intended to "reduce the loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from natural disasters." Under this legislation, state, tribal, and local governments must develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance through FEMA's Hazard Mitigation Assistance. FEMA regulations implementing DMA 2000 are found under 44 CFR § 201.6 *et seq.*

FEMA prescribes four major planning steps (Figure 3-1):

- **Step 1:** Organize Resources
- **Step 2:** Assess Risk
- **Step 3:** Develop a Mitigation Strategy
- **Step 4:** Adopt and Implement the Plan

Tehama County and the other participating jurisdictions all followed the FEMA four-step planning process. Figure 3-2 provides a detailed, phased breakdown of the process that was completed. In this case, the four steps were integrated with a 10-step planning process used for FEMA's Community Rating System (CRS) program to establish floodplain management credit and meet requirements of the Flood Mitigation Assistance (FMA) program.

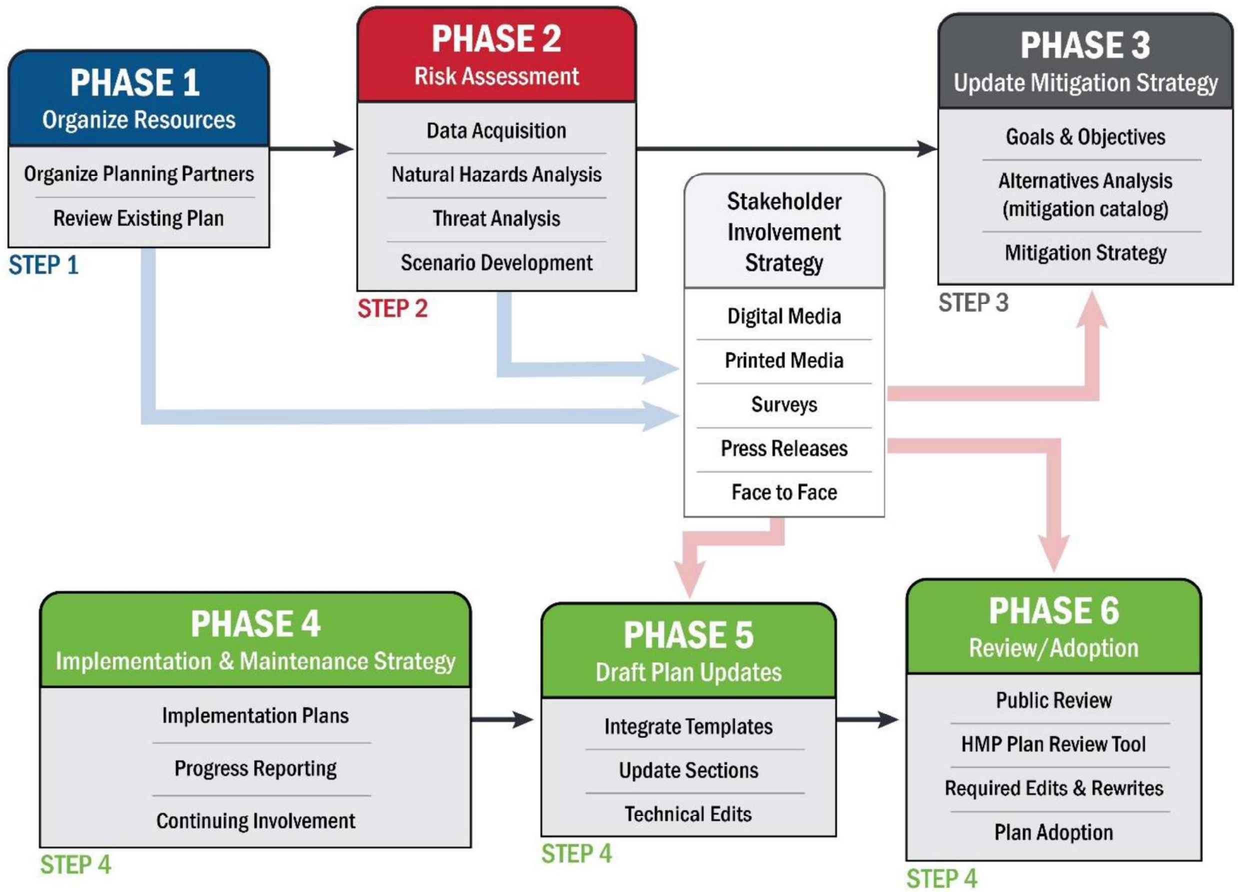


Figure 3-2: Planning Process Breakdown

STEP 1: Organize Resources

The first step of the MJHMP planning process was organizing resources, consisting of developing the Planning Stakeholders, organizing the Hazard Mitigation Planning Team, reviewing relevant existing documents, and organizing public outreach.

People & Expertise

Planning Stakeholders

Tehama County worked with Planning Stakeholders for their relevant expertise to develop a deeper understanding of hazard vulnerabilities, vulnerable and special needs populations, and overall hazard perceptions in the planning area. Planning Stakeholders served as liaisons to the greater community outside of the Hazard Mitigation Planning Team and Steering Group also described in this section and included persons representing local agencies, non-profits, neighboring jurisdictions, businesses, academia, and members of the public. Outreach with stakeholders consisted of phone interviews, email correspondence, public survey sharing, and invitations to public outreach events conducted by the Steering Group and Consultant Team on behalf of each individual jurisdiction. Planning Stakeholders involved in the planning process are listed in Table 3-1.

Hazard Mitigation Planning Team (HMPT)

The Hazard Mitigation Planning Team (HMPT) was comprised of persons with specific expertise to contribute to the planning process, including staff from participating jurisdictions, key decisionmakers, and representatives from regional agencies such as the CalFire and neighboring jurisdictions. The HMPT was involved in the following planning processes:

- Structured coordination and meetings
- Collection of valuable local information and other requested data
- Decision-making on plan process and content
- Development of mitigation actions
- Review and comment on plan drafts
- Coordination of public outreach

All HMPT members were included in communications about the HMP and were invited to stakeholder meetings; however, not all members attended all meetings. Some planning team members participated by providing data, assisting in developing the vulnerability assessment, helping with public outreach efforts, reviewing draft documents, or supporting other stages of the process. Table 3-2 provides a list of all HMPT members. Documentation of stakeholder meeting invitations and attendance is provided in Appendix B.

Steering Group

The Steering Group was at the core of the planning process and integral to ensuring its success, including plan implementation and future maintenance. Members of the Steering Group, listed in Table 3-3, consisted of department leads from participating jurisdictions and were also part of the hazard mitigation stakeholders. In addition, the Steering Group led the county's effort to update the General Plan Safety Element alongside the MJHMP update.

Consultant Team

Tehama County enlisted a consulting firm, Dynamic Planning + Science (DP+S), for plan development and facilitation based on the firm's expertise in assisting public sector entities with developing hazard mitigation plans. As the Consultant Team, DP+S facilitated the planning process, collected and analyzed data, produced meeting materials, and developed drafts of the MJHMP for review. The Consultant Team consisted of a variety of hazard mitigation and certified planning professionals (Table 3-4).

Stakeholder Meetings

The hazard mitigation plan stakeholders and jurisdiction leads met throughout development of the MJHMP update. Table 3-5 through Table 3-6 documents conducted meetings, including the date, type, and topics discussed for each. Meeting documentation, including agendas, hazard maps, PowerPoint presentations, minutes, sign-in sheets, and other relevant handouts, are provided in Appendix B.

Table 3-1: Steering Group

Jurisdiction Lead	Title	Department
City of Corning		
Brant Mesker	City Manager	Administration
Christina Meeds	Planning	Planning
Elijah Stanley	Public Works Director	Public Works
City of Red Bluff		
Matthew Shobash	Division Chief	Emergency Services
Michael Bachmeyer	Fire Chief	Emergency Services
R. Scott Miller	Public Works Director	Public Works
City of Tehama		
Carolyn Steffan	City Clerk/Administrator	Administration
Ron Warner	Flooding	Citizen Advisory
Tehama County Fire Planning Team		
Monty Smith	Fire Chief – CALFIRE Tehama Glen Unit	Tehama County Fire
Bob Farias	Fire Chief – CALFIRE Tehama Glen Unit	Tehama County Fire
Gerry Magaña	Deputy Chief, Operations	Tehama County Fire
Laurianne Griffin	Associate Governmental Program Analyst	Tehama County Fire

Table 3-2: Hazard Mitigation Planning Team (HMPT) Members

Stakeholder	Title	Department	CRS Expertise
City of Corning			
Brant Mesker	City Manager	Administration	Emergency Services, Property Protection (e.g., elevation)
Christina Meeds		Planning	Emergency Services, Property Protection (e.g., elevation)
Elijah Stanley	Public Works Director	Public Works	Emergency Services, Property Protection (e.g., elevation)
Gary Strack	Public Advisory	Citizen Advisory	Emergency Services, Property Protection (e.g., elevation)
Kale Graham	Building Official	Planning	Emergency Services, Property Protection (e.g., elevation)
Kristina Miller	City Manager	Administration	Emergency Services, Property Protection (e.g., elevation)
Robin Kampmann	Public Works Engineering Consultant	Public Works	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Rosie Flores	Real Estate Agent	Citizen Advisory	Emergency Services, Property Protection (e.g., elevation)
Steve Kimbrough	Public Advisory	Citizen Advisory	Emergency Services, Property Protection (e.g., elevation)
Steve Lindeman	Assistant Public Works Director	Public Works	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Tom Tomlinson	Fire Chief, City of Corning	Emergency Services	Emergency Services, Property Protection (e.g., elevation)
City of Red Bluff			
Beth Lindauer	Community Development Director	Planning	Emergency Services, Property Protection (e.g., elevation)
Chuck Vereschagin	Water Department Supervisor	Public Works	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects)
Dusty Brown	Supervisor, Waste Water/Sewer Division	Public Works	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects)
Jeff Godwin	Assistant Public Works Director	Public Works	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects)
Justin Kingsley	Division Chief	Red Bluff Fire Department	Emergency Services, Property Protection (e.g., elevation)
Kyle Sanders	Police Chief	Emergency Services	Emergency Services, Property Protection (e.g., elevation)
Mark Moyer	Division Chief	Emergency Services	Emergency Services, Property Protection (e.g., elevation)
Matthew Shobash	Division Chief	Emergency Services	Emergency Services, Property Protection (e.g., elevation)

Stakeholder	Title	Department	CRS Expertise
Michael Bachmeyer	Fire Chief	Emergency Services	
Mitchell Dean	Building Inspector	Planning	Emergency Services, Property Protection (e.g., elevation)
R. Scott Miller	Public Works Director	Public Works	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Rick Lara	Roads Department Supervisor	Public Works	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Tom Westbrook	City Manager	Administration	Emergency Services, Property Protection (e.g., elevation)
City of Tehama			
Carolyn Steffan	City Clerk/Administrator	Administration	
Ron Warner	Flooding	Citizen Advisory	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects)
Tehama County Planning Team			
Amanda Young	Planning	Tehama County Environmental Health	Property Protection (e.g., elevation), Structural Flood Control Projects
Amber Schertz	Office Manager II	Public Works	Public Education
Andy Houghtby	Lieutenant / OES Manager	County Sheriff's Office	Natural Resource Protection
Angela Ford	Office Manager	Building Dept	Emergency Services
Annaly Ramirez	Asst. Engineer Public Works	Public Works	Property Protection (e.g., elevation), Structural Flood Control Projects, Public Information
Ashley Fox	Tehama County Transit Agency Board	Associate Transportation Planner	Property Protection (e.g., elevation), Structural Flood Control Projects
Bill Goodwin	Chief Administrator	Tehama County	Property Protection (e.g., elevation)
Bill Moule	Chairman of the Board	Board of Supervisors	Preventative Measures (e.g., codes), Property Protection (e.g., elevation), Natural Resources Protection, Public Information
Bob Farias	Unit Chief - Tehama Glen Unit	CAL FIRE, Emergency Services	Natural Resource Protection, Structural Flood Control Projects
Brian DeSmet	Fire Marshal	Tehama County Fire	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Brian Wright	Fire Marshal	CAL FIRE, Emergency Services	Natural Resource Protection, Structural Flood Control Projects
Britt Schumacher	Ag Department	Tehama County Ag Dept	Preventative Measures (e.g., codes), Natural Resource Protection
Carissa Crawford	Community Health Educator Supervisor	Tehama County Health and Human Services	Emergency Services, Property Protection (e.g., elevation)

Stakeholder	Title	Department	CRS Expertise
Chris Wagoner	Project Manager	RCDTC	Natural Resource Protection, Structural Flood Control Projects
Christine McClintock	Shelter Manager	AG/Animal Services	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Christine Thompson	Cal Fire Chief	CAL FIRE, Emergency Services	Property protection (e.g., elevation), Natural resource protection, Public Information
Cliff Curry	Superintendent	Administration	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Danielle Harris	Sergeant	Tehama County Sheriff	Emergency Services, Property Protection (e.g., elevation)
Dava Hohlman	Administrative Services Director	County Administration	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Dave Branscombe	Operations Superintendent	Public Works	Natural Resource Protection, Structural Flood Control Projects
Dave Kain	Sheriff	County Sheriff's Office	Emergency Services, Property Protection (e.g., elevation)
David Brower	Food Inspector	Department of Environmental Health	Emergency Services, Property Protection (e.g., elevation)
David Stoffel	Apiary Inspector	Tehama County Department of Agriculture	Natural Resource Protection, Structural Flood Control Projects
Doni Rulofson	Agricultural Commissioner	Tehama County Ag Dept	Natural Resource Protection, Structural Flood Control Projects
Drew Hammond	Emergency Services Coordinator	CAL OES	Property protection (e.g., elevation), Natural resource protection, Public Information
Ed Griego	Building Official	County Building Department	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Fred Botts	Maintenance Supervisor Bridge	Public Works	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Gabriel Hydrick	Chief Administrator	County Administration	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Gail Wallace	Systems Support Analyst	Public Works	Property Protection (e.g., elevation), Natural Resource Protection, Structural Flood Control Projects
Gerry Magaña	Deputy Chief, Operations	CAL FIRE, Emergency Services	Emergency Services, Property Protection (e.g., elevation)
Jason Tompkins	Forestry Project Specialist	RCDTC	
Jay Bradley	Maintenance Supervisor District B	Public Works	
Jessica Pecha	Senior Civil Engineer	Public Works	

Stakeholder	Title	Department	CRS Expertise
Jessica Riske-Gomez	County Planning Department	Planning Department	
Jim Simon	Director of Public Works	Public Works	
Joey Holard	Battalion Chief	CAL FIRE, Emergency Services	
John Leach	Tehama County Supervisor District 5	Board of Supervisors	
John Stover	Building Official	Department of Building & Safety	
John Wunder	Information Systems Specialist II / GIS	Public Works	
Jon Barrett	District Manager	Resource Conservation District of Tehama County	
Jud Pray	2nd Vice President	Tehama County Farm Bureau	
Justin Hamilton	President	Cattleman Association	
Justin Jensen	Flood Control and Water Resources Manager	Public Works	
Kathryn Raeder	Forestry Project Specialist	Tehama RCD	
Lauri Dilworth	Registered Environmental Health Specialist 3	County Environmental Health	
Laurianne Griffin	Associate Governmental Program Analyst	CAL FIRE, Emergency Services	
Mark Dutro	Citizen Advisory	Local Farmer/Landowner	
Martin Spannaus	President of the Board	Tehama County Farm Bureau	
Matt Silvera	Fleet Operations Manager	Public Works	
Mike Murphy	Citizen Advisory	Gerber Las Flores Community Services District	
Minnie Sagar	Public Works Director	Tehama County Public Health	
Missi Elliot	Project Coordinator	Resource Conservation District of Tehama County	
Monty Smith	Assistant Chief CALFIRE/ Tehama County Fire	CAL FIRE, Emergency Services	
Pati Nolen	Tehama County Supervisor District 3	Board of Supervisors	

Stakeholder	Title	Department	CRS Expertise
Rachel Ross	Tehama County Landfill Manager	Tehama County Landfill	
Rich Duvarney	Superintendent of Schools	Tehama County Department of Education	
Robert Brownfield	Deputy County Surveyor I	Public Works	
Ruth Ann Rowen	SECH - Tehama	Emergency Management Coordinator	
Scott Hardage	Citizen Advisory	Dye Creek Conservancy	
Scott Timboe	County Planning Department	Planning Department	
Shawn Furtado	Civil Engineer	Public Works	
Sims Hawkins	Administrative Officer Assistant Chief	CAL FIRE, Emergency Services	Property protection (e.g., elevation), Natural resource protection, Public Information
Speero Tannous	Sanitation Engineering Tech III	Public Works	
Thomas Moss	Assistant Agriculture Commissioner	Tehama County Ag Dept	
Tia Branton	Environmental Health Director	County Environmental Health	
Travis Flournoy	Maintenance Supervisor District C	Public Works	
Will Clement	Maintenance Supervisor District A	Public Works	
Will Pike	County Surveyor	Public Works	

Table 3-3: Planning Stakeholders

Stakeholder	Title	Department
Bureau of Land Management		
Garrett Dunn	BLM	Redding FMO
Jennifer Mata	Field Manager	North Coast Regional Water Quality Control Board
Jeremy Strait	Fire Mitigation & Education Specialist	Fire Management
Tim Bradley	Fire Management Officer	Fire Management
Bureau of Reclamation		
David LeBLanc	Emergency Management Specialist	Emergency Management
Butte County		
Cindi Dunsmoor	Emergency Services Officer	OEM
Josh Jimerfield	Deputy Administrative Officer, Emergency Management	OEM
Josh Pack	Director of Public Works	Public Works
Cal OES		
Bill Ehorn	Supervising Engineering Geologist - Northern Region	California Department of Water Resources
Constantin Raether	Emergency Management Coordinator	State
Gary Lippner	Flood Management and Dam Safety Deputy Director	California Department of Water Resources
Gina Buccieri-Harrington	Grants Administration/Emergency Services Coordinator	CAL OES
Jasen Vela	Senior Emergency Services Coordinator	CAL OES
Jennifer Johnson	Region 3 Liaison	Regional Disaster Medical Health Coordinators and Specialists
Jody Newton	Local mitigation planning team	CAL OES
John Paasch	Security and Emergency Management Program Deputy Director	California Department of Water Resources
Miranda Steffler	Local mitigation planning team	CAL OES
Patricia Tam	Emergency Management Coordinator	State
Patti Carter	Region 3 Liaison	Regional Disaster Medical Health Coordinators and Specialists
Steven Larson	Pre-Disaster and Flood Mitigation Division	CAL OES
Terrance Washington	Local mitigation planning team	CAL OES
Tina Phan	Local mitigation planning team	CAL OES
Victoria LaMar-Haas	Local mitigation planning team	CAL OES
California Department of Water Resources		
Levi Warr	CA DWR	Senior Engineer
Remy Gill	CA DWR	Engineer
California Highway Patrol		
Michael Pizzi	Captain	Highway Patrol
Capay Fire District		
Ian Turnbull	Fire Chief	Capay Volunteer Fire Department
Glenn County		
Amy Travis	Deputy Director OES	Emergency Services
Donald Rust	Director of Public Works	Public Works
Kevin Backus	Director of Environmental Health	Environmental Health
Mendocino County		
Brentt Blaser	Emergency Services Coordinator	Sheriff's Office
Michael Oliphant	Building Official	Building Official
Nash Gonzalez	Mendocino County Disaster Recovery Director	Executive Office
Mendocino National Forest		
Curtis Coots	Forest Fire Chief	Region 5 - Pacific Southwest

Stakeholder	Title	Department
Leif Kuno	Safety and Occupational Health Manager	Region 5 - Pacific Southwest
National Park Service		
Bill Miller	Forest Fire Management Officer -Training Specialist	Lassen National Forest
Brigitte Foster	Fire Prevention Officer	Lassen National Forest
Jim Richardson	Superintendent to Lassen National Park	Lassen National Forest
John Fish	Chief Ranger	Lassen National Forest
Mike Klimek	FMO	Lassen National Forest
Nick Bunch	Deputy Chief - Fuels	Lassen National Forest
Plumas County		
Charles White	Building Services Director	Building Department
Joe Blackwell	Plumas County Public Works - Deputy Director	Public Works
Shasta County		
Al Cathey	Director of Public Works	Public Works
Anthony Bertain	Lieutenant	Tehama County Sheriff
Kody Bodner	Lieutenant	Sheriff's Office
Paul Hellman	Senior Environmental Health Specialist	Resource Management
Tehama County		
Olivia Silvera	Health Educator	Public Health Department
Tiffany Jensen	Accountant II	Accounting
Trinity County		
Edward Prestley	Director	Sheriff's Office
Kelly Forth	Administrative Coordinator II	Environmental Health
Liz Hamilton	Director of Health and Human Services	Office of Emergency Services
Philip Simi	Director	OES Manager
USDA		
Ruth Ford	County Executive Director	Department of Agriculture

Table 3-4: Consultant Team Members

Name	Title/Role
Ethan Mobley, AICP	Project Manager
Brian Greer	GIS Manager/Spatial Analyst
Cory Schriener	Outreach Manager, Planning Manager
Alex Krebs	GIS Associate
Raini Ott, AICP, CFM	Hazard Mitigation Planner
Daven Solis	Hazard Mitigation Planner

Table 3-5: Summary of HMPT Large Group Meetings

Date	Meeting Type	Topics
May 3rd, 2023	Kickoff Meeting with Steering Group	▪ *Review Planning Team Activities* ▪ *Review Scope of Work* ▪ *Review expectations of Steering Group and jurisdictional planning team.*
June 12th, 2023	Meeting #1	▪ *Mitigation Planning Defined* ▪ *Project and Website Review* ▪ *FEMA Hazard Mitigation Program* ▪ *2014 Mitigation Plan Review and What has Changed?* ▪ *Review Outreach Materials*
August 7th, 2023	Meeting #2	▪ *Hazard Prioritization Exercise* ▪ *Community Vulnerability and Risk Assessment* ▪ *Hazard Problem Statement Review* ▪ *Review Preliminary Survey Results & Outreach Materials*
November 8th, 2023	Meeting #3	▪ *Review Mitigation Alternatives* ▪ *Setting Plan Goals* ▪ *Aligning Mitigation Strategy with HMA Funding*
November 15th, 2023	Meeting #4	▪ *Review Mitigation Alternatives* ▪ *Setting Plan Goals* ▪ *Aligning Mitigation Strategy with HMA Funding*

Table 3-6: Summary of Participating Jurisdiction Break Meetings by Topic

Date	Meeting Type	Topics
July 12th, 2023	City of Tehama Breakout #1	▪ *Mitigation Planning Defined* ▪ *Project and Website Review* ▪ *FEMA Hazard Mitigation Program* ▪ *2018 Mitigation Plan Review and What has Changed?* ▪ *Review Outreach Materials*
August 1st, 2023	City of Red Bluff Breakout #1	▪ *Mitigation Planning Defined* ▪ *Project and Website Review* ▪ *FEMA Hazard Mitigation Program* ▪ *2018 Mitigation Plan Review and What has Changed?* ▪ *Review Outreach Materials*
January 1st, 2024	City of Tehama Meeting #2	▪ *Review Areas of Concern* ▪ *Review Mitigation Alternatives* ▪ *Setting Plan Goals* ▪ *Aligning Mitigation Strategy with HMA Funding*
February 5th, 2024	City of Corning Breakout #1	▪ *Mitigation Planning Defined* ▪ *Project and Website Review* ▪ *FEMA Hazard Mitigation Program* ▪ *2018 Mitigation Plan Review and What has Changed?* ▪ *Review Outreach Materials* ▪ *Review Areas of Concern* ▪ *Review Mitigation Alternatives* ▪ *Setting Plan Goals* ▪ *Aligning Mitigation Strategy with HMA Funding*
February 5th, 2024	City of Red Bluff Meeting #2	▪ *Review Areas of Concern* ▪ *Review Mitigation Alternatives* ▪ *Setting Plan Goals*

Date	Meeting Type	Topics
		▪ *Aligning Mitigation Strategy with HMA Funding*

Planning Process Library

Tehama County and the other participating jurisdictions have completed this MJHMP by following a planning process which complies with, and in many cases exceeds, FEMA guidelines. By engaging with the hazard mitigation plan stakeholders at specific points throughout the plan update lifecycle, perspectives from each stakeholder category can be integrated into the entire MJHMP itself rather than being mentioned as an afterthought or an appendix.

There were four exercises for which the hazard mitigation plan stakeholders of the county and participating jurisdictions completed as components of the planning process over the series of meetings listed above. The outcomes of conducted exercises are documented in the form of a Planning Process Library. Table 3-7 provides more details on the planning process library created for each participating jurisdiction in relation to these exercises. The exercises were completed in a series with topics including:

- **Risk Assessment:** The intent of the risk assessment is to identify the vulnerabilities of a community to the greatest extent possible given available data. Hazard overlay and other mapping products were used to engage the hazard mitigation plan stakeholders in discussion of local hazard concerns and priorities to develop the risk assessment.
- **Hazard Prioritization:** The hazard mitigation plan stakeholders considered and screened a broad set of hazards presented in relevant local, regional, and statewide hazard mitigation planning documents. Past hazard events and analysis of climate projections also informed the selection of hazards for profiling in this plan. The crosswalk of documents reviewed, as well as the results of screening relevant hazards, are outlined in Section 4-29.
- **Areas of Concern:** The hazard mitigation plan stakeholders identified the areas of concern and potential impacts of each of the identified hazards on the planning area. Problem statements were developed for areas of concern, which describe the nature of the consequences or effects of a hazard occurrence on the community and its assets, ensuring the identified mitigation actions are tailored for the community and to the specific problems created by various hazard scenarios.
- **Capabilities Assessment:** A capabilities assessment consists of an analysis of the existing planning and regulatory capabilities of the county and other participating jurisdictions. Planning and regulatory tools typically used by local jurisdictions to implement hazard mitigation activities are building codes, subdivision and zoning regulations, floodplain management policies, and other local planning documents. The hazard mitigation plan stakeholders reviewed current capabilities relative to the previous MJHMPs and provided updated information.

Table 3-7: Planning Process Library

Jurisdiction	Library Links
Tehama County	Risk Assessment – View Maps / Download Maps Hazard Prioritization – View Risk Matrix Areas of Concern – View Problem Statements Capabilities Assessment – View Capabilities Assessment
City of Corning	Risk Assessment – View Maps / Download Maps Hazard Prioritization – View Risk Matrix Areas of Concern – View Problem Statements Capabilities Assessment – View Capabilities Assessment
City of Red Bluff	Risk Assessment – View Maps / Download Maps Hazard Prioritization – View Risk Matrix Areas of Concern – View Problem Statements Capabilities Assessment – View Capabilities Assessment
City of Tehama	Risk Assessment – View Maps / Download Maps Hazard Prioritization – View Risk Matrix Areas of Concern – View Problem Statements Capabilities Assessment – View Capabilities Assessment

Multi-Jurisdictional Planning Process

Multi-jurisdictional hazard mitigation planning offers many benefits, such as increased coordination and efficiency in planning and implementation efforts. At the same time, each jurisdiction has specific hazards and specific mitigation actions that must be individually addressed. This MJHMP balances the benefits of a comprehensive, coordinated approach to hazard mitigation with the specific realities of individual participating jurisdictions. Multi-jurisdictional plans are contemplated under FEMA regulations at 44 C.F.R. § 201.6(4).

Volume 2 of this MJHMP documents each participating jurisdiction's unique hazards, assessment of vulnerabilities and capabilities, and mitigation strategy in a stand-alone annex that was created following the same planning process as Tehama County.

Review & Incorporation of Existing Documents

The hazard mitigation plan stakeholders and Consulting Team reviewed and incorporated existing plans, studies, reports, and technical information in the formation of this MJHMP. The review of past documents is described in more detail in Section 2.5. Relevant documents are cited throughout the plan and hazard profiles (Section 4.5). Documents are examined more closely in the Capabilities Assessment (Section 5.4) and in each hazard profile subsection discussing plans, policies, and the regulatory environment.

All documents cited in this MJHMP are included in Section 7, Works Cited.

Public Involvement & Outreach

Public involvement is an important and requisite component of any MJHMP. The public outreach strategy for this 2025 update met FEMA requirements and maximized participation throughout the planning process using a project website, public survey, social media, document review periods, and other mechanisms. Outreach efforts included engagement with Planning Stakeholders, who were integral in reaching underserved and vulnerable populations. These efforts are described below and were conducted online as well as in-person, with numerous in-person events held across the county.

Public Survey

A 17-question community survey was distributed by the county and other participating jurisdictions via several online platforms, including the project website, participating jurisdictions' websites and social media, partner organizations' social media, and local news outlets. Planning Stakeholders assisted in distributing the survey to a wide audience, including underserved and vulnerable populations such as agricultural workers. A total of 142 responses were received, and the results of the survey were used to ensure that mitigation priorities in the plan match those of community members. The survey was administered online from November 2023 to November 2024. Section 5.6.1.2 details how the results of the survey were used to influence the prioritization of mitigation actions.

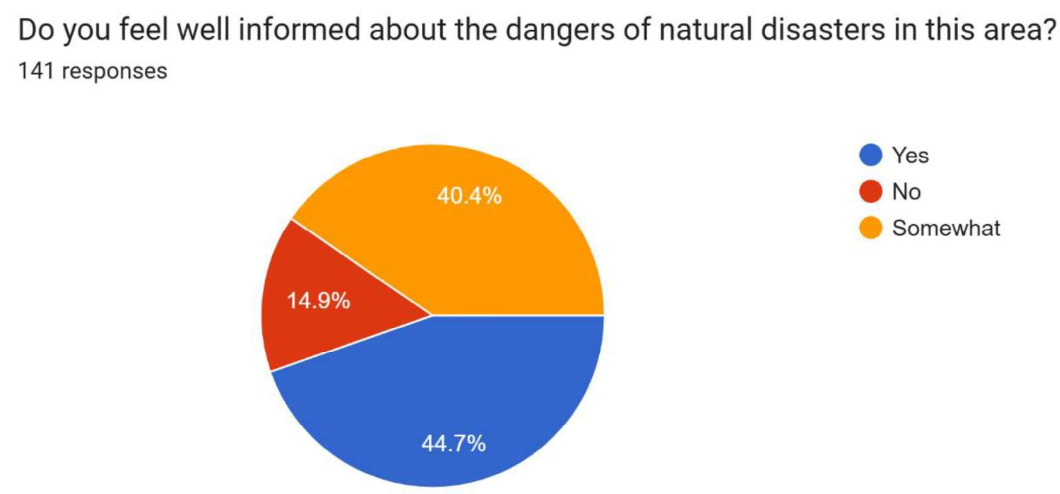


Figure 3-3: Sample Graphic from Public Survey

Project Website

For the 2025 Tehama County MJHMP update, a project website located at mitigatehazards.com/tehamaMJHMP serves as an ongoing and centralized project information, tracking, and file-sharing platform. The site will remain active even after adoption of the MJHMP and provides a tool for project management, a hub for public notices and outreach, and a one-stop-shop for mitigation planning resources.

In addition to internal coordination, the project website played a critical role in public involvement and documentation throughout the planning process, including community survey distribution, stakeholder meetings, and work sessions. Resources such as the Risk Assessment Mapping Platform (RAMP) and links to all meeting summaries are available to the public via the website. Project participants and stakeholders used the website as a resource for the duration of the planning process and will continue to have access during the five-year update cycle and beyond.

Public Draft Review

Members of the public were given the opportunity to review and comment on the draft 2025 Tehama County MJHMP from December 12, 2024, to January 31, 2025. During that time, the draft document was available on the project website, and the public had access to a collaborative review PDF, online comment submission form, and project team contact information. Public advertisement of the draft release was channeled through multiple media outlets, including social media and traditional print. Though no public comments were received, jurisdictional staff and stakeholders that participated in the plan development reviewed the public draft and provided comments on minor revisions, and the necessary community feedback for plan development was obtained during other public outreach efforts and through completed public surveys.

STEP 2: Assess Risk

In accordance with FEMA requirements, the hazard mitigation plan stakeholders identified and prioritized hazards affecting the Tehama County planning area. The stakeholders also assessed the county's vulnerability to identified hazards. This risk assessment process, as described in this section, informed appropriate mitigation actions. The substance of the risk assessment for this 2025 MJHMP update is detailed in Section 4.

Identify & Profile Hazards

Based on a review of past hazard events, existing plans, reports, and other technical studies, data, and information, the hazard mitigation plan stakeholders determined what local and regional hazards could affect the planning area then screened and prioritized specific hazards to assess for the MJHMP. A risk assessment finalized the prioritization process by ranking hazards according to the potential impacts and threats posed to the planning area.

Assess Vulnerabilities

Assessing vulnerabilities reveals the unique characteristics of individual hazards and begins the process of narrowing down which areas within the county are exposed to specific hazard events. The vulnerability assessment included a GIS overlaying method for examining exposure in-depth. The participating jurisdictions reviewed their GIS vulnerability information and completed this exercise, which was supplemented by hazard mitigation plan stakeholders meeting discussions regarding areas of concern for each prioritized hazard. Identified hazards and vulnerabilities varied widely depending on the geographic and demographic make-up of, priorities of, and services provided by the individual jurisdictions. Using these methods, the hazard mitigation plan stakeholders estimated vulnerable populations, infrastructure, and potential losses from hazards.

Updated content for each county-wide hazard profiled, including vulnerability, is provided in Section 4.5 of Volume 1. The same is provided for hazards that are unique to an individual participating jurisdiction in its Volume 2 annex.

Risk Assessment Mapping Platform (RAMP)

The web-based and interactive Risk Assessment Mapping Platform (RAMP) that is accessed via the project website allows interactive discovery of risk, vulnerability, and exposure data developed especially for

Tehama County. RAMP is a mapping platform built specifically for mitigation planning. It displays facilities and buildings overlaid with hazard layers to bring interactivity and individual discovery to the GIS analysis performed for the MJHMP. Figure 3-4 shows the RAMP application launch page on the project website.

The hazard mitigation plan stakeholders used RAMP to understand the vulnerabilities of populations, critical facilities and infrastructure, and properties exposed to hazards with spatial footprints within the planning area. Users can interactively filter facilities and buildings by hazard zone and construction type. RAMP's robust data filtering and summation calculations allow the user to understand and visualize vulnerabilities at the facility level with detailed information on the number of structures exposed to various hazards. As such, the platform enables the county and other participating jurisdictions to pinpoint vulnerabilities and reinforces problem statements in the mitigation strategy. Figure 3-4 demonstrates RAMP's web-based interface.

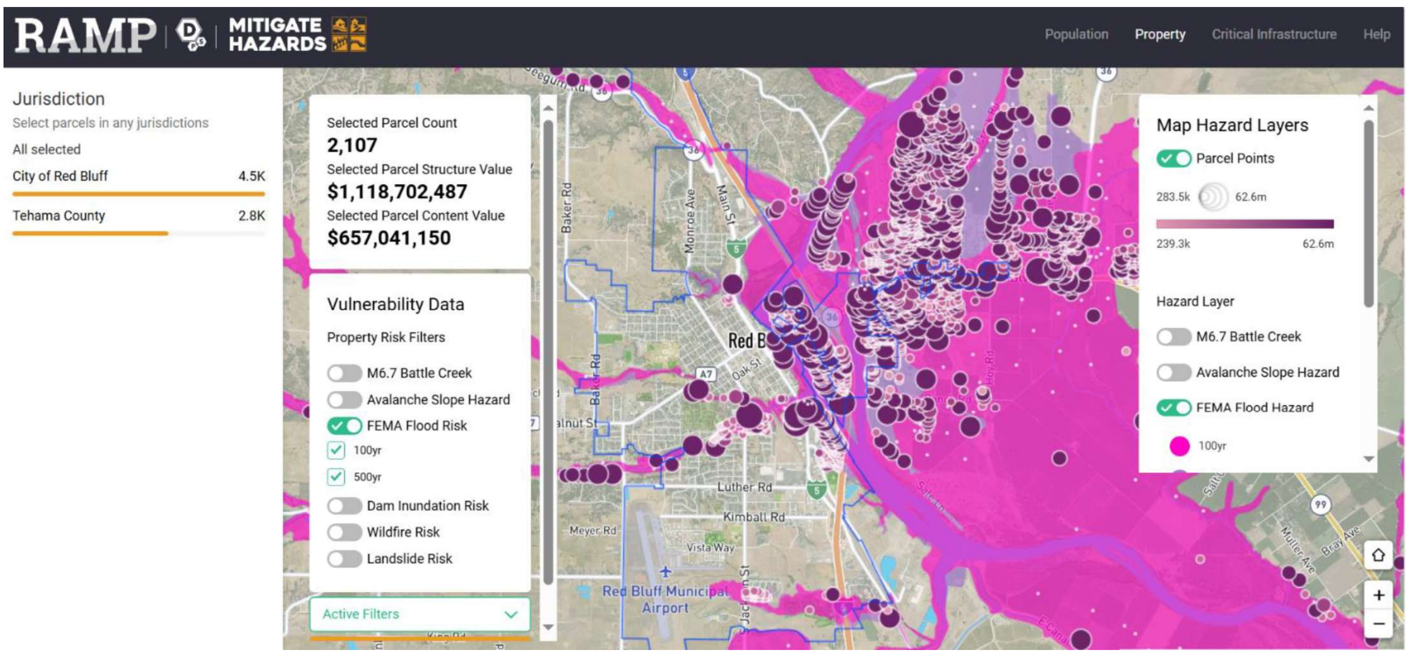


Figure 3-4: RAMP Example of Properties Exposed to Flood Risk

STEP 3: Develop Mitigation Strategy

This plan provides a strategy and blueprint for reducing potential losses identified in the risk assessment based on existing authorities, policies, programs, and resources, as well as the participating jurisdictions' abilities to expand on and improve existing tools. Plan development included identifying goals, assessing existing capabilities, reviewing goals in the pervious MJHMPs, and identifying new mitigation actions. The 2024 Tehama County MJHMP update was prepared in accordance with requirements from DMA 2000, the

Governor's Office of Planning and Research (OPR), and FEMA's MJHMP guidance. The process is described in this section, and the substance of the mitigation strategy is detailed in Section 5.

Identify Goals

The hazard mitigation plan stakeholders reviewed the goals of each participating jurisdictions previous MJHMP, neighboring jurisdictions' recent MJHMPs, and the state-wide MJHMP to craft updated goals consistent with state and FEMA requirements. Goals were updated to meet the current hazard environment and to be consistent with more recent changes in priorities and policies. The four goals for the 2024 MJHMP update are presented in Section 5.5.

Develop Capabilities & Adaptive Capacity Assessment

A capabilities assessment is a comprehensive review of a jurisdiction's capabilities and tools to implement mitigation actions in the MJHMP. Capabilities assessments also include considerations of a community's adaptive capacity for climate change, which is a community or region's existing ability to moderate climate change impacts. Hazard mitigation plan stakeholders identified technical, financial, and administrative capabilities to implement mitigation actions, as detailed in Section 5.4. Additionally, each participating jurisdiction explored its individual capabilities in its Volume 2 annex.

Identify Hazard Problem Statements

Hazard mitigation plan stakeholders developed mitigation actions to address vulnerabilities and areas of concern that could originate from the hazards prioritized through the risk assessment, in line with identified capabilities of each participating jurisdiction. Mitigation actions were created first by developing problem statements for prioritized hazards. Best practice is for each hazard problem statement to be mitigated with a combination of short- and long-term planning activities, and through both operational and physical projects. Problem statements are provided in table format at the conclusion of each hazard profile in Volume 1 and in each jurisdictional annex, and they are also uploaded in an interactive, web-based tool called the Mitigation Action Support Tool (MAST). Problem statements are categorized as impact-related, victim-related, or threat-related, as demonstrated in Figure 3-5.

IMPACT

- Casualties
- Property Damage
- Business Interruption
- Financial Loss
- Environmental Contamination

VICTIM

- School Children in High Hazard Areas
- Care Facilities in High Hazard Areas
- Vulnerable Population Exposed to Hazards

THREAT

- Increased Fuels due to Drought
- Hotter, Drier Climate
- More Intense Storms
- Impervious Surfaces

Figure 3-5: Categories of Issues Addressed in Problem Statements

Identify Mitigation Actions

As part of the planning process, the hazard mitigation plan stakeholders reviewed and analyzed the status of mitigation actions identified in the 2018 MJHMP. Some actions were determined to be outdated based upon new county and municipal priorities and changes to the hazard environment. The stakeholders then worked together to identify and develop new mitigation actions with implementation elements. Additional detail on these mitigation actions is provided in Section 5.6.

Mitigation Action Support Tool (MAST)

Hazard problem statements and mitigation activities are presented and will be updated through a web-based interface developed specifically for Tehama County coined as the Mitigation Action Support Tool (MAST). MAST provides a living support tool that can be continually updated and is a valuable resource into the future for mitigation tracking. The county's MAST application is accessible in perpetuity through the project website at mitigatehazards.com.

The MAST application is an interactive tool that enables multiple users to search, view, enter, and update mitigation actions, ideas or projects, and other information. MAST provides participating jurisdictions and external plan reviewers, such as FEMA, access to valuable mitigation information that can be leveraged by future planning or other risk reduction efforts. Through MAST, the jurisdictions can update the status of mitigation projects throughout the planning lifecycle, and this web-based tool will improve the ability of each eligible jurisdiction to apply for FEMA's HMA grant programs.

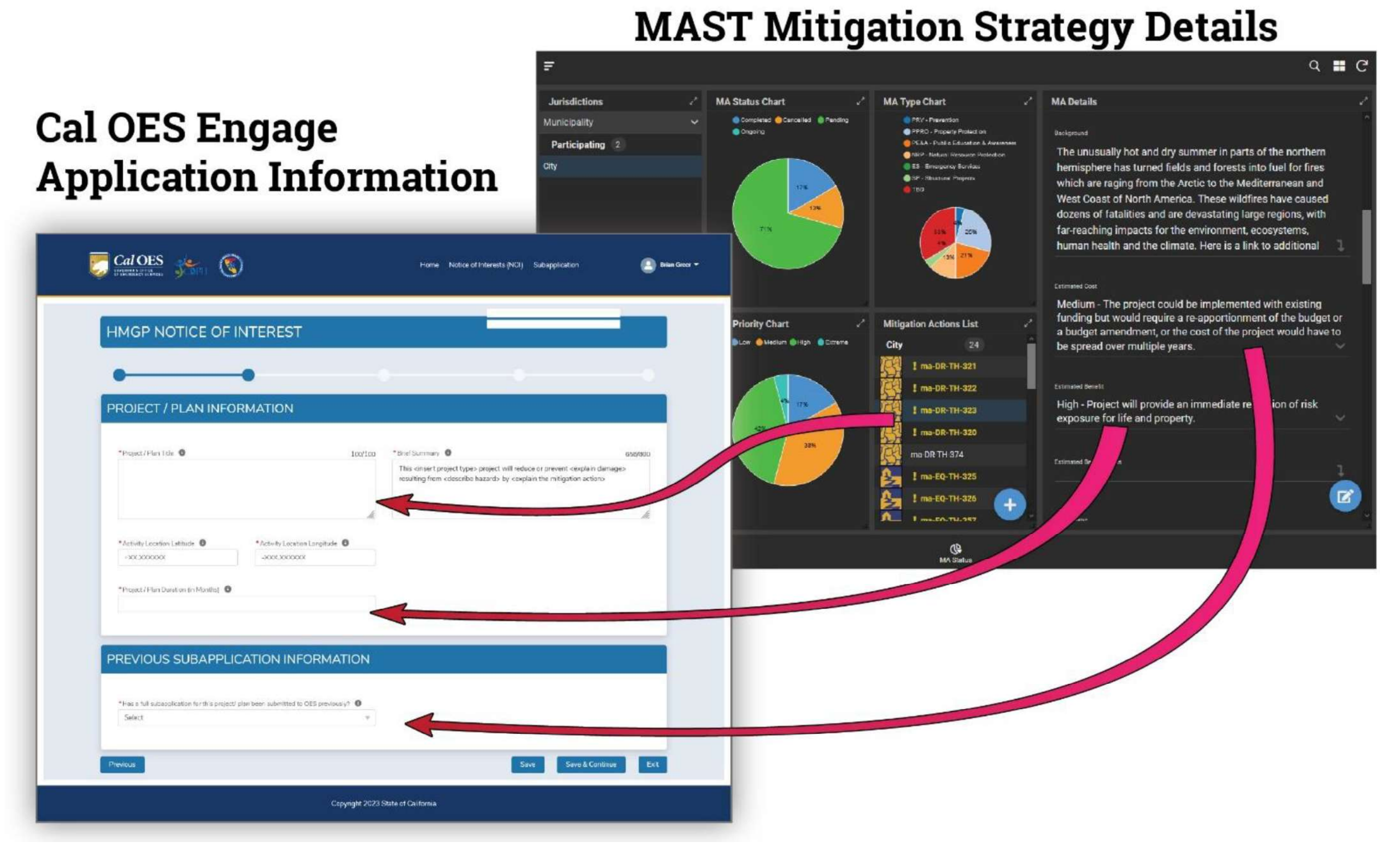


Figure 3-6: MAST Elements and Cal OES Grant Applications

STEP 4: Adopt & Implement

After completion of the risk assessment and mitigation action strategy, information, data, and associated narratives were compiled into the MJHMP document. Section 2 provides detailed information on new and updated elements of the 2024 Tehama County MJHMP.

Draft Plan Review & Revision

Once the draft MJHMP update was completed, an open period was established for public and government official review and revision. Public comments were solicited through mitigatehazards.com, individual jurisdiction websites, social media, and a public meeting. Review input was incorporated into the document as appropriate. Applicable comments from local officials and the public were received and addressed prior to authorization to submit to FEMA and Cal OES. The notice of the public comment period is included in Appendix B.

FEMA Submittal & Final Adoption

This 2024 Tehama County MJHMP was submitted to and approved by FEMA and Cal OES, with official adoption by the Tehama County Board of Supervisors on **DATE TBD**. Similarly, other participating jurisdictions adopted Volume 1 of the plan in its entirety, as well as their respective annex in Volume 2. The adoption of the plan recognizes each participating jurisdictions' commitment to reducing the impacts of hazards within the planning area. Copies of all adoption records are provided in the Executive Summary.

Implementation

The true worth of any mitigation plan is its implementation and success under FEMA's Hazard Mitigation Assistance (HMA) grant programs. This MJHMP has been assembled to reduce the risk of hazards, but also to meet the requirements of DMA 2000 and maintain eligibility for federal funding. FEMA administers three programs that provide funding for local agencies with an approved MJHMP:

- **Hazard Mitigation Grant Program (HMGP)**, which assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration.
- **Building Resilient Infrastructure and Communities (BRIC) Program**, which provides funds for hazard mitigation planning and projects on an annual basis.
- **Flood Mitigation Assistance (FMA) Program**, which provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis.

For more information about FEMA HMA grant programs, visit fema.gov/hazard-mitigation-assistance.

Plan Maintenance

Tehama County and other participating jurisdictions will regularly monitor, evaluate, and revise this plan in accordance with FEMA requirements to maintain eligibility for HMA grant programs. Section 6 includes the measures each participating jurisdictions will take to ensure the MJHMP's continuous long-term implementation, including monitoring, reporting, evaluation, maintenance, and revision procedures. Most of this implementation and maintenance will be done through MAST. Figure 6-1 demonstrates how MAST information will translate into Cal OES Notices of Interest (NOIs) and grant sub-application requests. Section 6 also contains specifics on integrating mitigation with day-to-day decision making.

Section 4. Risk Assessment

The risk assessment measures the potential impacts of hazards on life, property, and the economy within the Tehama County planning area. The intent of a risk assessment is to identify the qualitative and quantitative vulnerabilities of a community to the greatest extent possible given available data. These assessments increase understanding of hazard impacts and provide the foundation to develop and prioritize mitigation actions. In turn, mitigation actions reduce damage from disasters through increased preparedness and focusing resources on areas of the greatest vulnerability.

This risk assessment section evaluates potential losses from a given hazard event by analyzing the vulnerabilities of buildings, infrastructure, and people. It identifies the characteristics and potential consequences of hazards, explores how much of the planning area could be affected by a hazard, and assesses the impacts on jurisdictional assets. The risk assessment approach consists of five components:

- Hazard Identification & Screening (Section 4.1)
- Hazard Prioritization (Section 4.2)
- Community Profile (Section 4.3)
- Vulnerability Assessment Methods (Section 4.4)
- Vulnerability to Specific Hazards (Section 4.5)

Section 4.3 offers a geographic and demographic overview of the county, highlighting detailed demographics of the community members most vulnerable to hazards. By tailoring risk-informed development to the needs of underrepresented communities, planners and policymakers can foster more resilient, equitable, and sustainable environments. This approach not only safeguards the most vulnerable populations but also enhances the overall resilience of the entire community.

4.1 Hazard Identification & Screening

Per FEMA guidance, the first step in developing the risk assessment is to identify hazards. Hazard selection is a twofold process. First, the hazard mitigation stakeholders considered and screened a broad set of hazards profiled in local, regional, and state-wide hazard planning documents. A crosswalk of this first step is outlined in Section 4.1.1. Second, the hazard mitigation plan stakeholders reviewed historic hazard events which affected the planning area to inform the prioritization process outlined in Section 4.1.2.

4.1.1 Potential Hazards

The hazard mitigation plan stakeholders reviewed previously prepared MJHMPs by the participating jurisdictions as well as the plans of regional and state entities to determine the realm of hazards with the potential to affect the planning area and surrounding region.

Table 4-1 provides a crosswalk of county-wide hazards identified in the 2017 Tehama County MJHMP, the 2009 Tehama County General Plan, and the 2023 State of California MJHMP. Through this document review, 20 different potential hazards were identified. The crosswalk was used to develop a preliminary hazards list, providing a framework for the hazard mitigation plan stakeholders to evaluate which hazards were truly relevant to the planning area and which were not. For example, tsunami was considered to have no relevance, whereas earthquake was profiled in every planning document.

Presented in Table 4-3, the document review crosswalk provides the basis for further prioritizing hazards. Prioritized hazards have detailed hazard profiles in Section 4.5.

Table 4-1: Document Review Crosswalk of Potential County-Wide Hazards

Hazard	Tehama County General Plan 2009*	Tehama County MJHMP 2017	Shasta County HMP 2023	Glenn County HMP 2018	California State HMP 2023
Agricultural Pests					■
Avalanche					■
Climate Change					■
Dam Failure	■	■	■	■	■
Drought		■	■	■	■
Earthquake	■	■	■	■	■
Extreme Heat			■		■
Extreme Weather		■	■	■	■
Flood	■	■	■	■	■
Hazardous Materials	■				■
Human-Caused					■
Insects					■
Landslide		■			■
Levee Failure				■	■
Pandemic Disease					■
Sea Level Rise					■
Terrorism / Tech	■				■
Tsunami					■
Volcanic			■		■
Wildfire	■	■	■	■	■

**May Include additional elements such as safety element.*

4.1.2 Past Major Hazard Events

An important consideration in identifying and prioritizing hazards is past major hazard events, especially those which have triggered federal or state disaster declarations. The hazard mitigation plan stakeholders reviewed and considered past major hazard events affecting the planning area as part of the hazard screening and identification process.

Most available information on major past hazard events comes from federal or state disaster declarations. Additional federal and state disaster funding is generally available in response to a disaster declaration, which may be granted when the severity or magnitude of an event surpasses the abilities of the governing body to respond and recover. State funding assistance is provided when a local government's capacity to respond to a disaster is exceeded. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued, allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs that accompany major disaster declarations. The quantity and type of damage are the determining factors.

A USDA disaster declaration occurs when agricultural areas are particularly impacted by an event. This type of declaration certifies that the affected county has suffered at least a 30% loss in one or more crop or livestock areas and provides affected producers with access to low-interest loans and other programs to help mitigate the impacts. Importantly, all counties neighboring those receiving USDA disaster declarations are eligible for the same assistance.

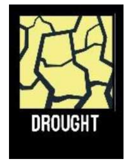
Hazard events occurring outside the planning area can also directly or indirectly impact the community. For example, dam failures or wildfires may occur outside Tehama County but either hazard event could affect watersheds that drain into the planning area, resulting in flooding or longer-term watershed health impacts. Power supply also could be interrupted due to extraterritorial hazard occurrences.

24 Disaster Declarations Since 1953 in Tehama County

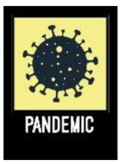
Wildfire (x5)

Flooding Event (x9)

Extreme Weather Event (x8)



Drought[1] (x1)



Pandemic Events[2] (x2)

The Tehama County planning area has received 25 federal disaster declarations[3] since 1953, some of which were statewide. Table 4-2 lists all the federal disaster declarations in Tehama County since 1953. Extreme weather and flooding events are most likely to occur in the winter months, with 13 of the 25 federally declared disasters occurring in January and February in Tehama County. (FEMA, 2024) Wildfires have typically occurred in late summer and fall, with 5 wildfire declarations from July through September since 1953. (FEMA, 2024).

Table 4-2: Past Disaster Declarations

Year	Incident Description	Disaster Number
7/25/2024	Fire	DR-5519-CA
1/14/2023	Flood	DR-4683-CA
1/09/2023	Flood	DR-3591-CA
8/24/2021	Wildfire	DR-4691-CA
3/22/2020	COVID-19	DR-4482-CA
3/13/2020	COVID-19	EM-3428-CA
5/17/2019	Severe Weather	DR-4434-CA
4/1/2017	Severe Winter Storms, Flooding, and Mudslides	DR-4308-CA
8/19/2012	Wildfires	DR-5007-CA
9/13/2005	Hurricane	DR-3248-CA

[1] These are Presidential Declarations under FEMA's umbrella. USDA has declared 19 drought disaster declarations for Tehama County since 2012. See Section 4.5.5.10 on past drought events.
[2] COVID-19 pandemic had 2 Presidential Disaster Declarations
[3] Officially, 25 disasters have been declared, as California was declared as part of the Hurricane Katrina evacuation; however, no disaster occurred in California.

Year	Incident Description	Disaster Number
8/26/2005	Wildfires	DR-2580-CA
9/01/1999	Wildfires	DR-3140-CA
2/09/1998	Severe Weather	DR-1203-CA
1/4/1997	Severe Storms, Flooding, Mudslides, and Landslides	DR-1155-CA
3/12/1995	Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1046-CA
1/10/1995	Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1044-CA
2/11/1991	Severe Freeze	DR-894-CA
2/21/1986	Severe Storms and Flooding	DR-758-CA
2/9/1983	Coastal Storms, Flooding, Slides, and Tornadoes	DR-677-CA
1/7/1982	Severe Storms, Flooding, Mudslides, and High Tide	DR-651-CA
1/20/1977	Drought	DR-3023-CA
1/25/1974	Flood	DR-412-CA
2/16/1970	Severe Storms, High Tides, and Flooding	DR-283-CA
1/26/1969	Severe Storms and Flooding	DR-253-CA
12/24/1964	Heavy Rains and Flooding	DR-183-CA

Source: FEMA Disaster Database, Accessed 12/1/2023 via mitigatehazards.com/hazard-mapping

4.1.3 Compounding Hazard Events

This MJHMP generally examines the vulnerabilities of hazard events in the planning area individually; however, hazards often occur in combination. Frequently, a secondary hazard is triggered by or occurs following the first event, such as a severe rain event following a wildfire that causes debris flows in the burn scar. Other events are compounded by outside factors, like wildfire evacuations occurring during Public Safety Power Shutoff (PSPS) events. This MJHMP discusses multiple hazard risks within the hazard profiles by highlighting these potential secondary hazards.

This plan also considers the pairing of hazard events with the need for emergency evacuation or response in light of experiences during the recent Park Fire. Local governments are actively considering response and mitigation needs that can help reduce the impacts of a multiple-hazard event that include pandemics and another hazards, such as flood, earthquake, or wildfire.

4.2 Hazard Prioritization

The hazard mitigation stakeholders' hazard prioritization process combines historic data, local knowledge, and consensus opinions to produce a risk assessment matrix that illustrates whether each profiled hazard is an extreme or high priority. Table 4-3 summarizes reasons why various hazards were or were not included in the prioritization exercise. Then, the rating criteria in Figure 4-1 were used to evaluate hazards and prioritize those with the highest risks in the planning area based on probability and anticipated impacts of a given hazard occurrence. Results of the process are shown in the completed Hazard Prioritization Risk Assessment Matrix (see Figure 4-1).

It is important to note that the county-wide priority hazards chosen by the Hazard Mitigation Planning Team through the risk assessment process include those that have lower risk ratings, such as slope and dam failure, in addition to the hazards identified as medium, high, and extreme risk. In addition to prioritizing county-wide hazards, each participating jurisdiction also completed the hazard prioritization process specifically for its unique risks and prioritized hazards accordingly, which may or may not include lower-risk hazards in addition to those of higher risk. These individual hazard prioritization risk assessment matrices are available in the jurisdictional annexes in Volume 2 of the plan.

Table 4-3: Hazard Prioritization (County-Wide)

Hazard Type	Explanation
Climate Change	**High priority, included as compounding climate vulnerability.**
Sea-Level Rise	Due to the distance from the ocean, this hazard was not identified as a priority.
Wildfire	**High priority, profiled hazard.**
Flood	**High priority, profiled hazard.**
Dam / Levee Failure	**High priority, profiled hazard.**
Earthquake / Seismic	**High priority, profiled hazard.**
Tsunami	Due to the distance from the ocean, this hazard was not identified as a priority.
Volcanic	Due to the distance from volcanoes and the limited chance of an eruption, this hazard was not identified as a priority.
Geologic	**High priority for slope failure.**
Slope Failure / Landslide	**High priority, profiled as part of Slope Failure.**
Soil	While limited soil hazards exist in Tehama County (erosion and shifting soils), these are not prioritized in this plan; erosion is discussed under Flood.
Mineral	While mineral hazards, such as radon, exist in Tehama County, this was not considered a priority and is not profiled in this plan.
Avalanche	Avalanches are rare in Tehama County and not identified as a priority for this plan.
Drought	**High priority, profiled hazard.**
Tornado	Impacts to the county from tornados are extremely unlikely and this hazard was not considered a priority.
Extreme Heat	**High priority, profiled hazard.**
Extreme Weather	**High priority for high wind and heavy rain**
Hail	Hail events are rare in the county and not considered a priority.
High Wind / Straight Line Wind	**High priority, profiled as part of Extreme Weather.**
Heavy Rain	**High priority, profiled as part of Extreme Weather.**
Fog	Fog events are rare in the county and not considered a priority.
Lightning	Not a priority as an extreme weather event; discussed as a source of wildfire.
Severe Thunderstorm	Severe thunderstorms were not identified as a priority in this plan.
Winter Storm / Extreme Cold / Freeze Events	Winter storms are rare in Tehama County and not identified as a priority for this plan.

Hazard Type	Explanation
Terrorism / Tech / Human-Caused	While terrorism is a threat to the county and participating jurisdictions, it is best addressed in other plans as this MJHMP does not address human-caused threats except as discussed under Climate Change.
Hazardous Materials	While hazardous materials can be released and impact the county, there are better avenues to address this hazard outside of this plan. For example, in the County's Emergency Operations Plan
Pandemic Disease*	While pandemic disease can impact the county, there are better avenues to address this hazard outside of this plan. *
Insects / Agricultural Pests	While hazardous insects exist in Tehama County, this was not considered a priority and is not profiled in this plan.

**During the COVID-19 pandemic, Tehama County determined that pandemic disease was not a priority in this MJHMP because it is already addressed by Tehama County Health Services Agency. Rather than develop a second, possibly overlapping, redundant, or conflicting document, the County elected to defer to the existing and ongoing work of the Tehama County Health Services Agency. Visit https://www.tehamacohealthservices.net/covid-19/ for more information for ongoing COVID-19 response.*

Risk Assessment Matrix Definitions

PROBABILITY RATING

The likelihood of a hazard event occurring within a time period?

PROBABILITY	
Highly Likely	**Highly likely** - 100% annual probability. Or Likely to occur every year in your lifetime.
Likely	**Likely** - between 10 & 100% annual probability. Or will occur several times in your lifetime.
Possible	**Possible** - between 1 & 10% annual probability. Or Likely to occur some time in your lifetime.
Unlikely	**Unlikely** - less than 1% annual probability. Or unlikely but possible to occur in your lifetime.

IMPACT RATING

In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs? The impact could be in terms of one hazard event (flooding from a culvert failure) or a large-scale event (multiple rivers flooding) in the same jurisdictional boundary.

IMPACT			
Minor	Limited	Critical	Catastrophic

Minor - very few injuries, if any. Only minor property damage & minimal disruption on quality of life. Temporary shutdown of critical facilities.

Limited - minor injuries only. Approx. 10% or less of property in disaster footprint damaged or destroyed. Complete shutdown of critical facilities for more than one day.

Critical - multiple deaths/injuries possible. Between 25% and 50% of property in disaster footprint is damaged or destroyed. Complete shutdown of critical facilities for more than one week.

Catastrophic - high number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.

To concentrate resources, the jurisdictional planning team will focus on "High" and "Extreme" risk hazards. These hazards have the higher probability and greater impact as it relates to the jurisdictions planning area.

Hazard definitions are included in **Vol. 1** of this plan. Some hazards are discussed as subset hazards— e.g., "Dam Failure" within the "Flood" hazard profile. If a hazard is not present on the risk matrix or are grey in color, the jurisdictional planning team felt the hazard had a minimal footprint within their planning area and was not ranked.

Hazard Information / Legend:

CLIMATE CHANGE

Climate Change impacts will be addressed at the end of each hazard section within the plan and as a stand alone section for each jurisdiction

County and Municipal governments are required to address climate change impacts in the Safety Element of their General Plan. Climate change may change the frequency, duration and intensity of hazards listed above.

Tehama County Risk Matrix

PROBABILITY \ IMPACT	Minor	Limited	Critical	Catastrophic
Highly Likely	Medium	High	Extreme	Extreme
Likely	Medium	DROUGHT, FLOOD	WILDFIRE	Extreme
Possible	SLOPE FAILURE, EARTHQUAKE	EXTREME WEATHER, HIGH HEAT	High	High
Unlikely	Low	DAM FAILURE	Medium	Medium

Figure 4-1: Hazard Prioritization Risk Assessment Matrix

4.3 Community Profile

The community profile for Tehama County sets the stage for the vulnerability assessment. Pairing the hazard-specific vulnerability assessments (see Section 4.5) with a consideration of local geography, demographic characteristics, and economic conditions can help more effectively direct mitigation strategies and actions toward key populations and areas. The hazard mitigation plan stakeholders reviewed geographic and demographic data as part of the risk prioritization and assessment process.

4.3.1 Geography

Tehama County has a total land area of approximately 2,949 square miles and is one of 10 counties located in the northern Sacramento Valley. The Sacramento River divides the western and eastern portions of the county. See Figure 4-2 for location of the county in the regional context.

Tehama County's elevation varies drastically throughout, averaging around 728 feet above sea level, with the highest points occurring in the east along the Sierras at around 8,200 feet. The county then lowers into foothills and then the valley floor, which sits at around 305 ft in Red Bluff. The eastern portion of the county is dominated by the Western Sierra Nevada Mountain range which then dips down into foothills and an agricultural valley. The western portion of the county contains the Coastal Range which then dips into foothills and the valley floor. Lassen Peak, the southernmost active volcano in the Cascade Range, is another notable geographic feature. It sits outside of the northeast corner of Tehama County and has had multiple eruptions in the last century.

4.3.2 Major Transportation Routes and Airports

There are many transportation routes, transit providers, and transit facilities throughout Tehama County. Regional access routes include Interstate 5 (I-5), as well as State Route (SR) 99, SR 36, and SR 32. Transit agencies include the Tehama Rural Area eXpress, as well as a system of bus routes throughout municipalities and unincorporated communities including Red Bluff, Corning, Los Molinos, Gerber, and Tehama. Amtrak passenger trains and Greyhound bus lines provide long-distance and inter-city service through and around the county. The nearest Amtrak stations are in Redding and Chico, outside the north and south boundaries of the county. Red Bluff contains the only Greyhound stop in the county with two more in Redding and Chico. Public aviation airports in Tehama County include the Red Bluff and Corning Municipal Airports.

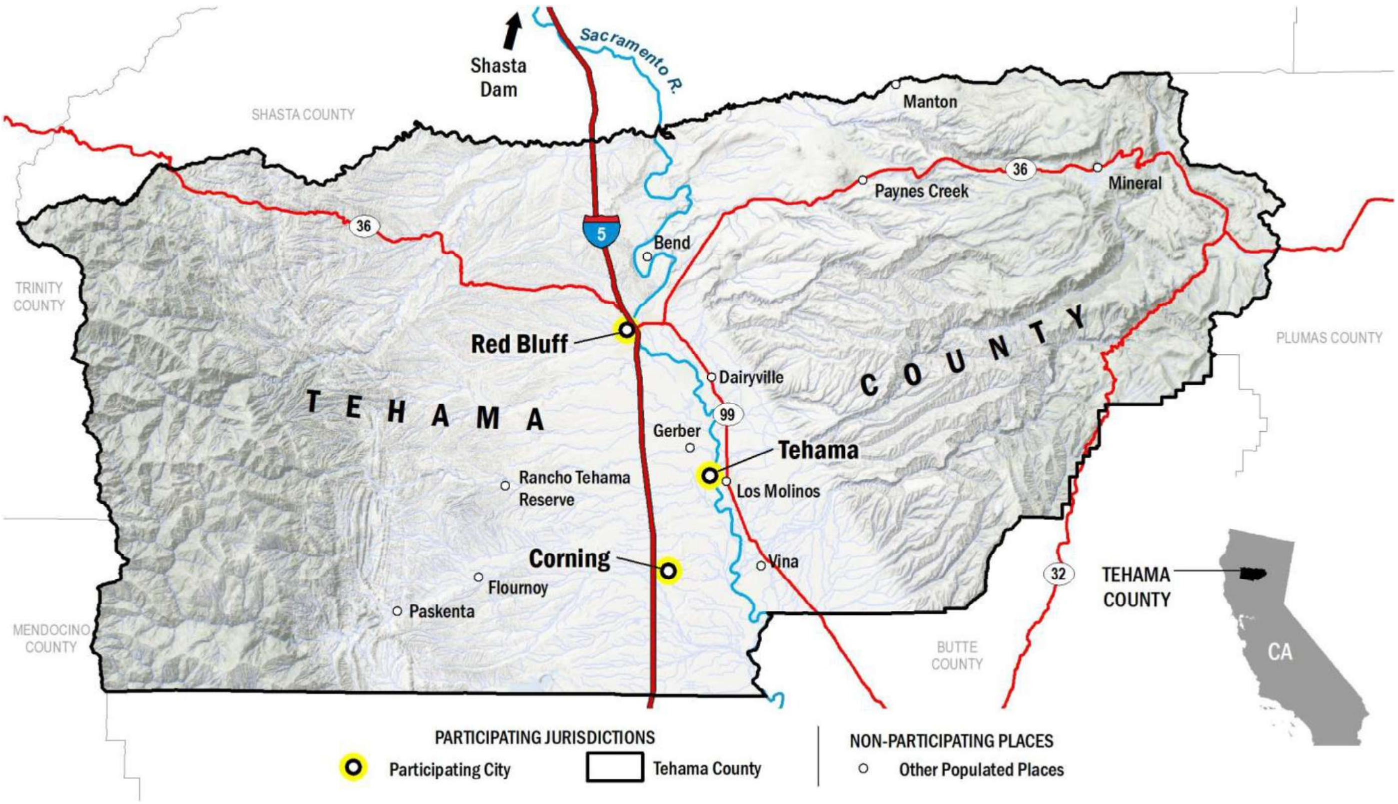


Figure 4-2: Geographic Overview

4.3.3 Climate

As Tehama County's landscape varies from valley to surrounding mountains, so does its climate. The valley areas are characterized by hot, dry summers and mild, wet winters. Mountain regions in Tehama County offer warm, dry summer weather, while the higher elevations are considerably colder and snowy during winter.

Due to the inland location, temperatures in Tehama County vary significantly between summer and winter. According to 30-year monthly normal from 1991-2020 as provided by PRISM, Valley temperatures in the City of Red Bluff average highs of 95.0ºF during July and lows of 38.1ºF in January. Red Bluff is located about 350 feet above sea level and the mean annual temperature is 62.0ºF. In the mountain town of Mineral, located at 4,872 feet above sea level, the annual average temperate is 49.4ºF, average highs in July are 83.9°F and average lows in January are 27.1°F. (PRISM Climate Group, 2022)

Rain may occur year-round in Tehama County, although most precipitation occurs during the winter. Much of the rainfall is due to storm fronts coming from the west across the Pacific Ocean. Much of the moisture from the Pacific storms falls on the windward (western) side of the Coastal Ranges. The leeward (east) side of the Coastal Range and valley within Tehama County is in a rain shadow and is therefore considerably drier. Annual average precipitation in Red Bluff is 25.71 inches. Areas of the County on the windward side of the Sierra Nevada, east of the valley, see higher precipitation levels. Mineral's mean annual precipitation exceeds 56 inches. Mineral's historic average snowfall is about 152 inches, however this is an average obtained from the Western Regional Climate Center (WRCC) with a Period of Record going from 1909 to 2016 and may not be an accurate representation of the current climate.

Refer to Section 4.6 for more information on Climate Change, its interaction with profiled hazards, and its potential impact on Tehama County.

4.3.4 Demographics & Vulnerable Populations

This section explores the various demographic and economic characteristics of Tehama County to inform future hazard mitigation planning efforts. Natural disasters are social phenomena as well as physical and meteorological events. The demographic make-up of a planning area determines how impacts of hazard events will be distributed throughout the community, especially for groups with underlying vulnerabilities who face greater obstacles to disaster preparedness, response, and recovery. Understanding the unique social and economic fabric of the area can also help to identify the potential social costs of damage to infrastructure such as housing, industry, public facilities, essential services, and transportation.

The demographics information contained herein for Tehama County and surrounding areas has been post-processed based on the U.S. Census Bureau's American Community Survey (ACS) five-year estimate period from 2016 to 2021 and will not necessarily match the figures presented in other regional demographic studies or plans. Inherently, the margin of error for this data can be high, especially in more rural areas and for data collected at the block group level, which is made publicly available as spatial data files but not as a part of the Census Bureau's tabular reporting. The figures referenced in this section are not intended for administrative activities such establish housing needs for a community but have been developed to suggest larger trends in the region with relevance to hazard mitigation planning efforts.

4.3.4.1 Population and Households

Tehama County's estimated population in 2021 was 65,345, slightly increasing from the population of 63,463 in 2010 (see Table 4-4). Overall, since 2010 Tehama County's population has remained relatively stable with a mild growth rate significantly lower than that of California as a whole, which grew at a rate of eight percent from 2010 to 2018. (SCAG Regiona Council, 2019)

The unincorporated portion of the county, while growing in population, has experienced a steadily declining growth rate over the past quarter century. Part of this is explained by a significant decline in net migration to the county. Net migration is based mainly on the abundance or lack of jobs in an area. The decline in net migration occurred during a time of economic recession in California, which may partially explain the decline. (Tehama County Planning Department, 2019)

There were an estimated 27,347 households in 2021, with an average of 2.36 individuals per household. Tehama County had an overall population of 22.3 individuals per square mile, lower than California as a whole.

Table 4-4: Total Households (HH) and Populations

Jurisdiction	Population	Households	Average HH Size
Tehama County	65,345	27,347	2.36
California	39,455,353	14,328,539	2.70

Source: 2016-2021 ACS 5-Year Estimates

Note: The demographics information contained herein has been post-processed based on the U.S. Census Bureau's five-year estimate period from 2016-2021 and will not necessarily match other demographics-based regional studies or plans. In order to examine geometries not available in census reports, including unincorporated county areas, a weighted GIS analysis combined and redistributed block groups. Inherently, the margin of error for this data can be high, especially in more rural areas. This section provides a generalized approximation of specific demographics, reported by various planning study areas. It is not meant to provide any definitive information, but merely to suggest larger trends in the region.

4.3.4.2 Introduction to Vulnerable Populations

Exploring local demographic data may help to identify groups and geographic areas with specific vulnerabilities to hazard events. Certain populations face greater risks following a hazard event due to age, economic status and mobility, physical or mental disability, geographic location, or a combination of these and other factors. Vulnerability in the face of a hazard event is not a fixed characteristic; the same individual may be at greater risk from some hazards but not others. For example, a low-income family without a car may face increased risks during a wildfire or flood event where rapid evacuation is necessary, but the same family may be adequately prepared for an earthquake. Some individuals can reduce their personal vulnerability through mitigation, whereas others face more permanent vulnerability to disasters. This is especially true for individuals who rely on caregiving networks to navigate daily life, such as children, the elderly, and persons with disabilities. (National Center for Disaster Preparedness, 2020) Inequality in the geographic distribution of environmental risk burden also means that lower-income and marginalized communities are more likely to live in hazard-prone neighborhoods with fewer mitigation resources.

In the context of all-hazards preparedness and response planning, **at-risk individuals** (often used interchangeably with vulnerable populations) are defined federally as "children, pregnant women, senior citizens, and other individuals who have access or functional needs in the event of a public health emergency." (42 USC § 2802(b)(4)(B)) Examples of these populations include, but are not limited to, persons who are poor, are living with chronic medical conditions, come from historically marginalized communities, have limited English proficiency or are non-English speaking, lack transportation, or are experiencing homelessness.

Planning for vulnerable populations in hazard mitigation can help prioritize limited resources where they will be the most effective. Examples include cost-sharing to reduce wildfire fuels, stabilize structures against earthquake, or implement flood mitigation measures. Translating emergency information and preparedness programs into languages other than English, based on the local community's needs, is another example.

4.3.4.3 Income & Housing

Income level is one of the most important predictors of hazard vulnerability. Low-income residents are more likely to occupy housing which is inadequately maintained or otherwise poorly built to withstand extreme events. For example, mobile homes are more susceptible to damage in earthquakes and floods than other types of residences, and older homes are less likely to contain air conditioning or cooling units to cope with high heat events. In urban areas, low-income residents are more likely to occupy homes and apartment buildings with unreinforced masonry, which is particularly susceptible to earthquake damage.

Renters are also more vulnerable to hazards, as they are less likely to have personal property insurance and the decision to make major structural improvements typically lies with the property owner. Federal disaster recovery services can exacerbate inequalities between renters and homeowners; payout amounts are significantly higher for homeowners applying through FEMA's Individual Assistance (IA) program. From 1999 to 2013, homeowners saw their wealth increase with local hazard damages, whereas renters' wealth decreased. (Howell & Elliott, 2019)

Reading from Table 4-5, Tehama County had an overall homeownership rate of 67% in 2021, with owner occupied units being the dominant form of housing supply. Figure 4-3 shows renter occupancy rates among the block groups within Tehama County.

Within Tehama County, limited variability exists between neighborhoods in city limits; some city neighborhoods vary only by a percentage. (See Figure 4-4) Approximately 33% of occupied housing units in Tehama County were renters as of 2021, compared to 55% for California as a whole. (See Table 4-8) Renters and owners as a proportion of housing tenure are also shown on a block group basis in Figure 4-4.

Table 4-5: Owner- and Renter Occupied Households

Jurisdiction	Total Occupied Housing Unites	Owner Occupied / (%)	Renter Occupied / (%)
Tehama County	24,551	16,496 (67%)	8,055 (33%)
California	13,217,586	5,882,339 (45%)	7,335,247 (55%)

Source: 2016-2021 ACS 5-Year Estimates

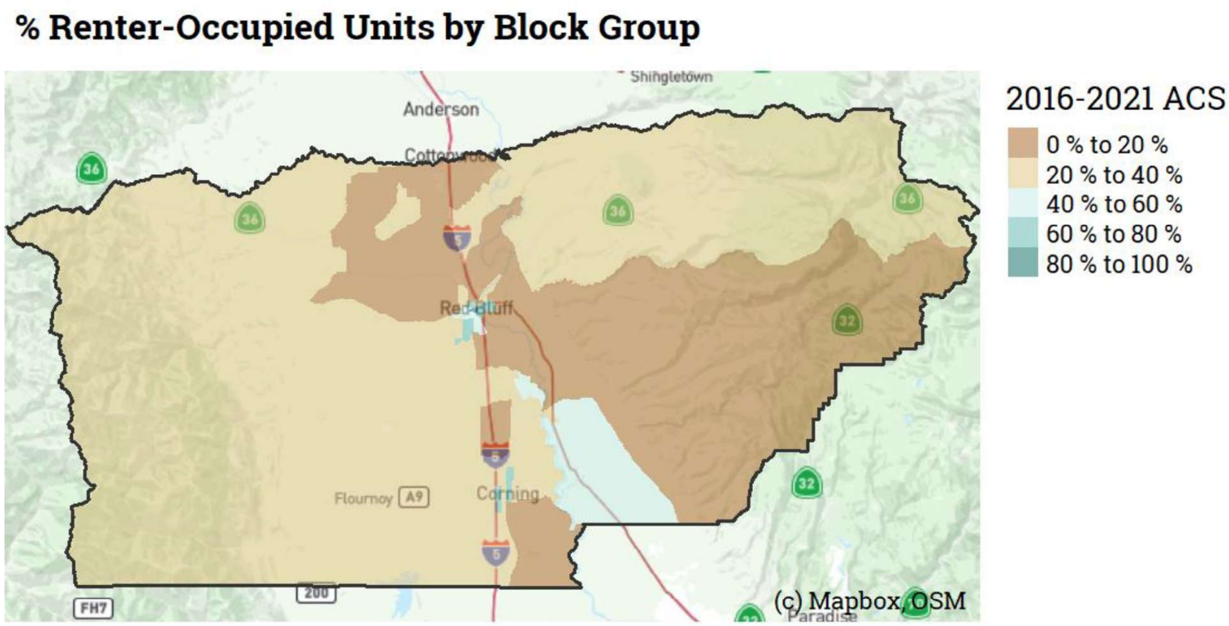


Figure 4-3: Share of Renter-Occupied Households in Tehama County and Surrounding Areas
Source: 2016-2021 ACS 5-Year Estimates

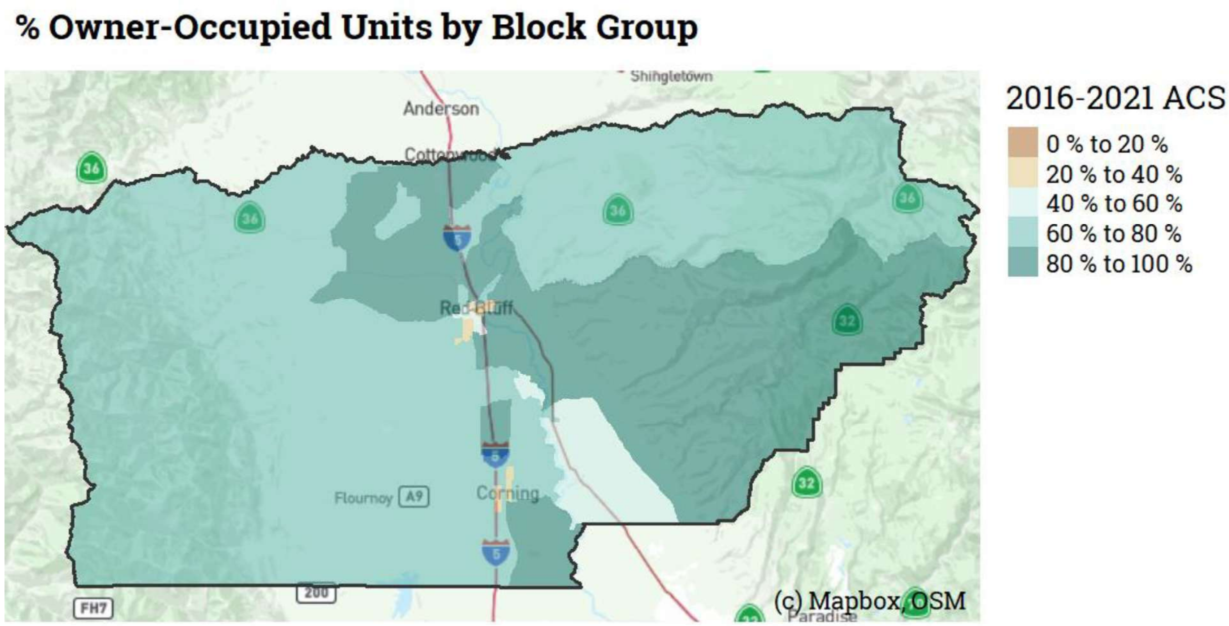


Figure 4-4: Home Ownership Rate by Block Group
Source: 2016-2021 ACS 5-Year Estimates

Low-income households and communities face disproportionate financial burdens from the costs associated with disaster preparedness, response, and recovery. Disasters create unexpected expenses which may serve as "tipping points" for families and individuals living on the edge of poverty or homelessness. Those who lack access to transportation may be unable to evacuate ahead of an emergency, and recovery costs may be higher for a household without the resources to conduct hazard mitigation activities ahead of time. (Krause & Reeves, 2017) Renters and low-income residents are also less likely to purchase insurance, meaning that those with the most to lose during a hazard event are also the least prepared to deal with potential losses. Major hurricane events in recent history, such as Harvey, Irma, and Katrina, all demonstrate that low-income and historically marginalized communities face increased vulnerability to hazards and struggle the most to recover. (*Id.*)

The median household income for Tehama County in 2021 was $52,901, with 17.98% of the population living in poverty. (See Table 4-6) Significant geographic variation is present among Tehama County and surrounding Cities of Corning, Red Bluff, and Tehama, as well as within neighboring areas of the county itself. The lowest-income neighborhoods and highest poverty rates in Tehama County are located north of the City of Corning. (See Figure 4-5 and Figure 4-6)

Table 4-6: Household Income and Poverty Levels

Jurisdiction	Population	Persons in Poverty	Poverty Rate	Median Household Income
Tehama County	65,345	6,967	17.98%	$52,901
California	39,030,000	4,781,175	12.25%	$84,097

Source: 2016-2021 ACS 5-Year Estimates

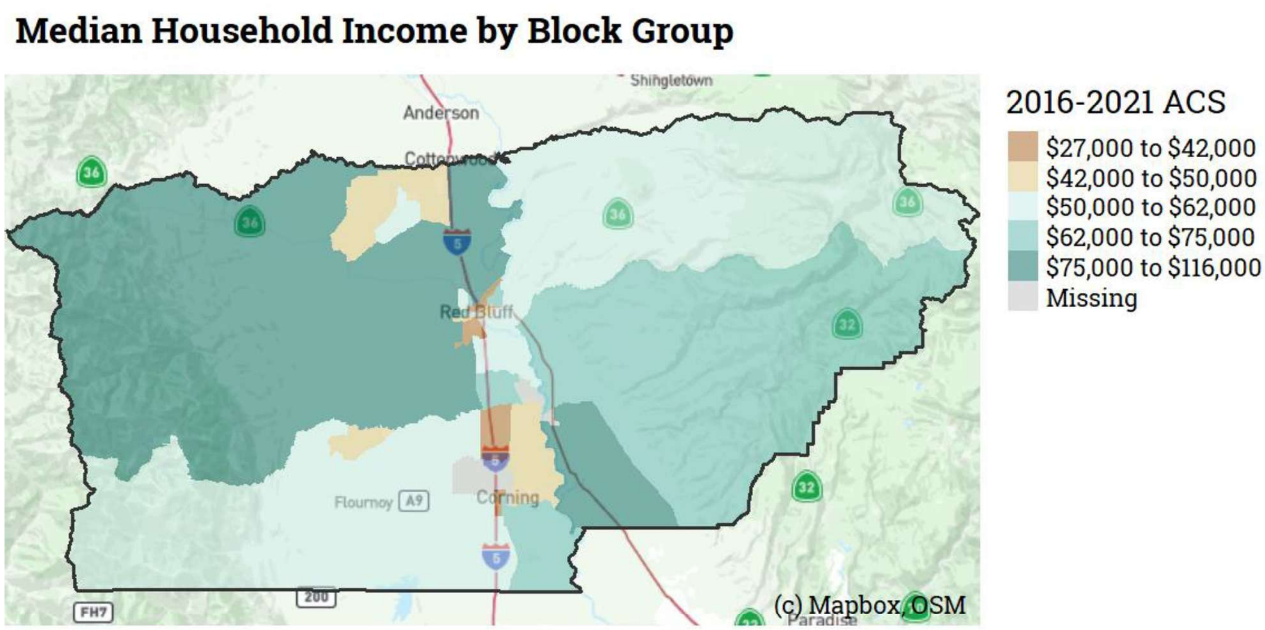


Figure 4-5: Median Household Income Distribution
Source: 2016-2021 ACS 5-Year Estimates

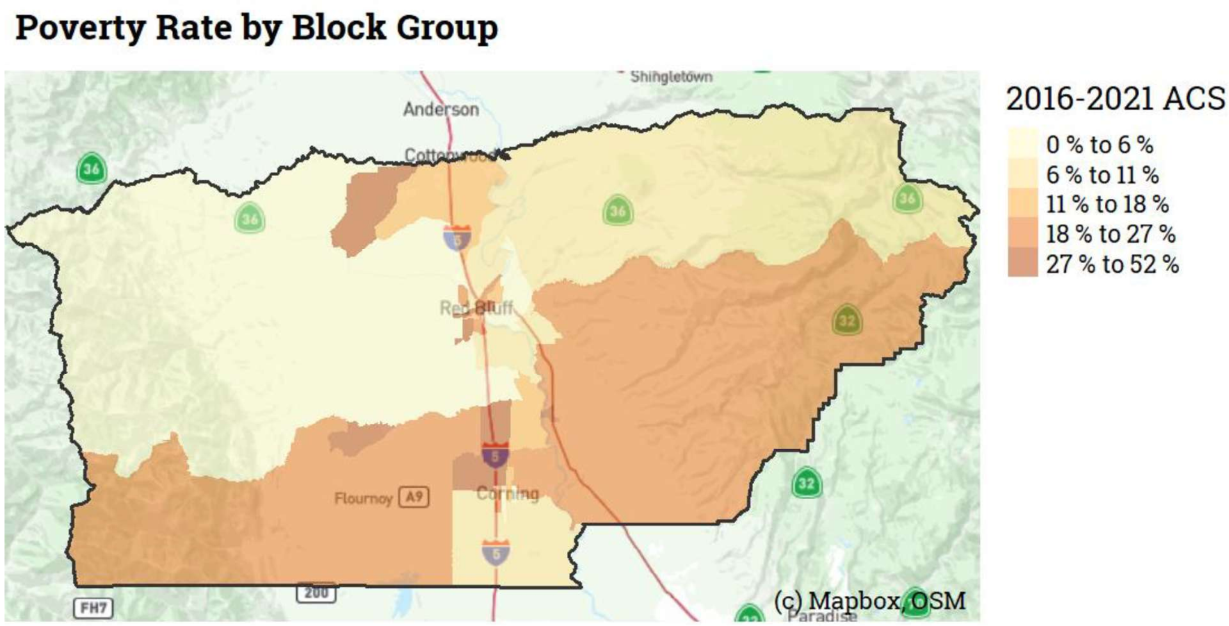


Figure 4-6: Poverty Rates by Block Group
Source: 2016-2021 ACS 5-Year Estimates

4.3.4.4 Age

Children and the elderly may be more vulnerable to the impacts of hazard events. Specific planning attention for elderly persons is important, especially given the current aging of the American population. Vulnerability among persons in the same age cohort varies significantly based on health, age, and economic security; nevertheless, senior residents as a group have a higher prevalence of physical and financial barriers to response and recovery, both during and after an emergency. Figure 4-7 and Figure 4-8 show the share of households with persons under the age of 18 or over the age of 65 within Tehama County and its incorporated areas.

In addition to physical limitations, an overall higher prevalence of chronic medical conditions among seniors translates to exacerbated health risks from specific disasters, including smoke from wildfires and extreme temperatures during weather events. This underlying vulnerability of elderly residents to hazards can be compounded by financial hardship. Further, seniors living alone may have more difficulty evacuating, especially for individuals with mobility challenges and those who lack internet access or fluency. Assisted-living facilities usually require extra notice and coordination to implement evacuation and are typically identified as "critical facilities" by emergency managers.

Over one-third of households in Tehama County include at least one senior individual (over 65 years of age), of which 3.6% experience poverty and 9% live alone (Table 4-7). Figure 4-7 shows a high concentration of elderly living in the eastern part of the County and south of Corning.

Children often depend on family and caregivers to navigate daily life. As such, their resilience during and after a disaster is only as strong as the networks of care upon which they rely. Disasters may also have detrimental long-term effects on children, especially those from poor families. 29% of households in the county include minors under the age of 18, 8.3% of which represent single caregiver households (Table 4-8). Figure 4-8 shows a high concentration of children living in the western part of the County and on the Highway I-5 corridor.

Table 4-7: Elderly Households

Jurisdiction	Total Households	Total Households w/ 65+	(%)	Households w/ 65+ Living Alone	Households w/ 65+ Living in Poverty
Tehama County	27,347	8,959	32.8%	2,449	988
California	14,328,539	3,977,705	27.8%	761,722	386,319

Source: 2016-2021 American Community Survey 5-Year Estimates

Table 4-8: Households with Minors and Single Parents

Jurisdiction	Total Households	Households w/ Minors	(%)	Single Parent Households with Minors <18
Tehama County	27,347	7,938	29%	2,273
California	14,328,539	4,462,011	31.1%	1,124,260

Source: 2016-2021 American Community Survey 5-Year Estimates

Figure 4-7: Population Over Age 65
Source: 2016-2021 ACS 5-Year Estimates

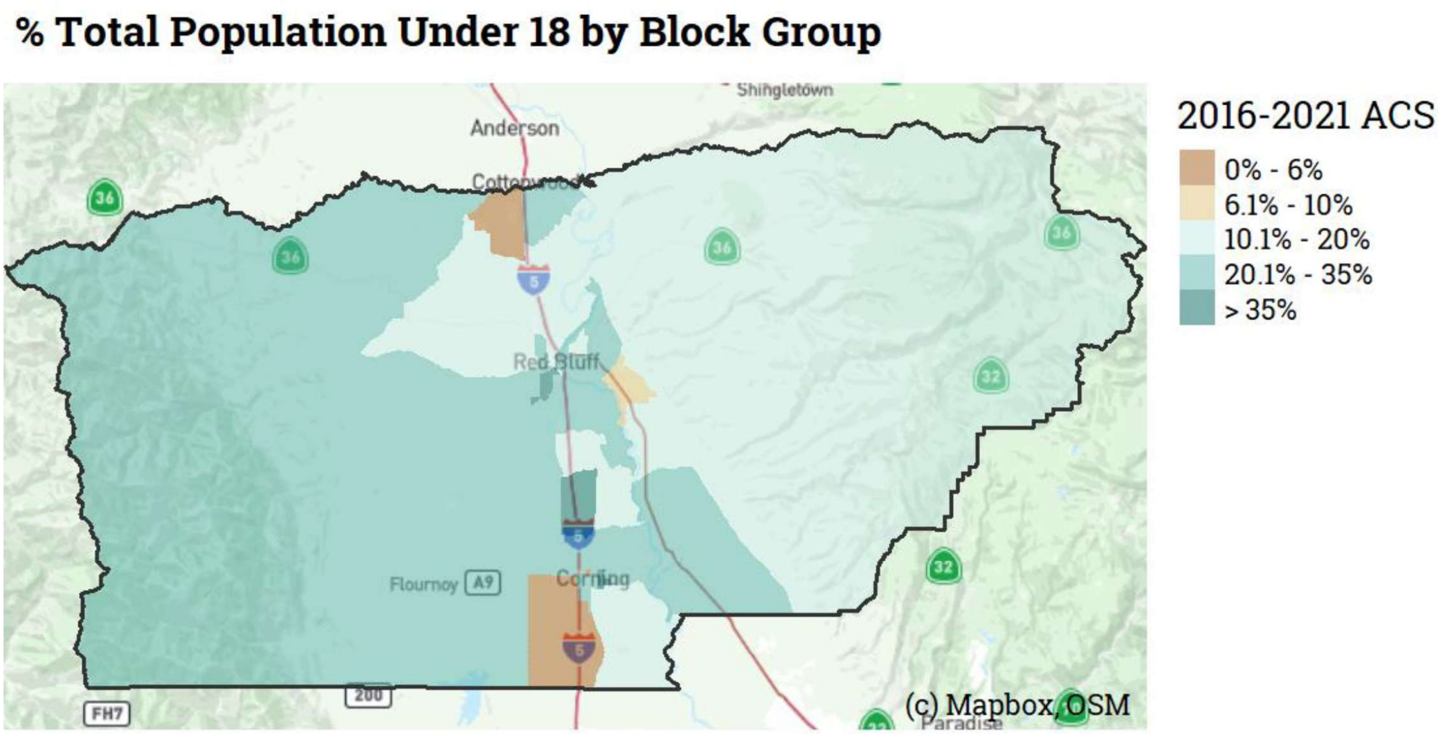


Figure 4-8: Population Under Age 18
Source: 2016-2021 ACS 5-Year Estimates

4.3.4.5 Race, Ethnicity & Language

Natural disasters compound racial disparities; non-white individuals and communities receive less recovery aid from FEMA than their white counterparts, even where the amount of damage is the same. (Howell & Elliott, 2019) (National Advisory Council, 2020) The recent COVID-19 pandemic was a testament to racial disparities in disaster outcomes, with non-white persons facing morbidity rates from COVID-19 infections anywhere from 70% to 350% higher than white, non-Hispanic persons. (CDC, 2020)

These disparities are evidence of the complicated relationship between disaster recovery and overlapping social vulnerabilities including race, income, language, and health. Black and Latinx residents are more likely to be low income and renters, conditions which create barriers to navigating FEMA's Individual Assistance programs. Communities with more non-white residents may have lower tax revenue and property values, which means less investment in mitigation and rebuilding efforts before and after an emergency.

As of 2021, 28% of the population identifies as Hispanic, 2% as Black or African American, and 80% as white (see Figure 4-9). Tehama County's demographics have shifted over the last century, with the major change being an increase in the Hispanic population since the 1980s.

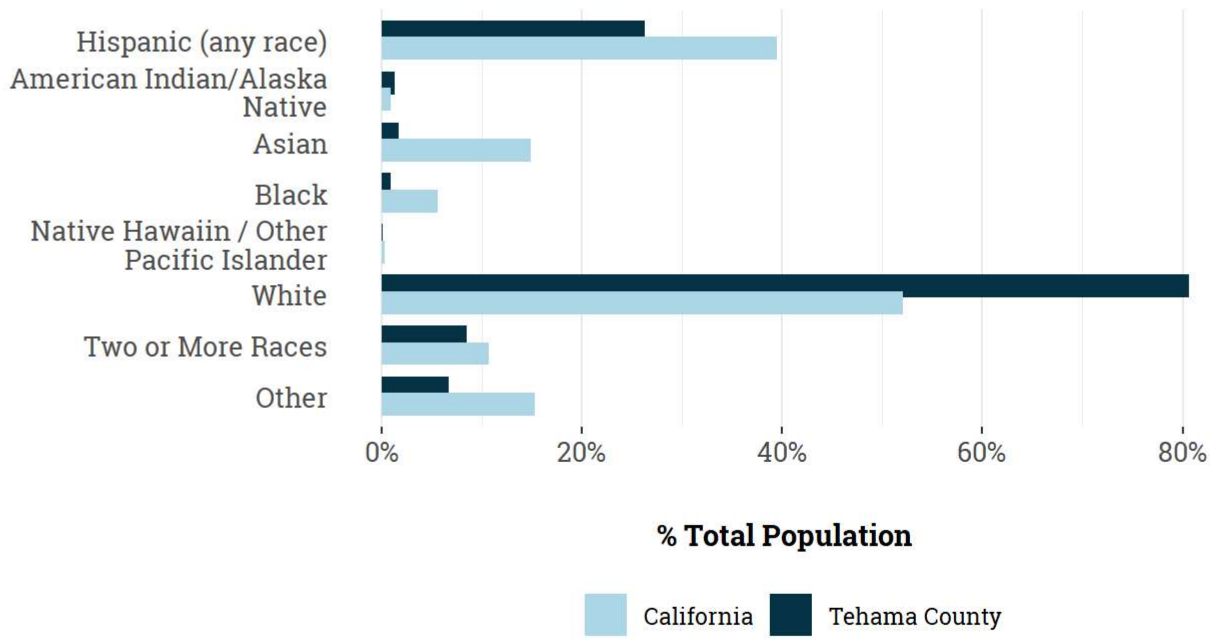


Figure 4-9: Tehama County Race Distribution in 2016-2021
Source: 2016-2021 ACS 5-Year Estimates
Note: (a) Incudes persons reporting only one race. (b) Hispanic persons may be of any race, so are included in applicable race categories. This has the effect of influencing total population percentage.

Individuals with no or limited English-speaking ability may be unable to access up-to-date emergency information and have difficulty navigating recovery programs. Local governments can take steps to increase equity in disaster preparedness and recovery outcomes, including timely translation of preparedness materials and emergency notifications and partnering with local community groups to target outreach to at-risk populations more effectively.

Approximately 12% of total households in the county are Spanish speaking, with 482 households speaking limited English (see Table 4-9). In general, these neighborhoods tend to be clustered towards the City of Corning with additional representation in the south of Red Bluff, as shown in Figure 4-10.

Table 4-9: Spanish Speaking Households

Jurisdiction	Total Households	Spanish Speaking Households	(%)	Spanish-Speaking, limited English
Tehama County	27,347	3,319	12.1%	482
California	14,328,539	2,853,853	19.9%	27,607

Source: 2016-2021 ACS 5-Year Estimates

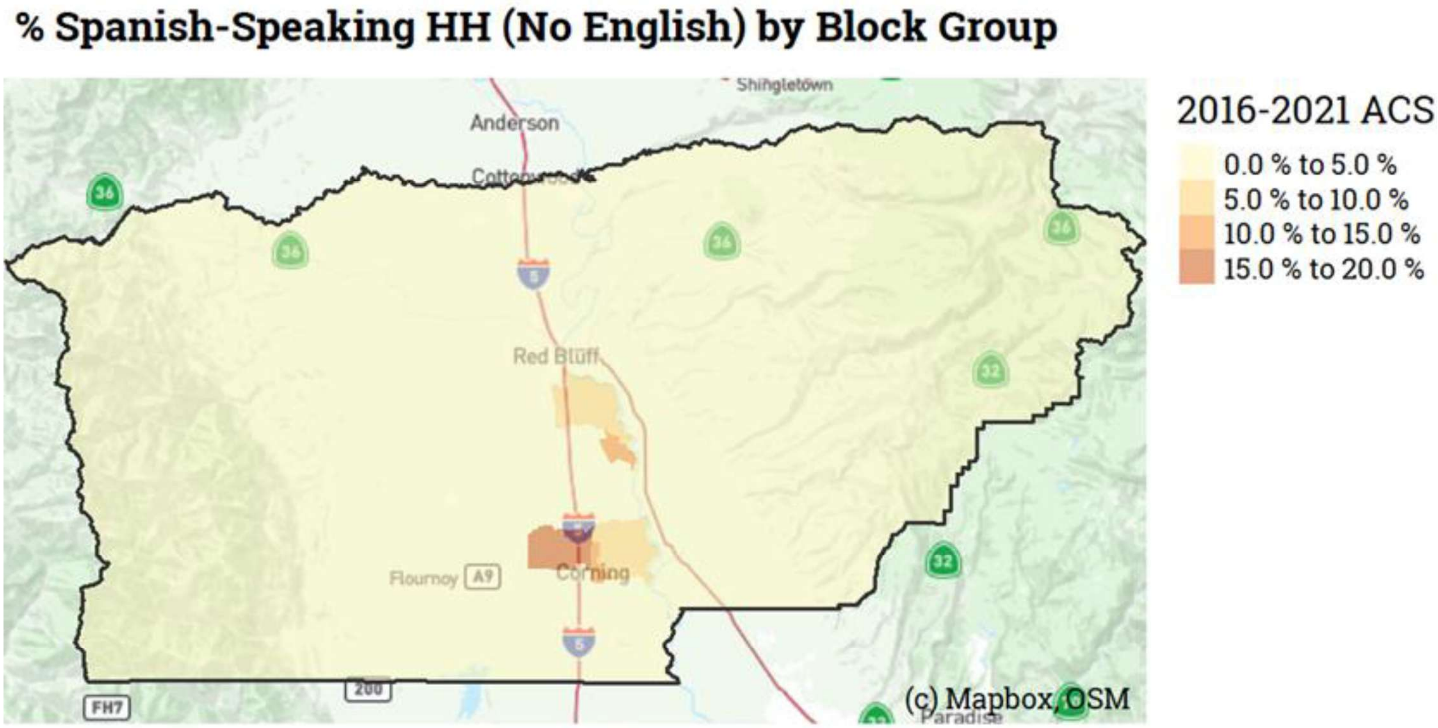


Figure 4-10: Spanish-Speaking (Non-English Speaking) Households by Block Group
Source: 2016-2021 ACS 5-Year Estimates

4.3.4.6 At-Risk Individuals with Access & Functional Needs

Access and functional needs may interfere with the ability for an at-risk individual to access or receive medical care before, during, or after a disaster or emergency event. Irrespective of a specific diagnosis, status, or label, the term "access and functional needs" (AFN) refers to a broad set of cross-cutting access-based or function-based needs, generally distinguished according to the following:

- **Access-based needs** require that resources are accessible to all individuals to maintain health, such as social services, accommodations, information, transportation, and medications.
- **Function-based needs** refer to restrictions or limitations an individual may have that requires assistance before, during, and after a disaster or public health emergency.

At-risk individuals may have additional needs that must be considered in planning for, responding to, and recovering from a disaster or emergency. An approach recommended by the U.S. Department of Health and Human Services (HHS) for integrating the access and functional needs of at-risk individuals is to consider elements based on the "CMIST" framework:

- **C = Communication** – Individuals with communication needs may have limitations that interfere with the receipt of and response to information, requiring information to be provided in an appropriate and accessible format. This can include individuals who are deaf or hard of hearing, speak American Sign Language (ASL), have limited or no English proficiency, are blind or have low vision, or have cognitive or physiological disabilities.

- **M = Maintaining Health –** Individuals may require specific services, supplies, equipment, medication, or nutrition to reduce negative impacts of a disaster or emergency and maintain activities of daily living, such as breathing, eating, dressing, grooming, transferring, and toileting.
- **I = Independence –** Continuity of access to necessary assistive devices, such as wheelchairs, or to other aids, like service animals, is crucial to maintaining independence for individuals who rely on these support tools to function autonomously.
- **S = Support –** Tailored, person-centered support may be necessary for individuals who have lost caregiver assistance, find it difficult to cope in a new or strange environment, have difficulty remembering or understanding, or have past trauma experiences. This includes support for victims of abuse, individuals with behavioral health needs, or those who have psychiatric conditions (e.g., Alzheimer's disease, Schizophrenia).
- **T = Transportation –** Individuals may lack access to personal transportation due to a variety of factors, including economic status, age, physical or mental disability, temporary condition or injury, or legal restriction. This requires coordination with mass transit and accessible transportation service providers to ensure access to support and necessary services. (HHS, n.d.)

While most individuals with access and functional needs do not have acute medical conditions requiring the support of trained medical professionals, many will require additional assistance to maintain health and minimize preventable negative outcomes. These at-risk individuals may also require more time or personnel to assist during an evacuation. Special attention from planners and emergency managers is warranted for this highly vulnerable population. It is estimated that approximately 18.8% of the total population of Tehama County lives with some form of a disability, as shown in Table 4-10.

In the event of a major disruption to public transit systems, families and individuals without personal transportation may face a limited ability to rapidly evacuate an impacted area and barriers to accessing medical or other essential services. Approximately 6% of households in the county have no access to a vehicle (see Table 4-10).

Table 4-10: Disability Status of Non-Institutionalized Population

Jurisdiction	Population	Persons with a Disability	(%)	Persons Reliant on Public Transit	Total Households (HH)	65+Households with no Vehicle / % HH
Tehama County	65,345	12,293	18.8%	62	27,347	1750 / 6.4%
California	39,455,353	4,145,501	10.5%	731,021	14,328,539	911,6551,161 / 6.4%

Source: 2016-2021 ACS 5-Year Estimates

Note: Age ranges are sums of multiple male/female and age range fields.

4.3.4.7 CDC Social Vulnerability Index (SVI)

The U.S. Centers for Disease Control (CDC) attempts to further quantify social vulnerability as it pertains to all-hazards mitigation planning by stewarding a composite index called the Social Vulnerability Index (SVI), which ranks Census Tracts on the basis of 16 different Census variables to identify at-risk populations. The four main themes the SVI uses to rank communities' percentile distribution on the basis of social vulnerability to public health emergencies and natural hazard events include socioeconomic status, housing type/transportation, racial and ethnic minority status, and household characteristics. Tracts in the top 10%, i.e., at the 90th percentile of SVI values, are considered highest vulnerability. As indicated in Figure 4-11, the areas with the highest SVI surround the City of Corning.

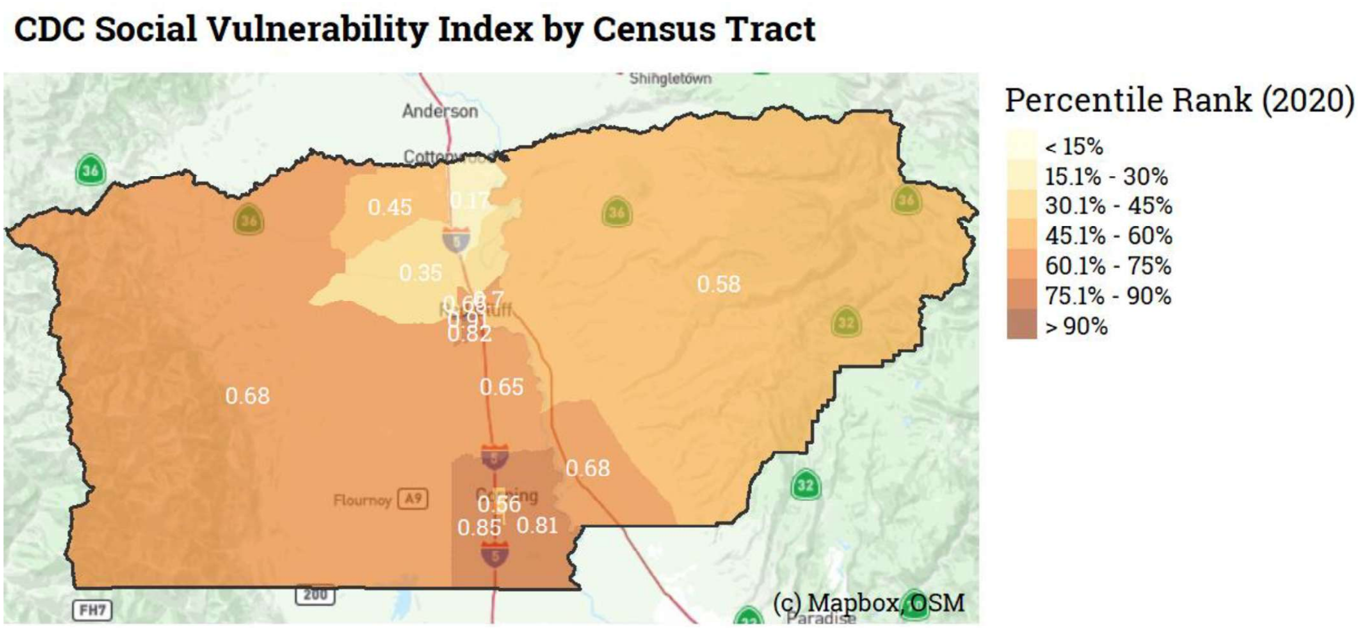


Figure 4-11: CDC Social Vulnerability Index by Census Tract
Source: 2016-2021 ACS 5-Year Estimates

4.3.4.8 Environmental Justice

Environmental justice issues can often exacerbate public health impacts from hazard events, and vice versa. The U.S. Environmental Protection Agency (EPA) defines environmental justice as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." (EPA, 2021)

As discussed in previous sections, hazard events can disproportionately impact low-income and vulnerable populations. Lower-income populations, for instance, are more likely to live in neighborhoods susceptible to flooding or near industrial areas or hazardous waste sites, which can put them at higher risk to toxic leaks associated with flood and storm damage. (Sherwin, 2019) With the increased frequency of wildfires in recent years, populations that are already living in air quality-impacted areas can be further affected by wildfire smoke. Often, these populations include elderly, low-income, or Native American residents who experience disproportionate health impacts from wildfire smoke, as well as other impacts from wildfires such as physical and psychological stress from evacuation, property loss, physical injury, or death. (Shahir Masri et al., 2021)

Certain locations within Tehama County are known to be at higher risk of hazard-related impacts to vulnerable populations. For instance, northern portions of the City of Corning are associated with higher pesticides and a larger Hispanic population. These same areas are associated with high unemployment, high poverty rates, and relatively high numbers of minority populations. These environmental justice concerns may contribute to adverse public health impacts in the event of flooding or high rain events in the area. It is vital that environmental laws and regulations, as well as hazard mitigation planning, meaningfully include these communities in their efforts at accounting for public health and safety.

4.3.4.9 Mental Health Impacts of Hazard Events

Hazard events are associated with many physical impacts on people and property, but they can also have mental health impacts. Specifically, hazards can precipitate anxiety, depression, shock, extreme stress, or Post Traumatic Stress Disorder (PTSD). (Makwana, 2019) Mental health challenges can also result from ongoing impacts after a disaster event, such as socio-economic losses from damage to housing resulting in displacement. The death or injury of a loved one can lead to substantial psychological vulnerabilities as well. (*Id.*)

4.3.5 Economy

Tehama County's General Plan indicates economic development as highly important to the community. Development of new businesses can expand the property tax base and increase sales tax, both directly and indirectly, as can the retention and expansion of existing businesses. Increasing County revenues has become more important in recent years due to declining revenues from the State of California and the decline in natural resource-related industries.

The County and its incorporated communities recognize that economic development is an important planning tool for managing growth to achieve a broad range of community goals and objectives, including economic diversification, entrepreneurial development, human resource development, job retention and growth of the tax base. These communities must coordinate economic development approaches to address logging cutbacks, lumber mill closures and other imminent changes.

In spite of current economic stresses, Tehama County possesses many crucial assets that may contribute to economic revitalization. Corning and Red Bluff are centrally located in Northern California on Interstate 5, the state's major north-south corridor. Tehama County is further advantaged by its proximity to major metropolitan growth centers including Shasta/Redding, Butte/Chico and the Sacramento Metropolitan Area. Many other County assets exist, including a large supply of entry-level labor; reasonably priced business environments; affordable housing; abundant cultural and recreational resources; and broad agricultural opportunities. Resource-based businesses are encouraged within the County by revitalizing traditional timber and agricultural industries. A change in demographics and culture promotes ecotourism, organic food production and to a lesser impact, recreation.

Tehama County's economy is strongly based in resource extraction as most of the land is used as cropland, range and pastureland, or woodland. The area's many natural resources support its primary industries of manufacturing, agriculture and trade.

Tehama County hosts a range of major employers including the Tehama County Government, Sierra Pacific Lumber and Millwork Industries, Wal-Mart store and distribution center and the Rolling Hills Casino. The County benefits from a variety of business activity ranging from heavy industrial/manufacturing to agriculture and to the retail services sectors.

Local unemployment statistics also reveal a tumultuous two-year period following the onset of the COVID-19 pandemic at the beginning of 2020, which saw a rise in unemployment to 15%. As the economy transitioned and more businesses were able to return to in-person and remote operations, the unemployment rate rapidly declined to almost 5.3% by the start of 2021, lower than the baseline unemployment rate before the pandemic. In 2024 the unemployment rate was 5.3% (California, 2024).

Table 4-11 shows the share of Tehama County's civilian labor force by industry, which is largely diversified. Education, retail, and agricultural based occupations comprise the largest percentage of total employment.

Table 4-11: Industry by Occupation for the Civilian Employed Population 16 Years and Over

Occupation	Total	Percent of total employment (%)
Total	25,597	100
Educational services, and health care and social assistance	5,871	22.9
Retail trade	2,989	11.6
Agriculture, forestry, fishing and hunting, and mining	2,503	9.8
Manufacturing	2,438	9.5
Public administration	2,170	8.4
Arts, entertainment, recreation, accommodation, and food services	1,992	6.7
Construction	1,873	7.3
Transportation, warehousing, and utilities	1,842	7.2
Professional, scientific, management, administrative, and waste services	1,735	23.3
Other services, except public administration	987	3.9
Finance and insurance, and real estate and rental leasing	784	3.1
Wholesale trade	298	1.1
Information	134	0.5

Source: 2022 ACS 5-Year Estimates For Employment

4.3.6 Past & Future Development Trends

Tehama County is a charter county that crafts its own development regulations and is subject to California State law. Future development is subject to compliance with state and local land use, planning, zoning, subdivision, and architecture laws. More recent development has occurred with minimized hazard risk because of the existing overlay of federal, state, and local regulations.

Tehama County's General Plan establishes long-range development policies and is designed to help the county address challenges and future goals related to land use, traffic circulation, infrastructure, housing, open space, resource conservation, noise, and public safety. For example, the Land Use Element of the General Plan helps guide the county in determining the type and location of appropriate future development.

In addition, the county has other long-range plans and policies that guide new development in defined areas, including capital improvement and area plans, which help shape the county's future within and adjacent to its jurisdictional boundary. One of the central functions in such planning documents is to decrease risks and impacts from natural and other hazards.

Moreover, while past development has occurred in hazard areas, increasing risks to some degree, more recent development standards and performance measures that are oftentimes incorporated into specific plans, policies, or area plans are employed to reduce risk. These development standards are continually improving and will strengthen in the future. This MJHMP has been revised to reflect the substantial changes in development patterns and continues to focus on avenues to better mitigate impacts from past development.

Tehama County has gone to great lengths to ensure future development within hazard areas is minimized and mitigated to the greatest extent possible. The Capabilities Assessment in Section 5.4 explains those proactive steps in greater detail. Buildings are increasingly more resilient to hazards through California's building codes, some of the strongest in the country. Nationally, building codes have continually improved disaster resilience and, since 1990, those great improvements have added only approximately one percent to construction costs. (National Institute of Building Sciences, 2019) Tehama County has also completed and continues to implement mitigation projects that decrease its vulnerability to hazards, as described in Section 5. The anticipated growth, minimal in nature, will not cause significant change in vulnerabilities to the priority hazards identified.

4.4 Vulnerability Assessment Methods

This section provides an overview of the methods used in the hazard-specific vulnerability assessments offered in Section 4.5. For each hazard type, a general explanation of the phenomenon is provided, and vulnerability is assessed using a two-step process. First, an inventory of population, critical facilities, and county parcels is taken to develop a "lay of the land." Second, the inventory is used to calculate estimated exposure and damage from hazards at various levels of severity. A more detailed explanation of methods is included in Appendix A.

The vulnerability assessment uses geospatial data along with local knowledge of past events. Geospatial data is essential in determining the population and assets exposed to hazards identified in this plan, and such analysis can be conducted if a hazard has a spatial footprint to be analyzed against locations of people and assets. In Tehama County, wildfire, earthquake, slope failure, dam inundation and flood hazards have identifiable geographic extents and corresponding spatial information. The geographic extents are then used to aggregate population and asset information described below.

4.4.1 Population & Asset Inventory

To describe vulnerability for each hazard, it is important to first understand the total population and total assets at risk. Population and asset inventories provide a baseline to measure vulnerability of people and assets to a given hazard. Asset inventories can also be used to estimate damages and losses expected during a given hazard event. Figure 4-12 provides a summary of how and what data sources were used to provide exposure and damage estimation results. More detail on the risk assessment analysis method is provided in Appendix A. The following sections describe the total population, critical facilities, and parcel inventory inputs.

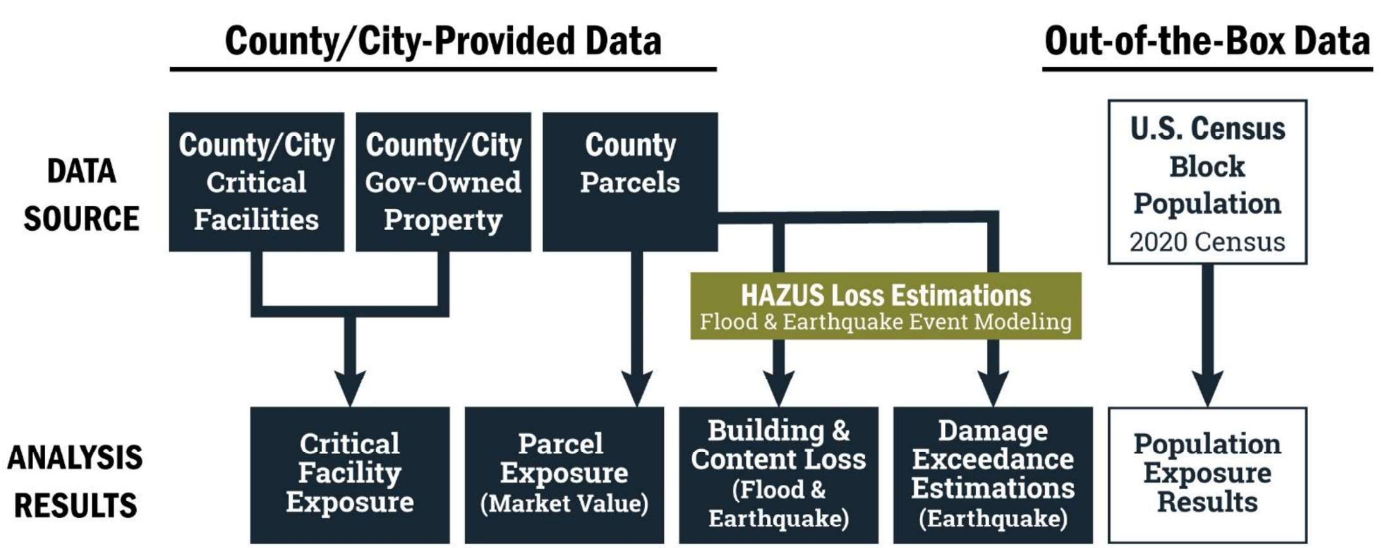


Figure 4-12: Data Source and Methodology

4.4.1.1 Population

An initial step in producing the hazard-specific vulnerability assessments is to determine population near each hazard. Each hazard scenario impacts county residents differently depending on the location relative to population distribution. For hazards that potentially affect the whole county, such as an earthquake or high heat event, the vulnerability assessment assumes 100% of the county's population is exposed. Vulnerability assessments presented in Section 4.5 summarize the total population exposure for each hazard as available.

4.4.1.2 Critical Facilities

A critical facility is a structure, infrastructure, or other improvement that, because of its function, size, service area, or uniqueness, has the potential to cause disruption of vital socioeconomic activities if it is destroyed, damaged, or functionally impaired. A critical facilities spatial database was developed to translate information into georeferenced[4] points and lines that represent physical locations.

- **Points** include critical facilities such as government buildings, police stations, fire stations, hospitals, elder care facilities, child care facilities, schools, and transportation and utility structures.
- **Lines** include critical facilities related to electrical power, liquid fuel, natural gas, and other crucial utility infrastructure lines as well as transportation routes.

The risk assessment for each hazard qualitatively discusses critical facilities with regard to each hazard's severity footprint. A current representation of critical facility points for Tehama County is provided in **Figure 4-13**. However, some critical facility information may be omitted from this document due to national security concerns, and a detailed list of facilities is not provided; more detailed critical facilities lists are on file with the individual jurisdictions and agencies that oversee those assets.

Critical facilities inventory data was developed from a combination of datasets, including from county, city, special purpose district, state, federal, and private industry sources. All data sources have a level of accuracy acceptable for planning purposes. Critical facilities are categorized as **Essential Facilities, High Potential Loss, or Transportation and Lifeline**. A **Hazardous Materials** category aids in identifying the potential for secondary hazards in the event they are impacted. For a list of included asset types, refer to Table A - 1 of Appendix A. Additionally, these categories can be further broken down by individual asset type into **Community Lifelines** through plan development and discussion with the hazard mitigation stakeholders and Steering Group.

[4] To georeference something means to define its existence in physical space; that is, to establish its location in terms of map projections or coordinate systems. The term is used both when establishing the relation between raster or vector images and coordinates and when determining the spatial location of other geographical features.

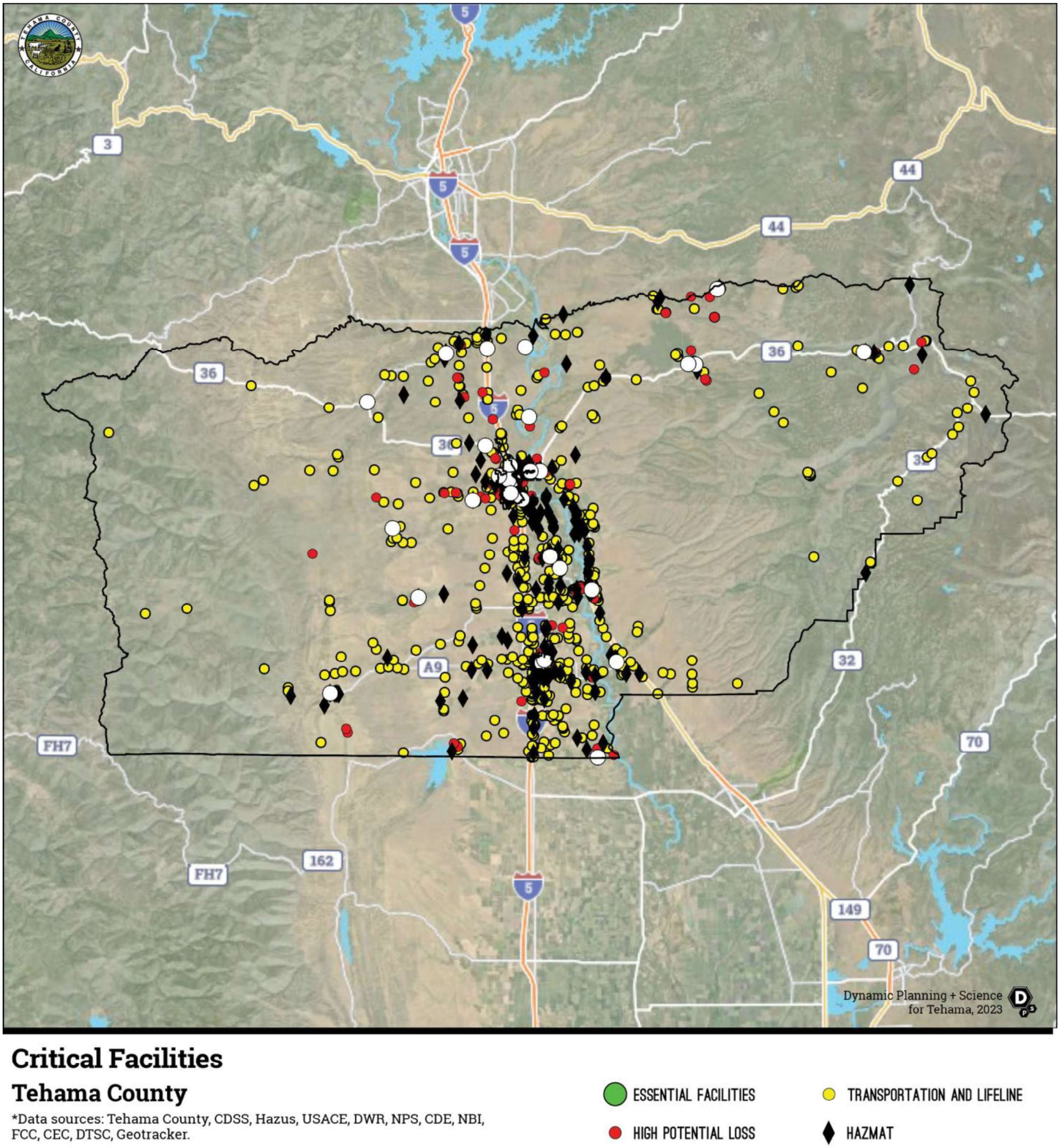


Figure 4-13: General Location of Critical Facilities

4.4.1.3 Parcel Value

The Tehama County Assessor's data is essential to developing an inventory of parcel values exposed to each hazard and includes the current fair market value of at-risk assets. Tehama County's parcel value inventory only includes parcels of land and improvements thereon that are located within the unincorporated county boundaries; individual inventories for other participating jurisdictions are provided in their respective annex in Volume 2 of this MJHMP. The inventories describe three main elements: market value, content replacement value, and total value ("total value"). The county's parcel count and total values are summarized in Table 4-12.

Total market value, as presented in this plan, reflects improvement replacement estimation based on Tehama County Assessor data. Where building floor areas were available, a replacement value of **$330 per square foot** was used. If no floor area was available for a given parcel of land, the value reflects the assessed improvement value as provided by the Assessor. **Total content value** was calculated based on the Tehama County Assessor's use codes then translated to occupancy-based multipliers. Each occupancy class prescribes a specific content cost multiplier used to calculate the total values shown in the summary and in the hazard profiles (Section 4.5). Occupancy-based content cost multipliers used in this plan reflect those found in the FEMA Hazus-MH 6.1 technical manuals.

Each hazard profile outlines predicted impacts to the parcel value inventory for the hazard's geographic extent. The three elements of value are called out separately in the table because, in the event of a disaster, the value of infrastructure or improvements on the land is usually the focus of concern. Generally, the land alone is not a total loss, while structures may need to be rebuilt or their contents replaced.

Table 4-12: Parcel Count and Value Summary

	Total Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)
Unincorporated County	6,668	$3,186,640,275	$2,078,097,240	$5,264,737,515

Note: Total market value as provided by County Assessor's Office and based on $330/sqft replacement cost where available. Content value calculated using content multipliers per Hazus occupancy classes per county land use designation. Total value is the sum of total market value and total content value. Improved Parcels Only.

4.4.2 Hazard Exposure & Damage Estimation

Population information and asset inventories are used to generate hazard-specific exposure and damage estimations based on the severity of a given hazard event. **Hazard exposure** analyses were completed for all spatially delineated hazards. Delineated hazards for this HMP include wildfire, flood, earthquake shakemaps, slope failure, and dam inundation. **Damage estimation** analysis using FEMA Hazus was completed for earthquake and flood hazards. For more information on distinguishing between hazard exposure vs damage estimation analysis refer to A.1.2

4.4.2.1 Population & Asset Exposure

Hazard exposure is the total count of parcels, people, critical facilities, and other assets within the planning area in which a hazard event has a geographically defined risk for occurrence. These geographic delineations are not fully inclusive and are suggestive tools for planning purposes. A geospatial overlay of hazards was developed to reflect the combination of known spatial footprints. The overlay method enables summarization of building values, parcel counts, population, and critical facilities that are exposed within a hazard's known geographic extents. Figure 4-14 illustrates hypothetical flooding exposure.

At-risk populations, critical facilities, improved parcels, and loss results for each hazard profiled in this plan are provided as summaries in Section 4.5 to evaluate the percentage of assets exposed to different types of hazards. This side-by-side comparison allowed the hazard mitigation plan stakeholders to evaluate the impacts of potential hazards and prioritize mitigation resources and energy.

Figure 4-14: Hazard Exposure Example

4.4.2.2 Damage Estimation

For earthquake and flood, detailed **damage estimations** were conducted through **FEMA's Hazus** software. Hazus is a nationally applicable, standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. Hazus uses Geographic Information Systems (GIS) technology to estimate the physical, economic, and social impacts of disasters.

In the hypothetical scenario shown in Figure 4-15, even though both structures are exposed to flooding, it is expected that the structure with a first-floor elevation below the depth of flooding will receive significantly more damage than the structure with a first floor elevation above anticipated floodwater depth. For a more detailed explanation of risk assessment methods, see Appendix A.

Figure 4-15: Hazus Damage Estimation Example

4.5 Vulnerability to Specific Hazards

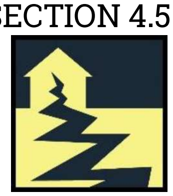
This section introduces prevalent, county-wide hazards affecting the planning area and reviews the analyzed vulnerability to each of populations, property, and critical facilities within Tehama County. The hazard mitigation strategy presented in Section 5 is informed by and responds to the specific vulnerabilities identified in this section. The mitigation strategy provides actions to achieve the greatest reduction of vulnerability based on the hazards and particular issues discussed, which results in saved lives, reduced injuries, reduced property damage, and increased protection for the environment during and after a hazard event. Methodologies for calculating exposure and loss estimates are described in Section 4.4 and Appendix A.

This section provides quantifiable exposures to people and property, as well as damage and loss estimates, for county-wide priority hazards. Participating jurisdiction annexes in Volume 2 of this MJHMP contain jurisdiction-specific vulnerabilities to hazards.

Wildfire
SECTION 4.5.1

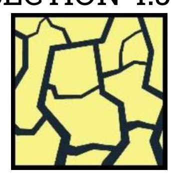
Flood
SECTION 4.5.2

Earthquake
SECTION 4.5.3

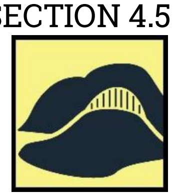


Extreme Weather
SECTION 4.5.4

Drought
SECTION 4.5.5



Slope Failure
SECTION 4.5.6



Extreme Heat
SECTION 4.5.7

Dam Failure
SECTION 4.5.8

Climate Change is discussed within related hazard profiles, problem statements, and mitigation actions as deemed pertinent by analysis, discussion, and the Hazard Mitigation Planning Team. Climate change is a complex phenomenon that has the potential to compound (make worse) a range of natural hazard events. For more information refer to Section 4.6.

4.5.1 Wildfire Hazard Profile

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity, such as smoking, campfires, equipment use, or arson. The 2023 California State Hazard Mitigation Plan defines wildfires as:

- Any free-burning vegetative fire
- Started by unplanned ignition, whether natural (e.g., lightning) or human-caused (e.g., powerlines, mechanical equipment, discarded cigarettes, escaped prescribed fires or intentionally set fires),
- With a management objective of full suppression. (Cal OES, 2023)

Wildfires are costly, putting lives and property at risk and compromising rivers and watersheds, open space, timber, range, recreational opportunities, wildlife habitats, endangered species, historic and cultural assets, scenic assets, and local economies. Vulnerability to flooding and debris flows increases following wildfires due to the loss of forest and ground cover within watersheds. The potential for damage to life and property increases in areas where development is adjacent to densely vegetated areas, known as wildland-urban interface areas. (FEMA, 2020) While some fires are allowed to burn naturally in order to maintain or restore the health of forest lands, out of control wildfires need to be prevented through cooperative, community, and land management planning.

4.5.1.1 Local Conditions Relating to Wildfire

Tehama County faces significant wildfire risks due to its local climate, geography, and vegetation. The county's inland location creates an environment where summer temperatures are high, and precipitation is sparse, leading to dry, highly flammable vegetation. Tehama experiences a Mediterranean climate, with hot, dry summers and mild, wetter winters. During the summer months, grasses and shrubs dry out, becoming hazardous fuels. These dry conditions, coupled with seasonal winds—often hot and dry from the west—can rapidly escalate fire danger.

The county's diverse topography, which includes valleys, rolling hills, and forested areas, also influences wildfire behavior. Areas with steep terrain can create conditions for faster-moving fires, while the expansive wildland-urban interface (WUI) increases the risk to residential communities. The rugged landscape often makes firefighting efforts more challenging, especially in remote areas. (NWCG, 2024) (Northwest Fire Science, n.d.)

- **Precipitation**: The county experiences a Mediterranean climate, with most rainfall occurring in the winter months. Summers are extremely dry, and precipitation is sparse between June and September. This prolonged dry period leaves vegetation like grasses, shrubs, and trees highly flammable, contributing to hazardous fuel conditions. The limited rain, particularly during critical fire season months, exacerbates the risk of wildfires, as fuels dry out and become primed for ignition.

- **Wind**: Winds in Tehama County play a crucial role in wildfire behavior. The region experiences seasonal winds, particularly from the west, that are often hot and dry. These winds can increase the spread and intensity of wildfires by pushing flames into new areas and drying out vegetation further. High winds also make it more challenging for firefighters to control blazes, as they can cause embers to travel long distances and ignite spot fires.
- **Terrain**: Tehama County's diverse terrain ranges from flat valley areas to rolling hills and mountainous regions, particularly near the Sierra Nevada and Cascade mountain ranges. This rugged topography can significantly influence wildfire behavior. Fires tend to move more rapidly uphill, and steep slopes can create dangerous conditions by funneling flames and increasing the speed of fire spread. Additionally, the county’s extensive wildland-urban interface (WUI) — areas where human development meets undeveloped wildland — makes many communities particularly susceptible to wildfire damage.

Depending on location, elevation, and weather patterns, the declared fire season typically lasts from early May to mid or late October. The fire season is a time of increased risk of conflagration to residential and other development within the county. Conflagration is an extensive fire that destroys a great deal of land or property. The hilly and mountainous terrain on both sides of the county strongly influences both wildland fire behavior and fire suppression capabilities. (*Id.*)

4.5.1.1.1 Sudden Oak Death

The county is also at risk of increased wildfire due to what is referred to as sudden oak death. Sudden oak death is caused by the pathogen *Phytophthora ramorum*, which has been responsible for massive die-offs of true oak (*Quercus* spp.) and tanoak (*Lithocarpus densiflorus*) in coastal and inland regions of both California and Oregon. These die-offs become a source of fuel and have consequently become an increasing concern for their potential to increase fire intensity throughout the region. (Yana S. Valachovic et al., 2011) At this time SOD is limited to the counties west of Tehama but the pathogen continues to spread inland. Climate change, more frequent droughts, and pathogen exposure are all necessary risks to consider when taking a proactive approach to ensuring long-term oak health and mitigating wildfire risk.

4.5.1.1.2 Human-Caused Wildfires and Urban Conflagration

One of the primary causes of wildfire ignition is humans. Nearly 85 percent of wildland fires in the United States are caused by humans. Human-caused wildland fires can be initiated by campfires that are left unattended, equipment use or malfunction, intentional acts of arson, or carelessly discarded cigarettes. (National Park Service, 2018)

Urban conflagration is typically characterized as a fire that occurs in the built environment, beginning with one structure and quickly spreading to many more. It can be caused by criminal acts, such as illegal explosives; civil unrest; residential accidents, such as improper use of electrical or heating appliances; or industrial accidents, such as transportation accidents.

4.5.1.1.3 Lightning

While humans cause the vast majority of wildfires, lightning-triggered wildfires burn about 70 percent of all acreage. Dry lightning, when lightning occurs alongside less than 2.5 millimeters of rainfall, can also start wildfires in remote places. (U.S. National Science Foundation, 2023) Climate change is predicted to increase the occurrence of lightning by as much as 12 percent for every degree Celsius (about two degrees Fahrenheit) rise in global temperature, which could be as much as a 50 percent increase in lightning by the end of the century. (Inside Climate News, 2022) This prediction is a blanket average increase across the continental United States; increases could be higher or lower depending on the distribution of increases over seasons or geographical area. (*Id.*)

4.5.1.1.4 Wildland-Urban Interface

The Wildland-Urban Interface (WUI) in Tehama County, presents significant challenges related to wildfire risk, as residential development has expanded into areas prone to wildfires. The WUI is defined as 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)

Tehama County's topography includes a variety of landscapes, from the Sacramento Valley's flatlands to the rugged foothills and mountains of the Coast Ranges and Sierra Nevada. This diverse terrain creates areas with dense vegetation, such as oak woodlands, chaparral, and mixed conifer forests, which can act as fuel during fire season. As more homes are built in these fire-prone areas, the risk of fire spreading from wildlands to residential areas becomes greater. (CAL FIRE, 2023)

The WUI in Tehama County is particularly vulnerable due to its dry climate, seasonal winds, and high vegetation density, which create conditions favorable for severe wildfires. The county has experienced multiple significant fires, including those sparked by lightning and human activity.

4.5.1.1.5 De-Energization and PSPS Events

Recent wildfire events have been linked to faulty electric transmission equipment, which in turn has led to public safety power shutoffs (PSPS), also referred to as de-energization. (California Public Utilities Commission, 2020) Pacific Gas and Electric (PG&E) reached a $13.5 billion settlement and pled guilty to 84 counts of manslaughter as its transmission facilities sparked wine country blazes in 2017 and the fire that nearly destroyed the town of Paradise in 2018. (Blume, 2019) In order to avoid these catastrophic wildfire events, electric utility companies have started massive and preemptive power shutoffs in high wind events to avoid sparking fires. This leaves communities and essential facilities without power, a particular challenge in preparing for and responding to hazard events and assisting vulnerable populations. (California Public Utilities Commission, 2020, p. 5) The increased frequency of PSPS events renewed focus on addressing the loss of power in hazard mitigation planning in Tehama County and around the state even as PSPS events grow more common. At this time PG&E has a 211 number residents can call and encourages residents to have an emergency supply kit.

4.5.1.2 Plans, Policies, and Regulatory Environment

Wildfire Protection Responsibility in California

Local, state, tribal, and federal organizations all have legal and financial responsibilities for wildfire protection. In many instances, two fire organizations have dual primary responsibility on the same parcel of land—one for wildfire protection and the other for structural fire protection. To address wildfire jurisdiction responsibilities, the California State Legislature outlined various wildfire responsibilities in Cal. Pub. Res. Code § 4291.5 and Cal. Health & Safety Code § 13108.5:

- **Federal Responsibility Areas (FRAs)—**FRAs are fire-prone wildland areas that are owned or managed by a federal agency, such as the U.S. Forest Service, National Park Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, or U.S. Department of Defense. Primary financial and rule-making jurisdiction authority rests with the federal land agency. In many instances, FRAs are interspersed with private land ownership or leases. Fire protection for developed private property is usually the responsibility of the relevant local government agency, not the relevant federal land management agency. (California Department of Forestry and Fire Protection, 2013-2018, p. 7)
- **State Responsibility Areas (SRAs)—**SRAs are lands in California where the California Department of Forestry and Fire Protection (CAL FIRE) has legal and financial responsibility for wildfire protection. CAL FIRE administers fire hazard classifications and building standard regulations in these areas. SRAs are classified into types of land based on cover, beneficial use of water from watersheds, probable damage from erosion, and fire risks and hazards. (California Legislative Information, pp. § 4102, § 4130)

  CAL FIRE adopts SRA boundaries and updates them every 5 years. Where SRAs contain structures or development, the relevant local government agencies have fire protection responsibility for those improvements. (Office of the State Fire Marshal, 2021)

- **Local Responsibility Areas (LRAs)—**LRAs include land in cities, cultivated agriculture lands, unincorporated non-flammable areas, and lands that do not meet the criteria for SRA or FRA. LRA fire protection is typically provided by city or county fire departments, fire protection districts, or by CAL FIRE under contract to local governments. LRAs may still include areas of flammable vegetation and WUI. (Office of the State Fire Marshal, 2021)

As part of General Plan requirements, California began requiring local governments in State Responsibility Areas (SRAs) and Very High Fire Hazard Severity Zones (VHFHSZ) to include in their safety element:

- Fire hazard severity zone maps available from the Department of Forestry and Fire Protection.
- Any historical data on wildfires available from local agencies or a reference to where the data can be found.
- Information about wildfire hazard areas that may be available from the United States Geological Survey.
- The general location and distribution of existing and planned uses of land in very high fire hazard severity zones (VHFHSZs) and in state responsibility areas (SRAs), including structures, roads,

utilities, and essential public facilities. The location and distribution of planned uses of land shall not require defensible space compliance measures required by state law or local ordinance to occur on publicly owned lands or open space designations of homeowner associations.

- The local, state, and federal agencies with responsibility for fire protection, including special districts and local offices of emergency services. (Gov. Code, § 65302, subd. (g)(3)(A).)
- Use wildfire safety guidelines and California Environmental Quality Act (CEQA) initial study wildfire hazards checklist updates issued by the Governor's Office of Planning and Research (OPR) when those become available. Cal. Gov. Code § 65040.20 and § 65302.5. (Governor's Office of Planning and Research, 2017, p. 144) (CA Governor's Office of Land Use and Climate Innovation, 2023)

For further information on the details and implications of these safety element requirements, see Progress Summaries 3.F and 8.A of the 2018 California State Hazard Mitigation Plan.

Senate Bill 63 (2021)

California Senate Bill 63 (SB 63), authored by Senator Henry Stern and passed in 2021, focuses on enhancing wildfire prevention efforts in the state. The bill expands programs for vegetation management, public education, and defensible space around properties, especially in fire hazard severity zones. It authorizes grants for fire prevention work, targeting communities at risk of wildfires. One significant aspect of SB 63 is that it promotes collaboration among state and local agencies to improve fire prevention and mitigation efforts, particularly in high-risk areas. The bill was officially signed into law on September 28, 2021.

Healthy Forests Restoration Act (2003)

The federal Healthy Forests Restoration Act (HFRA) appropriates funding to address five main sub-categories of the National Fire Plan (NFP): preparedness, suppression, reduction of hazardous fuels, burned-area rehabilitation, and state and local assistance to firefighters.

California Fire Code (2019)

Tehama County has adopted the 2022 Edition of the California Fire Code to establish minimum requirements and standards, aligned with nationally recognized best practices, to protect public health, safety, and welfare from risks such as fire, explosions, and other hazardous conditions in both new and existing buildings, structures, and properties. Additionally, it aims to ensure the safety of firefighters and emergency personnel by providing clear guidelines for emergency response and operations. The 2022 California Fire Code is applied through the Tehama County Charter and Code (§ 15.34.010), which describes what is required for a Fire Protection Plan, applicable to all new development within the Wildland-Urban Interface Fire Area. It stipulates that such a plan address water supply, access, fire resistance of buildings, fire protection systems and equipment, defensible space, and vegetation management. (Municode Library, 2024)

California Building Code (2022)

Tehama County has adopted the 2022 California Building Code, which establishes minimum standards that protect life, health, property, and public welfare by regulating and overseeing the design, construction, material quality, usage, occupancy, location, and upkeep of all buildings and structures within the jurisdiction. Additionally, it includes the regulation of specific equipment outlined within its provisions. See Cal. Building Codes, Chapter 7a (2022). (Municode Library, 2024)

CAL FIRE Clearance Requirements

Public Resources Code (PRC) Section 4290 establishes minimum fire safety standards for developments in State Responsibility Areas (SRAs), where CAL FIRE is responsible for wildfire protection. The code focuses on ensuring safe access, evacuation, and fire suppression capabilities.

One key aspect of PRC 4290 is roadway standards, which require roads to accommodate emergency response vehicles and allow for safe evacuation. These standards specify minimum width, grade, and turning radius requirements, while also limiting the length of dead-end roads based on the number of homes they serve. Road surfaces must be capable of supporting fire apparatus.

Driveways and bridges must also be designed to allow access for fire equipment. Driveways are subject to width and grade standards, while bridges must be capable of supporting the weight of emergency vehicles.

Addressing and signage requirements ensure that addresses are visible and legible from the road. Signs must be reflective, made from non-combustible materials, and clearly mark road names to assist emergency responders in locating properties quickly.

Water supply provisions mandate that new developments provide an adequate water source for firefighting. This can include hydrants, water tanks, or other sources that meet specific volume and accessibility standards.

Additionally, PRC 4290 requires fuel breaks and defensible space around new developments. This includes clearing vegetation around structures and along roadways to reduce wildfire risk.

Overall, PRC 4290 ensures that new developments in wildfire-prone areas incorporate essential fire safety measures to protect lives, property, and emergency responders. Let me know if you need further clarification or details on specific applications.

As required by Public Resources Code Section 4291, the County of Tehama Department of Building and Safety requires County Fire and Road Clearances for the following:

- Single Family Residences
- Manufactured Home-Soft Set Foundation
- Ag Exempt Permits
- Commercial
- Temporary Structures
- EPA Facilities
- Additions
- Manufactured Home-Permanent Foundation (New Or Replacement)
- Outbuildings (Barn, Shop, Shed, Garage)
- Antennae Towers
- Enclosed Porches
- Conversions (If Applicable)
- Setback Requirements

As required by Public Resources Code Section 4291, the following setbacks are required for Structure Defensible Space (Tehama County Ordinance 2023, Section 914.071 and 4291)

- All parcels one (1) acre and larger within Tehama County shall provide a minimum 30 foot setback for building and all accessory buildings from all property lines and/or the center of a road.
- For parcels less than one acre within Tehama County, local jurisdictions shall provide for the same practical effect.

-

Tehama County Fire Safe Regulations

The Tehama County Fire Safe Regulations (Chapter 9.14) constitute the basic wildland fire protection standards of the County of Tehama, which are intended to be equal to the minimum standards of the California Department of Forestry and Fire Protection ("CAL FIRE") in accordance with California Code of Regulations, Title 14, Section 1270.03.

These regulations have been prepared and adopted for the purpose of establishing minimum wildfire protection standards in conjunction with building, construction and development in the county. The future design and construction of structures, subdivisions and developments in the county shall provide for basic emergency access and perimeter wildfire protection measures as specified. These measures shall provide for emergency access; signing and building numbering; private water supply reserves for emergency fire use; and vegetation modification.

Residential Burn Permits

In Tehama County, residential debris burning is allowed but only with a valid LE-62 Residential Burn Permit. Only burning of natural debris on the property it is from is allowed on permissive burn days.

Agricultural burning is allowed with a Tehama County Air Pollution Control (TCAPC) permit and CAL FIRE LE-5 permit but only on permissive burn days.

It is recommended that residents check with their local fire officials for burning restrictions within the Corning city limits. All residential burning has been banned within the city limits of Red Bluff.

County Residential Development

The County Residential Development requirements include the following addressing wildfire safety:

- **Disposal of Flammable Vegetation and Fuels.** Disposal, including chipping, burning or removal to a landfill site of flammable vegetation and fuels caused by site development and construction, and fuel modification shall be completed prior to completion of road construction or final inspection of a building permit

- **Waste accumulation prohibited.** Combustible waste material creating a fire hazard shall not be allowed to accumulate in buildings or structures or upon premises.

- **Fire Break.** A fire break of at least one-hundred (100) feet wide or to the property line whichever is nearer shall be provided around all structures.

CAL FIRE Strategic Fire Plan, Tehama Glenn Unit (2023)

The California Department of Forestry and Fire Protection (CAL FIRE) Tehama Glenn Unit (TGU) serves the counties of Glenn and Tehama. The TGU Strategic Fire Plan is a product of the implementation of the 2024 Strategic State Fire Plan.

This State Fire Plan analyzes fire fuel hazards and risks to design and implement mitigating activities. The TGU Fire Management Plan includes background information, data on fuels and fire, proposed projects, and individual Battalion reports detailing annual mitigating activities. This plan serves as a local roadmap for both the fire service and the public to create and maintain defensible landscapes that protect vital state assets and citizens. Below, you'll find descriptions of each CAL FIRE Battalion within the TGU Strategic Fire Plan, along with a location map in Figure 4-16.

The TGU Strategic Fire Plan outlines a comprehensive program aimed at reducing government costs and citizen losses from wildland fires. It also seeks to support the public through assistance and education, fostering the development of fire-adapted communities that can safely withstand wildland fires.

To achieve these goals, CAL FIRE is implementing strategies focused on:

- Firefighter and public safety
- Hazardous fuel treatment
- Fire suppression
- Information and education
- Inter-agency cooperation

Battalion I (administered by Battalion 2511)

Battalion I (East) lies in the northeast corner of Tehama County. The Battalion runs from the eastern foothills on the east side of the Sacramento Valley to the Lassen National Forest boundary on the east, and from the Butte County line in the south to the Shasta County line in the north.

Topography within Battalion I includes rolling foothills in the west to mountain terrain in the east, with predominant volcanic influence in geography. This area includes several major drainages, generally running east to west, including Deer Creek, Antelope Creek, Mill Creek, and Battle Creek. These drainages form steep canyons, which present substantial access problems and promote rapid fire spread.

Fuels within Battalion I consist of grass and oak woodlands in the lower foothills with increasing brush, pine, and mixed conifer forests as the foothills rise to mountains in the east. These grass fuels have historically carried fast spreading, wind-driven, high intensity fires, with moderate to high resistance to control, impart due to access problems and volcanic rock. Fires occurring in the grass, oak-woodland, brush mix, and timber present the greatest resistance to control, and when they occur, account for the greatest damage to natural resources and structures. Often, lightning strikes cause multiple fires and can be difficult to access.

Assets at risk within Battalion I include extensive timber, rangelands, watershed, associated fisheries, and several rural communities including hundreds of isolated structures. The communities of Payne's Creek, Manton, Ponderosa Sky Ranch, and Mineral have historically suffered damage to homes and property during periodic fires in these areas. Larger fires within the Battalion have caused widespread damage to communities, range lands and fisheries and cost millions of dollars to suppress. (CAL FIRE, 2023)

Battalion II (administered by Battalion 2512)

Battalion II lies primarily within the Sacramento Valley floor area of Tehama County and covers a large portion of Tehama County's Local Response Area (LRA). The Battalion consists of the communities of Bend, Antelope, Dairyville, Los Molinos, Tehama, Proberta, El Camino and Vina. The SRA area within the battalion transitions from the valley floor along the Interstate 5 corridor into the rolling hills and steep drainages in the Southeastern portions of Tehama County. Some of the more notable landmarks are the Deer Creek drainage and western portions of the Mill Creek drainage.

The predominant fuel type within the battalion is grass and oak woodland; however, as the topography transitions into the steeper east side drainages, chaparral and other native brushes become extensive. As you transition into the far eastern portion of the battalion smaller stands of timber become evident. The battalion has a wide variety of fuel types that can challenge fire suppression efforts during the hot summer days. Another fire suppression challenge in Battalion II can be proximity to water sources. Because of this fact, a 10,000 gallon water tank, used for fire suppression efforts has been in place for years on Denny Land and a new heliwell system (a large portable water tank that can remotely be deployed) is now available for helicopters in remote areas.

Weather and access are big factors relating to fire spread within the battalion. It is not uncommon to have temperatures over 100° Fahrenheit, relative humidity in the low teens and strong North winds during summertime periods. On top of these challenges, access to most areas East of Highway 99E is extremely limited and slow due to very rocky, rugged conditions. The Campbell Fire burned 131,500 acres in 1990 and is one of the larger fires in California history. The fire burned in the foothills East of Vina and suppression efforts were hampered by hot and dry conditions and rugged, inaccessible terrain.

The most common fire causes within the battalion are equipment use/mechanical and debris pile escapes; however accidental human caused, arson, lightning and undetermined cause fires are not uncommon. A large percentage of the fires within the battalion occur along the heavily traveled roadways such as Interstate 5, State Highway 36 and State Highway 99.

Battalion III (administered by Battalion 2513)

Battalion III lies in the northwest portion of Tehama County and includes the communities of Lake California, Bowman, Dibble Creek, R-Wildhorse Ranch, Ridgeway and Red Bank. The Battalion runs from the

I-5 corridor and west Red Bluff area to the western border with Trinity and Mendocino National forests, and the Yolly Bolly Wilderness Area. It runs from the Shasta County line in the North to the Red Bank area in the south. Values at risk include a large number of residential and associated structures on large lot or ranchette settings. Livestock grazing and recreation are important economically within the Battalion. The loss of infrastructure such as high voltage electrical lines and underground natural gas lines not only affects Tehama-Glenn Unit, but the entire state.

Fuels within Battalion III consist of grass and oak-woodlands in the valley and lower foothills. The mid slopes transition into heavy brush of chemise, manzanita and grey pines until reaching the mixed conifer forests of Beegum Peak and Tomhead Mountain at approximately 4500' to 6000' elevation. Large ranches and structures are found throughout the mountainous areas.

Battalion IV (administered by Battalion 2514)

Battalion IV encompasses the southern portion of Tehama County including the Local Responsibility Area (LRA) along the Interstate 5 corridor and all the State Responsibility Area (SRA) of Glenn County. The SRA boundary lies west of Interstate 5 to the Mendocino National Forest, south to the Glenn-Colusa County line, and north to Elder Creek in Tehama County. Communities within the battalion include Richfield, Corning, Rancho Tehama, Flournoy, Henleyville, Paskenta, Chrome, Grindstone Rancheria, Stonyford, and Elk Creek. Outside of the larger communities, the population is dispersed through rural residences and ranchlands.

The predominate vegetation in the battalion consists of grassland, oak-woodland mixture, and chaparral. Blue Oak, Live Oak and chaparral are the primary fuel types with a mix of Foothill Pine in higher elevations. Manzanita and Chemise are the primary chaparral in the area with dense patches present on the slopes and ridges below the Mendocino National Forest. Large annual grass crops intermixing with the chaparral cause the greatest fire suppression hazard in regards to fuels in the battalion. The light fuels carry fire rapidly and are receptive to spotting activity.

Likewise, grass is an exceptional carrier of fire into the brush and brush canopy depending on fuel height and thickness. The most common fire causes within the battalion are equipment use/mechanical and debris pile escapes. Historically, fires in the State Responsibility Area (SRA) occur along traveled county roads, at rural ranchlands and within the larger populated Rancho Tehama community. Arson and accidental human caused fires are not uncommon in the area. Lightning levels on the west side of the battalion are another contributor to fire activity within the battalion.

Besides the communities and residences located in the battalion, other assets in the battalion are at risk from fire. A majority of the battalion is rural ranch land with both grazing and agricultural field and farmland. There is a high value placed on the annual grasses in the area due to livestock grazing. Likewise, the infrastructure on the ranch lands such as barns, fences, feeders, and equipment are vital to the ranching operation. Also located in the battalion are the water reservoirs, Black Butte Lake and Stony Gorge. Both Black Butte and Stony Gorge provide summertime water and camping recreation to the public. (Unit Strategic Fire Plan Tehama-Glenn Unit, 2023)

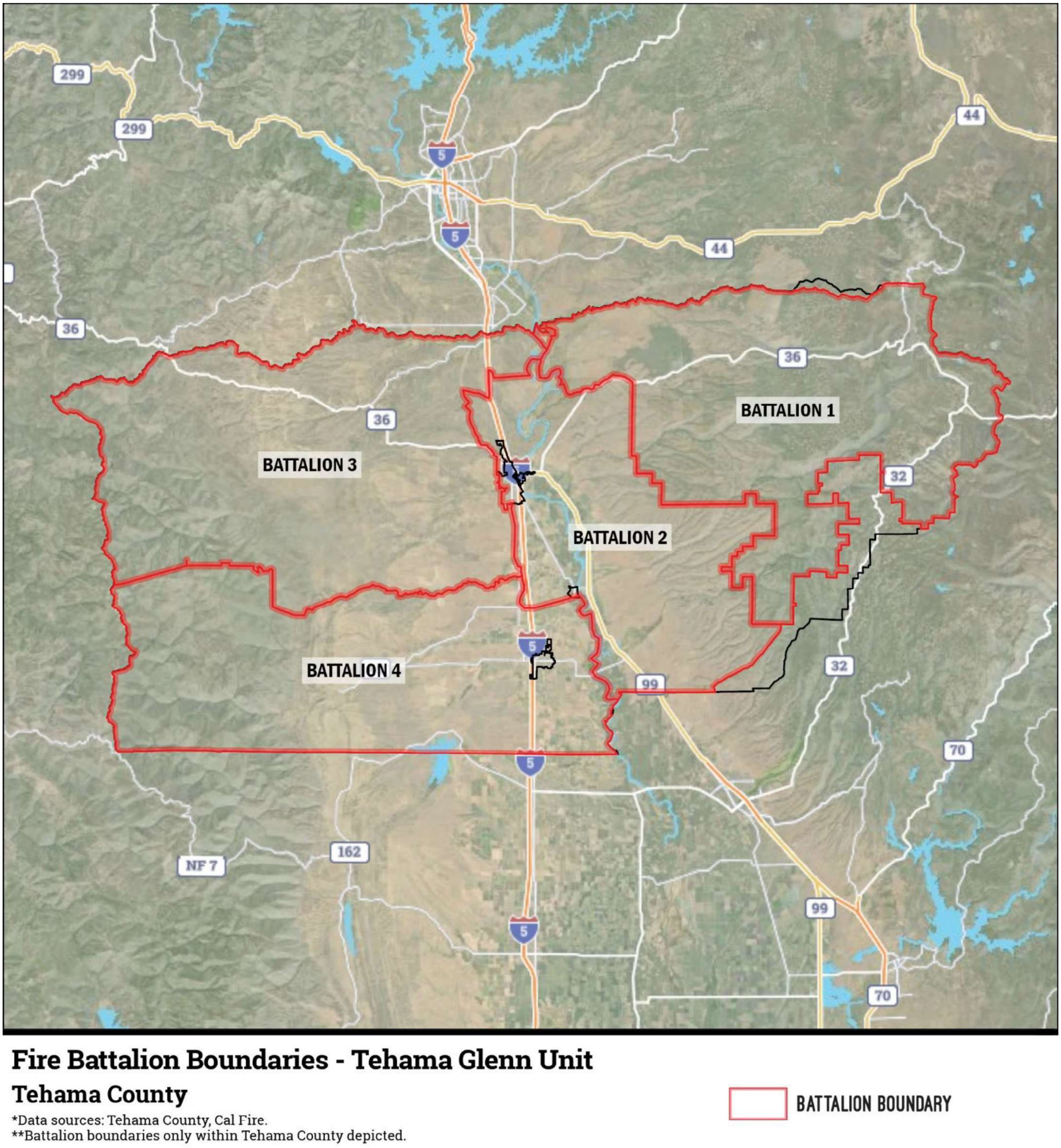


Figure 4-16: TGU Battalion Location Map

Title 24 California Code of Regulations

The California Building Standards Code, Title 24, which incorporates the California Fire Code, is adopted every three years by order of the California Legislature with supplements published in intervening years. Title 24 mandates specific requirements for new building construction, placing strong emphasis on proper address signage, apparatus access, water requirements, and defensible space.

California Code, Public Resources Code § 4290

The Public Resources Code § 4290 became effective in September of 1991. These regulations require the future design and construction of structures, subdivisions, and developments in SRA to provide wildfire protection measures for basic emergency access and perimeter. These measures provide for emergency access, signing and building numbering, private water supply reserves for emergency fire use, and vegetation modification.

California Code, Public Resources Code § 4291

The Public Resources Code § 4291 require property owners in mountainous areas, forest-covered lands, or any land that is covered with flammable material to create, at a minimum, a 100-foot defensible space buffer around their homes and other structures. Defensible space must at least extend to the property line if a 100-foot buffer cannot be achieved.

Tehama County General Plan

The 2009 Tehama County General Plan includes a number of policies in the Land Use and Safety Element sections to mitigate the effects of wildfires. These policies aim to prevent wildfires through the requirement of defensible space associated with building construction, the prohibition of development in areas of extreme risk, required incorporation of fire-safe building methods in development, maintain a valid Community Wildfire Protection Plan (CWPP) and the consolidation of efforts to prevent or abate fuel buildup.

Fire Protection Features in Tehama County Code

The Tehama County Code aids in reducing fire risks by implementing vegetation clearances, defensible space and fire breaks. Tehama County Fire consequently has the authority to order the clearing of land or the removal of dry grass, stubble, brush, rubbish, litter, or other flammable material (§ Tehama County Ordinance (TCO) 2023 Chapter 9.14).

4.5.1.3 Past Events

There are four major factors that contribute to historic wildfire events:

1. Extreme vegetation diversity,
2. Diverse fire weather and fire behavior,
3. Dynamic fire history, and
4. Complex land use patterns.

From 2000-2024, there were 34 wildfires in Tehama County, some of which overlapped with neighboring counties, each burning over 100 acres in the region. The recent Park Fire in 2024 caused an estimated seven million USD in damages property damages. These events are listed in Table 4-13 and displayed in Figure 4-18.

Table 4-13: Fire Perimeter Sizes and Dates (100 Acres or Greater 2000-2023)

Date	Name	Property Damage	Fatalities	Injuries	Size in Acres
2024	Park Fire*	NA	0	0	429,603
2023	Slide 1 Fire	0	0	0	473
2022	Peter	0	0	0	304
2022	Rancho Fire	0	0	0	593
2021	Dixie	0	0	0	963,309
2021	Dairy	0	0	0	165
2021	McFarland	0	0	0	122,653
2020	August	0	1	2	1,032,648
2020	North	270 K	0	0	6,882
2020	Butte/Tehama/Glenn Lightning Complex	0	0	1	19,609
2020	Zogg	67 K	4	1	56,338
2020	Stump	0	0	0	684
2019	Rawson	0	0	3	605
2019	Red Bank	0	0	0	8,838
2019	South	0	0	0	5,332
2019	Ranch	0	0	0	2,534
2018	Apple	0	0	0	2,956
2018	Lane	0	0	0	3,889
2018	Sun	0	1	4	459,123
2018	Camp	17 B	86	12	153,336
2018	Stoll	0	0	0	268
2016	Saddle	0	0	3	850
2014	Bully	0	1	21	12,661
2013	Clover	0	1	6	8,073
2009	Elephant	0	0	0	445
2009	Silver	0	0	0	307
2008	Humbolt Fire	0	0	8	23,162
2008	Whiskey Fire	0	0	0	7,783
2008	SHU Complex	0	0	6	87,000
2008	Canyon Complex	0	0	0	12,922
2008	Cub Complex	0	0	0	3,622
2008	Butte Lightning Complex	0	0	6	16,000
2000	Red Bluff 9/29	547 M	0	0	8,284
2000	Red Bluff 10/1	0	0	0	8,284

Source: California Fire, Incident Database
**54 Structures damaged in Park Fire. Damage in USD not available at time of this plan development.*

4.5.1.3.1 Recent Large Wildfire Events

Park Fire (2024)

The Park Fire was a wildfire that began on July 24th, 2024, and was declared 100% contained on September 27th, at 7:12 AM. The fire was declared arson and under investigation. The fire rapidly spread due to dry vegetation, high winds, and extreme heat conditions. In total, the fire burned 429,603 acres throughout Tehama and Butte County, damaged 54 structures and destroyed 709 structures without any fatalities or confirmed injuries. (CAL FIRE , 2024)

August Complex (2020)

The August Complex was a massive wildfire that burned in the Coast Range of Northern California, in Glenn, Lake, Mendocino, Tehama, Trinity, and Shasta Counties. The complex originated as 38 separate fires started by lightning strikes on August 16–17, 2020. Four of the largest fires, the Doe, Tatham, Glade, and Hull fires, had burned together by August 30. On September 9, the Doe Fire, the main fire of the August Complex, surpassed the 2018 Mendocino Complex to become both the single-largest wildfire and the largest fire complex in recorded California history. On September 10, the combined Doe Fire also merged with the Elkhorn Fire (originally a separate incident) and the Hopkins Fire, growing substantially in size. The August Fire burned over 1,032,648 acres and destroyed 935 structures, causing roughly $320 million in damage. It killed one firefighter and injured two firefighters.

Figure 4-17: 2020 August Complex Fires
Photo: Jose Carlos Fajardo (Patch, August 2020)

Camp Fire (2018)

The Camp Fire was the most destructive and deadly wildfire in California. It began on November 8, 2018, and was contained on November 25, 2018. It is suspected to have started as a result of damaged powerlines catching on dry grass and exacerbated by high winds and dry conditions. Although it burned for less than a month, it burned over 153,000 acres and destroyed 18,804 structures, causing roughly $17 billion in damage. It killed 86 people and injured 12 civilians and 5 firefighters. While the fire did not spread into the boundary of Tehama County, it impacted the county with smoke and ash.

See Figure 4-18 for locations of historic fires since 2013 greater than 100 acres.

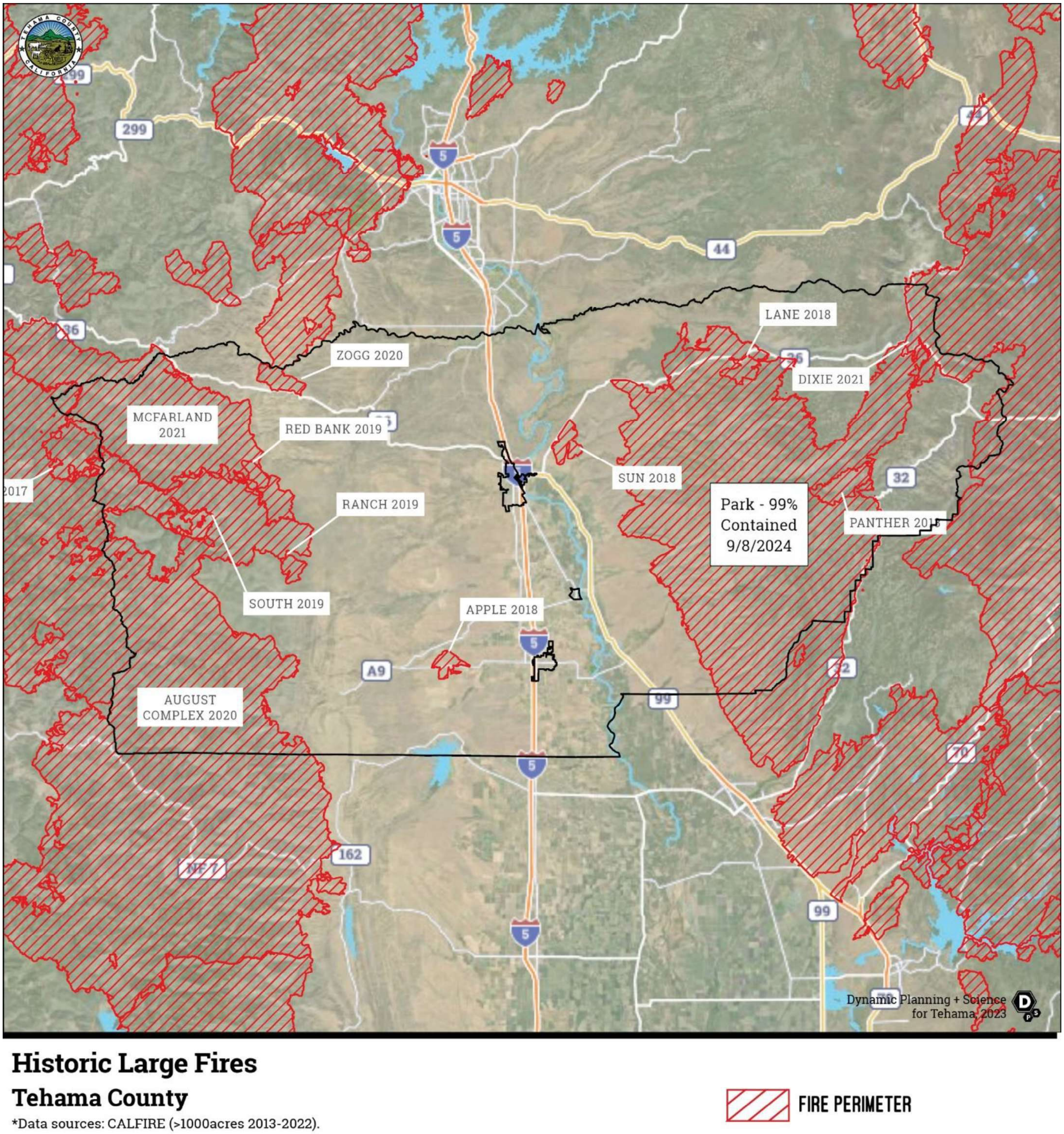


Figure 4-18: Historic Fire Occurrence Map (Fires Greater than 100 Acres, 2013-2023)

4.5.1.4 Fire Hazard Severity Zones (FHSZs)

Tehama County's hilly areas contain major wildland fire hazard risks for residential structures and other development, characterized by steep slopes, poor fire suppression delivery access, inadequate emergency water supply, and highly flammable vegetation. To help better define areas of wildfire concern, CAL FIRE establishes and maps **Fire Hazard Severity Zones (FHSZ),** or areas of significant fire hazards based on factors such as fuel, weather, terrain, and the number of days of moderate, high, and extreme fire hazard. These zones define the application of various mitigation strategies to reduce the risk associated with wildfires.

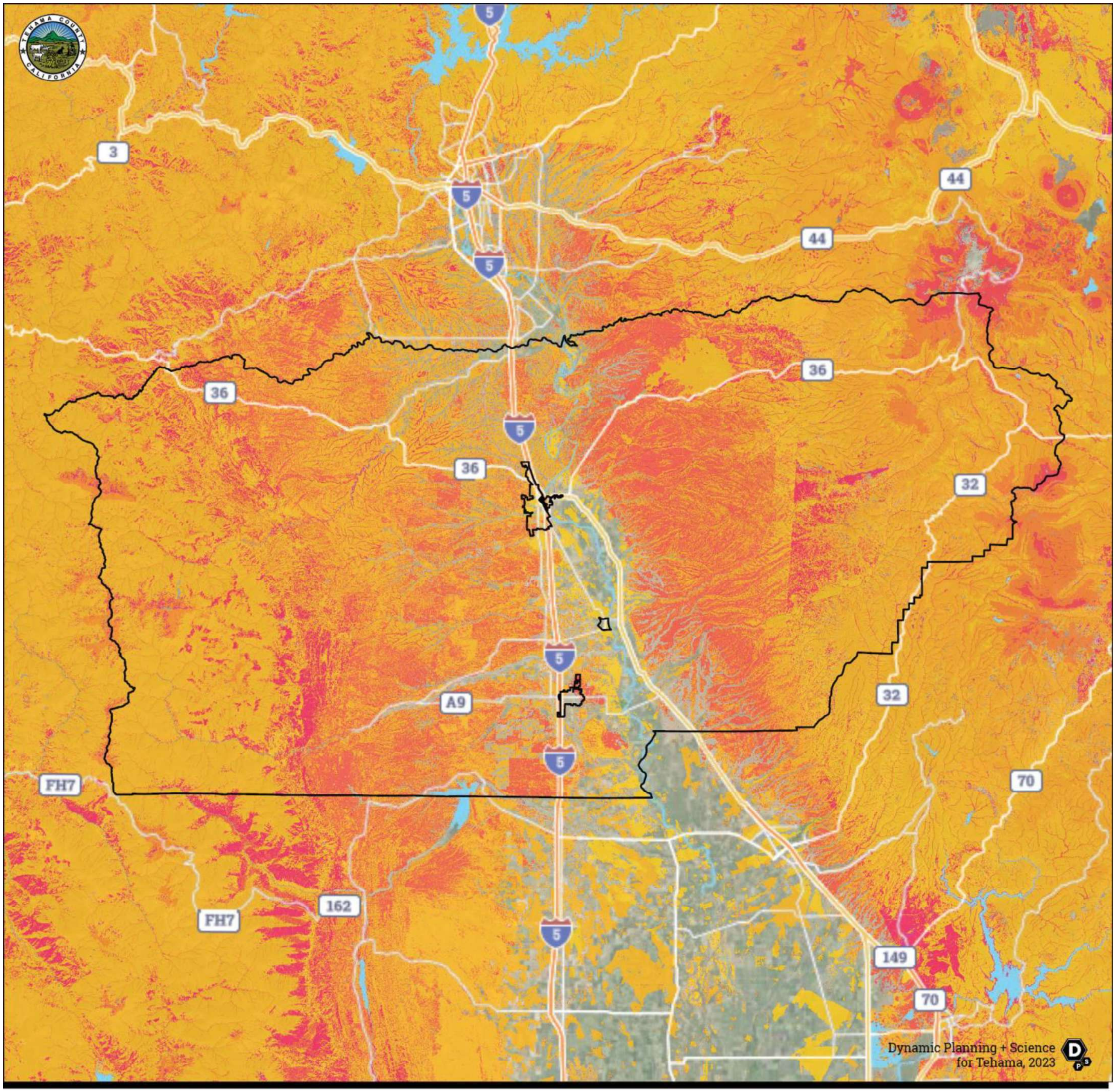
The FHSV model inputs frequency of fire weather, ignition patterns, expected rate-of spread, and past fire history. It also accounts for flying ember production based on the area of influence where embers are likely to land and cause ignitions. The FHSZ model is built from existing data and hazard constructs and, thus, does not necessarily take into consideration significant land use and structural resiliency. The geography, weather patterns, and vegetation in the planning area provide ideal conditions for recurring wildfires.

See Figure 4-19 and Figure 4-20 for wildfire return intervals and fire severity zones. These maps are the basis for this wildfire risk assessment.

4.5.1.5 Frequency and Probability of Future Occurrences

The majority of wildfires in Tehama County have taken place during summer months (typically June through August). Fire conditions arise from a combination of hot weather, an accumulation of vegetation, and low moisture content in the air. These conditions, when combined with high winds and years of drought, increase the potential for a wildfire to occur. Urban wildfires often occur in those areas where development has expanded into the rural areas. A fire along this urban-rural interface can result in major losses of property and structures. There are three major factors that sustain wildfires and allow for predictions of a given area’s potential to burn: fuel, topography, and weather.

Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles, leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Man-made structures and other associated combustibles are also considered fuel sources. The type of prevalent fuel in an area directly influences the behavior of wildfire. Light fuels, such as grasses, burn quickly and serve as a catalyst for fire spread. The volume of available fuel is described in terms of fuel loading. Certain areas in and surrounding Tehama County are extremely vulnerable to fires as a result of dense grassy vegetation combined with a growing number of structures being built near and within rural lands.



Mean Fire Return Interval

Tehama County

*Data sources: USGS LANDFIRE.

AVERAGE PERIOD BETWEEN FIRES (YEARS)

0–5, 6–10, 11–15, 16–20, 21–25, 26–30, 31–35, 36–40, 41–45, 46–50, 51–60, 61–70, 71–80, 81–90, 91–100, 101–125, 126–150, 151–200, 201–300, 301–500, 501–1000, >1000

Figure 4-19: Tehama County – Mean Fire Return Interval Map

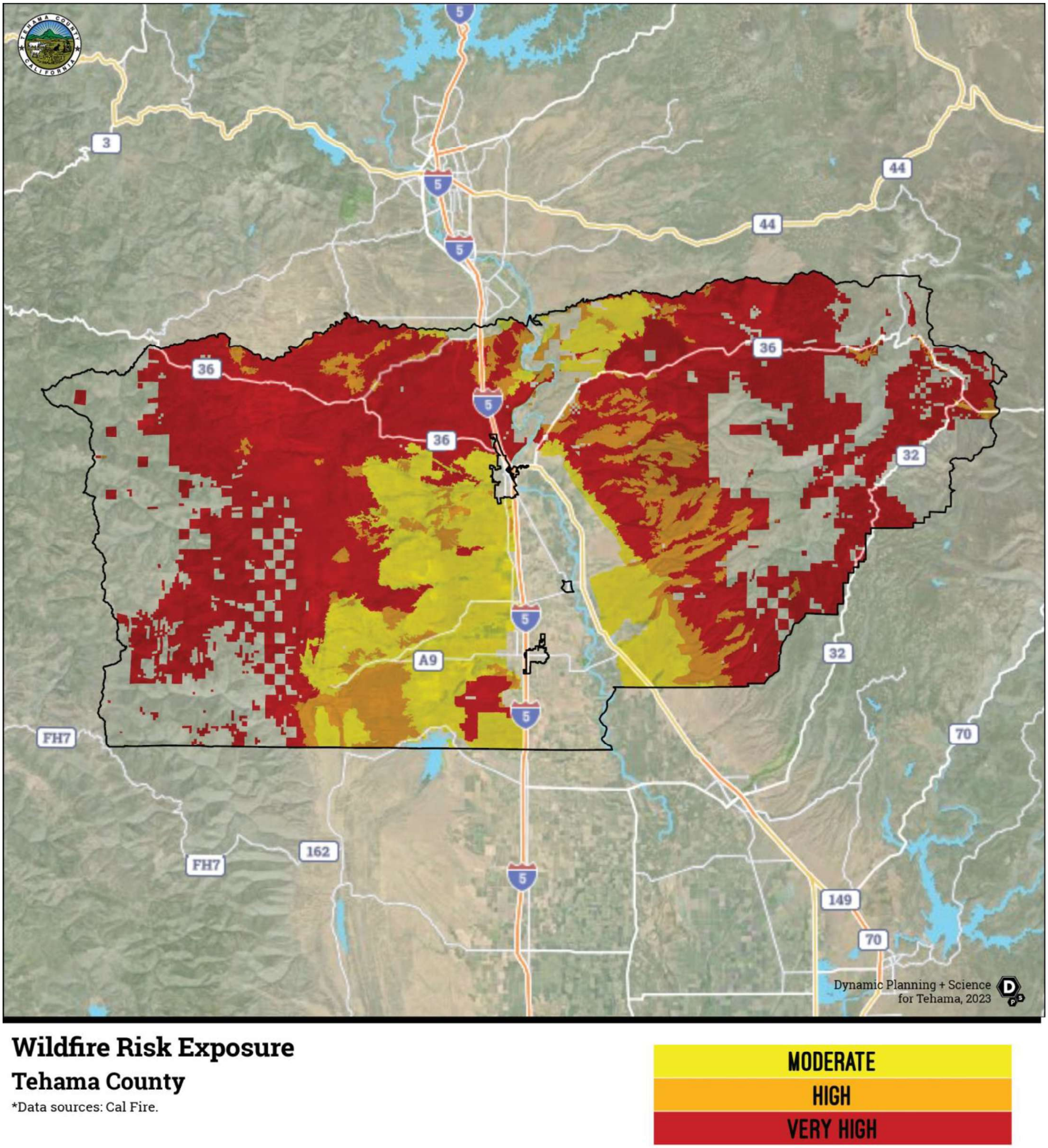


Figure 4-20: Tehama County –Fire Hazard Severity Zone Map (CAL FIRE)

An area's topography also affects its susceptibility to wildfire spread. Fire intensities and rates of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. Where fire quickly spreads up a canyon, gully, or other similarly constrained topographic feature, this is referred to as the "chimney effect." The natural arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes.

Weather components, such as temperature, relative humidity, wind, and lightning, also affect the potential for wildfire. High temperatures and low relative humidity dry out the fuels that feed the wildfire creating a situation where fuel will more readily ignite and burn more intensely. Wind is the most additive weather factor. The greater a wind, the faster a fire will spread and the more intense it will be. Winds can be significant at times in Tehama County. In addition to high winds, wind shifts can occur suddenly due to temperature changes or the interaction of wind with topographical features, such as slopes or steep hillsides. Related to weather is the issue of recent drought conditions contributing to concerns about wildfire vulnerability. During periods of drought, the threat of wildfire increases. (NOAA, 2018)

As seen in Figure 4-19, fire occurrences were historically common in mountainous areas in the west and east portion of Tehama County, especially in the mountainous areas. While historic return intervals are typically not a reflection of current conditions and habitat, they offer an indication of how often burns took place historically, and how adapted the native ecosystem was to fire. The greater the discrepancy between MFRI and current fire rates, the greater the presumed build-up of forest fire fuels and potential for more damaging wildfire.

4.5.1.6 Severity and Extent

Tehama County has an extensive history of large and damaging fires, mostly in WUI areas, resulting in losses of property and life. Given the immediate response times to reported fires, the likelihood of injuries and casualties is minimal, but the area burned can be significant. The severity of the wildland fire hazard is determined by the relationship between three factors: fuel classification, topographic slope, and critical fire weather frequency. Tehama County has a significant amount of wildfire fuels and susceptible topographic slope. Critical fire weather conditions also occur in periods of low relative humidity, high heat, and high winds.

Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations such as children, the elderly, and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. In addition, wildfire can lead to ancillary impacts, such as landslides in steep ravine areas and flooding due to the impacts of silt in local watersheds.

4.5.1.7 Warning Time

Response time can be rapid and warning time short for wildfires. Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when one might occur. The Fourth of July can be a time of heightened concern and outreach around wildfires since fireworks can cause fires and usage is high. Dry seasons and droughts greatly increase fire likelihood. Lightning from dry thunderstorms, where precipitation evaporates before reaching the ground, may also trigger wildfires. Extreme weather can be predicted, so special attention should be paid during weather events that may include lightning or high wind. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm.

If a fire does break out and spread rapidly, residents may need to evacuate 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 in recent years has contributed to a significant improvement in warning time. (California Fire, 2020)

4.5.1.8 Secondary Hazards

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism and commerce. Wildfires also cause the contamination of reservoirs, destroy transmission lines, and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff, debris flows, weakening soils, and causing slope failures. Major landslides can occur several years after a wildfire. Wildfires that burn hot and for long durations can bake soils, especially those high in clay content, creating hydrophobic soils that repel water. When it rains in burned areas, more soil washes off the hills and into roads, ditches, and streams and increases flooding. (United States Department of Agriculture, n.d.)

4.5.1.9 Climate Change Impacts

Fire in western ecosystems is determined by climate variability, local topography, and human intervention. Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot, dry spells create the highest fire risk. Drought and increased temperatures intensify wildfire danger by warming and drying out vegetation. Climate change also may increase winds that spread fires. Faster fires are harder to contain and, thus, are more likely to expand into residential neighborhoods. (Center for Climate and Energy Solutions, n.d.)

A changing climate is expected to subject forests to increased stress due to drought, disease, invasive species, and insect pests. These stressors are likely to make forests more vulnerable to catastrophic fires. While periodic fires are natural processes and fulfill an important ecological function, catastrophic fire events that cannot be contained or managed can cause serious threats to homes and infrastructure, especially for properties located at the wildland urban interface.

Moreover, rain events are predicted to become more severe in our changing climate. This could worsen post-rain flood events. (*Id.*) With or without rain, climate change also may bring an increased occurrence of lightning, which is responsible for a significant number of wildfires and amount of acreage burned, as discussed above in Section 4.5.1.1.3.

Predicted climate changes throughout this century include significant increases in average temperatures, particularly in the summer months (July–September), where temperatures may rise between 2.7°F and 10.8°F. Inland regions are expected to experience more dramatic warming, potentially up to 7.2°F higher than coastal areas. Heat waves are projected to intensify, with both daytime and nighttime temperatures rising, accompanied by longer durations and broader geographic impacts. The Western U.S. has seen an increase in wildfire frequency, severity, and total area burned, partly due to climate change and forest management practices that have created densely packed forests with substantial fuel accumulation. Climate conditions are expected to lead to wetter winters and drier summers, which could exacerbate wildfire risks. More rain in winter leads to increased vegetation growth, providing more fuel for fires during the drier spring and summer months. Earlier spring seasons and reduced summer moisture are likely to contribute to larger, more intense wildfires. (California's Fourth Climate Change Assessment, 2018) Historically, drought patterns in the West are related to large-scale climate patterns in the Pacific and Atlantic oceans. The El Niño–Southern Oscillation in the Pacific varies on a 5- to 7-year cycle, the Pacific Decadal Oscillation varies on a 20- to 30-year cycle, and the Atlantic Multidecadal Oscillation varies on a 65- to 80-year cycle. As these large-scale ocean climate patterns vary in relation to each other, drought conditions in the U.S. shift from region to region. El Niño years bring drier conditions to the Pacific Northwest and more fires.

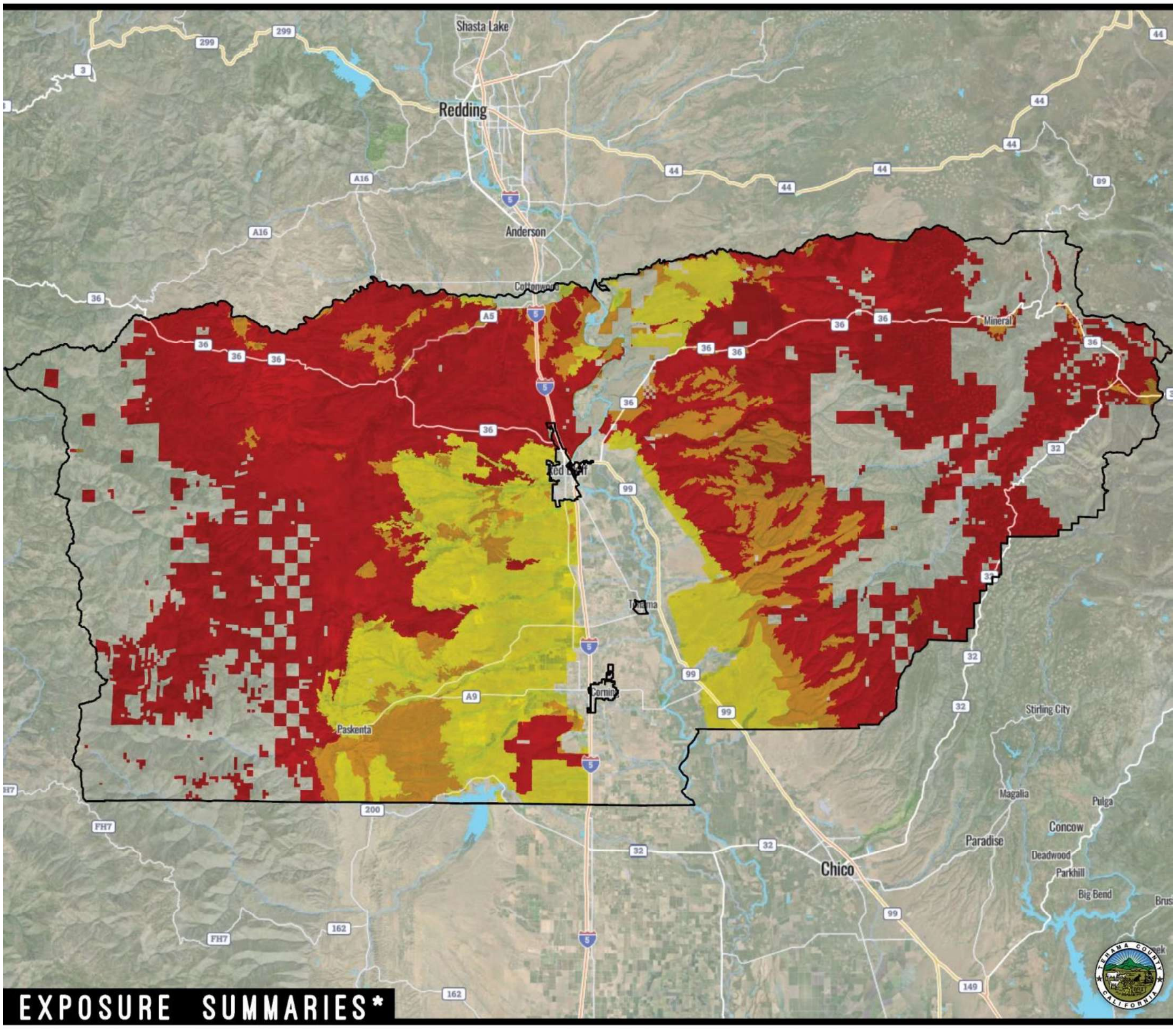
For more information on Climate Change's potential impact, refer to Section 4.6

4.5.1.10 Wildfire Vulnerability Analysis

This section describes vulnerabilities to wildfire in terms of population, property, and infrastructure. Wildfire population, parcel value, critical facilities, and lifeline exposure numbers were generated by overlaying the inventory outlined in Section 4.3 with CalFire Wildfire Hazard Severity Zones. Figure 4-21 shows a Snapshot Map of wildfire vulnerability in Tehama County. Details for all data found in the Snapshot Map can be found in this section. All data sources have a level of accuracy acceptable for planning purposes.

WILDFIRE RISK EXPOSURE

TEHAMA COUNTY



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
11,809	28%
Count Includes:	VERY HIGH

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
5,570	30%
Count Includes:	VERY HIGH

PARCEL VALUE IN HAZARD AREA

	Exp. Rate**
Sum of Improvement Value $2,361,995,330	30%
Sum of Content Value $1,273,282,973	28%
Count Includes:	VERY HIGH

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**	Count/Sum Includes:
Essential Facilities	6	27%	VERY HIGH
Hazmat	20	13%	
High Potential Loss	28	19%	*Sum of Transportation & Lifeline Linear Mileage*
Transportation & Lifeline	146	22%	2,708 44%

MAP LEGEND

- MODERATE
- HIGH
- VERY HIGH

*Exposure summaries include very high risk areas. Hazard data source: Cal Fire.
**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

Dynamic Planning + Science for Tehama County, 2023

Figure 4-21 Tehama County - Snapshot Layout - Wildfire Risk Exposure

4.5.1.10.1 Population

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations such as children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire contains visible and invisible emissions, including particulate matter such as soot, tar, water vapor, and minerals; gases such as carbon monoxide, carbon dioxide, and nitrogen oxides; and toxins such as formaldehyde and benzene. Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency or temperature of combustion, and the weather. Inhalation of ash can damage the respiratory system leading to long-term negative health effects. Public and mental health impacts associated with wildfire include difficulty breathing, odor, reduction in visibility, depression, and anxiety. Likewise, first responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Wildfire is of greatest concern to populations residing in the moderate, high, and very high fire hazard severity zones. U.S. Census Bureau block data was used to estimate populations within the CAL FIRE identified hazard zones. Figure 4-22, and Table 4-14 for detail on populations residing in wildfire risk areas.

Table 4-14 Populations Exposed to Wildfire Risk (Unincorporated County)

	Total Population
Unincorporated County	42,150

Wildfire Severity Zone	Population Count	% of Total
Very High	11,809	*28.02%*
High	2,983	*7.08%*
Moderate	4,063	*9.64%*
Total	**18,856**	**44.74%**

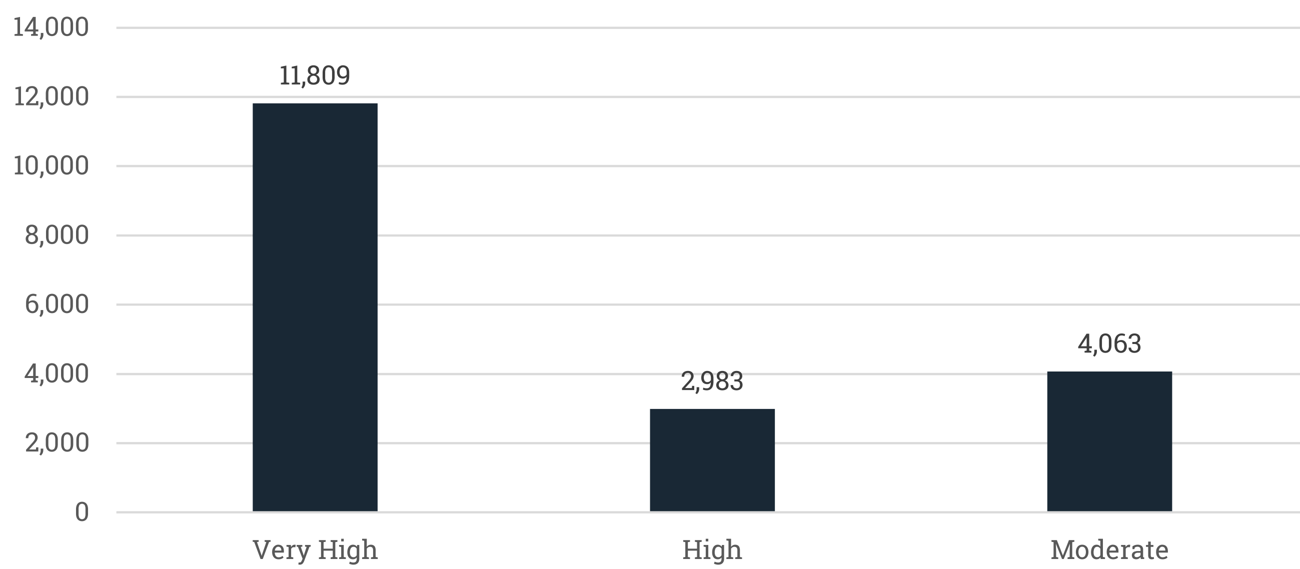


Figure 4-22: Population Exposed to Wildfire Risk

4.5.1.10.2 Property

This section calculates parcel count and estimated replacement costs for wildfire exposure across severity zones. See Table 4-15, which uses county parcel information to calculate exposure in wildfire severity zones. In some cases, a parcel will be within multiple fire threat zones. For this exercise, every parcel with a square footage value greater than zero was developed in some way. Only improved parcels were analyzed.

Table 4-15: Improved Parcel and Content within Wildfire Severity Zones (Unincorporated County)

	Total Parcels		Total Market Value ($)	Total Content Value ($)	Total Value ($)	
Unincorporated County	18,434		$7,780,396,144	$4,574,842,260	$12,355,238,404	
Fire Hazard Severity Zone	**Parcel Count**	**% of Total**	**Market Value Exposure ($)**	**Content Value Exposure ($)**	**Total Exposure ($)**	**% of Total**
Very High	5,570	*30.2%*	$2,361,995,330	$1,273,282,973	$3,635,278,303	*29.4%*
High	1,894	*10.3%*	$916,113,619	$499,054,067	$1,415,167,686	*11.5%*
Moderate	1,736	*9.4%*	$719,561,512	$478,169,156	$1,197,730,668	*9.7%*
Total	**9,200**	**49.9%**	**$3,997,670,460**	**$2,250,506,197**	**$6,248,176,657**	**50.6%**

Critical Facilities and Infrastructure

Critical facilities of wood frame construction are especially vulnerable during wildfire events. Power lines are also at risk from wildfire because some poles are made of wood and are susceptible to burning.

In many cases, roads and railroads would not be susceptible to damage except in the worst scenarios, but a wildfire event could create response issues, if affected. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Wildfire typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed. Many bridges in areas of high to moderate fire risk are important because they provide the only ingress and egress to large areas and, in some cases, to isolated neighborhoods. Additionally, wildfires may cause the loss of function of cellular phone sites or cell towers, which can limit emergency services, including tracking and evacuation.

Critical facilities data was overlain with fire hazard severity zone data to determine the type and number of facilities within each risk classification. Table 4-16 lists the critical facilities in wildfire hazard severity zones for Tehama County, and Table 4-17 similarly lists critical infrastructure.

Table 4-16: Critical Facility Exposure to Wildfire Severity Zones (Unincorporated County)

Critical Infrastructure - Wildfire Severity Zone			
Infrastructure Type	Very High	High	Moderate
Essential Facility	6	4	2
Emergency Operations Center	-	-	-
Fire Station	6	3	2
Hospital	-	-	-
Law Enforcement	-	1	-
High Potential Loss	28	18	11
Adult Residential Facility	3	3	4
Child Care Center	1	-	-
Dam	2	2	-
Historic Building	-	-	-
Power Plant	2	-	-
Real Property Asset	11	10	2
Residential Elder Care Facility	-	1	-
School	9	2	5
Transportation and Lifeline	146	26	118
Airport	-	-	-
Bridge	56	21	97
Cell Tower	4	-	-
FM Transmission Tower	4	-	-
Microwave Service Tower	74	3	15
Natural Gas Station	1	-	3
Paging Transmission Tower	4	-	-
Park	-	2	1
Substation	2	-	2
Wastewater Treatment Facility	1	-	-
Hazmat	20	7	29
Geotracker CleanupSite	9	1	8
HWTS Active Facility	11	6	21
Grand Total	**200**	**55**	**160**

Table 4-17: Lifelines in Wildfire Severity Zones (Unincorporated County)

Lifelines (miles) - Wildfire Severity Zone			
Infrastructure Type (Linear)	Very High	High	Moderate
NG Pipeline	39.92	9.48	65.04
Railroad	15.68	-	-
Street	2518.02	460.38	742.07
4WD trail	165.86	39.94	7.78
4WD trail, major	4.37	0.03	1.13
Alley	-	-	-
Cul-de-sac	0.30	-	0.06
Driveway	52.26	9.04	25.68
Interstate	9.33	9.16	8.15
Local road	1990.82	340.79	522.20
Local road, major	41.92	6.43	14.69
Primary highway	33.79	5.53	6.23
Primary highway, major	-	-	-
Ramp	1.94	2.14	1.25
Service road	1.43	1.00	-
State/county highway	213.59	46.34	153.47
Thoroughfare, major	-	-	1.42
Walkway	2.40	-	-
Transmission Line	134.79	54.37	159.34
Grand Total	**2708.42**	**524.23**	**966.44**

4.5.1.11 Future Trends in Development

As further discussed in Section 4.3.4, Tehama County's population has remained relatively stable with a mild growth rate that is significantly lower than the statewide growth rate. The unincorporated areas of the county, in particular, have seen a steady decline in the rate of growth, partially due to a decline in net migration. Tehama is a relatively rural county, with an overall population density of approximately 22 people per square mile, which is lower than California as a whole. This growth trend is expected to continue.

Although new development continues to occur across the county, local planning, zoning, building, and other development regulations work to plan for and address wildfire hazards, helping to limit exposure, reduce risk, and mitigate impacts. As discussed in Section 4.3.6, this regulatory framework includes the county's General Plan, as well as those general plans of other participating jurisdictions, that addresses land use, infrastructure improvement and expansion, resource conservation, and public safety, among other topics. These general plans are periodically reviewed as part of hazard mitigation capability assessments, enabling local agencies to identify potential gaps or deficiencies. Any identified needs can be integrated as mitigation actions, thereby strengthening each jurisdiction's ability to support sustainable development and manage wildfire impacts effectively.

All areas of the county could be affected by wildfire, directly or indirectly. Future development in high hazard areas must meet strict building, access, water supply, and vegetation management standards. In addition, the county and other participating jurisdictions are working toward reducing risks and mitigating impacts of wildfire on existing development that does not meet current regulations.

Fuel reduction projects are ongoing on federal, state, and private lands in Tehama County. Such projects include vegetation management, broadcast burning, pre-commercial thinning, and the removal of dead, dying, and diseased trees. Historically, Tehama County has had presence of citizen groups around wildfire prevention, such as Fire Safe Councils. The establishment of the Tehama-Glenn Fire Safe Council (TGFSC). TGFSC is currently providing assistance for fire resistant plants and fire smart landscaping. These efforts assist in Tehama County's Community Wildfire Protection Plan (CWPP). In 2023, the USDA Forest Service awarded the Resource Conservation District of Tehama County (RCDTC) $102,038 through the Community Wildfire Defense Grant program to update the 2017 Tehama East/Tehama West CWPP.

Through anticipated input from over 60 collaborators and the public, improvements in the CWPP planning process and document, and project development based on fuel management strategies and objectives discussed in various State and national planning documents, the Tehama County CWPP Update will support local entities' efforts to reduce wildfire risk to communities and local resources. The update is anticipated to be completed in 2025.

4.5.1.12 Wildfire Hazard Problem Statements

As part of the mitigation action identification process, the Planning Committee for the county and for each jurisdiction identified issues and weaknesses, also called problem statements, for their respective facilities. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and wildfire hazard data. Wildfire problem statements for all participating jurisdictions are listed in Table 4-18; problem statements for all other participating jurisdictions are accessed in Volume 2 of this plan.

Identifying these common issues and weaknesses assists the Planning Committee in understanding the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and the corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-18 and Table 5-6.

Table 4-18 Wildfire Problem Statements

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-WF-TC-101	Wildfire	Victim	PE&A , PRV	**Tehama County**	The need for public education and outreach will become greater as new residents move into the area who may not be familiar with the wildfire risk in the County. As climate change continues and conditions become drier, this will be even more relevant.	Y	ma-WF-TC-29, ma-AH-CC-36
ps-WF-TC-102	Wildfire	Impact	PPRO	**Tehama County**	Lack of vegetation management activities. Factors may include a lack of funding/ resources for property owners or an aging population who may be physically unable to perform mitigation actions.	N	ma-WF-CoT-97, ma-WF-TC-2
ps-WF-TC-104	Wildfire	Threat	PRV , PPRO	**Tehama County**	The Tehama West Watershed faces the growing problem of expansion of residential development into increasingly remote and historically fire prone areas (Wildland Urban Interface aka WUI). These areas usually fall outside the boundaries of local fire districts and in State Responsibility Areas (SRA) that are handled by CalFire. This adds a new complication to standard wildland firefighting tactics.	N	ma-WF-TC-1, ma-WF-TC-3, ma-WF-TC-4, ma-WF-TC-29

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-WF-TC-105	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Paynes-Antelope Hwy 36E Corridor CWPP Planning Unit. This includes populations and structures at risk near Dales, Paynes Creek, Ponderosa Sky Ranch Area, Lyman Springs, Jelly's Ferry Rd and Surrey Village.	Y	ma-WF-TC-1
ps-WF-TC-106	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Sacramento River Corridor. This includes populations and structures at risk near the communities of Surrey Village, Lake California and riparian areas of East Sand Slough near Antelope Blvd. Limited emergency access and multiple evacuation routes.	Y	ma-WF-TC-1
ps-WF-TC-107	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Cottonwood Beegum CWPP Planning Unit. This includes populations and structures at risk near the Bowman Area.	Y	ma-WF-TC-1
ps-WF-TC-108	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Battle Creek- Manton CWPP Planning Unit. This includes populations and structures at risk near the Manton area.	Y	ma-WF-TC-1
ps-WF-TC-109	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Elder Creek CWPP Planning Unit. This includes populations and structures at risk near the Rancho Tehama area.	Y	ma-WF-TC-1
ps-WF-TC-110	Wildfire	Threat	PPRO	**Tehama County**	High potential loss / essential facilities are located within high and very high wildfire severity zones: Manton, Plum Creek, Reeds Creek, Elkins and Flournoy schools and others.	Y	ma-WF-RB-73, ma-WF-TC-3

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-WF-TC-101	Wildfire	Victim	PE&A , PRV	**Tehama County**	The need for public education and outreach will become greater as new residents move into the area who may not be familiar with the wildfire risk in the County. As climate change continues and conditions become drier, this will be even more relevant.	Y	ma-WF-TC-29, ma-AH-CC-36
ps-WF-TC-102	Wildfire	Impact	PPRO	**Tehama County**	Lack of vegetation management activities. Factors may include a lack of funding/ resources for property owners or an aging population who may be physically unable to perform mitigation actions.	N	ma-WF-CoT-97, ma-WF-TC-2
ps-WF-TC-104	Wildfire	Threat	PRV , PPRO	**Tehama County**	The Tehama West Watershed faces the growing problem of expansion of residential development into increasingly remote and historically fire prone areas (Wildland Urban Interface aka WUI). These areas usually fall outside the boundaries of local fire districts and in State Responsibility Areas (SRA) that are handled by CalFire. This adds a new complication to standard wildland firefighting tactics.	N	ma-WF-TC-1, ma-WF-TC-3, ma-WF-TC-4, ma-WF-TC-29
ps-WF-TC-105	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Paynes-Antelope Hwy 36E Corridor CWPP Planning Unit. This includes populations and structures at risk near Dales, Paynes Creek, Ponderosa Sky Ranch Area, Lyman Springs, Jelly's Ferry Rd and Surrey Village.	Y	ma-WF-TC-1

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-WF-TC-106	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Sacramento River Corridor. This includes populations and structures at risk near the communities of Surrey Village, Lake California and riparian areas of East Sand Slough near Antelope Blvd. Limited emergency access and multiple evacuation routes.	Y	ma-WF-TC-1
ps-WF-TC-107	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Cottonwood Beegum CWPP Planning Unit. This includes populations and structures at risk near the Bowman Area.	Y	ma-WF-TC-1
ps-WF-TC-108	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Battle Creek- Manton CWPP Planning Unit. This includes populations and structures at risk near the Manton area.	Y	ma-WF-TC-1
ps-WF-TC-109	Wildfire	Threat	PPRO	**Tehama County**	High wildfire risk within the Elder Creek CWPP Planning Unit. This includes populations and structures at risk near the Rancho Tehama area.	Y	ma-WF-TC-1
ps-WF-TC-110	Wildfire	Threat	PPRO	**Tehama County**	High potential loss / essential facilities are located within high and very high wildfire severity zones: Manton, Plum Creek, Reeds Creek, Elkins and Flournoy schools and others.	Y	ma-WF-RB-73, ma-WF-TC-3

4.5.2 Flood Hazard Profile

Flooding is one of the three primary hazards in California, along with earthquake and wildfire, and represents the second most destructive source of hazard, vulnerability, and risk statewide. (Cal OES, 2018) Flooding is a priority hazard for Tehama County.

Connections between a river and its floodplain are most apparent during and after major flood events. A **floodplain** is the area adjacent to a river, creek, or lake that becomes inundated during a flood. Floodplains may be broad, such as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon. These areas form a complex physical and biological system that supports a variety of natural resources and provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, its natural, built-in benefits can be lost, altered, or significantly reduced (FEMA, 2020).

There are three types of flood events that might occur within the Tehama County area: riverine, flash and urban stormwater. Regardless of the type, the cause is primarily the result of extreme weather and excessive rainfall, either in the flood area or upstream reach. (The National Severe Storms Laboratory, 2020)

Riverine flooding, the most common type of flood event, occurs when a watercourse exceeds its bank-full capacity. Riverine flooding occurs as a result of prolonged rainfall that is combined with saturated soils from previous rain events, or combined with snowmelt, and is characterized by high peak flows of moderate duration and by a large volume of runoff. Riverine flooding occurs in river systems whose tributaries drain large geographic areas and can include many watersheds and sub-watersheds. The duration of riverine floods varies from a few hours to many days. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, soil moisture content, channel capacity, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. (*Id.*)

In Tehama County, riverine flooding can occur anytime during the period from November through May. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions and often results in flooding to a number of streams. Specifically, flood risk is intensified during long duration rain events cover streams that lead to the Sacramento River. (Group, 2014).

The Sacramento River divides Tehama County, flowing through the County from north to south. The Sacramento River at the Red Bluff Diversion Dam drains approximately 9,150 square miles. Except for small drainage areas that drain to Black Butte Reservoir and Stony Creek on the west side and Pine Creek on the east side, all water originating in Tehama County drains to the Sacramento River within the county or on the county's boundary

The term "flash flood" describes localized floods of great volume and short duration, generally in less than four hours. In contrast to riverine flooding, this type of flood usually results from heavy rainfall in a relatively small drainage area. Precipitation of this sort usually occurs in the spring and summer. (*Id.*)

Urbanization may increase peak flow runoff, as well as the total volume of stormwater runoff from a site. The increase is dependent upon the type of soil and its topography in relation to the proposed development. Comparison of the peak flow and volume impacts to the watershed should be analyzed whenever development is proposed to assure that any increases are accommodated. (USGS, 2016)

Flooding may be a secondary impact from an earthquake, which may cause failure of dams, canal banks, or landslides that block drainage channels, streams, or rivers. See Section 4.5.6 for the Earthquake Hazard Profile.

FEMA Floodplain Definitions

100-YR Floodplain
The boundaries of the 100-YR floodplain coincide with an annual risk of one percent and are a FEMA study product consisting of both floodway and flood fringe.

500-YR Floodplain
The boundaries of the floodplain coincide with an annual risk of 0.2 percent and are a FEMA study product. The 500-YR floodplain includes the 100-YR.

Floodway
This includes the channel of the tributary and the land adjacent to it. This zone needs to remain free from obstruction so the 100-YR flood can be conveyed downstream.

Flood Fringe
This is the remaining portion of the 100-YR floodplain, excluding the floodway. This zone can be obstructed or developed if criteria are met.

Special Flood Hazard Area (SFHA)
An area having special flood, mudflow, or flood-related erosion hazards and shown on a Flood Insurance Rate Map (FIRM). The SFHA is the area where the National Flood Insurance Program’s (NFIP) floodplain management regulations must be enforced.

Floodplain Ecosystems

Floodplains can support ecosystems that are rich in quantity and diversity of plant and animal species. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients left over from the last flood resulting from the rapid decomposition of organic matter that had accumulated. Microscopic organisms thrive, and larger species enter a rapid breeding cycle. Opportunistic feeders, particularly birds, move in to take advantage. The production of nutrients peaks and falls away quickly; however, the surge of new growth endures for some time. This makes floodplains particularly valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, trees in floodplains and riparian areas tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

Floodplains that are undisturbed or have been restored to a natural state provide many benefits to both human and natural systems. In their natural vegetative state, undisturbed floodplains provide the following benefits:

- Slow the rate at which incoming surface runoff reaches the main body of water, slowing down the impact of flood events.
- Maintain water quality by allowing surface runoff to drop sediment into the natural soil, preventing it from depositing in streams and rivers.
- Recharge groundwater. The slowing of runoff allows additional time for the runoff to recharge existing groundwater aquifers.
- Provide habitat for large and diverse populations of plants and animals.

Floodplains are often compromised by human development. Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate on floodplains because water is readily available, the land is fertile and suitable for farming, transportation by water is easily accessible, and the land is flatter and easier to develop.

Human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

4.5.2.1 Plans, Policies, and Regulatory Environment

National Flood Insurance Program (NFIP)

The NFIP makes federally-backed flood insurance available to homeowners, renters, and business owners in participating communities. Tehama County and the cities of Corning, Red Bluff and Tehama participate in NFIP.

For most participating communities, FEMA has prepared a detailed Flood Insurance Study (FIS). The study presents water surface elevations for floods of various magnitudes, including the one-percent annual chance flood (the 100-YR flood) and the 0.2-percent annual chance flood (the 500-YR flood).

Base Flood Elevations (BFEs) and the boundaries of the 100- and 500-YR floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principal tool for identifying the extent and location of the flood hazard. FIRMs also designate and display the floodway, which is the channel of the river or stream and adjacent land that must remain free from obstruction so that the 100-YR flood can be conveyed downstream. FIRMs are the most detailed and consistent data source available, and for many communities, they represent the minimum area of oversight under their floodplain management program. The most recent county-wide FIS and FIRMs, which includes the unincorporated county and all participating jurisdictions, were completed on September 29, 2011, and locally adopted thereafter.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-YR flood;
- New floodplain development must not aggravate existing flood problems or increase damage to other properties; and
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

Structures permitted or built in the county before December 31, 1974, are called “pre-FIRM” structures, and structures built afterward are called “post-FIRM.” Post-FIRM properties are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Pre-FIRM properties are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The insurance rate is different for the two types of structures.

Compliance is monitored by FEMA regional staff and by the California Department of Water Resources under a contract with FEMA. Maintaining compliance under the NFIP is an important component of flood risk reduction. All participating jurisdictions that participate in the NFIP have identified initiatives to maintain their compliance and good standing.

Community Rating System (CRS)

The Community Rating System (CRS) is a voluntary program within the NFIP that encourages floodplain management activities that exceed minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the three goals of the CRS: 1) reduce flood losses, 2) facilitate accurate insurance rating, and 3) promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of five percent according to the community’s classification. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a five percent discount. Class 10 communities are those that do not participate in the CRS; they receive no discount. The CRS classes for local communities are based on 18 creditable activities related to public information, mapping and regulations, flood damage reduction, and flood preparedness. As of October 2024, the City of Tehama is the only jurisdiction in Tehama County with an active CRS rating (Class 5) (CRS, 2024).

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation’s flood risk; over 66 percent of the NFIP’s policy base are communities in the CRS. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks. Table 4-19 lists NFIP and CRS statistics for the county; annexes list NFIP and repetitive loss information for participating jurisdictions.

Table 4-19: Flood Insurance Statistics for Tehama County (Unincorporated)

NFIP and CRS Status & Information	
Tehama County (Unincorporated)	
NFIP Status	Joined 6/1/1982
CRS Class	-
Policies in Force	487
Policies in SFHA	332
Policies in non-SFHA	155
Total Claims Paid	$3,688,297
Paid Losses	291
Repetitive Loss Properties	60
Repetitive Loss Payment by NFIP on Building	$1,518,294
Repetitive Loss Payment by NFIP on Contents	$443,536

Source: FEMA Region IX Mitigation Division NFIP Report (2024)

Note:. The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of certain types of data to the public. Flood insurance policy and claims data are included in the list of restricted information. FEMA can only release such data to state and local governments, and only if the data are used for floodplain management, mitigation, or research purposes. Therefore, this plan does not identify the repetitive loss properties or include claims data for any individual property.

Cobey-Alquist Floodplain Management Act

The Cobey-Alquist Floodplain Management Act of 1965 provided state-level guidance and review of floodplain management, including the review of floodplain management plans, establishment of floodplain management regulations, and the use of designated floodways. The California Department of Water Resources (DWR) adopts regulations, maintains a statewide flood management data collection and planning program, manages a statewide grant program, and helps coordinate emergency flood response operations.

Central Valley Flood Protection Board

The Central Valley Flood Protection Board (CVFPB), formerly known as the California State Reclamation Board, is the regulating authority over flood risk management in the Central Valley, and the Sacramento-San Joaquin Drainage District. In addition, CVFPB is charged with the review and adoption of the Central Valley Flood Protection Plan (CVFPP). The CVFPB's governing body consists of seven Governor-appointed and Senate-confirmed members. This board works in close partnership with DWR, the U.S. Army Corp of Engineers (USACE), and stakeholders to implement the CVFPP. The CVFPB also works closely with the California Department of Fish and Wildlife, U.S. Fish and Wildlife, and the National Marine Fisheries Service to evaluate the environmental impacts of flood control.

The area of the board's jurisdiction includes the entire Central Valley, including all tributaries and distributaries of the Sacramento and San Joaquin Rivers and the Tulare and Buena Vista basins. Eastern Tehama County encompasses parts of the lower Sacramento watershed under CVFPB jurisdiction.

Tehama County General Plan

The 2009 Tehama County General Plan includes several policies in the Public Health and Safety Element aimed at ensuring county-wide flood protection. Among these is Policy SAF-5.4, which directs the County to review flood-related planning documents for consistency with the Central Valley Flood Protection Plan and the General Plan upon the adoption of both. The County is also encouraged to consider adopting a local plan of flood protection under Water Code Sections 8201 et seq. and to review and update the Floodplain Management Ordinance to meet FEMA requirements. Additionally, the County will collaborate with relevant agencies to identify flood-prone areas and prepare comprehensive flood emergency plans and mitigation programs in accordance with Water Code Sections 9621 through 9623. Furthermore, the flood hazard provisions of the Land Use, Open Space & Conservation, and Safety Elements of the General Plan will be reviewed for consistency with the Central Valley Flood Protection Plan (County, 2009).

Tehama Groundwater Management Plan

The primary purpose of the Plan is to sustain groundwater levels that balance long-term extraction and replenishment. Annual recovery of spring groundwater levels after the previous summer season of more intensive groundwater extraction and following each winter season will be used to assess annual groundwater recharge. Long-term trends of Tehama County Groundwater Management Plan 2012 annual groundwater recharge shall be the primary basis for evaluating the long-term balance between extraction and replenishment (Division, 2012).

Tehama East Watershed Management Plan

The Tehama East Watershed Management Plan is an action document resulting from the evaluation of the Tehama East Watershed Assessment (TEWA 2010), which provides the necessary background information on existing conditions within the watershed. The watershed assessment project was funded through a grant from the California Department of Water Resources through the CalFed Watershed Program. Many other contributions from state, federal, and private sources have made the assessment possible. The community-based process provided the opportunity for public input through public meetings that were held in various locations within the assessment area. From those meetings and from additional interviews and written comments, conclusions and recommendations were reached concerning possible improvement activities. Further comments concerning this management plan will also provide input and implementation of projects in the future (Tehama County Resource Conservation District, 2010).

Guidance and assistance addressing the conclusions and recommendations were provided by the Technical Advisory Committee (TAC) members consisting of individuals from private industry and public agencies, together with other stakeholders, including private landowners.

Tehama County Code Chapter 15.52: Floodplain Management Regulations

The Tehama County Code contains stringent provisions designed to reduce flood loss and protect life and property that are implemented and enforced by the floodplain administrator. The county's floodplain administrator is also the building official or their designee, who is housed in the Department of Building and Safety and works in conjunction with the Tehama County Flood Control and Water Conservation District.

New development within special flood hazard areas must meet specific construction standards and receive approval from the floodplain administrator, in accordance with minimum NFIP requirements. All new construction and substantial improvements, and repairs to substantially damaged structures, must be anchored to resist flotation, collapse, or lateral movement due to hydrodynamic and hydrostatic loads. Construction materials used must be resistant to flood damage, and methods must minimize flood risks, with electrical and mechanical systems designed to prevent water infiltration during flooding.

Residential and non-residential construction within special flood hazard areas, including in association with substantial improvement or damage to an existing structure, must adhere to elevation and floodproofing standards. For residential structures, the lowest floor must be elevated above the base flood elevation, as determined by a registered professional. Non-residential structures may either meet the same elevation requirement or be floodproofed to ensure impermeability and structural integrity against flood forces. Certification from a professional engineer or architect is required for compliance with these standards.

Further, subdivisions greater than fifty lots or five acres must identify flood hazard areas and provide certified elevation data for proposed structures and pads. Public utilities and facilities, such as water and sewer systems, must be designed and constructed to minimize flood damage. Adequate drainage measures must be in place to reduce flood hazards across all subdivision plans.

The Floodplain Management Ordinance prohibits encroachments, including fill or new construction, unless certified by a registered professional engineer or licensed surveyor and approved by the county. This regulation also mandates special consideration for managing altered natural floodplains, stream channels, and protective barriers, ensuring that development does not increase flood risks or divert floodwaters in a way that could create hazards in alternate areas.

4.5.2.2 Major Flood Events

Table 4-20 shows the flood events that took place in Tehama County since the year 2000 that caused either property or crop damage. Heavy rain and flooding in early January 2023 were particularly damaging, with $14.97 million in reported damages. (NOAA, 2020)

Table 4-20: Tehama County Flood Events Since 2014

Row Labels	Sum of Crop Damage Value ($)	Sum of Property Damage Value ($)	Sum of Injuries	Sum of Deaths
Flash Flood	$745,000	$6,000,000	0	0
12/3/2014	$745,000	$6,000,000	0	0
12/6/2014	$0	$0	0	0
Flood	$0	$14,660,000	0	0
12/3/2014	$0	$0	0	0
12/11/2014	$0	$400,000	0	0
1/23/2016	$0	$5,000	0	0
2/17/2017	$0	$50,000	0	0
2/20/2017	$0	$0	0	0
1/16/2019	$0	$15,000	0	0
2/14/2019	$0	$0	0	0
2/26/2019	$0	$0	0	0
4/2/2019	$0	$0	0	0
9/18/2019	$0	$0	0	0
1/1/2023	$0	$14,190,000	0	0
1/14/2023	$0	$0	0	0
3/14/2023	$0	$0	0	0
12/19/2023	$0	$0	0	0
2/4/2024	$0	$0	0	0
2/17/2024	$0	$0	0	0
2/19/2024	$0	$0	0	0
Grand Total	**$745,000**	**$20,660,000**	**0**	**0**

Source: NOAA Storm Events Database
Flood events summarized by date.

4.5.2.3 Location

Tehama County has a significant number of potential flood sources due to its varied geography and climate. Figure 4-23 depicts FEMA flood zones within Tehama County. More detailed views of FEMA flood zones are available for participating jurisdictions through the Risk Assessment Mapping Platform (RAMP) on mitigatehazards.com

Flood risk within Tehama County is heightened by several factors, including levee failure, heavy rainfall, and the overflow of local streams and drainage canals. Historically, Tehama County has experienced significant flooding events, particularly along the Sacramento River and its tributaries, which serve as primary floodways for the region. In the unincorporated areas of the county, flooding often poses the greatest risk near drainage canals that collect local runoff. These canals, many of which were originally designed for agricultural purposes, can become overwhelmed during severe storms, leading to localized flooding.

Additionally, the region's aging levee system has faced increased pressure during heavy rain events, raising concerns about potential levee breaches that could inundate large areas. Low-lying areas near Coyote Creek, Elder Creek, and Antelope Creek are particularly susceptible to such events, as well as areas adjacent to the

Sacramento River floodplain. The county's combination of urban, rural, and agricultural landscapes, along with its location in a flood-prone watershed, further compounds flood risks, particularly during extreme weather conditions tied to climate variability.

The extent of flooding associated with a one percent annual probability of occurrence (the base flood or 100-YR flood) is used as the regulatory boundary by many agencies and helps identify the location and extent of flooding in areas across Tehama County. This area, the Special Flood Hazard Area (SFHA), is a convenient tool for assessing vulnerability and risk in flood-prone communities. Figure 4-23 shows the FEMA 100-YR and 500-YR floodplain zones, calculated based on a flood that has a one percent (100-YR) and 0.2 percent (500-YR) chance of occurring in any given year. Vulnerabilities to flood within these flood zones are included in Section 4.5.2.9.

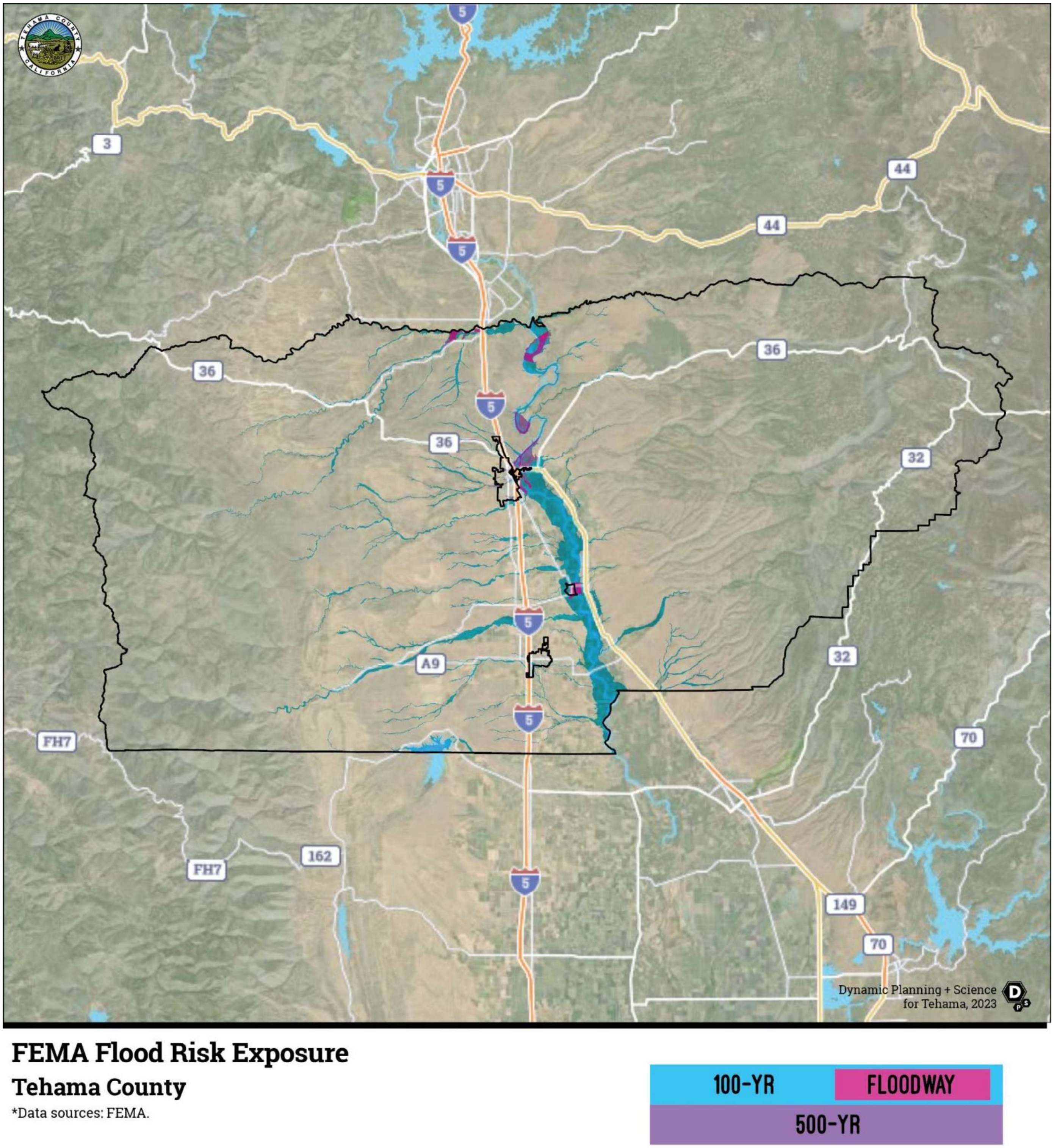


Figure 4-23: Tehama County FEMA Identified Flood Plan

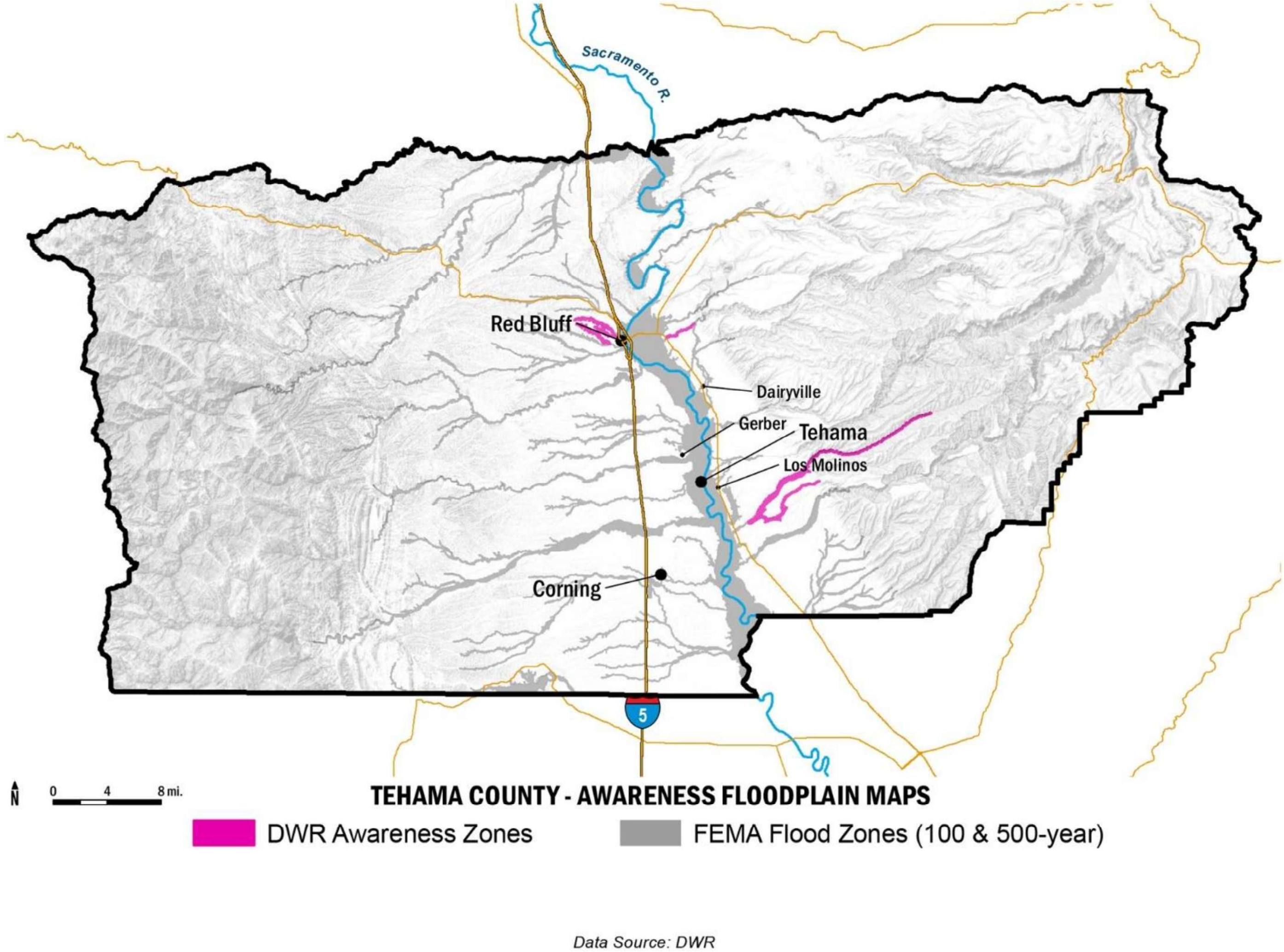


Figure 4-24: Tehama County DWR Flood Awareness Zones Map

4.5.2.3.1 State Awareness Zones

The intent of the Awareness Floodplain Mapping project is to identify all pertinent flood hazard areas for areas that are not mapped under the Federal Agency Management Agency's (FEMA) National Flood Insurance Program (NFIP) and to provide the community and residents an additional tool in understanding potential flood hazards currently not mapped as a regulated floodplain. The awareness maps identify the 100-YR flood hazard areas using approximate assessment procedures. These floodplains are shown simply as flood prone areas without specific depths and other flood hazard data.

There are currently six Awareness Floodplain Maps available for Tehama County. These maps cover the following areas: Red Bluff West, Red Bluff East, Los Molinos, Acorn Hollow, Ishi Caves and Vina. Shown in Figure 4-24

4.5.2.3.2 DWR Flood Awareness Zones and 200-year Floodplain in Sacramento Watershed

DWR designates Flood Awareness Zones to highlight areas of additional flood, extending beyond FEMA-designated floodplains, that pose a threat throughout the state. The mapping provides communities and residents with an additional tool in understanding potential flood hazards. These floodplains are shown simply as flood-prone areas without specific depths and other flood hazard data.

DWR's best available mapping also includes the 200-year floodplain as identified by the Army Corps of Engineers from the 2002 Sacramento and San Joaquin River Basins Comprehensive Study. The 200-year floodplain is only mapped for the areas of Tehama County within the lower Sacramento watershed, within the Sacramento-San Joaquin Drainage District.

Senate Bill (SB) 5 requires a 200-year level of flood protection from urban and urbanized areas within the Central Valley. All cities and counties in the Central Valley are required to incorporate the data and analysis of the CVFPP into their general plans and zoning ordinances. Tehama County will be required to include CVFPP data relating to the following categories as they are relevant to flood-specific outcome categories: public safety outcomes, ecosystem vitality, and economic stability outcomes. Under SB 5, development in moderate or special hazard areas within the Central Valley is allowed if the local agency can provide substantial evidence that the development would be subject to less than three feet of flooding during a 200-year flood event.

4.5.2.3.3 Areas Protect by Levees

Levees are used to control flooding in parts of the County. The county has over 13.64 miles of earthen levees and revetments managed by Tehama County Flood Control District. In addition to these District maintained levees, there are numerous private earthen berms (non-engineered) and levees (engineered) that exist throughout the County.

The California Department of Water Resources has used the best available information to identify areas within the county where flood levels are predicted to be more than three feet deep if a project levee were to fail; these areas are known as **Levee Flood Protection Zones (LFPZ)**. Most of these zones are located by the Sacramento River.

There are also two County maintained levee systems that are operated and maintained by the Tehama County Flood Control and Water Conversation District. The Deer Creek levee system includes 4 systems near Vina, CA that flow into the Sacramento River. The levee systems were primarily constructed by locals for the purpose of flood control beginning in the late 1940s. In addition to the channel improvement work performed for approximately 5.4 miles of the existing levees by the US Army Corps of Engineers (USACE), new levees were constructed during the 1958 improvements. The Elder Creek levee systems are a portion of the Sacramento River and Major and Minor Tributaries Project. The Sacramento River and Major and Minor Tributaries Project is comprised of levees, weirs, pumping stations, and bypass channels on the Sacramento River and associated tributaries. The Elder Creek levee systems are located west of the Sacramento River along Elder Creek near Gerber, California. Elder Creek's Gerber Leveed area includes the town of Gerber and most of the assets therein.

4.5.2.3.4 Historic Flood Areas

Sacramento River

The Sacramento River divides Tehama County, flowing through the County from north to south. The Sacramento River at the Red Bluff Diversion Dam drains approximately 9,150 square miles. Except for small drainage areas that drain to Black Butte Reservoir and Stony Creek on the west side and Pine Creek on the east side, all water originating in Tehama County drains to the Sacramento River within the county or on the county's boundary.

The flooding resulting from high tributary flow is exacerbated when it coincides with high stages in the Sacramento River.

The 100-YR floodplain along the Sacramento River that has been delineated by the USACE in its Comprehensive Study of the Sacramento and San Joaquin Rivers, is broader than that delineated on the FEMA FIRMs. The differences and the reasons for the differences between these maps and any other 100-YR flood stage designations should be reviewed so that Tehama County, in administering the NFIP, can be certain the new information can and should be used as the "best available" information. The 2006 Tehama County Flood Mitigation Plan recommends that the County should conduct a workshop with FEMA, the USACE, the State Reclamation Board, and DWR to address this matter (District, Tehama County Flood Mitigation Plan (FMP), 2006).

Jewett and Burch Creek

The primary creeks and channels in the Antelope and the Corning areas overtop during high runoff events causing the respective areas to be plagued with widespread overland flooding that adversely impacts roadways and properties. These problems are attributed largely to Antelope, Jewett, and Burch Creeks for the two areas, respectively. Burch Creek overflows in to Jewett Creek or west of town during localized rain events. These areas do not have active stream flow stations. A precipitation station is located at the Corning airport. The respective areas would benefit from having access to real-time data and flood forecasting information in view of the "flashy" hydrology of the systems. It is recommended by the 2006 Tehama County Flood Mitigation Plan that both watersheds be equipped with real-time data monitoring stations and data acquisition systems for stream flow and precipitation.

Another high priority project listed in the 2006 Tehama County Flood Mitigation was to formulate a Flood Management Plan for Jewett and Burch Creeks in the vicinity of Corning. so that a comprehensive evaluation can be made of the constraints and opportunities for managing floodwater from the watersheds. The consideration of detention storage and other flood management facilities was first investigated in 1969 by the California Department of Conservation. Although nothing materialized from that effort, the concept could offer opportunity to mitigate damage to public infrastructure and provide floodplain information to facilitate sound land use planning and a basis for administering the NFIP for the area (Id.).

Dairyville

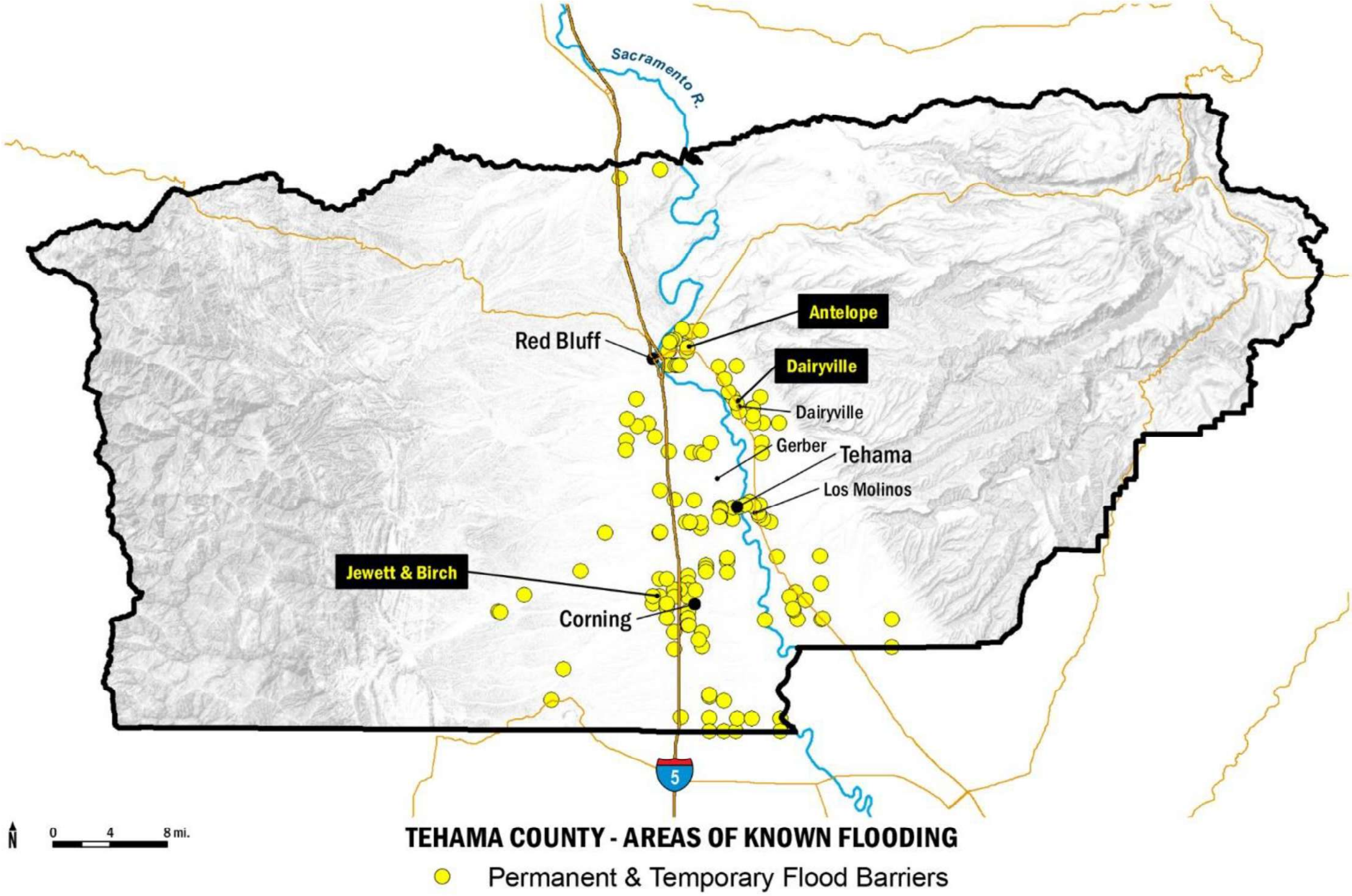
The Dairyville area and surrounding rural residential properties are at risk to flooding due to the Antelope Creek and its distributaries. Dairyville is an example where several repetitive loss properties are not within a mapped flood zone. Properties in Dairyville and Antelope have been damaged by floods, however, they were not covered under the NFIP and repairs were paid for by the owners.

Figure 4-25: Dairyville Flooding

Source: Tehama County Flood Control

Salt Creek and Antelope Creek distributaries cause flood risk to McHie Subdivision, Dairyville and other rural residential areas. More studies need to be done locally to validate the accuracy of the existing flood hazard mapping produced by FEMA reflecting the true flood risk within the planning area. This is most prevalent in areas protected by levees not accredited by the FEMA mapping process such as the Antelope/ Salt Creek area and others. Flood control structures that are not recognized by FEMA include roads, railroads and other non-certified flood control structures (Id.).

See Figure 4-26 for Historic Flood Areas Described Above. These maps are the basis for the flood vulnerability assessment.



Data Source: Tehama County

Figure 4-26 Tehama County - Areas of Known Flooding Map

4.5.2.4 Repetitive Loss Areas Analysis

A repetitive loss (RL) property is a FEMA designation, defined as an insured property (or formerly insured) that has made two or more claims of more than $1,000 in any rolling 10-year period since 1978. Claims must be at least 10 days apart but within 10 years of each other. The term “rolling 10-year period” means that a claim of $1,000 can be made in 1991 and another claim for $2,500 in 2000, or one claim in 2001 and another in 2007, as long as both qualifying claims happen within 10 years of each other. A RL property may be classified as a Severe Repetitive Loss (SRL) property under certain conditions. A Severe Repetitive Loss property has had four or more claims of at least $5,000, or at least two claims that cumulatively exceed the buildings reported value.

A property does not have to be currently carrying a flood insurance policy to be considered a RL or SRL property. Often homes in communities do not carry flood insurance but are still on the community’s repetitive loss list. The “repetitive loss” designation follows a property from owner to owner, from insurance policy to no insurance policy, and even after the property has been mitigated. Having an insurance policy and making claims that fall into the repetitive loss criteria will put a property on the RL list. Even after the policy on a property has lapsed or been terminated, the property will remain on Tehama County’s RL list.

This Repetitive Loss Areas Analysis (RLAA) examines areas where multiple RL properties exist in close proximity to each other and share similar flooding source conditions. Thirteen RL areas have been identified as part of Tehama County.

The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of certain types of data to the public. Flood insurance policy and claims data are included in the list of restricted information. FEMA can only release such data to state and local governments, and only if the data are used for floodplain management, mitigation, or research purposes. Therefore, this plan does not identify the repetitive loss properties or include claims data for any individual property.

Figure 4-27 shows the general repetitive loss areas in Tehama County.

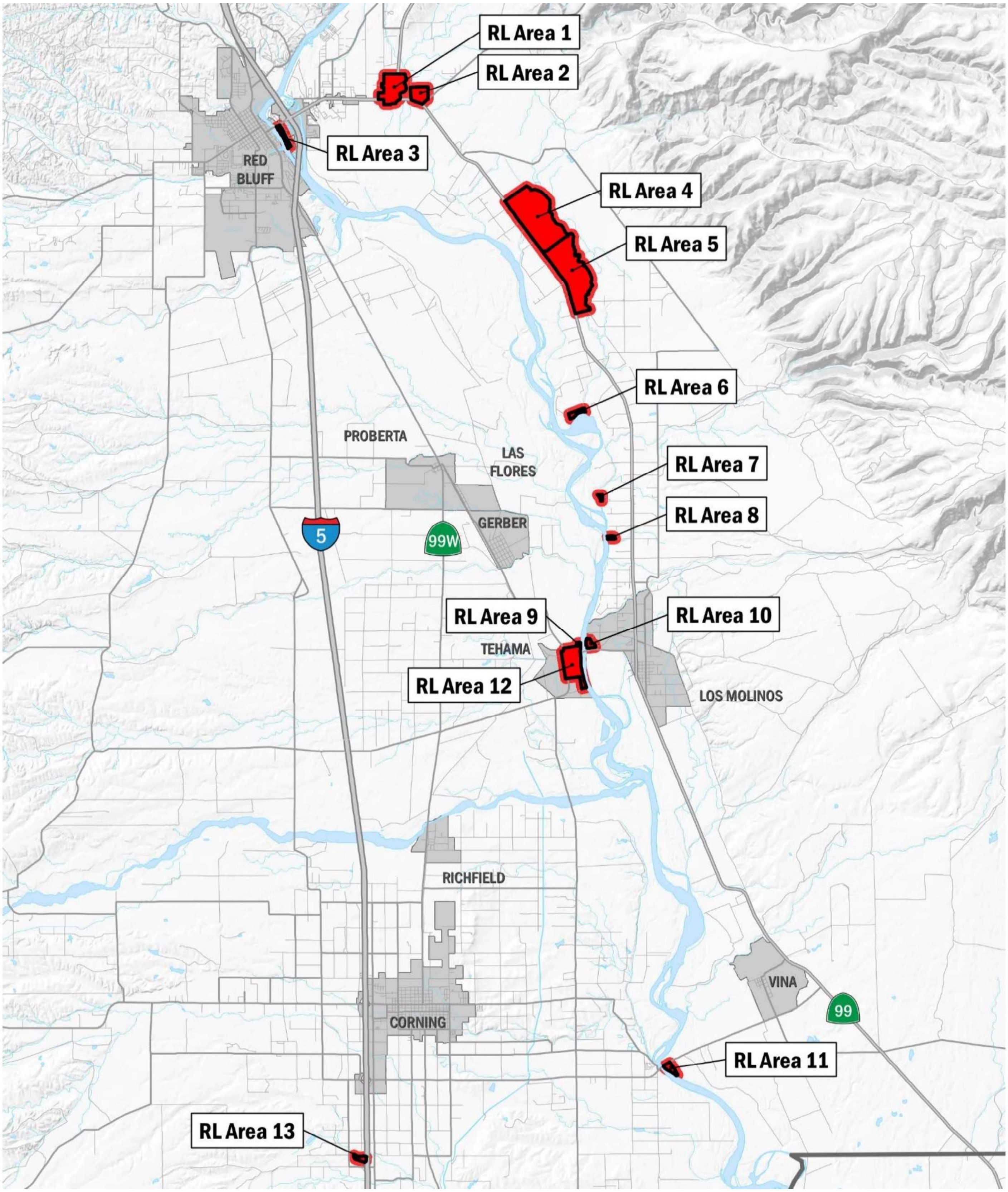


Figure 4-27 Tehama County – RL Locater

4.5.2.5 Measuring Frequency and Severity

The frequency and severity of flooding are measured using a discharge probability, a statistical tool that defines the probability that a certain river discharge or flow level will be equaled or exceeded within 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-YR discharge has a one 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-YR 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 one percent annual probability of occurrence (the base flood or 100-YR flood) is used as the regulatory 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 elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

4.5.2.6 Frequency and Probability of Future Occurrences

Tehama County will experience flooding in the future, with the probability of flooding in Tehama County between 10 and 100 percent annually. The majority of the floods in Tehama County have occurred from winter-through-spring rainfall. The Pacific high is known to cause increased intensity in weather patterns. As it moves southwards, it encourages storm formation across the state, producing widespread rain at low elevations and snow at high elevations. It is responsible for occasional heavy rains that are known to cause serious flooding. The semi-permanent high-pressure area of the north Pacific Ocean is also responsible for storms, causing heavy rains and widespread flooding during winter months. (Western Regional Climate Center, 2020)

Flooding in California is often associated with the El Niño weather phenomenon. El Niño is a term originally used to describe the appearance of warm (surface) water from time to time in the eastern equatorial Pacific region along the coasts of Peru and Ecuador. This ocean warming can strongly affect weather patterns all over the world. El Niño events are often associated with above-normal precipitation in the southwestern United States and often occur during the winter. La Niña is the opposite or "cold phase" of the El Niño cycle. Current understanding suggests that El Niño has a return period of four to five years. When an El Niño event occurs, it often lasts from 12 to 18 months. (National Oceanic and Atmospheric Administration , 2020).

4.5.2.6.1 Severity and Extent

The main factors affecting flood damage are water depth and velocity. Deeper and faster flood flows can cause more damage. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges; Table 4-21 lists peak flows used by FEMA to map the floodplains of Tehama County.

Table 4-21: Summary of Peak Discharges in Tehama County

	Drainage sq. MILES	Discharge (cubic feet/second)			
Source/Location	**Area**	**10-Year**	**50-Year**	**100-Year**	**500-Year**
Brewery Creek, at the mouth	2.3	290	720	1,020	1,800
Brewery Creek Tributary, at the mouth	0.5	–	–	230	–
Brickyard Creek, at the mouth	7.0	840	1,750	2,340	3,610
Cottonwood Creek					
At US Highway 99	917	54,153	–	102,750	–
Upstream of confluence with Hooker Creek	878	–	–	98,500	–
Upstream of confluence with SF Cottonwood Creek	475	–	–	54,280	–
Dibble Creek					
At mouth	31.1	2,580	5,440	6,700	9,860
At McCoy Bridge	13.5	1,310	–	3,325	–
~ 3.25 miles upstream of McCoy Rd. Bridge	7.1	–	–	2,030	–
East Sand Slough, at divergence from Sacramento River	–	35,300	55,500	65,000	–[1]
Grasshopper Creek, at the mouth	4.8	410	980	1,330	2,310
HWY 99 overflow, at confluence of Red Bank Creek	–	–	–	130	1,280
Hooker Creek, at confluence with cottonwood Creek	26.5	2,830	–	4,050	–
Jewett Creek					
At Interstate 5	8.1	800	1,200	2,300	3,350
Downstream of State HWY 99 (Edith Ave)	–	–	–	2,500[1]	–
Downstream of Toomes Ave	–	–	–	2,100[1]	–
Payne Creek Slough, at divergence from Sacramento River	–	11,400	24,500	31,000	–[2]
Reeds Creek					
At the mouth	74.7	4,950	9,500	13,500	17,650
Upstream of confluence with Brickyard Creek	67.7	–	–	12,000	–
Sacramento River, near the City of Tehama	10,000	155,000	220,000	245,000	580,000
Sacramento River, near the city of Red Bluff					
At Red Bluff Diversion Dam	9,150	141,000	194,000	220,000	546,000
Downstream of confluence with Reeds Creek	8,900	140,000	192,000	217,500	541,000
Sacramento River, near Lake California, below confluence with Battle Creek	8,800	133,000	183,000	205,000	525,000
Samson Slough, at divergence from Paynes Creek Slough	–	3,300	8,000	11,750	–[2]

	Drainage sq. MILES	Discharge (cubic feet/second)			
Source/Location	**Area**	**10-Year**	**50-Year**	**100-Year**	**500-Year**
South Fork Cottonwood Creek, *(At confluence with Cottonwood Creek)*	395	23,560	—	45,390	—
Spyglass Dr. overflow, *(At convergence with Grasshopper Creek)*	—[3]	—[3]	—[3]	200	890

[1] Jewett Creek floodwaters collect against the upstream (west) embankment of Interstate Highway 5 (I-5) and then continue to the east through the opening in I-5. However, the channel capacity downstream of I-5 is increasingly smaller as it continues through the study area, resulting in overbank losses and decreased channel flows.

[2] Controlling Discharge from Sacramento River

[3] Drainage not available

Source: Table 5 Summary of Discharges from FEMA FIS Text, 2011

4.5.2.6.2 Warning Time

The type and rate of flooding experienced in Tehama County varies. In general, warning times for floods can be between 24 and 48 hours to prepare communities to reduce flood damage. Seasonal notification for flooding can enhance awareness for citizens at risk, and, when communicated effectively, advance notification can reach target audiences on a large scale.

4.5.2.6.3 DWR Awareness Zones Notification

The Flood Risk Notification Program (FRN Program) is part of DWR's FloodSAFE California Initiative. The program's key goal is to increase flood risk awareness by effectively communicating that risk to individual property owners, the public, and local, state, and federal agencies. This includes encouraging people to understand the levee system that protects them; be prepared and aware of their flood risk; and take appropriate actions before, during, and after flooding to protect themselves, minimize damage to their property or personal possessions, and facilitate recovery.

To achieve this goal, the FRN Program:

- Sends out an annual notice to property owners whose property is at risk of flooding,
- Maintains accurate Levee Flood Protection Zone (LFPZ) maps[5] and an associated parcel information database,
- Provides people with useful ways to assess risk and reduce flood loss,
- Establishes outreach and educational projects with public involvement,

[5] These maps are different from Federal Emergency Management Agency regulatory maps.

- Expands its interactive Flood Risk Notification website, and
- Collaborates with federal agencies, local agencies, and communities.

In September of 2010, DWR provided the first annual written notice of flood risks to each landowner whose property is protected by State Plan of Flood Control (SPFC) levees and is within an LFPZ. The notice informs recipients of their property's potential flood risks and potential sources of flooding and offers flood emergency planning and preparedness tips. It also encourages recipients to take preventative actions, such as purchasing flood insurance, elevating or "floodproofing" their buildings, and preventing blockage of channels, drains, and ditches.

4.5.2.7 Secondary Hazards

In Tehama County, secondary flood hazards arise as a result of primary flooding events, often exacerbating the damage and impacting both natural and built environments. Some of the most common secondary hazards include landslides, erosion, and contamination of water resources. Floodwaters often destabilize soil, particularly in hilly and mountainous areas, increasing the likelihood of landslides that can obstruct roads, destroy infrastructure, and threaten homes. Additionally, flooding accelerates erosion along riverbanks, impacting agricultural lands and threatening habitats. Another significant concern is the contamination of water sources; floodwaters can carry hazardous materials, pesticides, and untreated sewage into rivers and groundwater supplies, jeopardizing public health and local ecosystems. (Department of Environmental Conservation, 2020). Wildland fires within a watershed can exacerbate flood hazards by virtue of increased rate and volume of runoff and attendant erosion and sediment discharge (USGS, 2020). These secondary impacts add complexity to flood recovery and resilience efforts, underscoring the need for robust flood management and land-use planning in Tehama County.

Public Health

Following any natural disaster that leaves excess moisture or standing water in its wake, such as a flood, the risk of mold growth in homes or other buildings greatly increases. Controlling moisture within a structure is the most critical factor for preventing mold growth. Any exposed buildings should be cleaned up and dried out quickly, within about 24 to 48 hours if possible, and any remaining wet porous items should be removed. People with asthma, allergies, respiratory conditions, or immune suppression are at the greatest risk for health effects from contact with mold. (CDC, 2020)

4.5.2.8 Climate Change Impacts

Climate change will likely worsen a number of natural hazards, including flooding. Climate change will shift rainfall patterns, making heavy rains more frequent in some areas. An increase in heavy rain events will lead to more flooding, including flash floods. Heavy rain events can inundate and overwhelm stormwater drainage systems resulting in localized flooding where pooling of water in low-lying areas can cause significant damage to buildings. Overwhelmed stormwater drainage facilities can also cause hazardous conditions on roadways where pooled water creates dangerous driving conditions. (US EPA, 2020)

4.5.2.9 Flood Vulnerability Analysis

Both an exposure analysis and Hazus loss estimation analysis were conducted to develop the flood vulnerability analysis for Tehama County. Flood exposure numbers were generated using the inventories outlined in Appendix A. These inventories were overlaid with FEMA delineated flood plains to determine exposure. The risk assessment exposure analysis values are separate from Hazus-generated damage estimation results.

Hazus flood vulnerability data was generated using a Level 2 Hazus 6.1 analysis. Hazus is a FEMA software product that uses a GIS to analyze 100-YR depth grids derived from FEMA 100-YR "A" zones with Base Flood Elevations to estimate loss. Parcel data defined in Section Appendix A was imported into Hazus as User Defined Facilities (UDF) and serves as the basis for replacement and content cost estimations, as well as associated loss. Where flood vulnerability is mentioned absent of Hazus, exposure analysis figures are used.

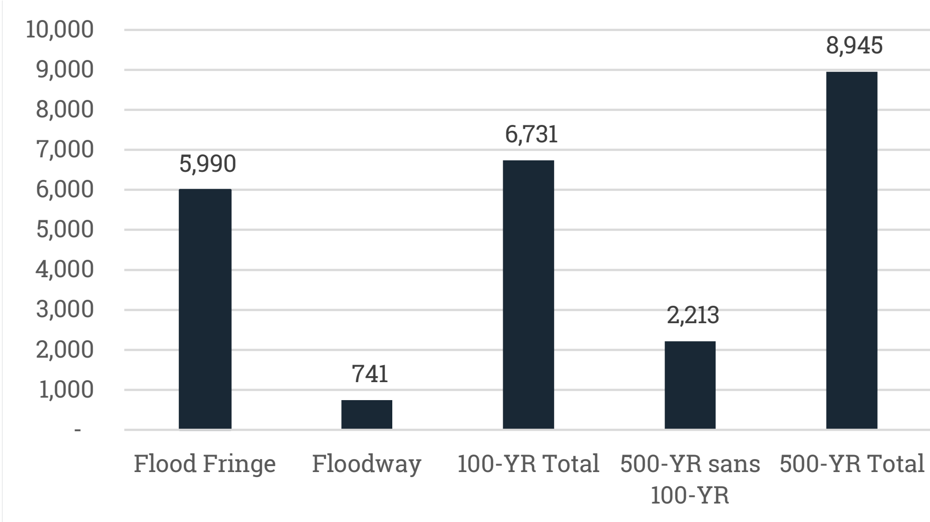
4.5.2.9.1 Flood Exposure

The tables and graphs in this section detail the populations, properties, and infrastructure exposed to flooding in *unincorporated* Tehama County. Flood exposure is categorized by exposure to different flood hazard zones, including the floodway, flood fringe, 100-YR floodplain, and 500-YR floodplain. The tables and graphs also include a category of the 100-year total, which is a combined total of floodway and flood fringe.. The 500-YR sans 100-YR category includes only the 500-YR floodplain, and the 500-YR total includes all of the categories combined. Refer to Section 4.5.1 for floodplain definitions to better understand these flood hazard areas.

Population

Using GIS, U.S. Census Bureau information was used to intersect the floodplain, and an estimate of population was calculated by weighting the population within each census block with the percentage of the flood risk area. Using this approach, Figure 4-28 and Table 4-22 and display the results of this analysis showing how much of the county population is exposed to flood hazard zones.

Flooding can disproportionately impact vulnerable communities. Lower-income populations, for instance, are more likely to live near industrial areas and hazardous waste sites, which can put them at higher risk to toxic leaks associated with flood and storm damage or in rental homes that may not adequately address mold issues. In areas with greater risk of flooding, housing prices are often cheaper which can lead to greater numbers of lower income populations living in higher risk areas. Additionally, lower-income populations are less likely to be able to afford flood insurance. (Sherwin, 2019)



Population Exposure

Population Count in the 100-Year and 500-YR Floodplains

Figure 4-28: Population Exposure to Flood (Unincorporated County)

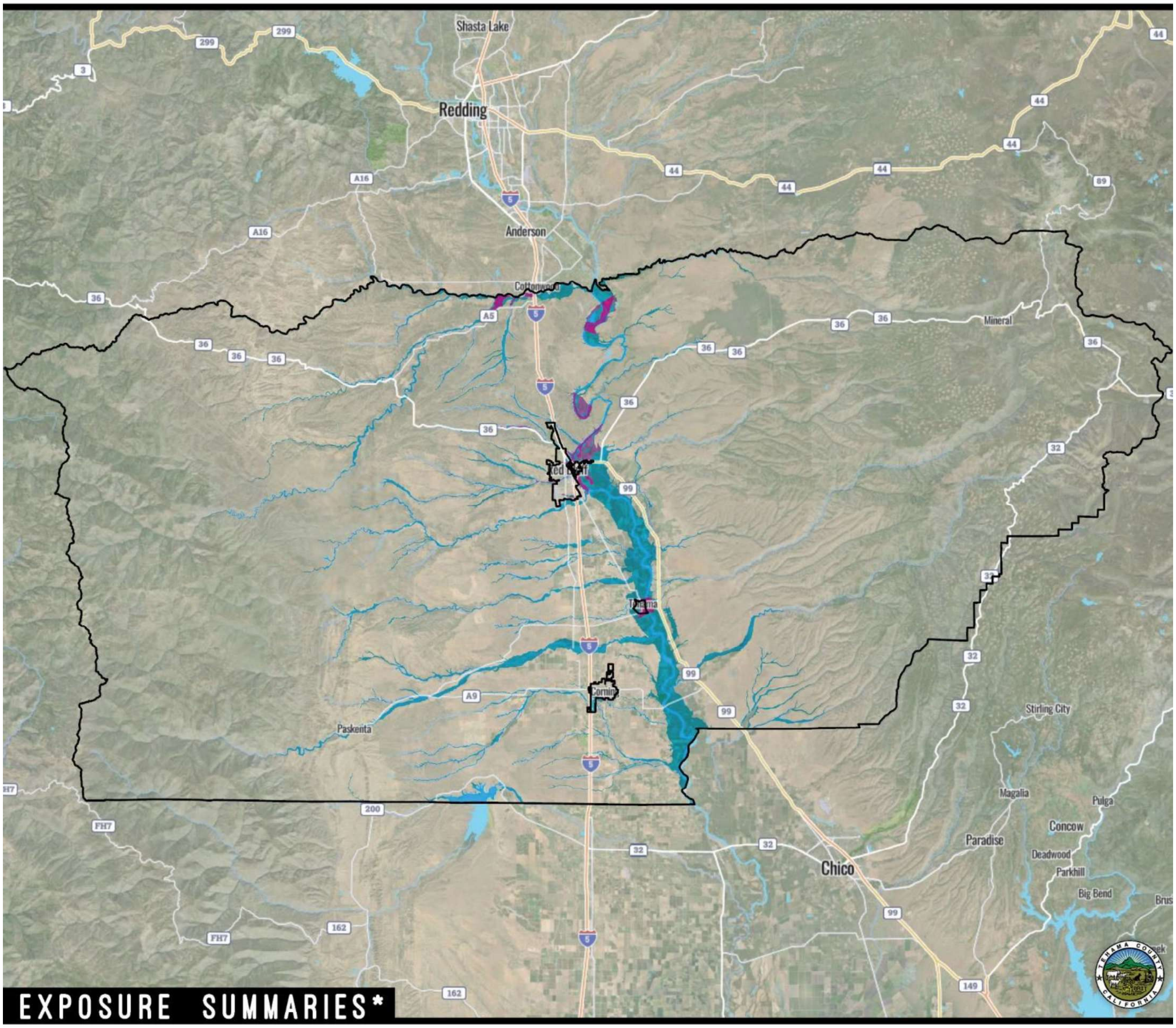
Table 4-22: Summary Population Exposure to Flood (Unincorporated County)

	Total Population
Unincorporated County	42,150

Flood Hazard Zone	Population Count	% of Total
Flood Fringe	5,990	*14.21%*
Floodway	741	*1.76%*
100-YR Total	6,731	*15.97%*
500-YR sans 100-YR	2,213	*5.25%*
500-YR Total	8,945	*21.22%*

FEMA FLOOD RISK EXPOSURE

TEHAMA COUNTY



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
8,945	21%

Count Includes: 100 + 500

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
3,126	17%

Count Includes: 100 + 500

PARCEL VALUE IN HAZARD AREA

	Value	Exp. Rate**
Sum of Improvement Value	$1,476,234,613	19%
Sum of Content Value	$847,995,106	19%

Count Includes: 100 + 500

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**
Essential Facilities	2	9%
Hazmat	20	13%
High Potential Loss	34	24%
Transportation & Lifeline	232	35%

Count/Sum Includes: 100 + 500

Sum of Transportation & Lifeline Linear Mileage: 304 5%

MAP LEGEND

100-YR | FLOODWAY | 500-YR

*Exposure summaries include 100-year and 500-year flood zone areas. Hazard data source: FEMA.

**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

Dynamic Planning + Science for Tehama County, 2023

Figure 4-29 Tehama County - Snapshot Layout - FEMA Flood Risk Exposure

Economy

Flooding can have a significant impact on Tehama County's agricultural industry, which is a vital part of the local economy. Floodwaters interfere with crop production, particularly affecting key crops like alfalfa, walnuts, and olives that are grown in the region. Flooding prevents oxygen absorption by the plants, leading to oxygen deprivation, which is the primary cause of plant death and reduced yields.

In areas of Tehama County where soils become waterlogged during flood events, the availability of oxygen to plant roots is significantly reduced. Plants, including the county's grapevines and nut orchards, require oxygen to generate the high-energy compounds essential for growth and survival. When soil is saturated for prolonged periods—beyond 36 to 48 hours—plants can suffer from reduced metabolism and eventual death due to oxygen starvation. Additionally, waterlogged soils may lead to the accumulation of harmful chemicals, further compounding the stress on crops. The effect is drastically reduced metabolism and, eventually, death if oxygen levels are reduced for more than 36 to 48 hours; these effects are often reversible if the duration of low oxygen conditions are limited within this tolerance. (Wiebold, 2007)

Structures and Parcel Value

Table 4-23 summarizes parcels in unincorporated Tehama County that are exposed to flood hazard areas. The beginning of Section 4.5.1 includes definitions of the various flood hazard areas.

Table 4-23: Parcels Exposed to NFIP Flood Zones (Unincorporated County)

		Total Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)	
Unincorporated County		18,434	$7,780,396,144	$4,574,842,260	$12,355,238,404	
Flood Hazard Zone	**Parcel Count**	**% of Total**	**Market Value Exposure ($)**	**Content Value Exposure ($)**	**Total Exposure ($)**	**% of Total**
Flood Fringe	2,171	*11.8%*	$989,056,669	$590,793,721	$1,579,850,390	*12.8%*
Floodway	120	*0.7%*	$57,518,533	$31,566,086	$89,084,619	*0.7%*
100-YR Total	2,291	12.4%	$1,046,575,202	$622,359,807	$1,668,935,009	13.5%
500-YR sans 100-YR	835	*4.5%*	$429,659,411	$225,635,299	$655,294,710	*5.3%*
500-YR Total	3,126	17.0%	$1,476,234,613	$847,995,106	$2,324,229,719	18.8%

Note: The table above does not display loss estimation results; the table exhibits total value at risk based upon the hazard overlay and Tehama County Assessor data.

Critical Facilities and Infrastructure

Table 4-24 summarizes the critical facilities and infrastructure located in the 100-YR floodplain (flood fringe and floodway) and 500-YR floodplains of Tehama County.

Table 4-24: Critical Facility Points in the Floodplain

Infrastructure Type	Flood Fringe	Floodway	100-YR Total	500-YR sans 100-YR	500-YR Total
Essential Facility	2	-	2	-	2
Emergency Operations Center	-	-	-	-	-
Fire Station	1	-	1	-	1
Hospital	-	-	-	-	-
Law Enforcement	1	-	1	-	1
High Potential Loss	22	6	28	6	34
Adult Residential Facility	6	2	8	3	11
Child Care Center	-	-	-	1	1
Dam	2	-	2	-	2
Historic Building	-	1	1	-	1
Power Plant	1	-	1	-	1
Real Property Asset	11	3	14	-	14
Residential Elder Care Facility	1	-	1	-	1
School	1	-	1	2	3
Transportation and Lifeline	213	18	231	1	232
Airport	-	-	-	-	-
Bridge	208	15	223	1	224
Cell Tower	-	-	-	-	-
FM Transmission Tower	-	-	-	-	-
Microwave Service Tower	-	-	-	-	-
Natural Gas Station	1	-	1	-	1
Paging Transmission Tower	-	-	-	-	-
Park	3	2	5	-	5
Substation	-	-	-	-	-
Wastewater Treatment Facility	1	1	2	-	2
Hazmat	18	-	18	2	20
Geotracker CleanupSite	3	-	3	1	4
HWTS Active Facility	15	-	15	1	16
Grand Total	**255**	**24**	**279**	**9**	**288**

**Real Property Assets are digitized insurance rolls for demonstrating value and ownership and may have overlapping points with other categories such as fire stations and law enforcement.*

Linear Utilities

It is important to determine who may be at risk if infrastructure is damaged by flooding. Roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the county, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems, and underground utilities can be damaged. Levees can fail or be overtopped, inundating the land that they protect. Table 4-25 shows analyzed critical facilities (linear) in the floodplain.

Table 4-25: Lifelines in the Floodplain (Unincorporated County)

Lifelines (miles) - Flood Risk Exposure					
Infrastructure Type (linear)	Flood Fringe	Floodway	100-YR Total	500-YR sans 100-YR	500-YR Total
NG Pipeline	14.8	0.4	15.2	0.3	15.5
Railroad	4.4	1.0	5.4	-	5.4
Street	214.6	10.0	224.6	29.0	253.7
4WD trail	2.7	-	2.7	-	2.7
4WD trail, major	0.1	-	0.1	-	0.1
Alley	-	-	-	-	-
Cul-de-sac	-	-	-	-	-
Driveway	7.2	0.1	7.2	0.8	8.0
Interstate	4.8	0.8	5.5	1.0	6.6
Local road	152.1	6.5	158.6	23.6	182.2
Local road, major	4.3	-	4.3	0.3	4.6
Primary highway	4.0	-	4.0	-	4.0
Primary highway, major	0.1	-	0.1	-	0.1
Ramp	0.9	-	0.9	0.3	1.1
Service road	0.2	-	0.2	-	0.2
State/county highway	34.8	1.7	36.4	3.1	39.5
Thoroughfare, major	3.6	1.1	4.7	-	4.7
Walkway	-	-	-	-	-
Transmission Line	27.5	1.4	28.9	0.1	29.0
Grand Total	**261.3**	**12.9**	**274.2**	**29.4**	**303.6**

Roads

Tehama County Public Works maintains a hazard map that can be used to find which roads in the county may be closed during a flood event. This list can be viewed by visiting https://tcpw.ca.gov/road-closures/

Water and Sewer Infrastructure

Water and sewer systems can be affected by flooding. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers, and streams.

4.5.2.9.2 Flood Damage Estimation

Hazus calculates losses to structures from flooding by analyzing the depth of flooding and type of structure. Using historical flood insurance claim data, Hazus estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, all non-vacant parcels with current market values were used instead of the default inventory data provided with Hazus. Table 4-26 and Figure 4-30 show the 100-YR flood loss estimation (based on depth) in NFIP flood zones by occupancy type. Figure 4-31 and Table 4-27 show the 500-YR flood loss estimation (based on depth) in NFIP flood zones by occupancy type.

Tehama County's insurance data was obtained and formatted for use in Hazus for a detailed damage estimation of county-owned facilities. This combined government dataset has additional information, including the number of floors, building value, content value, and construction type that greatly enhances Hazus results.

Damage Estimation for 100-YR Floodplain

Table 4-26 and Figure 4-30 display damage estimation summaries for the 100-YR floodplain in unincorporated Tehama County by improved parcel loss.

Table 4-26: 100-YR Flood Damage Estimation by Occupancy Type – Unincorporated County

Building Type	Building Damage ($)	Building Damage (% of total loss)	Content Damage ($)	Content Damage (% of total loss)	Total Damage ($)	Proportion of Loss (%)
Agriculture	$16,745,837	4.2%	$34,179,789	8.5%	$50,925,626	13%
Commercial	$2,752,081	0.7%	$8,437,671	2.1%	$11,189,752	3%
Government	$60,548	0.0%	$393,456	0.1%	$454,004	0%
Industrial	$452,035	0.1%	$671,588	0.2%	$1,123,624	0%
Religion	$291,997	0.1%	$2,145,208	0.5%	$2,437,205	1%
Residential	$256,850,385	63.9%	$78,791,453	19.6%	$335,641,838	84%
Total					**$401,772,049**	

Note: Total Inventory Values
1 - Building Replacement Costs = $7,780,025,882
2 - Content Replacement Costs = $4,574,657,132
3 - Total Value = $12,354,683,014

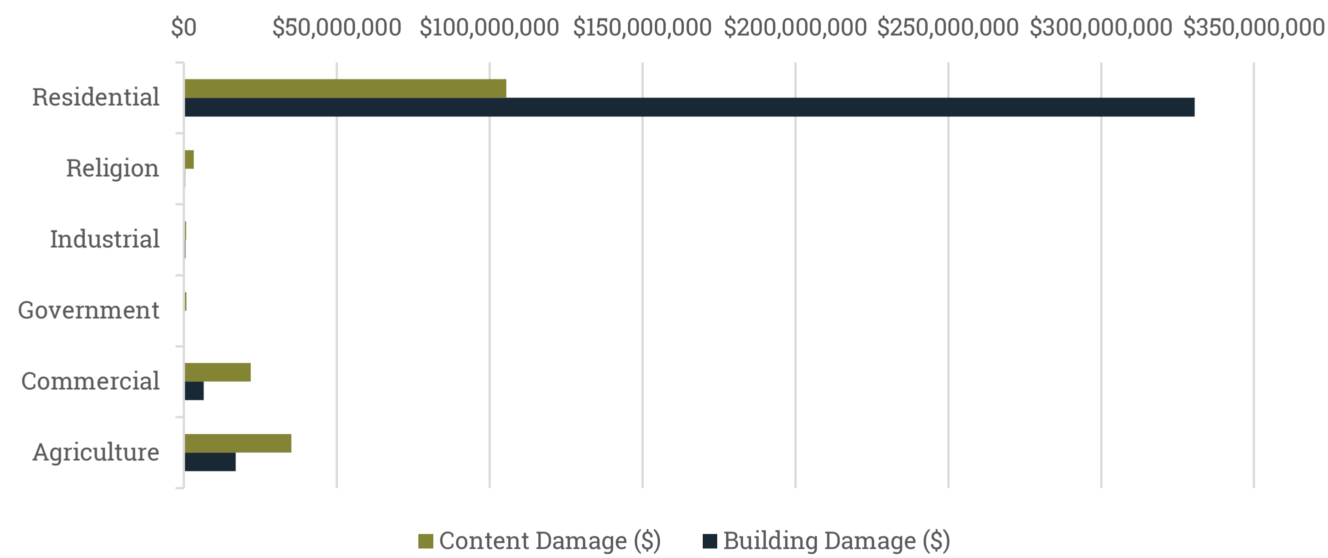


Figure 4-30: 100-YR Flood Damage Estimation by Occupancy - Unincorporated County

Damage Estimation for 500-YR Floodplain

Table 4-27 and Figure 4-31 display damage estimation summaries for the 500-YR floodplain in unincorporated Tehama County by improved parcel and government property loss.

Table 4-27: Damage Estimation Summary for 500-YR. Floodplain – Unincorporated County

Building Type	Building Damage ($)	Building Damage (% of total lossl)	Content Damage ($)	Content Damage (% of total loss)	Total Damage ($)	Proportion of Loss (%)
Agriculture	$0	0.0%	$0	0.0%	$0	0%
Commercial	$161,764	0.9%	$627,127	3.6%	$788,890	5%
Government	$0	0.0%	$0	0.0%	$0	0%
Industrial	$1,401	0.0%	$1,156	0.0%	$2,557	0%
Religion	$0	0.0%	$0	0.0%	$0	0%
Residential	$12,708,299	72.8%	$3,948,584	22.6%	$16,656,882	95%
Total					**$17,448,330**	

Note: Total Inventory Values
1 - Building Replacement Costs = $7,780,025,882
2 - Content Replacement Costs = $4,574,657,132
3 - Total Value = $12,354,683,014

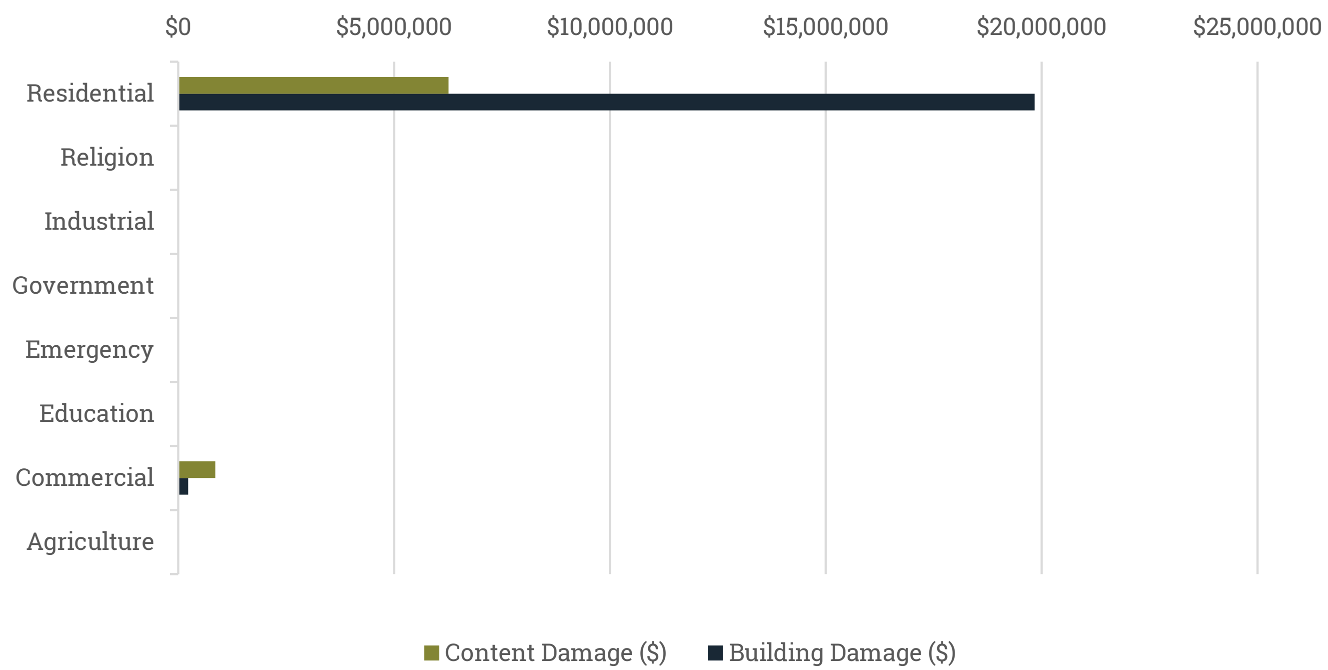


Figure 4-31: 500-YR Flood Damage Estimation by Occupancy Type – Unincorporated County

4.5.2.10 Future Trends in Development

As further discussed in Section 4.3.4, Tehama County's population has remained relatively stable with a mild growth rate that is significantly lower than the statewide growth rate. The unincorporated areas of the county, in particular, have seen a steady decline in the rate of growth, partially due to a decline in net migration. Tehama is a relatively rural county, with an overall population density of approximately 22 people per square mile, which is lower than California as a whole. This growth trend is expected to continue.

Although new development continues to occur across the county, local planning, zoning, building, and other development regulations work to plan for and address flood hazards, helping to limit exposure, reduce risk, and mitigate impacts. As discussed in Section 4.3.6, this regulatory framework includes the county's General Plan, as well as those general plans of other participating jurisdictions, that addresses land use, infrastructure improvement and expansion, resource conservation, and public safety, among other topics. These general plans are periodically reviewed as part of hazard mitigation capability assessments, enabling local agencies to identify potential gaps or deficiencies. Any identified needs can be integrated as mitigation actions, thereby strengthening each jurisdiction's ability to support sustainable development and manage flood impacts effectively.

Much of the county could be affected by flood hazards, including existing and future development. Infrastructure in Tehama County has been developed to protect communities from flood damage, particularly along key waterways such as the Sacramento River and its tributaries. The county is prepared to manage future growth within flood hazard areas, and the Tehama County General Plan includes goals and policies designed to avoid and mitigate flood impacts from new development. The Tehama County Code (Chapter 15.52 - Floodplain Management Regulations) provides strict provisions for flood hazard reduction, limiting and mitigating the risks associated with new development in floodplains.

Tehama County also implements additional review measures for sensitive flood-prone areas, particularly near the Sacramento River, Coyote Creek, and other critical waterways that are vital for flood management and environmental protection. The plans and policies presented in Section 4.5.2.1 ensure that properties are protected from flood risks and that the natural floodplain areas continue to provide important environmental services, such as water filtration, wildlife habitats, and floodwater absorption.

4.5.2.11 Flood Hazard Problem Statements

As part of the mitigation action identification process, the Planning Stakeholder for the county and for each jurisdiction identified issues and weaknesses, also called problem statements, for their respective assets. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and flood data. Flood problem statements for the county are listed in Table 4-28; problem statements for all other participating jurisdictions are accessed in Volume 2 of this plan.

Identifying these common issues and weaknesses assists the Planning Committee in understanding the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and the corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-28 and Table 5-6.

Mitigation Alternatives

Tehama County and other participating jurisdictions considered a range of mitigation alternatives for identified areas of concern and flood hazard problems, as discussed in more detail in Section 5.3. Among these were actions from the 2018 MJHMP that were no longer relevant, such as activities to support joining FEMA's CRS program, or that have been completed since 2018. See Table 2-2 for all cancelled county mitigation actions and Table 2-3 for county actions that have been completed. Other mitigation actions that were considered were ultimately made part of the county-wide mitigation strategy and are listed in Table 5-6. The cancelled, completed, and maintained mitigation actions for other participating jurisdictions are provided in their individual annexes in Volume 2.

Table 4-28 Flood Problem Statements

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-FL-TC-30	Flood	Impact	SP	**Tehama County**	Older or non-engineered levees such as Elder Creek, Deer Creek and others are subject to failure or do not meet current building practices for flood protection. Development behind privately built levees/earthen berms occurs on the valley floor. Many of these people have not purchased flood insurance because regulatory maps do not show them as being in the flood plain.	Y	ma-FL-TC-9
ps-FL-TC-31	Flood	Threat	SP	**Tehama County**	Climate change impacts flood conditions in Tehama County. More severe weather events could compromise local drainage and flood control.	Y	ma-FL-CC-43, ma-FL-CoT-84, ma-FL-CoT-85, ma-FL-CoT-86, ma-FL-CoT-87, ma-FL-CoT-98, ma-FL-RB-66, ma-FL-RB-75, ma-FL-CC-41, ma-FL-CC-42, ma-FL-CC-45, ma-FL-CC-49, ma-FL-TC-21
ps-FL-TC-35	Flood	Victim	PEA	**Tehama County**	Residents need more education about flood preparedness, flood insurance and the resources available during and after floods on a continual basis.	Y	ma-FL-CC-35, ma-FL-CoT-81, ma-FL-CoT-82, ma-FL-CoT-89, ma-FL-CoT-90, ma-FL-CoT-92, ma-FL-RB-65, ma-FL-TC-5

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-FL-TC-38	Flood	Impact	PPRO , NRC	**Tehama County**	Placing fill, constructing levees or berms, modifying drainage channels and streams, constructing and maintaining private and public roads, and grading property without regard or the understanding of the potential impact to drainage or the risk from flooding can create problems where none existed previously.	N	ma-FL-CC-37, ma-FL-CoT-79, ma-FL-TC-11
ps-FL-TC-40	Flood	Victim	PPRO - Property Protection , NRP - Natural Resource Protection	**Tehama County**	Lack of well head protection plans for private wells or single individual wells providing domestic supply to single family resident.	Y	ma-FL-CoT-100, ma-FL-TC-13
ps-FL-TC-42	Flood	Threat	PRV	**Tehama County**	More studies need to be done locally to validate the accuracy of the existing flood hazard mapping produced by FEMA reflecting the true flood risk within the planning area. This is most prevalent in areas protected by levees not accredited by the FEMA mapping process such as the Antelope/ Salt Creek area and others. Flood control structures that are not recognized by FEMA include roads, railroads and other non-certified flood control structures.	N	ma-FL-TC-7, ma-FL-CC-50
ps-FL-TC-44	Flood	Impact	PRV	**Tehama County**	Lack of historical damage data, such as high-water marks on structures and damage reports, to measure inundation and the cost-effectiveness of future mitigation projects.	Y	ma-FL-TC-10, ma-FL-CoT-82, ma-FL-CC-50

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-FL-TC-46	Flood	Impact	PRV	**Tehama County**	There is a lack of detailed information regarding existing drainage patterns and floodplains in areas of existing development and, in most cases, areas where future development will likely occur. As a consequence, implementation of a no adverse impact management policy is problematic. Even where FEMA has identified SFHAs, the BFEs are not always available.	N	ma-FL-TC-7
ps-FL-TC-47	Flood	Threat	SP , PPRO	**Tehama County**	Salt Creek and Antelope Creek distributaries causing flood risk to McHie Subdivision and other rural residential areas.	Y	ma-FL-TC-14, ma-FL-TC-15
ps-FL-TC-48	Flood	Threat	SP	**Tehama County**	Antelope Creek distributaries causing flood risk to Daryville area and surrounding rural residential properties.	Y	ma-FL-TC-16
ps-FL-TC-49	Flood	Impact	SP , PPRO	**Tehama County**	Unmitigated repetitive loss structures exist within the county unincorporated areas	N	ma-FL-TC-8
ps-FL-TC-50	Flood	Impact	PRV	**Tehama County**	A significant number of NFIP claims are outside of FEMA-designated SFHAs. The determination of the causes of flooding on existing structures and the siting of new facilities, so as not to be adversely impacted by flooding or adversely impacting adjacent or neighboring properties, is problematic due to the lack of topographic data and mapping.	N	ma-FL-CC-34, ma-FL-CC-47, ma-FL-CC-50, ma-FL-TC-8

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-FL-TC-52	Flood	Impact	NRP	**Tehama County**	Over time the transport of material from these rugged upland areas to the valley floor has resulted in the deposition of large alluvial fans and gravel reserves along the lower foothills. Sediment loading continues to be a problem in the Tehama watersheds.	Y	ma-FL-TC-17
ps-FL-TC-53	Flood	Impact	SP	**Tehama County**	Watershed streams show rapid responses to storms, and flow levels fluctuate or flash between storm periods in a localized environment.	Y	ma-FL-CC-41, ma-FL-CC-42, ma-FL-CC-45, ma-FL-CC-46, ma-FL-CC-49, ma-FL-RB-70, ma-FL-TC-21, ma-FL-CC-43
ps-FL-TC-58	Flood	Impact	SP	**Tehama County**	Burch Creek overflows in to Jewett Creek west of town during localized rain events.	Y	ma-FL-CC-39, ma-FL-TC-17
ps-FL-TC-70	Flood	Impact	PRV	**Tehama County**	Many small tributaries in the watersheds have high levels of siltation and diminished flood-carrying capacity due to vegetation (due to Arundo and Tamarisk) overgrowth. Debris-clearing is a challenge due to environmental permitting restrictions from Fish and Game/Fish and Wildlife. The establishment of Arundo in the streams in Tehama County has seriously limited their conveyance capacity.	Y	ma-FL-TC-12, ma-FL-CC-38, ma-FL-CoT-84, ma-FL-RB-64

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-FL-TC-78	Flood	Impact	SP , PE&A	**Tehama County**	During high flows, the Sacramento River's overflow channel near Jellys Ferry Rd. and Saron Fruit Colony Rd. becomes inundated, keeping people from accessing the western area via Saron Fruit Colony Road.	Y	ma-FL-TC-33

4.5.3 Earthquake Hazard Profile

An earthquake is the sudden shaking of the ground caused by the passage of seismic waves through the Earth's rocks. Seismic waves are produced when some form of energy stored in the Earth's crust is suddenly released, usually when masses of rock straining against one another abruptly fracture and "slip." Earthquakes associated with this type of energy release are called tectonic earthquakes. Energy also can be released by elastic strain, gravity, chemical reactions, or even the motion of massive bodies. Earthquakes occur most often along geologic **faults**, narrow zones where rock masses move in relation to one another. (USGS)

Earthquakes have different properties depending on the type of fault that causes them. See Figure 4-32. The usual fault model has a "strike" (that is, the direction from north taken by a horizontal line in the fault plane) and a "dip" (the angle from the horizontal shown by the steepest slope in the fault). The lower wall of an inclined fault is called the footwall. Lying over the footwall is the hanging wall. When rock masses slip past each other parallel to the strike, the movement is known as strike-slip faulting. Movement parallel to the dip is called dip-slip faulting. In dip-slip faults, if the hanging-wall block moves downward relative to the footwall block, it is called "normal" faulting. The opposite motion, with the hanging wall moving upward relative to the footwall, produces reverse or thrust faulting. (*Id.*)

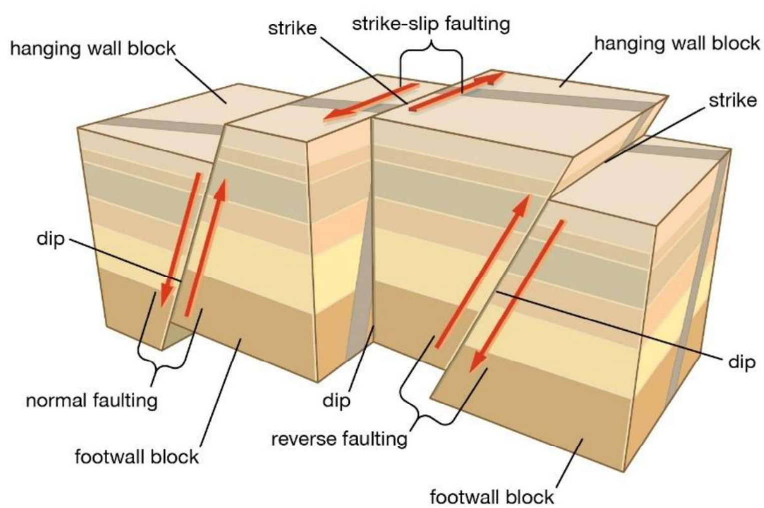


Figure 4-32: Earthquake Faulting

As a fault rupture progresses along or up the fault, rock masses are flung in opposite directions and then spring back to a position where there is less strain. (*Id.*)

Soil Liquefaction

Liquefaction occurs during an earthquake in areas where sand and silt that are saturated behave as a liquid. Areas most impacted by liquefaction are near sources of water where landfilling has been done decades ago, by humans in areas that were once bodies of water. The bay margins in coastal California are typically most associated with liquefaction risk. While neither the USGS or CGS have delineated liquefaction risk for Tehama County, and therefore cannot be mapped, larger stream channels and other geologic phenomena such as alluvial fans may be susceptible. (USGS)

Artificial Induction

USGS research on human induced earthquakes reviews injection of waste fluids into deep wells, pumping of groundwater, the excavation of mines, and the filling of large reservoirs. In fluid injection, the slip is thought to be induced by the fluid's increased pressure counteracting frictional forces on faults. (USGS)

Earthquake Classifications

Earthquakes are typically classified either 1) by the amount of energy released, measured as **magnitude**; or 2) by the impact on people and structures, measured as **intensity**. (USGS)

The most common method for measuring earthquakes is magnitude, which measures the strength of earthquakes. While the majority of scientists generally use the **Moment Magnitude (Mw) Scale** to measure earthquake magnitude, the **Richter (M) Scale** is the most universally-known measurement. The magnitude of an earthquake is related to the total area of the fault that ruptured, as well as the amount of offset (displacement) across the fault. As shown in Table 4-29, there are seven earthquake magnitude classes on the Mw scale, ranging from great to micro. A magnitude class of great can cause tremendous damage to infrastructure, compared to a micro class, which results in minor damage to infrastructure. (*Id.*)

Table 4-29: Moment Magnitude Scale

Earthquake Magnitude Classes (Mw)

Magnitude Class	Magnitude Range (M = Magnitude)	Description
Great	M > 8	Tremendous damage
Major	7 <= M < 7.9	Widespread heavy damage
Strong	6 <= M < 6.9	Severe damage
Moderate	5 <= M < 5.9	Considerable damage
Light	4 <= M < 4.9	Moderate damage
Minor	3 <= M < 3.9	Rarely causes damage.
Micro	M < 3	Minor damage

Intensity

The effects of an earthquake are also measured by intensity. Earthquake intensity decreases with increasing distance from the epicenter of the earthquake. The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects experienced at that place. (USGS)

The **lower** numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The **higher** numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above. Table 4-30 is an abbreviated description of the levels of Modified Mercalli Intensity. (*Id.*)

Table 4-30: Modified Mercalli Intensity Level Descriptions

Intensity	Shaking	Description/Damage
I	**Not felt**	Not felt except by a very few under especially favorable conditions.
II	**Weak**	Felt only by a few persons at rest, especially on upper floors of buildings.
III	**Weak**	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations are similar to the passing of a truck. Duration estimated.
IV	**Light**	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Similar to a heavy truck striking a building. Standing motor cars rocked noticeably.
V	**Moderate**	Felt by nearly everyone, many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	**Strong**	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	**Very strong**	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	**Severe**	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	**Violent**	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	**Extreme**	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS, Abridged from The Severity of an Earthquake, USGS General Interest Publication 1989-288-913

Ground Motion

Earthquake hazard assessment is based on expected ground motion. This involves determining the annual probability that certain ground motion accelerations will be exceeded, then summing the annual probabilities over the time period of interest. The most commonly-mapped ground motion parameters are the horizontal and vertical peak ground accelerations (PGA) for a given soil or rock type. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. These readings are recorded by state and federal agencies that monitor and predict seismic activity. (Pacific Northwest Seismic Network)

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," such as single-family dwellings. Longer-period response components determine the lateral forces that damage larger structures with longer natural periods, such as apartment buildings, factories, high-rises, and bridges. Table 4-31 lists the damage potential and perceived shaking by PGA factors, compared to the Mercalli scale. (USGS)

Table 4-31: Modified Mercalli Scale and Peak Ground Acceleration

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA (%g)
		Resistant Buildings	Vulnerable Buildings	
I	Not Felt	None	None	<0.17%
II-III	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%

Sources: USGS, 2008; USGS, 2010
Note: PGA measured in percent of g, where g is the acceleration of gravity

4.5.3.1 Plans, Policies, and Regulatory Environment

Alquist-Priolo Earthquake Fault Zoning Act and Seismic Hazards Mapping Act (1972)

The 1971 San Fernando Earthquake resulted in the destruction of numerous structures built across its path. This led to passage of the Alquist-Priolo Earthquake Fault Zoning Act in 1972. This Act prohibits the construction of buildings for human occupancy across active faults in the State of California. Similarly, extensive damage caused by ground failures during the 1989 Loma Prieta Earthquake focused attention on decreasing the impacts of landslides and liquefaction. This led to the creation of the Seismic Hazards Mapping Act, which increases construction standards at locations where ground failures are probable during earthquakes. Tehama county does not have delineated zones of required investigation within California Geologic Society data.

2022 California Building Standards Code

The 2022 California Building Code, adopted by Tehama County in December 2022, includes materials requirements, construction methods, and maintenance standards for earthquake protection and resiliency.

Tehama County General Plan

The 2009 Tehama County General Plan includes a number of policies in the Safety Element to mitigate the effects of earthquakes. Under the General Plan Safety Element, seismic and geologic hazards are combined, including liquefaction, landslides, and expansive soils. Alongside ensuring compliance with California Building Code, its policies require new development proposals in seismic hazard areas to undergo a geotechnical evaluation prior to approval. The Tehama County General plan notes that the county is exposed to minimal seismic hazards due to geologic location.

4.5.3.2 Past Events

In recent history, only two earthquakes have occurred within Tehama County. Both took place on January 19, 2008. These were 4.7 and 4.5 Magnitude events with epicenters approximately 25 miles west of Red Bluff. Both of these events had minimal impacts. (USGS) There have been no state or federal disaster declarations for earthquake since the 2018 MJHMP.

4.5.3.3 Location

While the exact location of earthquakes cannot be predicted, the Battle Creek fault defined by UCERF3 is the most likely source of a damaging earthquake within Tehama County. Figure 4-34 shows the areas within Tehama County most likely to experience shaking as described in the paragraphs below (4.5.3.4).

4.5.3.4 Frequency and Probability of Future Occurrences

According to the California State Hazard Mitigation Plan, earthquakes large enough to cause moderate damage to structures—those of M5.5 or larger—occur three to four times a year statewide. Strong earthquakes of M6 to M6.9 strike on an average of once every two to three years. Major earthquakes of M7 to M7.9 occur in California about once every 10 years.

30-Year Earthquake Probability (UCERF3)

Probability of earthquake events is based on the approximate location of earthquake faults within and outside the Tehama County region. The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3)[6] is a comprehensive model of earthquake occurrence for California. It represents the best available science for authoritative estimates of the magnitude, location, and likelihood of potentially damaging earthquakes in California. According to UCERF3 and as shown in Figure 4-33, the Battle Creek fault is the only rated fault within the county and it has a 1% or less liklihood of producing an M6.7 or greater earthquake in a given 30-Year period.

[6] Quaternary faults are those active faults that have been recognized at the surface and which have evidence of movement in the past 1.6 million years (the duration of the Quaternary Period).

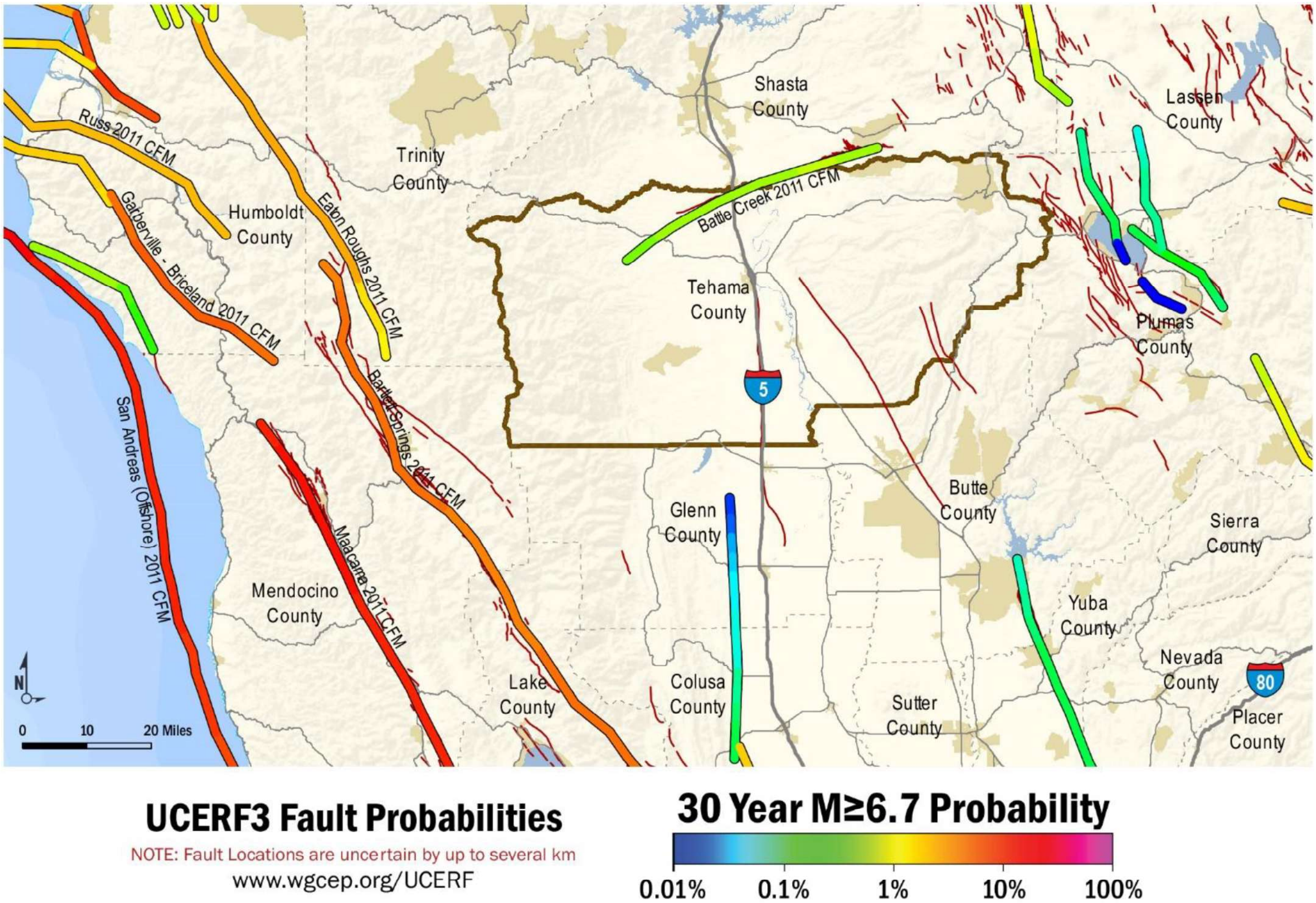


Figure 4-33 Tehama County UCERF3

Earthquake Shaking Potential

The Earthquake Shaking Potential Map, Figure 4-34, shows potential seismic shaking from anticipated future earthquakes. It is probabilistic in the sense that the analysis takes into consideration the uncertainties in the size and location of earthquakes and the resulting ground motions that can affect a particular site. (CGS, 2020) It is also useful in understanding the probability of severe shaking in different locations throughout the county, as discussed in Section 4.5.3.4.

The map is expressed in terms of the probability of exceeding a certain ground motion. The map shows a two percent probability of exceeding one second of ground motion in 50 years. Earthquake shaking potential in California is calculated based on the USGS National Seismic Hazard Model and in partnership with California Geological Survey (CGS). Earthquake shaking potential also considers historic earthquakes, slip rates on major faults, deformation throughout the region, and the potential for amplification of seismic waves by near-surface geologic materials. (CGS, 2020)

Higher hazard areas are those regions near major, active faults that will on average experience stronger earthquake shaking more frequently. This intense shaking can damage even strong, modern buildings. Lower hazard areas are those regions that are distant from known, active faults that will experience lower levels of shaking less frequently. In most earthquakes, only weaker, masonry buildings would be damaged. However, very infrequent earthquakes could still cause strong shaking in those locations. (D. Branum, 2016)

The shaking potential is calculated as the level of ground motion that has a two percent chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500-year average repeat time. Relatively long-period (1.0 second) earthquake shaking is shown. Long-period shaking affects tall, relatively flexible buildings, but also correlates with overall earthquake damage. Although the greatest hazard is in areas of highest intensity, as shown in Figure 4-34; potential does exist for damaging Earthquakes to occur in Tehama County.

The potential for earthquake ground shaking, as defined by the U.S. National Seismic Hazard Model, is used by engineers to design buildings for larger ground motions than what we think will occur during a 50-year interval, which will make buildings safer than if they were only designed for the ground motions that we expect to occur in the next 50 years. (USGS, 2020)

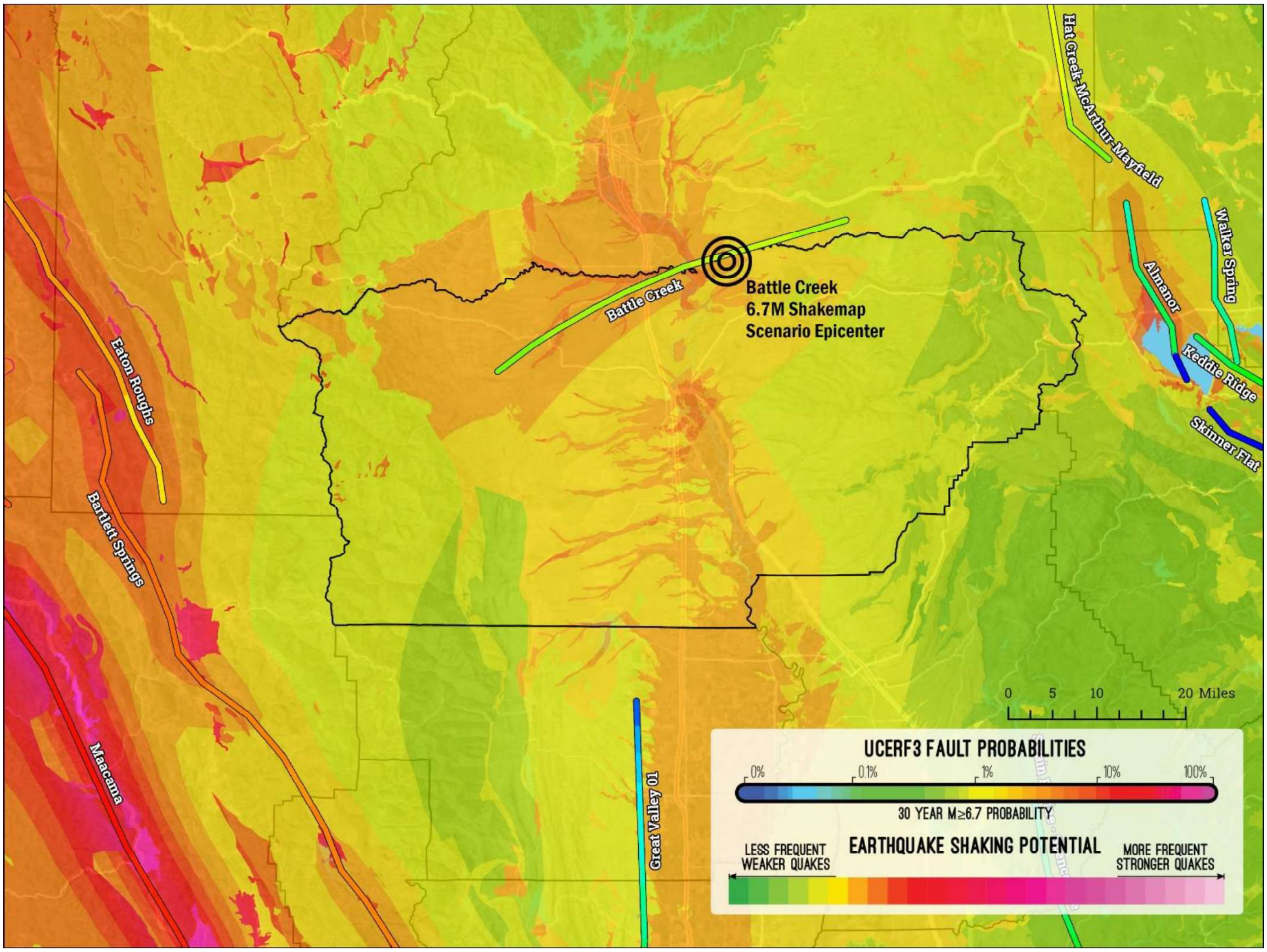


Figure 4-34: Earthquake Shaking Potential with UCERF3 Fault Probability Overlay.

4.5.3.5 Severity and Extent

While Tehama County has a lower probability and potential extent of a high shaking event, the UCERF3 rating of the Battle Creek fault does demonstrate a modeled potential for a Magnitude 6.7 or greater earthquake within a 30 year period. The probability is low, but the severity of such an event would be greater than some structures and lifelines could handle. The potential for loss and hardship could be compounded by collateral emergencies, such as fires, hazardous material spills, utility disruptions, landslides, transportation emergencies, or inundation from levee failure.

Neither the occurrence of an earthquake nor the severity can be predicted. Instead, scientists can only calculate the probability that a significant earthquake will occur in a specific area within a certain number of years.

4.5.3.6 Warning Time

There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. Seconds and minutes of advance warning can allow people and systems to take actions to protect life and property from destructive shaking. Even a few seconds of warning can enable protective actions specific to various sectors of the population, such as:

- **Public:** Citizens, including schoolchildren, drop, cover, and hold on; turn off stoves; safely stop vehicles.
- **Businesses:** Personnel move to safe locations; automated systems ensure elevator doors open; production lines are shut down; sensitive equipment is placed in a safe mode.
- **Medical services:** Surgeons, dentists, and others stop delicate procedures.
- **Emergency responders:** Open firehouse doors; personnel prepare and prioritize response decisions.
- **Power infrastructure:** Protect power stations and grid facilities from strong shaking.

4.5.3.7 Earthquake Vulnerability Analysis

A moderate to severe seismic incident within the county could lead to the following general impacts:.

- Extensive property damage, particularly to pre-1930's unreinforced masonry structures.
- Possible fatalities and injuries.
- Damage to water and sewage systems.
- Disruption of communications systems.
- Broken gas mains and petroleum pipelines.
- Disruption to electrical utility lines.
- Disruption of transportation arteries.
- Competing requests for regional aid resources.

Community needs may exceed the response capability of the Tehama County Office of Emergency Services, requiring mutual assistance from state, federal, volunteer, and private agencies.

In an earthquake, the primary consideration is saving lives. Time and effort must also be given to providing for people's mental health by reuniting families, providing shelter to displaced persons, and restoring basic needs and services. A major effort will be needed to remove debris and clear roadways, demolish unsafe structures, assist in reestablishing public services and utilities, and provide continuing care and temporary housing for affected residents.

After an earthquake, there will be a loss of income both in private and public sectors. Individuals can lose wages due to businesses inability to function because of damaged goods or facilities. Resulting from business losses, Tehama County and the cities in the planning area will lose revenue. Economic recovery from even a minor earthquake is critical.

Note there are no delineated liquefaction zones or zones of required investigation within Tehama County, therefore earthquake exposure analysis does not include liquefaction exposure and exposure to zones of required investigation. These are not subhazards of earthquake but are meant to further illustrate the types of impacts to which the population, parcels, and infrastructure are exposed.

4.5.3.7.1 Earthquake Exposure

An exposure analysis was conducted to develop earthquake vulnerability data throughout Tehama County using the methods outlined in Section 4.4. To develop earthquake exposure data for the county, asset inventories for people, property, and critical facilities were superimposed with the USGS M6.7 Battle Creek Earthquake Scenario Shakemap.

M6.7 Battle Creek Earthquake Scenario

The M6.7 Battle Creek Fault earthquake scenario from the USGS was chosen for the vulnerability analysis from an objective assessment of likelihood given the UCERF3 and Shake Map Potential insights from Section 4.5.3.4.

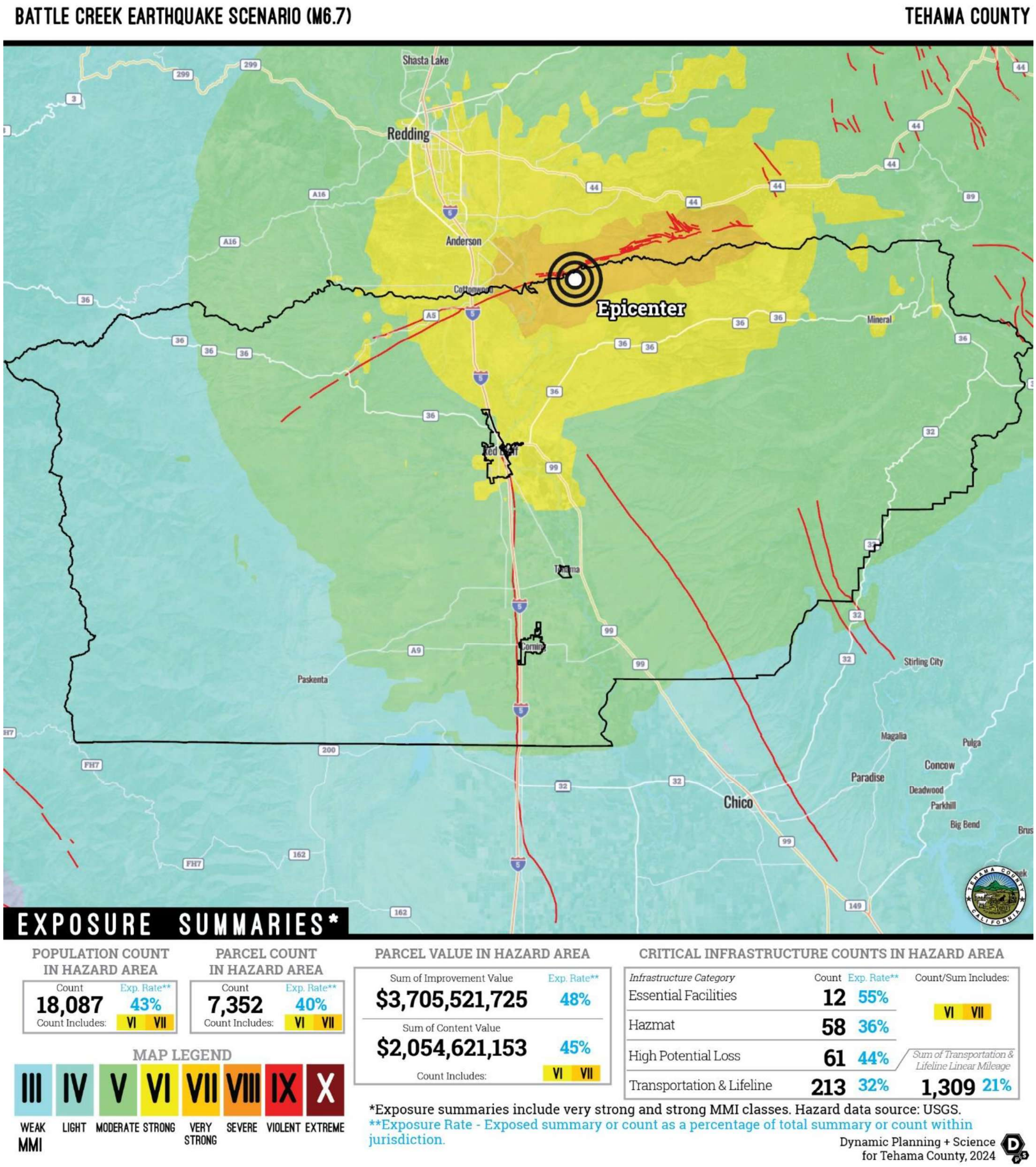


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Figure 4-35: M6.7 Battle Creek Scenario Exposure Summary – Unincorporated County

Population

A significant number of people in Tehama County are exposed to Moderate or greater shake zones in the M6.7 Battle Creek Scenario, with a limited portion of the North Central part of the county exposed to strong or very strong shake zones. Vulnerable populations, including low-income communities, in particular might be located in areas with older housing which is more susceptible to damage from earthquakes.

Table 4-32 summarizes population exposure results for the M6.7 Battle Creek Scenario. The degree of exposure depends on many factors, including the age and construction type of dwellings, the soil types on which their homes are constructed, and proximity to fault location. Whether directly or indirectly impacted, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself.

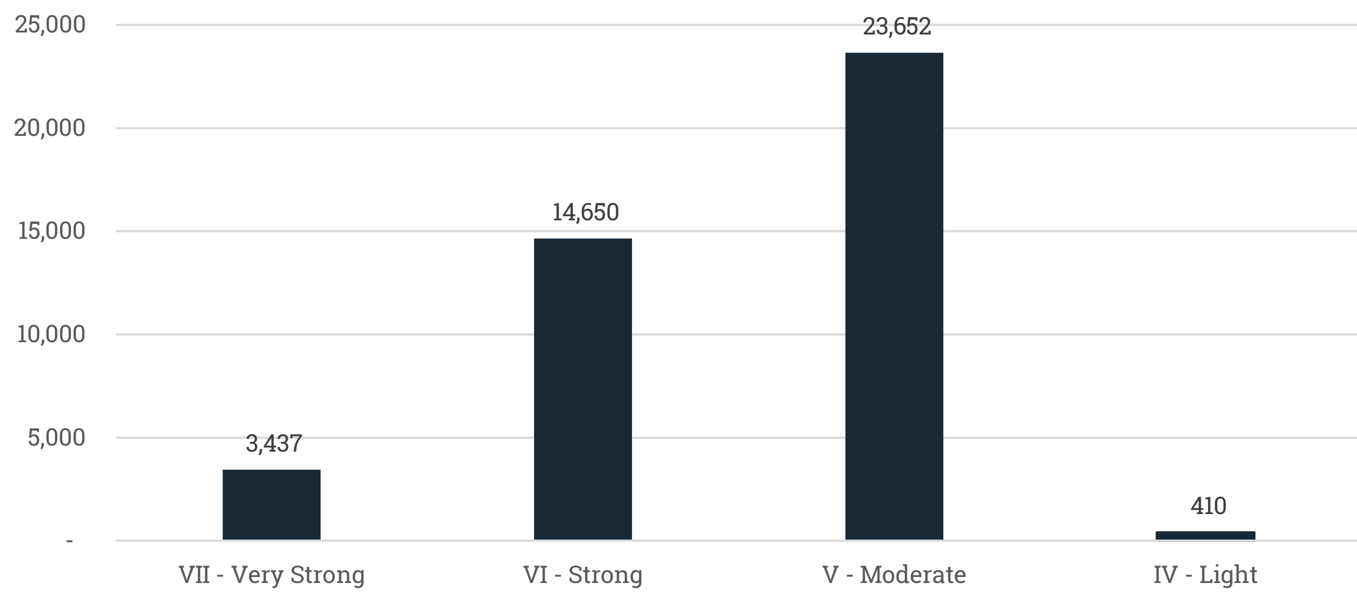

Figure 4-36: M6.7 Battle Creek Scenario Population Exposure Bar Chart

Table 4-32: Population Exposure to M6.7 Battle Creek Scenario

	Total Population	
Unincorporated County	42,150	
Shake Severity Zone	**Population Count**	**% of Total**
VII - Very Strong	3,437	8.15%
VI - Strong	14,650	34.76%
V - Moderate	23,652	56.12%
IV - Light	410	0.97%
Total	**42,150**	**100.00%**

Property and Building Ages

The vulnerability of buildings and structures to an earthquake depends on determining two important factors:

(1) The year in which seismic codes were initially adopted and enforced by the jurisdiction having authority, and
(2) The year in which seismic codes were improved and enforced.

These are known as **benchmark years**, marking significant milestones in California Building Code (CBC) requirements that directly affect the structural integrity of development in California. Also included in the list are benchmark Uniform Building Code (UBC) years.

Tehama County adheres to the California Building Code. Table 4-33 provides a listing of code improvements. Benchmark years are indicated in bold. For reference, Table 4-34 provides the definitions of building types.

Table 4-33: Seismic Benchmark Years

Code Edition	Effective Date	Building Type
(2022 CBC)	January 1, 2023	
(2019 CBC)	January 1, 2020	
(2016 CBC)	January 1, 2017	
(2013 CBC)	January 1, 2014	N/A
(2012 IBC)		
(2010 CBC)	January 1, 2011	N/A
(2009 IBC)		
(2007 CBC)	January 1, 2008	N/A
(2006 IBC)		
(2001 CBC)	November 1, 2002	N/A
(1997 UBC)		
(1998 CBC)	**July 1, 1999**	**W1a, S2, S2a, RM1, PC1, PC1a**
(1997 UBC)		
(1994 UBC)	**January 7, 1996**	**S1, S1a, C1, C2, C2a, RM2**
(1991 UBC)	**November 29, 1992**	**URM**
(1988 UBC)	**April 29, 1990**	**S2 & S2a**
(1985 UBC)	November 8, 1987	N/A
(1982 UBC)	December 9, 1984	N/A
(1979 UBC)	June 21, 1981	N/A
(1976 UBC)	**November 1, 1977**	**W1 and W2**
(1973 UBC)	April 13, 1975	N/A
(1970 UBC)	August 29, 1971	N/A
(1967 UBC)	July 12, 1968	N/A
(1964 UBC)	July 1, 1965	N/A
(1961 UBC)	August 17, 1962	N/A
(1958 UBC)	October 1, 1958	N/A
(1955 UBC)	January 1, 1956	N/A
(1955 UBC)	January 1, 1956	N/A
(1946 UBC)	June 18, 1948	N/A
(1943 UBC)	July 13, 1944	N/A
(1940 UBC)	April 4, 1941	N/A
(1937 UBC)	September 10, 1937	N/A
(1930 UBC)	March 20, 1933	N/A

Source: ASCE 41-13. County Building Dept.

Table 4-34: Definitions of FEMA Building Types

FEMA Building Type	Definition
W1	Wood Light Frame
W1A	Wood Light Frame (multi-unit residence)
W2	Wood Frame (commercial and industrial)
S1	Steel Moment Frames
S2	Steel-Braced Frames
S3	Steel Light Frames
S4	Steel Frames with Concrete Shear Walls
S5	Steel Frames with Infill Masonry Walls
C1	Concrete Moment Frames
C3	Concrete Frames with Infill Masonry Shear Walls
C2	Concrete Shear Walls
PC1	Tilt-Up Concrete Shear Walls
PC2	Precast Concrete Frames with Shear Walls
RM1	Reinforced Masonry Walls with Flexible Diaphragms
RM2	Reinforced Masonry Walls with Stiff Diaphragms
URM	Unreinforced Masonry Bearing Walls

Property Value Exposure

Properties exposed to earthquake shaking can experience varying degrees of damage depending upon construction parameters. This section highlights the overall exposure to shake zones within the scenario. For more detailed analysis on estimated damages to buildings based on construction type, year and size, refer to the Earthquake Damage Estimation section later in this chapter.

Table 4-35: Parcel Exposure to M6.7 Battle Creek Scenario (Unincorporated County)

	Total Parcels		Total Market Value ($)	Total Content Value ($)	Total Value ($)	
Unincorporated County	18,434		$7,780,396,144	$4,574,842,260	$12,355,238,404	
Shake Severity Zone	**Improved Parcel Count**	**% of Total**	**Market Value Exposure ($)**	**Content Value Exposure ($)**	**Total Exposure ($)**	**% of Total**
VII - Very Strong	1,434	7.8%	$717,070,738	$368,538,729	$1,085,609,467	8.8%
VI - Strong	5,918	32.1%	$2,988,450,986	$1,686,082,424	$4,674,533,411	37.8%
V - Moderate	10,740	58.3%	$3,980,159,055	$2,447,959,037	$6,428,118,092	52.0%
IV - Light	342	1.9%	$94,715,364	$72,262,070	$166,977,434	1.4%
Total	**7,352**	**39.9%**	**$3,705,521,725**	**$2,054,621,153**	**$5,760,142,878**	**46.6%**

Critical Facilities and Infrastructure

Impacts to critical infrastructure and lifelines under the M6.7 Battle Creek Scenario have strong and very strong shaking impacts mostly concentrated in the North Central part of the county. The potential impacts under this scenario include:

- Utility outages;
- Economic losses for repair and replacement of critical facilities, roads, buildings, etc.;
- Indirect economic losses, such as income lost during infrastructure downtime; and
- Roads that are blocked or damaged, preventing access throughout the area and isolating residents and emergency service providers that need to reach vulnerable populations or make repairs.

Linear utilities and transportation routes are vulnerable to rupture and damage during and after a significant earthquake event. The cascading impact of a single failure can have effects across multiple systems and utility sectors. Degrading infrastructure systems and future large earthquakes with epicenters close to critical regional infrastructure could result in system outages that last weeks for the most reliable systems, and multiple months for others. Additionally, earthquakes may cause the loss of function of cellular phone sites or cell towers, which can limit emergency services such as tracking and evacuation.

Critical infrastructure within the M6.7 Battle Creek ShakeMap zones are listed in Table 4-36. Lifelines are listed in Table 4-37.

Table 4-36: Critical Facility Exposure to M6.7 Battle Creek Scenario (Unincorporated County)

Critical Infrastructure - M6.7 Battle Creek				
Infrastructure Type	VII - Very Strong	VI -Strong	V - Moderate	IV - Light
Essential Facility	2	10	9	1
Emergency Operations Center	-	-	-	-
Fire Station	2	8	9	1
Hospital	-	-	-	-
Law Enforcement	-	2	-	-
High Potential Loss	4	57	75	8
Adult Residential Facility	-	16	6	-
Child Care Center	-	2	5	-
Dam	1	2	3	3
Historic Building	-	1	1	-
Power Plant	1	2	1	-
Real Property Asset	2	15	42	3
Residential Elder Care Facility	-	2	1	-
School	-	17	16	2
Transportation and Lifeline	30	183	414	40
Airport	-	-	-	-
Bridge	8	88	297	21
Cell Tower	-	5	7	1
FM Transmission Tower	-	5	-	5
Microwave Service Tower	19	68	81	11
Natural Gas Station	-	5	11	2
Paging Transmission Tower	1	3	-	-
Park	1	2	7	-
Substation	1	6	9	-
Wastewater Treatment Facility	-	1	2	-
Hazmat	5	53	90	11
Geotracker Cleanup Site	2	10	22	3

Critical Infrastructure - M6.7 Battle Creek				
Infrastructure Type	VII - Very Strong	VI -Strong	V - Moderate	IV - Light
HWTS Active Facility	3	43	68	8
Grand Total	**41**	**303**	**588**	**60**

**Real Property Assets are digitized insurance rolls for demonstrating value and ownership and may have overlapping points with other categories such as fire stations and law enforcement.*

Table 4-37: Lifeline Exposure M6.7 Battle Creek Scenario (Unincorporated County)

Lifelines (miles) - M6.7 Battle Creek Scenario				
Infrastructure Type (Linear)	VII - Very Strong	VI - Strong	V - Moderate	IV - Light
NG Pipeline	12.9	45.3	111.5	15.0
Railroad	-	19.4	39.5	-
Street	151.9	930.2	3,093.7	1,254.5
4WD trail	-	-	191.2	70.9
4WD trail, major	-	-	5.3	0.2
Alley	-	-	0.0	0.1
Cul-de-sac	-	0.0	0.5	-
Driveway	7.2	11.3	87.0	14.9
Interstate	-	23.5	44.4	2.0
Local road	111.0	714.7	2,215.6	1,044.8
Local road, major	1.9	21.5	50.2	8.8
Primary highway	-	43.0	50.0	-
Primary highway, major	-	0.1	-	-
Ramp	-	5.6	7.8	0.1
Service road	-	2.4	1.1	-
State/county highway	27.1	108.1	436.6	112.7
Thoroughfare, major	4.7	-	1.4	-
Walkway	-	-	2.4	-
Transmission Line	24.3	125.3	264.0	15.0
Grand Total	**189.1**	**1,120.3**	**3,508.7**	**1,284.5**

HazMat Fixed Facilities

Earthquakes can produce hazardous materials (HazMat) threats at extremely high levels. Depending on the year of build and construction of each facility containing HazMat, the earthquake-initiated hazardous material release (EIHR) potential will vary. HazMat contained within masonry or concrete structures built before certain benchmark years may be particularly vulnerable.

Water Supply Utilities

Tehama County receives approximately two thirds of its water supply from groundwater and the remaining one third from surface water (District, Water Inventory and Analysis, 2003). Most of the wells in the unincorporated County are individual domestic wells. Residents throughout the County have grouped together to form agricultural and municipal water supply agencies. These agencies were interviewed as part of the Tehama County Flood Control and Water Conservation District's Inventory and Analysis to learn more about the agency history, the water demands and water sources, and any issues and concerns.

An earthquake could impact water supply delivery from breaking of water delivery lines, wellheads, and the loss of power critical for pumping. Exposure to liquefaction and zones of required investigation could also cause large amounts of damage to water supply lines.

Natural Gas Utilities

Pacific Gas and Electric (PG&E), Tehama County's natural gas and electricity utility, is responsible for designing, constructing, maintaining, and operating natural gas infrastructure safely and efficiently. This includes all the facilities used in the delivery of gas to any customer up to and including the point of delivery to a customer's gas piping system.

Gas customers and Tehama County residents are responsible for using gas safely on their property and within their buildings and other facilities. Customers meet this responsibility by maintaining their gas appliances in good working condition, assuring that only qualified individuals are engaged to modify or maintain their gas service and facility piping, and knowing what to do before and after earthquakes to maintain the safe operation of their natural gas service.

Damage to natural gas systems mainly arises from issues on the customer side, typically involving the buildings that house these systems or the equipment connected to gas lines. Shifting or toppling of gas appliances, like water heaters and stoves, is the primary cause of gas-related fire ignitions following an earthquake. Additionally, building collapse or deformation of structural elements can damage interior gas piping. (California Seismic Safety Commission, 2002)

In addition, utility natural gas systems can be damaged through ground displacements, including surface faulting, landslide-like movements, and soil failure or liquefaction produced by strong ground shaking. However, this is mainly a concern for older pipelines that may be weakened by corrosion or were constructed using outdated methods and materials. Cast iron, aging bare steel pipe, and pipe with threaded connections are the most susceptible to damage from ground shaking. (*Id.*) Breaks in the system will affect large portions of the county, and restoration of natural gas service could be significantly delayed.

Common characteristics of earthquakes and their impacts on natural gas safety include:

- Ground shaking generally leads to substantially more instances of building damage than fire ignitions.
- Building damage caused by substantial ground shaking is the most likely to impact utility and customer gas systems and lead to gas-related fire ignitions.
- Twenty percent to 50 percent of post-earthquake fire ignitions will be related to natural gas.
- The consequences of post-earthquake fire ignitions for residential gas customers are largely financial. A fire ignition only becomes a life safety concern when inhabitants are unable to exit the building following earthquakes. While experience in past earthquakes indicates that egress from earthquake-damaged single-family homes is generally possible, residents in larger multifamily units, especially on higher floors, may be at risk since they provide a greater chance for damaging the structure and trapping the occupants and greater difficulty evacuating. (*Id.*)

Gas customers and Tehama County residents are responsible for using gas safely on their property and within their buildings and other facilities. Customers meet this responsibility by maintaining their gas appliances in good working condition, assuring that only qualified individuals are engaged to modify or maintain their gas service and facility piping, and knowing what to do before and after earthquakes to maintain the safe operation of their natural gas service.

The following conditions, when combined, pose the greatest risk for post-earthquake fire damage:

- Unoccupied buildings, as they post problems with mitigating damage to gas systems or control small fires.
- Liquefaction.
- High building density.
- Dense vegetation that could catch fire.
- High wind and low humidity weather conditions.
- Damage to water systems to limit firefighting capabilities.
- Impaired communications, numerous requests for assistance, direct damage to fire stations, restricted access because of traffic congestion and damaged roadways, and delays in mutual aid from neighboring fire districts, which can create delays in firefighting response. (Id.)

Telecommunication

Telecommunication systems will be affected by a system failure, overloads, loss of electrical power, and possible failure of some alternate power systems. Immediately following an event, numerous failures will occur, compounded by system use overloads.

Public Schools

The Field Act was enacted on April 10, 1933, one month after the Long Beach Earthquake in which many schools were destroyed or suffered major damage. Since then, public school construction has been governed by the Act and enforced by the Division of the State Architect. In any community, public schools constructed under the Field Act after 1978 are likely to be among the safest buildings in which to experience a major earthquake. The Field Act requires:

- School building construction plans to be prepared by qualified California licensed structural engineers and architects.
- Designs and plans to be checked by the Division of the State Architect (DSA) for compliance with the Field Act before a contract for construction can be awarded.
- Qualified inspectors, independent of the contractors and hired by the school districts, to continuously inspect construction and verify full compliance with plans.
- The responsible architects and structural engineers to observe the construction periodically and prepare changes to plans, if needed, subject to approval by DSA.
- Architects, engineers, inspectors, and contractors to file reports, under penalty of perjury, to verify compliance of the construction with the approved plans emphasizing the importance of testing and inspections to achieve seismically safe construction. Any person who violates the provisions or

makes any false statement in any verification report or affidavit required pursuant to the Act is guilty of a felony. (Seismic Safety Commission, 2009)

Private schools are not subject to the Field Act and fall solely under the jurisdiction of the local building departments and building code requirements. Private schools are covered under the Private Schools Building Act of 1986, with the legislative intent that children attending private schools be afforded life safety protection similar to that of children attending public schools. (*Id.*)

In the late 1960s, regulations were put in place to have pre-Field Act (1933) buildings retrofitted, removed from school use, or demolished. (Cal. Edu. Code § 15516, Appendix X, 1968) The Field Act also prohibits the use of unreinforced masonry buildings as school buildings. Seismic building standards, in general, were greatly strengthened after significant damage to buildings was observed, especially in the 1971 San Fernando earthquake. The Field Act regulations in place since 1978 are considered adequate for public school buildings in most cases. (*Id.*)

Transportation

Earthquake events can significantly impact bridges and overpasses, which often provide the only access to some neighborhoods. Since soft soil regions generally follow floodplain boundaries, bridges that cross watercourses are considered vulnerable. Areas which experience liquefaction or zones of required investigation are also particularly vulnerable and transportation in these areas is susceptible to increased risk.

There are multiple transportation routes and transit providers and facilities throughout Tehama County. Regional access routes in the county include Interstates 5 and State Routes (SRs) 32, 36, 89, 99, and 172. Portions of these routes could become impassable after an earthquake event, which could isolate portions of the county until road crews are able to complete road restoration. Throughout Tehama County, Amtrak and Greyhound bus lines provide long-distance inter-city service. Table 4-37 show transportation infrastructure exposed to shake severity zones in the event of the Battle Creek earthquake scenario.

4.5.3.7.2 Earthquake Damage Estimation

Damage estimations for the one scenario in this MJHMP were calculated using FEMA's Hazus software, namely a Level 2 Hazus 6.1 analysis. For the Tehama County Hazus analysis, the M6.7 Battle Creek earthquake scenario was used.

Hazus uses GIS to analyze multiple factors influencing earthquake damage estimates, including peak ground velocity (PGV), peak ground acceleration (PGA), and soil type for a given scenario and geographic area. Once the location and size of a hypothetical earthquake is identified, Hazus software estimates the intensity of the ground shaking and calculates, based on building characteristics and location, the number of buildings damaged, the percent of damage occurring to each building, and the estimated loss due to damage in US dollars. The parcel data defined in Section 4.3 was imported into Hazus as User Defined Facilities (UDF) serving as the basis for replacement and content cost, as well as associated damage estimation and loss. Building damage outputs from Hazus are categorized into slight, moderate, and extensive damage. Ranges of damage are used to provide the user with an understanding of a building's physical condition. Table 4-38 provides a physical description of each damage state.

While there are several limitations to the FEMA Hazus earthquake models, it does allow for potential loss estimation for each building construction category. County-wide loss estimation results are summarized by building category type in Table 4-39. Hazus loss estimation values for earthquakes are categorized in exceedance values. From reviewing Table 4-39 one might infer the probability of structures exceeding extensive damage is relatively low. However, if damage were to occur, the economic loss is averaged and summarized for each building type defined in the software.

Damage estimation does not include damage to transportation routes, infrastructure, and other public and private utilities located throughout the county. An important concept in loss data is the "probability" of damage to exceed a certain degree. It is unlikely that buildings in county would receive "extensive" damage from earthquake shaking.

Table 4-38: Hazus Building Damage Descriptions

Damage State	Damage Description
Slight	Small plaster cracks at corners of door and window openings and wall/ceiling intersections; small cracks in masonry chimneys and masonry veneers. Small cracks are assumed to be visible with a maximum width of less than 1/8 inch (cracks wider than 1/8 inch are referred to as "large" cracks).
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.

Damage State	Damage Description
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations.
Complete	Structure may have large permanent lateral displacement or be in imminent danger of collapse due to cripple wall failure or failure of the lateral load resisting system; some structures may slip and fall off the foundation; large foundation cracks. Three percent of the total area of buildings with Complete damage is expected to be collapsed, on average.

Damage Estimation Improved Property Loss

Hazus 6.1 was used to estimate the loss potential to improved properties exposed to the M6.7 Battle Creek earthquake scenario (Table 4-39). Hazus reports the damage potential and loss potential from a given earthquake scenario in four categories: slight damage, moderate damage, extensive damage, and economic loss. Economic loss consists of estimations on the cost of repair and replacement to damaged or destroyed buildings and contents, relocation expenses, capital-related income, wage losses, and rental income losses.

Table 4-39: Loss Estimations for M6.7 Battle Creek Scenario – Unincorporated County

Building Type	Average of Potential Damage to Exceed "Slight"	Average of Potential Damage to Exceed "Moderate"	Average of Potential Damage to Exceed "Extensive"	Average Economic Loss for Each Building Category	Sum of Economic Loss	Proportion of Loss (%)
Agriculture	17%	7%	1%	$14,928	$48,753,745	23%
Commercial	18%	8%	1%	$37,699	$9,198,563	4%
Education	14%	4%	0%	$10,705	$21,411	0%
Government	12%	4%	0%	$958	$9,579	0%
Industrial	21%	9%	1%	$41,539	$2,367,720	1%
Religion	8%	1%	0%	$16,706	$434,365	0%
Residential	14%	3%	0%	$9,948	$147,515,990	71%
Total					**$208,301,372**	

Note: Total Inventory Values

1 - Building Replacement Costs = $7,780,025,882

2 - Content Replacement Costs = $4,574,657,132

3 - Total Value = $12,354,683,014

4.5.3.8 Future Trends in Development

As further discussed in Section 4.3.4, Tehama County's population has remained relatively stable with a mild growth rate that is significantly lower than the statewide growth rate. The unincorporated areas of the county, in particular, have seen a steady decline in the rate of growth, partially due to a decline in net migration. Tehama is a relatively rural county, with an overall population density of approximately 22 people per square mile, which is lower than California as a whole. This growth trend is expected to continue.

Although new development continues to occur across the county, local planning, zoning, building, and other development regulations work to plan for and address earthquake hazards, helping to limit exposure, reduce risk, and mitigate impacts. As discussed in Section 4.3.6, this regulatory framework includes the county's General Plan, as well as those general plans of other participating jurisdictions, that addresses land use, infrastructure improvement and expansion, and public safety, among other topics. These general plans are periodically reviewed as part of hazard mitigation capability assessments, enabling local agencies to identify potential gaps or deficiencies. Any identified needs can be integrated as mitigation actions, thereby strengthening each jurisdiction's ability to support sustainable development and manage earthquake impacts effectively.

In particular, the safety elements of these general plans establish standards and policies for the protection of the community from hazards. All new development in the county can be affected by earthquakes; however, the information in this plan provides the participating jurisdictions a tool to ensure that there is no increase in exposure in areas of high seismic risk. Development in the planning area will be regulated through building standards and performance measures so that the degree of risk will be reduced. The geologic hazard portions of the planning area are heavily regulated under California's Building Code, which has some of the most stringent seismic building standards in the nation.

4.5.3.9 Earthquake Hazard Problem Statements

As part of the mitigation action identification process, the Planning Committee for the county and for each jurisdiction identified issues and weaknesses, also called problem statements, for their respective facilities. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and earthquake data. Earthquake problem statements for all participating jurisdictions are listed in Table 4-40; problem statements for all other participating jurisdictions are accessed in Volume 2 of this plan.

Identifying these common issues and weaknesses assists the Planning Committee in understanding the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and the corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-40 and Table 5-6.

Table 4-40 Earthquake Problem Statements

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-EQ-TC-28	Earthquake	Impact	PPRO	**Tehama County**	Low probability of liquefaction within the planning area is evident from data collection efforts. Having this information developed would significantly enhance seismic risk assessment.	N	ma-EQ-TC-32
ps-EQ-TC-119	Earthquake	Threat	PRV - Prevention , PPRO - Property Protection	**Tehama County**	Unreinforced masonry buildings continue to be a threat to residents.	N	ma-EQ--114

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4.5.4 Extreme Weather Hazard Profile

Extreme weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. Extreme weather may form over wide geographic areas or occur within a more limited geographic area.

The MJHMP Planning Committee identified two types of extreme weather events that typically impact Tehama County: High Wind and Heavy Rain.These two types of extreme weather are also discussed in the context of climate change. The following are characteristics of extreme weather events that can occur in Tehama County.

High Wind

Damaging winds are classified as those exceeding 60 mph. Damage from such wind accounts for half of all extreme weather reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles.

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 up to 168 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, temperature drop, 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.

- 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 wind damage at the ground

Heavy Rain

Heavy rain can lead to flooding even on dry soil and especially on impervious surfaces. In urban areas, direct runoff is relatively extensive, not only because of the density of roofs and impermeable pavements which allow less rain to infiltrate the ground, but also because storm-sewer systems carry more water directly to streams and lakes. As outlined in 4.3.3, most precipitation falls during the winter, and substantial snowfall is limited to higher elevations. Rainfall is often from storms that move in from the northwest.

4.5.4.1 Plans, Policies, and Regulatory Environment

There are very few formal regulations that pertain directly to extreme weather events. The California Building Code,[7] adopted by Tehama County and the participating jurisdictions, is generally adequate to properly address development impacts from extreme weather events.

4.5.4.2 Past Events

Table 4-41: Tehama County Flood Events Since 2000

Date	Flood Type	Deaths	Injuries	Crop Damage Value ($)	Property Damage Value ($)
10/25/2014	High Wind	0	0	$0	$0
12/30/2014	Strong Wind	0	0	$0	$50,000
4/13/2015	Strong Wind	0	0	$0	$1,000,000
10/18/2015	Heavy Rain	0	0	$0	$0
12/10/2015	Strong Wind	0	0	$0	$0
1/3/2016	Thunderstorm	0	0	$0	$6,000
1/9/2017	Strong Wind	0	0	$0	$0
12/16/2018	Heavy Rain	0	0	$0	$0
11/20/2019	Strong Wind	0	0	$0	$8,000
1/26/2021	High Wind	0	0	$0	$0
10/25/2021	Heavy Rain	0	0	$0	$0
2/4/2024	High Wind	0	0	$0	$0

4.5.4.3 Location

Extreme weather events have the potential to happen anywhere in the planning area. Wind events are most damaging to areas that are heavily wooded. Heavy rain events can be more impactful in more populous

7 Available at https://www.dgs.ca.gov/BSC/Codes.

areas with greater impervious surfaces. The following figures show average weather conditions for Tehama County, including:

- Figure 4-37: Tehama County - Average Annual Precipitation
- Figure 4-38 Tehama County - California Annual Average Wind Speed

4.5.4.4 Frequency and Probability of Future Events

Extreme weather events since the year 2000 have caused a total of $7,407,000 worth of property damage in Tehama County. Extreme weather events occur annually in Tehama County to a varying degree, not always with property damage involved.

High Wind: Figure 4-37 displays average annual wind speeds by power class in Tehama County and Table 4-42 describes wind power classes.

Heavy Rain: Even if overall precipitation does not significantly depart from average in the future, heavy rainfall events are predicted to increase with climate change. (United States Geological Survey, n.d.)

Table 4-42: Classes of Wind Power Density at 10 m and 50 m[a]

Wind Power Class	10 m (33 ft) Wind Power Density (W/m2)	Speed[b] m/s (mph)	50 m (164 ft) Wind Power Density (W/m2)	Speed[b] m/s (mph)
1	0	0	0	
	100	4.4 (9.8)	200	5.6 (12.5)
2	150	5.1 (11.5)	300	6.4 (14.3)
3	200	5.6 (12.5)	400	7.0 (15.7)
4	250	6.0 (13.4)	500	7.5 (16.8)
5	300	6.4 (14.3)	600	8.0 (17.9)
6	400	7.0 (15.7)	800	8.8 (19.7)
7	1000	9.4 (21.1)	2000	11.9 (26.6)

[a] Vertical extrapolation of wind speed based on the 1/7 power law.
[b] Mean wind speed is based on Rayleigh speed distribution of equivalent mean wind power density. Wind speed is for standard sea-level conditions. To maintain the same power density, speed increases 3%/1000 m (5%/5000 ft) elevation.
Note: Each wind power class should span two power densities. For example, Wind Power Class = 3 represents the Wind Power Density range between 150 W/m2 and 200 W/m2. The offset cells in the first column attempt to illustrate this concept.

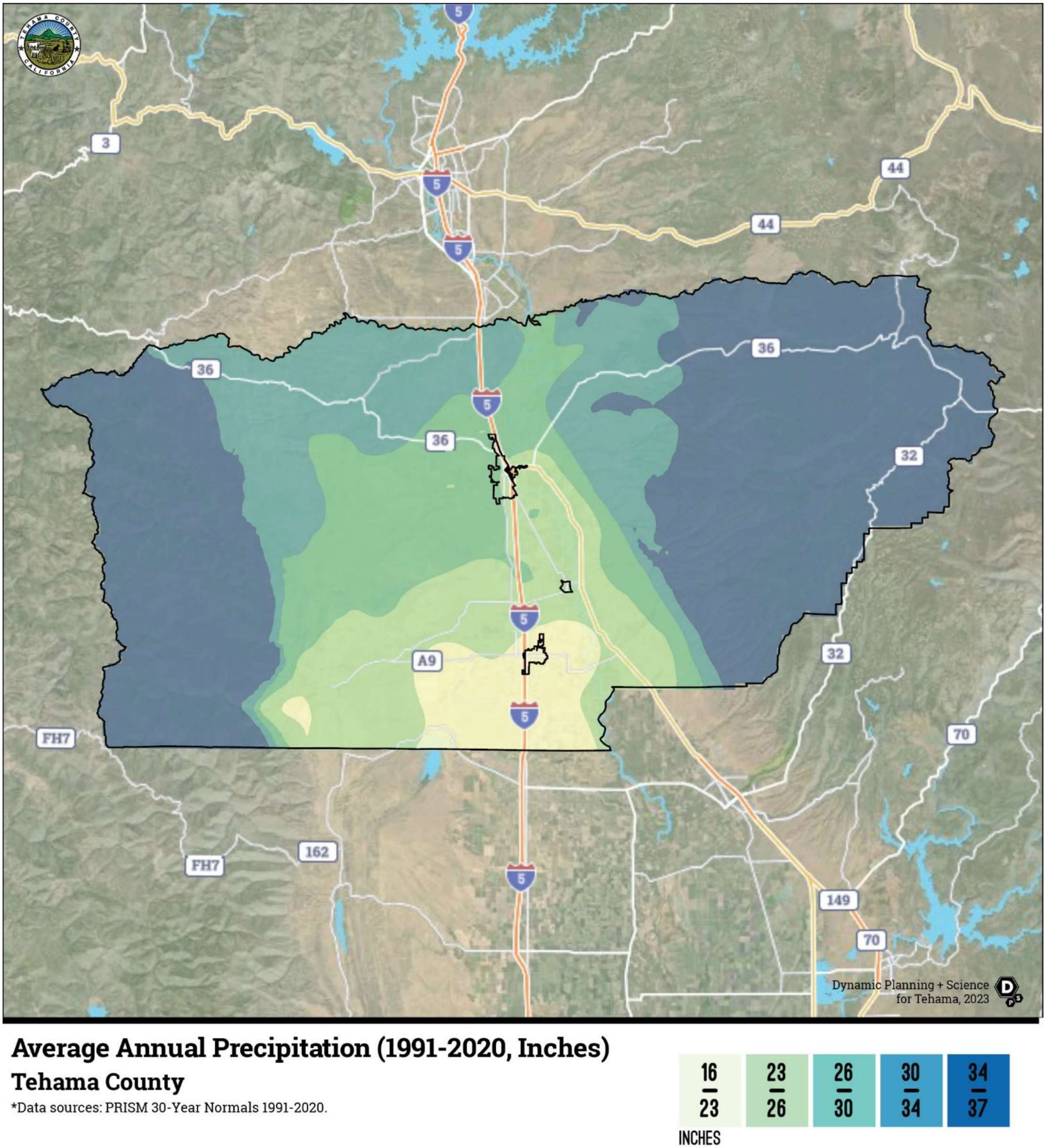

Figure 4-37: Tehama County - Average Annual Precipitation

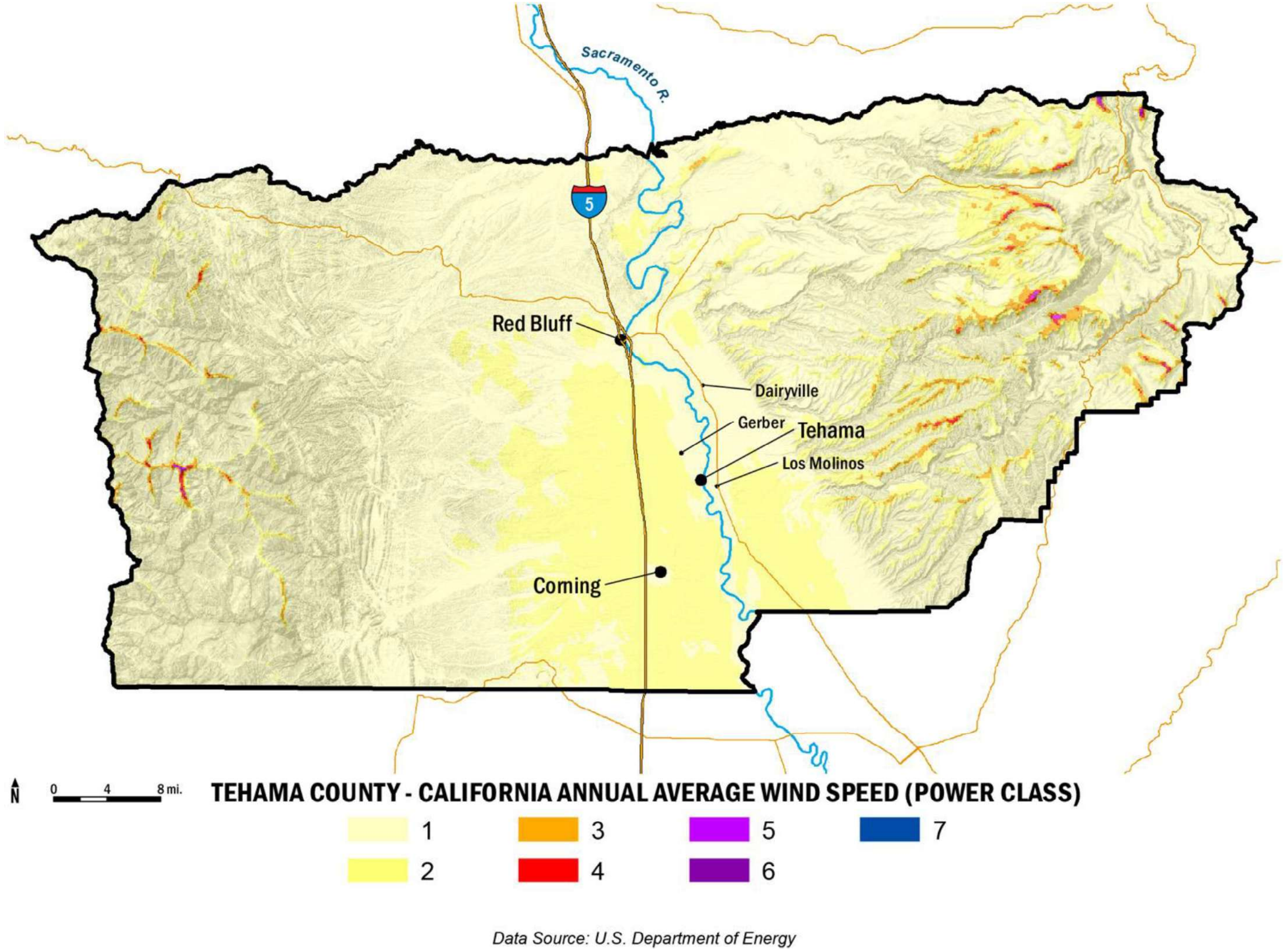

Figure 4-38 Tehama County - California Annual Average Wind Speed

4.5.4.5 Severity and Extent

The most common problems associated with high wind and heavy rain are immobility and loss of utilities. Fatalities are uncommon but can occur. In heavy rain or high wind events, roads may become impassable due to flooding, downed trees, or a landslide. Power lines may be damaged due to high winds, and services such as water or phone may not be able to operate without power.

High Wind: Windstorms can be a problem in the planning area and could cause damage to utilities. It is important to note that the predicted wind speed given in wind warnings issued by the National Weather Service is for a one-minute average; gusts may be 25 to 30 percent higher.

Heavy Rain: Heavy rain has been a problem in Tehama County and could cause future damage to facilities and utilities in the planning area. Increased flooding from heavy rain continues to impact the cities of Corning, Red Bluff and Tehama.

4.5.4.6 Warning Time

High Wind: Meteorologists can often predict the likelihood of high winds with several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of high winds. Some storms may come on more quickly and have only a few hours of warning time. A Red Flag Warning is issued when warm temperatures, very low humidity, and stronger winds are expected to combine in order to produce an increased risk of fire danger. (National Weather Service)

Heavy Rain: As with high winds, meteorologists can often predict the likelihood of a storm with heavy rains. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of heavy rain, or the precise locations of heavy rainfall. Some storms may come on more quickly and have only a few hours of warning time.

4.5.4.7 Secondary Hazards

High Wind: The most significant secondary hazards associated with high winds are falling and downed trees, downed power lines, and wildfire. High winds can cause damage to properties and destruction of roadways. Strong winds can magnify wildfires and increase the rate of fire spread.

Heavy Rain: The most significant secondary hazards associated with heavy rains are flooding, which also includes falling and downed trees, landslides, and downed power lines. Heavy rain can cause damage to properties and destruction of roadways. Landslides occur when the soil on slopes becomes oversaturated and fails. Landslides are further outlined as slope failure in Section 4.5.6, while flooding is analyzed in Section 4.5.1.

4.5.4.8 Climate Change Impacts

The effects of climate change are varied and include widespread and diverse weather patterns, such as global air and water currents and melting polar ice. As a result, climate change will likely worsen a number of natural hazards, including extreme weather. The likely effects of climate change on extreme weather are to create more frequent and prolonged periods of extreme heat. However, climate change will also result in unpredictable temperature fluctuations that could lead to freezing events during warmer months, potentially devastating the agricultural industry. (United States Environmental Protection Agency, 2016)

High Wind: Climate change is expected to increase the frequency and severity of high winds in portions of Tehama County. (Ackerly, 2018)

Heavy Rain: The number of extreme precipitation events each year is expected to increase in Tehama County under Representative Concentration Pathways (RCPs) 4.5 and 8.5, which are greenhouse gas emission scenarios. (Cal-Adapt, 2021)

4.5.4.9 Extreme Weather Vulnerability Analysis

4.5.4.9.1 Population

The entire planning area is exposed to extreme weather events to some extent, including high wind, high rain, and hail. Certain areas are more exposed due to geographic location and local weather patterns. Populations living at higher elevations with large stands of trees or overhead power lines may be more susceptible to wind damage and blackout.

Vulnerable populations, such as the elderly, low-income or linguistically isolated populations, or people with life-threatening illnesses, and residents living in rural areas may become isolated from major roads in extreme weather events. Power outages can be life-threatening to those dependent on electricity for life support systems, like oxygen. These populations face isolation and exposure during extreme weather events and could suffer more secondary effects of the hazard.

High Wind: High wind can impact the mobility of vulnerable populations, particularly the elderly and people with disabilities. Associated impacts from downed power infrastructure can also negatively impact these populations, many of whom rely on power for life support systems.

Heavy Rain: Heavy rain can pose a similar risk to vulnerable populations as high wind. In addition, heavy rain can limit mobility, decrease visibility, and isolate people who live more remotely

4.5.4.9.2 Property

All property is vulnerable during extreme weather events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Those located in higher elevations and on ridges may be more prone to wind damage and high rain. Property located under or near overhead power lines or near large trees may be vulnerable or may be damaged in the event of a collapse. Crops may be damaged by high wind, high heat, or heavy rain.

High Wind: High winds can cause significant property damage. Associated impacts to property include roofs being blown off, trees and branches falling onto property, fences being blown down, and damage to surrounding infrastructure.

Heavy Rain: Heavy rain can cause extensive property damage. It can flood properties and cause secondary impacts, such as waterlogged branches or trees falling onto property.

4.5.4.9.3 Critical Facilities and Infrastructure

All critical facilities are likely exposed to high wind, heavy rain, and hail. Facilities on higher ground may also be more exposed to wind damage or damage from falling trees. The most common problem associated with extreme weather is the loss of utilities. Downed power lines can cause blackouts, leaving large areas isolated and phone, water, and sewer systems inoperable. Roads may become impassable due to flooding, downed trees, or landslides.

High Wind: High winds can knock down critical infrastructure, such as powerlines, which can prevent information communication systems from functioning sufficiently. Severe winds can also cause structural and non-structural damage to critical facilities.

Heavy Rain: Heavy rains, especially when accompanied by a windstorm, can cause water damage to critical facilities and compromise functionality.

4.5.4.9.4 Lifelines

Loss of roads or power and communication lines are the primary transportation failures resulting from extreme weather and are mostly due to secondary hazards, such as floods, downed trees, landslides, and wildfire. Prolonged obstruction of major routes due to landslides, debris, or floodwaters can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts on an entire region.

High Wind: Severe windstorms and downed trees can create serious impacts on power and above-ground communication lines. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance. High winds can also cause significant damage to trees and power lines, blocking roads with debris, damaging transportation infrastructure, isolating populations, and disrupting ingress and egress routes.

Heavy Rain: Heavy rains can cause secondary hazards, such as landslides and floods, and they can cause trees to fall. These secondary hazards can compromise roads or power and communication lines.

4.5.4.10 Future Trends in Development

As further discussed in Section 4.3.4, Tehama County's population has remained relatively stable with a mild growth rate that is significantly lower than the statewide growth rate. The unincorporated areas of the county, in particular, have seen a steady decline in the rate of growth, partially due to a decline in net migration. Tehama is a relatively rural county, with an overall population density of approximately 22 people per square mile, which is lower than California as a whole. This growth trend is expected to continue.

Although new development continues to occur across the county, local planning, zoning, building, and other development regulations work to plan for and address extreme weather hazards, helping to limit exposure, reduce risk, and mitigate impacts. As discussed in Section 4.3.6, this regulatory framework includes the county's General Plan, as well as those general plans of other participating jurisdictions, that addresses land use, infrastructure improvement and expansion, and public safety, among other topics. These general plans are periodically reviewed as part of hazard mitigation capability assessments, enabling local agencies to identify potential gaps or deficiencies. Any identified needs can be integrated as mitigation actions, thereby strengthening each jurisdiction's ability to support sustainable development and manage extreme weather impacts effectively.

All future development will be affected by severe storms. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. Participating jurisdictions have adopted the California Building Code, which corresponds to the International Building Code, to meet California mandates. This code is equipped to deal with the impacts of extreme weather events, including high wind and heavy rain. Land use policies identified in general plans within the planning area also address many of the secondary impacts of extreme weather, such as floods and landslides. With these tools, the participating jurisdictions are well equipped to deal with future growth and the associated impacts of extreme weather.

4.5.4.11 Extreme Weather Hazard Problem Statements

As part of the mitigation action identification process, the Planning Committee for the county and for each jurisdiction identified issues and weaknesses, also called problem statements, for their respective facilities. Identification was based on the risk assessment and vulnerability analysis utilizing extreme weather hazard data. Extreme weather problem statements for Tehama County are listed in Table 4-43; problem statements for all other participating jurisdictions are accessed in Volume 2 of this plan.

Identifying these common issues and weaknesses assists the Planning Committee in understanding the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and the corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-43 and Table 5-6.

Table 4-43 Extreme Weather Problem Statements

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-EW-TC-79	Extreme Weather	Impact	PPRO	**Tehama County**	High Wind: Older building stock in the planning area do not meet code standards. These structures could be highly vulnerable to severe weather events such as windstorms.	Y	ma-EW-TC-28, ma-EW-TC-31
ps-EW-TC-83	Extreme Weather	Impact	ES	**Tehama County**	High Wind, Heavy Rain: Risk of power supply interruption due to severe storms.	Y	ma-EW-CC-51, ma-EW-CC-52, ma-EW-CoT-101, ma-EW-TC-18
ps-EW-TC-86	Extreme Weather	Impact	ES	**Tehama County**	High Wind, Heavy Rain: Lack of backup power generation at critical facilities.	Y	ma-EW-TC-19, ma-EW-CC-51, ma-EW-CC-52, ma-EW-CoT-101
ps-EW-TC-89	Extreme Weather	Victim	PE&A ES	**Tehama County**	High Wind, Heavy Rain: Road closures (both rural roads and state HWYs to isolated communities and Interstate-5, I.e. HWY 99, 36).	Y	ma-EW-TC-20
ps-EW-TC-90	Extreme Weather	Impact	ES	**Tehama County**	High Wind, Heavy Rain: Communication issues occur during weather events such as the phones going down. Back-Up power at communication towers is needed.	Y	ma-EW-TC-18, ma-EW-TC-19, ma-EW-CoT-101
ps-EW-TC-93	Extreme Weather	Victim	PRV	**Tehama County**	High Wind: Many large trees result in damages from storms (high winds). There are currently issues with tree trimmer local capacities.	Y	ma-EW-CC-53, ma-EW-CoT-93, ma-EW-RB-78, ma-EW-TC-28
ps-EW-TC-97	Extreme Weather		PE&A	**Tehama County**	High Wind, Heavy Rain: Isolated and vulnerable population centers exist throughout the County. I.e. Rancho Tehama, Manton, Pondarosa Sky Ranch, Lake California and others.	Y	ma-EW-TC-20

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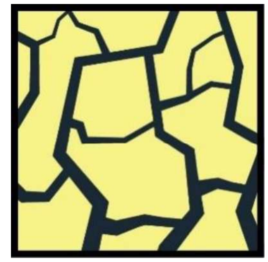
4.5.5 Drought Hazard Profile



California's water resources have been stressed by periodic drought cycles and overuse in some places, creating the need for unprecedented state and local restrictions in water use. Climate change is expected to increase drought and extreme weather, including high heat. While the duration and severity of drought is always in question, it is certain that California and Tehama County will continue to be impacted by drought. (California Department of Water Resources, 2021)

Drought has impacted almost every county in California at one time or another, causing billions in economic damage. Droughts exceeding three years are relatively rare in northern California, the source of much of the state's water supply. The 1929 to 1934 drought established the criteria commonly used in designing storage capacity and yield for large northern California reservoirs. (California Department of Water Resources, 2015)

Drought impacts in California are felt first by those most dependent on annual rainfall, including agencies fighting wildfires, ranchers engaged in dryland grazing, rural residents relying on wells in low-yield rock formations, or small water systems lacking a reliable water source. (California Department of Water Resources, 2015)

Most of California's precipitation comes from storms moving across the Pacific Ocean. The path followed by the storms is determined by the position of an atmospheric high-pressure belt that normally shifts southward during the winter, allowing low-pressure systems to move into the state. On average, 75 percent of California's annual precipitation occurs between November and March, with 50 percent occurring between December and February. If a persistent Pacific high-pressure zone takes hold over California mid-winter, the water year tends to be dry. (Western Regional Climate Center, 2020)

More information regarding Tehama County's climate is available in 4.3.3.

4.5.5.1 Tehama County Water Supplies

Tehama County obtains its water supply from local surface water resources and groundwater. Tehama County has an array of surface water resources, such as creeks, drainages, sloughs, and rivers, and infrastructure for delivering water for irrigation and municipal uses. The Sacramento River provides the majority of the county's surface water for urban and agricultural consumption.

4.5.5.2 Plans, Policies, and Regulatory Environment

California Sustainable Groundwater Management Act

On September 16, 2014, Governor Brown signed into law a package of bills (SB1168, AB1739 and SB1319) collectively called the Sustainable Groundwater Management Act (SGMA). SGMA requires governments and water agencies of high and medium priority basins to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. Under SGMA, these basins should reach sustainability within 20 years of implementing the sustainability plans. For critically over-drafted basins, that date will be 2040. For the remaining high and medium priority basins, 2042 is the deadline.

California Drought Contingency Plan

California's current Drought Contingency Plan focuses on addressing water shortages through a series of regionally coordinated efforts. The state implements both long-term and short-term strategies to mitigate the impacts of drought, including infrastructure improvements, water use restrictions, and conservation programs. One key element of the plan is the Water Conservation Legislation, which encourages water agencies to adopt drought response strategies, invest in efficient irrigation systems, and use groundwater storage solutions.

To address specific risks, especially in rural areas, the Department of Water Resources (DWR) has developed a risk assessment tool and recommendations to support the needs of small water systems, focusing on sustainable groundwater management and drought resilience through the 2021 Small Water and Rural Communities Drought and Water Shortage Contingency Planning and Risk Assessment. (DWR, 2021)

Statewide Emergency Water Conservation Regulations

In 2016, the State Water Resources Control Board (Water Board) adjusted emergency water conservation regulations in recognition of the differing water supply conditions and ongoing drought across the state to comply with an Executive Order from the California Governor declaring a drought emergency. Executive Order B-37-16 Making Water Conservation a California Way of Life updates temporary emergency water restrictions and transitions to permanent, long-term improvements in water use by:

- Providing wiser water use,
- Eliminating water waste,
- Strengthening local drought resilience, and
- Improving agricultural water use efficiency and drought planning.

In April of 2017, a new Executive Order lifted the drought emergency but retained many of the conservation requirements. Most regulations are still in effect with the exception of water supply “stress test” requirements and conservation standards for urban water suppliers. The temporary restrictions established a baseline of the types of benefits that are possible from water conservation requirements. The Executive Orders are here. waterboards.ca.gov/executive_orders (abbreviated link).

California Water Plan

The California Water Plan presents strategic plan elements, including a vision, mission, goals, guiding principles, and recommendations for current water conditions, challenges, and activities. The plan includes future uncertainties and climate change impacts, scenarios for 2050, and a roadmap for improving data and analytical tools needed for integrated water management and sustainability. The California Water Plan was updated most recently in 2023. See: https://water.ca.gov/Programs/California-Water-Plan.

Urban Water Management Plans (UWMP)

Jurisdictions either supplying over 3,000 acre-feet of water annually or serving more than 3,000 urban connections are required to submit an Urban Water Management Plan (UWMP) and update these plans every five years. Most jurisdictions participating in this MJHMP have UWMPs, which are explored in more detail in jurisdictional annex capabilities assessments in Volume 2. The City of Red Bluff adopted a UWMP in 2022.

UWMPs contain information on long-term water supply planning and managing demands in times of drought and are important for drought hazard planning. UWMPs also explore stormwater capacity and assist in planning and funding future stormwater needs, further described in Section 4.5.1. (CDWR, 2021)

County-Wide Drought and Water Shortage Contingency Plans

Drought can be particularly impactful to small, rural water systems or residents on individual wells. Urban water management and drought contingency planning are not required for these smaller systems. In the 2016 drought, this gap left these systems and residents unaware of how to react and opportunities for assistance during drought. A 2018 law, AB 1668, directed the California Department of Water Resources to identify small suppliers and rural communities at risk of drought and water shortage vulnerability and to develop recommendations for improving drought contingency planning for those areas. (DWR, 2021)

Tehama County does not currently have a county-wide drought and water shortage contingency plan. The County participates in the State's Save Our Water Campaign, and it developed a mitigation action to initiate the first plan during the life of this iteration of the MJHMP.

Tehama County General Plan

The 2009 Tehama County General Plan includes several polices in its public facilities and services element that encourage water conservation. These provisions ensure adequate water supplies by promoting water conservation through water-efficient landscaping, reuse of treated wastewater, rainwater harvesting, and water conserving appliances.

Tehama County West Watershed Management Plan

The Tehama West Watershed Management Plan is an action document resulting from the evaluation of the Tehama West Watershed Assessment (TWWA 2006), which provides the necessary background information on existing conditions within the watershed. Funded through a grant from the State Water Resources Control Board as part of the CALFED Watershed Program, this community-based process provided the opportunity for public input through public meetings that were held in various locations within the assessment area. From those meetings, plus additional interviews and written comments, conclusions and recommendations were reached concerning possible improvement activities.

Tehama County East Watershed Management Plan

The Tehama East Watershed Management Plan is an action document resulting from the evaluation of the Tehama East Watershed Assessment (TEWA 2010), which provides the necessary background information on existing conditions within the watershed. The watershed assessment project was funded through a grant from the California Department of Water Resources through the CALFED Watershed Program.

4.5.5.3 Past Events

Tehama County, California, has experienced significant drought events that have shaped the county's approach to hazard mitigation. Droughts in the region are often characterized by prolonged periods of low precipitation, which lead to reduced water supply, increased wildfire risk, and impacts on agriculture, which is a major economic sector in Tehama County. Some of the more notable drought events include:

- **1976-1977 Drought**: This severe drought is still remembered as one of the worst in California's history. Tehama County, like much of the state, saw water shortages that impacted agricultural output, with crops failing and livestock suffering due to the lack of water. This event pushed many local agencies to begin investing in water conservation techniques and storage infrastructure.
- **1987-1992 Drought**: Another prolonged drought, this six-year event significantly stressed local water systems. Tehama County experienced dwindling groundwater levels, prompting water agencies and agricultural operators to implement more efficient irrigation systems. This drought led to increased state involvement in water management through drought contingency planning.
- **2007-2009 Drought**: The Central Valley, including Tehama County, experienced intense water scarcity during this period. Agriculture, a cornerstone of the county's economy, was severely affected as water deliveries were cut due to depleted reservoirs and restricted groundwater pumping. Many farmers had to fallow fields, and livestock operations struggled to maintain herds due to feed shortages.
- **2012-2016 Drought**: One of the most intense and prolonged droughts in California's modern history, this event pushed Tehama County's water systems to their limits. Groundwater supplies dropped significantly, leading to the installation of new wells and deeper pumping. The drought also saw widespread wildfires, as the lack of moisture and persistent heat left the county's vegetation dry and combustible. Tehama County communities responded by implementing strict water conservation measures, while state and federal agencies increased efforts in long-term water planning and emergency response.
- **2020-Present Drought Conditions**: The ongoing drought has further strained water resources across Tehama County. The combination of reduced snowpack, hotter temperatures, and lower-than-average rainfall has created conditions where both surface and groundwater supplies are stressed. Agriculture continues to face challenges as wells run dry, and the region's wildfire risk remains elevated. (California Depatment of Water Resources, 2020)

- Tehama County's economy is heavily reliant on agriculture, with crops like walnuts, almonds, and livestock operations being particularly vulnerable to drought conditions. Droughts have historically led to reduced crop yields, increased irrigation costs, and heightened competition for water resources. As the county relies significantly on groundwater, sustained droughts have led to over pumping, further stressing the local water table.
-
- The USDA also issues disaster declaration for agriculture-related natural disaster events. The USDA has declared 17 drought disaster declarations for Tehama County since 2012 (Table 4-44). These declarations are issued by the Secretary of Agriculture and qualify producers in affected primary

and contiguous counties to receive emergency (EM) loans as well as other emergency assistance programs.
(USDA, 2024)The declaration process is significantly expedited for severe drought which occurs during the growing season – that is, eight consecutive weeks of D2 drought intensity value, or any duration of D1 or D0 drought intensity as reported by the U.S. Drought Monitor.

-
- In response to these repeated drought events, Tehama County has increasingly focused on water management and conservation. The county has worked with state and regional partners to enhance groundwater management under the Sustainable Groundwater Management Act (SGMA), investing in infrastructure like recharge basins and promoting more efficient irrigation techniques. The droughts also underscored the need for diversified water supply sources and better drought preparedness plans.

Table 4-44: USDA Drought Disaster Declarations for Tehama County, 2012 - 2023

Designation Number	Approval Date	Begin Date	End Date	Conditions Present	Fast Track?
S5371	3/17/2023	10/1/2022	N/A	Drought	**Yes**
S5146	4/8/2022	10/1/2021	N/A	Drought	**Yes**
S4916	3/5/2021	10/1/2020	N/A	Drought	**Yes**
S4691	6/10/2020	4/14/2020	N/A	Drought	**Yes**
S4675	5/6/2020	4/21/2020	N/A	Drought	**Yes**
S4467	3/22/2019	10/1/2018	N/A	Drought	**Yes**
S3964	3/2/2016	1/1/2016	N/A	Drought	**Yes**
S3952	2/17/2016	1/1/2016	N/A	Drought	**Yes**
S3943	12/23/2015	1/2/2015	N/A	Drought	**No**
S3784	2/4/2015	1/1/2015	N/A	Drought	**Yes**
S3743	9/17/2014	1/1/2014	N/A	Drought	**No**
S3637	1/23/2014	1/14/2014	N/A	Drought	Yes
S3569	8/21/2013	5/25/2013	8/19/2013	Drought	**Yes**
S3565	8/14/2013	6/18/2013	8/12/2013	Drought	**Yes**
S3379	9/5/2012	1/1/2012	N/A	Drought	**Yes**
S3268	7/12/2012	2/21/2012	5/14/2012	Drought	Yes
S3248	5/31/2012	10/1/2011	N/A	Drought	No

*USDA data does not include end dates for every designation number.

The National Drought Monitor provides drought data and maps nationally and on a localized, watershed scale. The National Drought Monitor is the product of 11 agencies, including the NDMC, NOAA and USDA, and is available at http://droughtmonitor.unl.edu/. The National Drought Monitor categorizes the level of drought from D0 through D4, with D4 being the highest "exceptional drought." Table 4-45 depicts drought classifications and impacts from the level of drought occurrence in California.

Figure 4-39 shows a time series of the level of drought in Tehama County from 2000 to 2023 according to the National Drought Monitor.

Table 4-45: Drought Classifications and Impacts for California

Category	Description	Possible Impacts
D0	**Abnormally Dry**	▪ Soil is dry; irrigation delivery begins early ▪ Dryland crop germination is stunted ▪ Active fire season begins ▪ Winter resort visitation is low; snowpack is minimal
D1	**Moderate Drought**	▪ Dryland pasture growth is stunted; producers give supplemental feed to cattle ▪ Landscaping and gardens need irrigation earlier; wildlife patterns begin to change

Category	Description	Possible Impacts
		▪ Stock ponds and creeks are lower than usual
D2	**Severe Drought**	▪ Producers increase water efficiency methods and drought-resistant crops ▪ Grazing land inadequate ▪ Fire season is longer, with high burn intensity, dry fuels, and large fire spatial extent; more fire crews on staff ▪ Lake- and river-based tourism declines; boat ramps close ▪ Trees are stressed; plants increase reproductive mechanisms; wildlife diseases increase ▪ Water temperatures increase; programs to divert water to protect fish begin ▪ River flows decrease; reservoir levels are low and banks are exposed
D3	**Extreme Drought**	▪ Federal water not adequate to meet irrigation contracts; extracting supplemental groundwater is expensive ▪ Fire season lasts year-round; fires occur in typically wet parts of the state; burn bans are implemented ▪ Ski and rafting business is low; mountain communities suffer ▪ Low water levels impede fish migration and cause lower survival rates ▪ Wildlife encroach on developed areas; little native food and water is available for bears, which hibernate less ▪ Water sanitation is a concern; reservoir levels drop significantly; surface water is nearly dry, flows are very low; water theft occurs ▪ Livestock need expensive supplemental feed, cattle and horses are sold; little pasture remains ▪ Well and aquifer levels decrease; homeowners drill new wells
D4	**Exceptional Drought**	▪ Fire season is very costly; number of fires and areas burned are extensive ▪ Many recreational activities are affected ▪ Fields are left fallow; orchards are removed; vegetable yields are low; honey harvest is small; agricultural unemployment is high, food aid is needed ▪ Fish rescue and relocation begins; pine beetle infestation occurs; forest mortality is high; wetlands dry up; fewer wildflowers bloom; wildlife death is widespread; algae blooms appear

Category	Description	Possible Impacts
		▪ Poor air quality affects health; greenhouse gas emissions increase as hydropower production decreases; West Nile outbreaks rise ▪ Water shortages are widespread; surface water is depleted; federal irrigation water deliveries are curtailed; water prices are extremely high; wells are dry, more and deeper wells are drilled; water quality is poor

Source: Adapted from U.S. Drought Monitor Drought Classifications and Impacts via https://droughtmonitor.unl.edu/DmData/StateImpacts.aspx

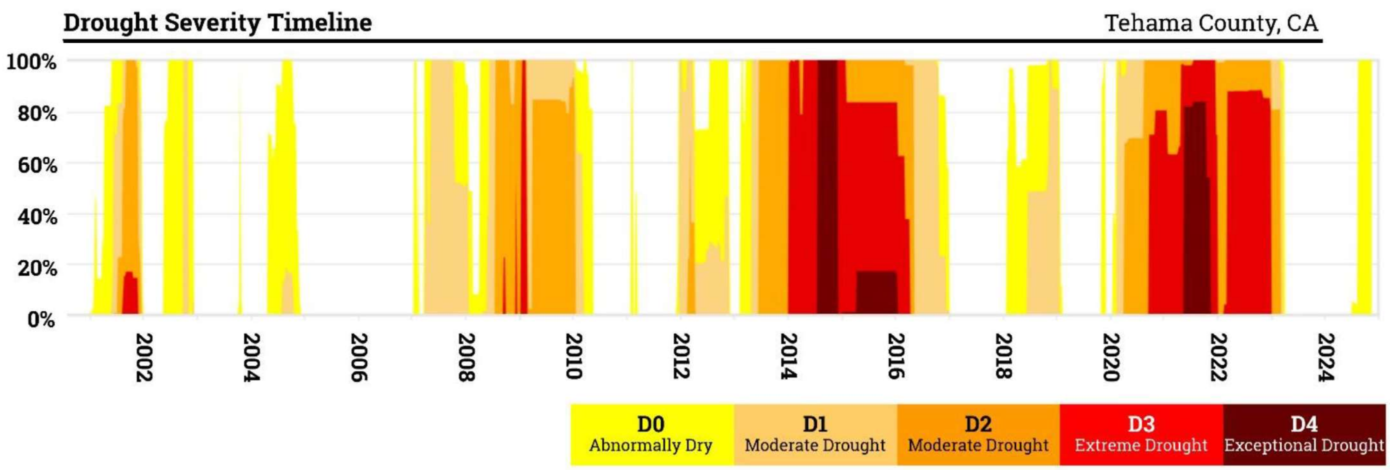


Figure 4-39: Tehama County Drought Severity Timeline 2000-2024

4.5.5.4 Location

Drought is one of the few hazards with the potential to impact the entire population of Tehama County directly or indirectly through water restrictions, higher water and food prices, reduced air and water quality, or restricted access to recreational areas. No portion of the county is immune from drought conditions.

Lack of winter snowfall in the mountains can eventually lead to agricultural impacts due to decreased stream flows. Reduced base flows may introduce additional challenges for communities that depend on direct drinking water supplies from rivers and tributaries. Droughts of just a few weeks during critical periods of plant development can have disastrous effects on agriculture production. Reduced reservoir storage from decreased runoff in the mountains can lead to water shortages. Droughts that occur in populated areas may not have direct effects on the residents but may increase the threat of wildfire in wildland urban interface areas.

4.5.5.5 Frequency and Probability of Future Occurrences

Predicting the precise probability of future drought depends on comprehensive and reliable data. Cal-Adapt, an authority on climate variance in California, projects an extended period of drought over a 20-year period. (Cal-Adapt, 2020) 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.

According to the results of the risk factor exercises for the participating jurisdictions, the probability of drought occurring in Tehama County is highly likely (100 percent annual probability) (NOAA, 2024) . Figure 4-39 provides a time series from the National Drought Monitor that shows Tehama County has been in some form of drought for much of the period from 2000 to 2024.

4.5.5.6 Severity and Extent

Droughts are unique among natural disasters because they typically develop gradually and can persist for extended periods. The severity and extent of a 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. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly.

Drought eventually affects groundwater sources but generally not as quickly as surface water supplies; groundwater supplies often take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems, such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest.

A drought directly or indirectly impacts all people in affected areas. A drought can result in farmers not being able to plant crops or the failure of planted crops. This results in loss of work for farm workers and those in food processing and winemaking jobs. Other water-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies), as well as landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them.

Table 4-45 describes the impacts of the various severity levels of drought in California according to the National Drought Monitor classifications.

4.5.5.7 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. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on a global scale. (National Institute of Water and Atmospheric Research, 2016)

4.5.5.8 Secondary Hazards

The secondary hazard most 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. (Syphard, 2019) The Park, August Complex, and the McFarland Fires are examples of how drought conditions, combined with increased fuel loads, can cause more frequent and intense wildfires.

4.5.5.9 Climate Change Impacts

The long-term effects of climate change on regional water resources are less known, but globally, water resources are already stressed from a growing population, poor water quality, groundwater overdrafts, and aging urban water infrastructure. Climate change will likely exacerbate many of these stresses.

With a warmer climate, droughts are projected to increase in severity, frequency, and duration. The associated costs from diminished water resources will also be significant. According to the California Water Library, the overall value-added impact of the 2022 drought in California agriculture and food processing are estimated at $2 billion ($600 million higher than in 2021) and about 19,414 jobs (4,700 more than in 2021). (California Water Library, 2022) More frequent extreme events like droughts could end up being more cause for concern than the long-term change in temperature and precipitation averages. (University of California, Davis Center for Watershed Sciences, 2020) According to California's Fourth Climate Change Assessment, variances in precipitation trend toward shorter winters and prolonged dry seasons, in addition to increased frequency of drought, which could limit water supplies from more local sources. (Grantham, 2018)

4.5.5.10 Drought Vulnerability Analysis

All people, property, and environments in the county planning area would be exposed to the impacts of moderate to extreme drought conditions to some degree.

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. The drought vulnerability of an activity usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand. California's 2023 Water Plan indicates that water demand in the state will continue to increase.

4.5.5.10.1 Population

According to the 2024-2029 Tehama County Housing Element, the county's population was projected to reach 91,677 by 2029, a growth that could place additional demands on groundwater resources. In response, the planning partnership can work to mitigate impacts on residents and water consumers in the event of consecutive dry years. The Tehama County Groundwater Sustainability Plans focus on sustaining groundwater levels to keep the county's well infrastructure functional over the long term through a comprehensive groundwater management program. (Tehama County Housing Element 2024-2029, 2024)

Overall, drought conditions in Tehama County are not anticipated to cause significant threats to life or health within the planning area.

4.5.5.10.2 Property

During drought years, property owners with shallow wells can be impacted by drought with increased demand on groundwater resources. Surface water supplies are often lower, which can reduce availability and increase costs. Drought conditions sometimes encourage agricultural producers who historically used surface water to switch to groundwater, which can further deplete the resource.

No structures will be directly affected by drought conditions, though some structures may become more vulnerable to indirect affects such as those from wildfires, which are highly likely to follow years of drought. Drought can also have significant impacts on landscapes, which could cause a financial burden to property owners, especially low-income populations who may not be able to afford to maintain their properties during water shortages. However, these impacts are not considered critical in planning for impacts from the drought hazard.

The agricultural sector is particularly susceptible to drought impacts. Agricultural drought impacts are normally felt earliest by those relying on unmanaged water supplies, such as entities carrying out dryland grazing and non-irrigated crop production, usually grain crops. Impacts on irrigated agriculture depend on the source and nature of the irrigation water supply, whether it be local groundwater, local surface water, or imported surface water, and any water rights or contractual provisions that may be associated with the source. The extent to which producers may mitigate water shortage impacts depends on multiple factors but is heavily influenced by economic considerations. Factors involved in making decisions about mitigating irrigation water shortages include availability and costs of pumping groundwater, price of alternative surface water sources, capital investments associated with maintaining permanent plantings, and status of international crop markets. (California Drought Contingency Plan, 2021)

4.5.5.10.3 Critical Facilities

Critical facilities, as defined for this plan, will continue to be operational during a drought. Critical facility elements, such as landscaping, may not be maintained due to limited resources, but the risk to the planning area's critical facilities will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

4.5.5.11 Future Trends in Development

Future trends in water management and development are closely tied to increasing demands on groundwater resources and the region's ongoing vulnerability to drought. With a high reliance on groundwater for agricultural and domestic use, the county has adopted the Sustainable Groundwater Management Act (SGMA) framework to establish Groundwater Sustainability Plans (GSPs). These plans are structured to ensure long-term water availability by monitoring groundwater levels, managing extraction, and coordinating conservation efforts across various agencies and sub-basins. This collaborative approach aims to counterbalance drought impacts and protect groundwater supplies from overuse, a pressing issue given the county's frequent and prolonged drought conditions

In addition to regulatory efforts, Tehama County's water management strategy includes adaptive planning to address anticipated population growth and subsequent water demand. This approach seeks to mitigate potential groundwater depletion due to increased agricultural activities and urban expansion. The SGMA and related local programs are designed to foster sustainable growth by promoting water efficiency, monitoring water usage, and involving community stakeholders to maintain stable groundwater levels across Tehama's sub-basins. This proactive planning is crucial in maintaining the county's agricultural viability and supporting its communities, particularly in years with limited rainfall or extended droughts. (Tehama County Flood Control and Water Conservation District, 2024)

The Tehama County Flood Control and Water Conservation District serves as an essential resource for educating the public and local water stakeholders about regional water and land management issues. It provides valuable information on water conservation strategies and offers programs, such as California's State Water Efficiency and Enhancement Program, to support water-saving efforts. Through this program, the district offers rebates for water-efficient landscaping, encouraging residents to replace traditional lawns with more sustainable options.

Each participating jurisdiction within Tehama County has a general plan that addresses land use and water resource management policies, aiming to protect water resources and sustain long-term water supply. These general plans are periodically reviewed as part of hazard mitigation capability assessments, enabling local agencies to identify potential gaps or deficiencies. Any identified needs can be integrated as mitigation actions, thereby strengthening each jurisdiction's ability to support sustainable development and manage drought impacts effectively.

4.5.5.12 Drought Hazard Problem Statements

As part of the mitigation action identification process, the Planning Committee for the county and for each jurisdiction identified issues and weaknesses, also called problem statements, for their respective facilities. Identification was based on the risk assessment and vulnerability analysis utilizing drought hazard data. Drought hazard problem statements for the county are listed in Table 4-46; problem statements for all other participating jurisdictions are accessed in Volume 2 of this plan.

Identifying these common issues and weaknesses assists the Planning Committee to understand the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-46 and Table 5-6.

Table 4-46: Drought Problem Statements

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-DR-TC-8	Drought	Victim	SP	**Tehama County**	The need for identification and development of alternative water supplies.	Y	ma-DR-TC-30
ps-DR-TC-9	Drought	Threat	SP , PRV	**Tehama County**	Lack of recharge to stabilize the groundwater supply.	Y	ma-DR-TC-25, ma-DR-TC-26, ma-DR-CC-57
ps-DR-TC-11	Drought	Threat	PRV	**Tehama County**	The probability of increased drought frequencies and durations due to climate change.	Y	ma-DR-CoT-103, ma-DR-RB-72, ma-DR-TC-25, ma-DR-TC-26, ma-DR-CC-56
ps-DR-TC-15	Drought	Impact	PRV , PE&A	**Tehama County**	The lack of promotion of active water conservation during drought and non-drought periods.	Y	ma-DR-CoT-96, ma-DR-RB-74, ma-DR-TC-24
ps-DR-TC-19	Drought	Impact	PPRO	**Tehama County**	Illegal groundwater use and water diverted from streams contribute to water wells going dry during periods of drought. Related expenses include re-drilling and head replacement.	Y	ma-DR-TC-27

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-DR-TC-20	Drought	Impact	PRV , NRC	**Tehama County**	There is a lack of available resources to evaluate private wells and water quality issues and/ or dry well reporting. No mapping currently exists of dry wells or groundwater, water tables or aquifers.	Y	ma-DR-CC-56, ma-DR-TC-27, ma-DR-TC-26

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4.5.6 Slope Failure Hazard Profile

Landslide, mudflow, debris flow, and rockfall, collectively known as slope failure, may cause damage across the county. These types of slope failure are addressed as one collective slope failure hazard in this profile, as the vulnerability assessment and mitigation strategies are similar among all types of slope failure.

While slope failure may result in loss of life and assets, it more often results in a disruption of everyday services, including emergency response capabilities. Landslides can block transportation routes, dam creeks and drainages, and contaminate water supplies. When these hazards affect transportation routes, they are frequently expensive to clean-up and can have significant economic impacts on the county. (United States Geological Survey, 2004)

The four most common types of slope failure (landslide, mudflow and debris flow, rockfall, and alluvial fans) are briefly described below.

Landslide

The many types of landslides are categorized based on form and type of movement. They range from slow-moving rotational slumps and earth flows, which can distress structures over time but are less threatening to personal safety, to fast-moving rock avalanches and debris flows that are a serious threat to structures and have been responsible for most fatalities during landslide events. Many large landslides are complex and a combination of more than one landslide type. (United States Geological Survey, n.d.)

Mudflow and Debris Flow

When slope material becomes saturated with water, a debris flow may develop. Debris flows can also occur from horizontal seismic inertia forces induced in a slope from ground shaking. From a geologic perspective, there are generally two types of debris flows: debris flows related to shallow landslides and post-wildfire debris flows. (United States Geological Survey, 2005)

Debris flows related to shallow landslides occur on hillslopes due to soil failure in which soil liquefies and runs downhill. This type of debris flow generally results from a shallow landslide (less than 10 to 15 feet deep) and has a discrete initiation zone and depositional area. Shallow landslides tend to occur in winter but are most likely after prolonged periods of heavy rainfall when soil materials are saturated. Debris flows are typically more dangerous because they are fast-moving, causing both property damage and loss of life. (*Id.*)

- **Post-wildfire debris flows** are a result of post-fire conditions, where burned soil surfaces enhance rainfall runoff that concentrates in a channel and picks up debris as it moves. The post-fire debris flow has a less discrete initiation zone but is similar to a debris flow derived from hillslopes in that it may result in inundation and a detrimental impact on lives and property within its zone of runout and deposition. It can also result in downstream flooding. (*Id.*)

Rockfall

Rockfall is the falling of a newly detached mass of rock from a cliff or rock outcrop, or a loose rock that erodes out of unconsolidated debris on a hillside and rolls or falls down a very steep slope. Over-steepened slopes, like those along roadcuts or in glaciated terrain, are susceptible to rockfall due to the steep slopes that are not highly vegetated or benched, which help attenuate rockfall. Rock outcrops that are highly fractured or undercut by weaker rock layers are also susceptible to rockfall. (CGS, 2020)

Alluvial Fan

Alluvial fans consist of sediment deposits leftover from a flood event. The sediment is carried by a flood and distributed in a fan-like shape. Alluvial fans represent a high risk of natural hazards in the form of debris flows as the deposited soil remains unstable after the flood event. Alluvial fan channels are located on foot slope landforms in the transition space between valley floodplains and steep mountain slopes and are preceded by high-gradient, contained channels. Coarse material deposits are formed by the rapid change in transport capacity as the high energy mountain slope streams spill onto the valley floor. Riparian areas resemble the shape of the landform, which is narrow at the apex and broader at the bottom where the fan widens. (United States Department of Agriculture)

4.5.6.1 Plans, Policies, and Regulatory Environment

Design Guidelines for Site Grading in Tehama County Code, § 9.43.340 -

All engineered grading requires a grading plan prepared by a civil engineer prior to commencement of work. The civil engineer who prepares a grading plan shall incorporate all recommendations from the soil engineering report and any engineering geology report into the grading plan. He/ she shall also be responsible for the professional inspection and approval of the grading within their area of technical specialty. This responsibility shall include, at a minimum, grade and drainage of the development area.

A soil engineering report shall be prepared for each grading plan prepared by a civil engineer. The soil engineer's area of responsibility shall include, at a minimum, the professional inspection and approval concerning the preparation of ground to receive fills, testing for required compaction, stability of all finish slopes and the design of buttress fills, where required, incorporating any data supplied by an engineering geologist.

If an engineering geologist is retained for the work, their area of responsibility shall include, at a minimum, professional inspection and approval of the adequacy of natural ground for receiving fills and the stability of cut slopes with respect to geological matters, and the need for subdrains or other ground water drainage devices. He/ she shall report their findings to the soil engineer and the civil engineer for engineering analysis. If an engineering geologist is not retained, the civil engineer who prepares the grading plan shall assume the responsibilities of the engineering geologist . "

Erosion Control in Tehama County Code, § 9.43.330

When construction activities propose to disturb areas of existing vegetation and ground cover by grading, effective erosion and sediment control measures shall be employed.

- Erosion Control Plan. Whenever a grading permit requires an erosion control plan, it shall be submitted with the grading plan as per stipulations in the grading permit. If the site or portion of the site is planned to be idle for more than forty-five days, then vegetative stabilization must be accomplished within seven days. The wet weather plan shall include a plan for the immediate (within twenty-four hours of the first forecast of a storm front) installation of emergency erosion control measures.
- Design Standards. Best management practices shall be employed.

4.5.6.2 Past Events

The majority of landslides in the unincorporated areas of Tehama County have happened during the late fall and early spring seasons. Landslides are typically caused by severe weather events in the county. There have been no federally-declared landslide events in Tehama County and there is little recorded information regarding landslides in the County. According to the California Department of Conservation Landslide tracker there have been no recorded landslide events in Tehama County since 1960 (Conservation, 2024). There are no records in the County of fatalities attributed to mass movement.

4.5.6.3 Location

The best available predictor of where slope failure 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 the periphery.

Recognizing ancient dormant mass movement sites is important to identify current areas susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Those ancient scars also consist of broken materials, frequently involve disruption of groundwater flow, and are vulnerable to construction-triggered sliding.

Figure 4-40 shows low, moderate, and high landslide risk exposure based on data from the California Geological Survey (CGS) (Table 4-47). The map depicts a general characteristic of higher risk outside of the valley. This map should be used with caution, as site-specific conditions can make some locations in low to moderate instability areas highly unstable and some high instability locations more stable. Geotechnical investigation is often required to determine the stability of a given site.

Table 4-47: Landslide Susceptibility Classifications

Landslide Susceptibility

Hazard	Native Class	Description
Low	1-5	These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weaker rocks.
Medium	6-7	Very high landslide susceptibility, classes VIII, IX, and X, includes moderate and steep slopes in hard rocks and weak rocks.
High	8-10	Very high landslide susceptibility, classes VIII, IX, and X, includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks.

Source: CGS Susceptibility to Deep-Seated Landslides in California

4.5.6.4 Frequency and Probability of Future Occurrences

Slope failures are most frequently triggered in periods of high rainfall. The hazard is greatest in areas with steep slopes, although landslides may occur on slopes of 15 percent or less under certain conditions. Slope steepness and underlying soils are the most important factors affecting the landslide hazard. However, surface and subsurface drainage patterns also have an effect, and vegetation removal can increase the likelihood of a landslide. (United States Geological Survey, 2004)

Slope failures are often triggered by other natural hazards, such as earthquakes, heavy rain, floods, or wildfires. Consequently, landslide frequency is often related to the frequency of these other hazards. The probability of slope failure occurring in Tehama County is likely, though the exact rate of future occurrence is unknown.

4.5.6.5 Severity and Extent

The severity of landslide problems depends upon the local bedrock and soil conditions, including moisture content, slope, and vegetation. Small landslides are common in the mountain areas of the county as loose material moves naturally down slope or fires cause loss of soil-stabilizing vegetative cover. In addition, many human activities tend to make earth material less stable and, thus, increase the chance of slope failure. Human activities contribute to soil instability through grading of steep slopes, overloading them with artificial fill, extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation. (USGS, 2020)

4.5.6.6 Warning Time

For hazards such as debris flows, rockfalls, and landslides, warning time is often short and may not occur at all. Identifying areas where these events are known to have occurred or which have ideal characteristics for these hazards to occur could help with hazard preparedness when triggering-type events like intense rainfall occur. This identification will not increase the warning time, but it will make proactive response and mitigation to potential triggering events more effective. (Manconi, 2016)

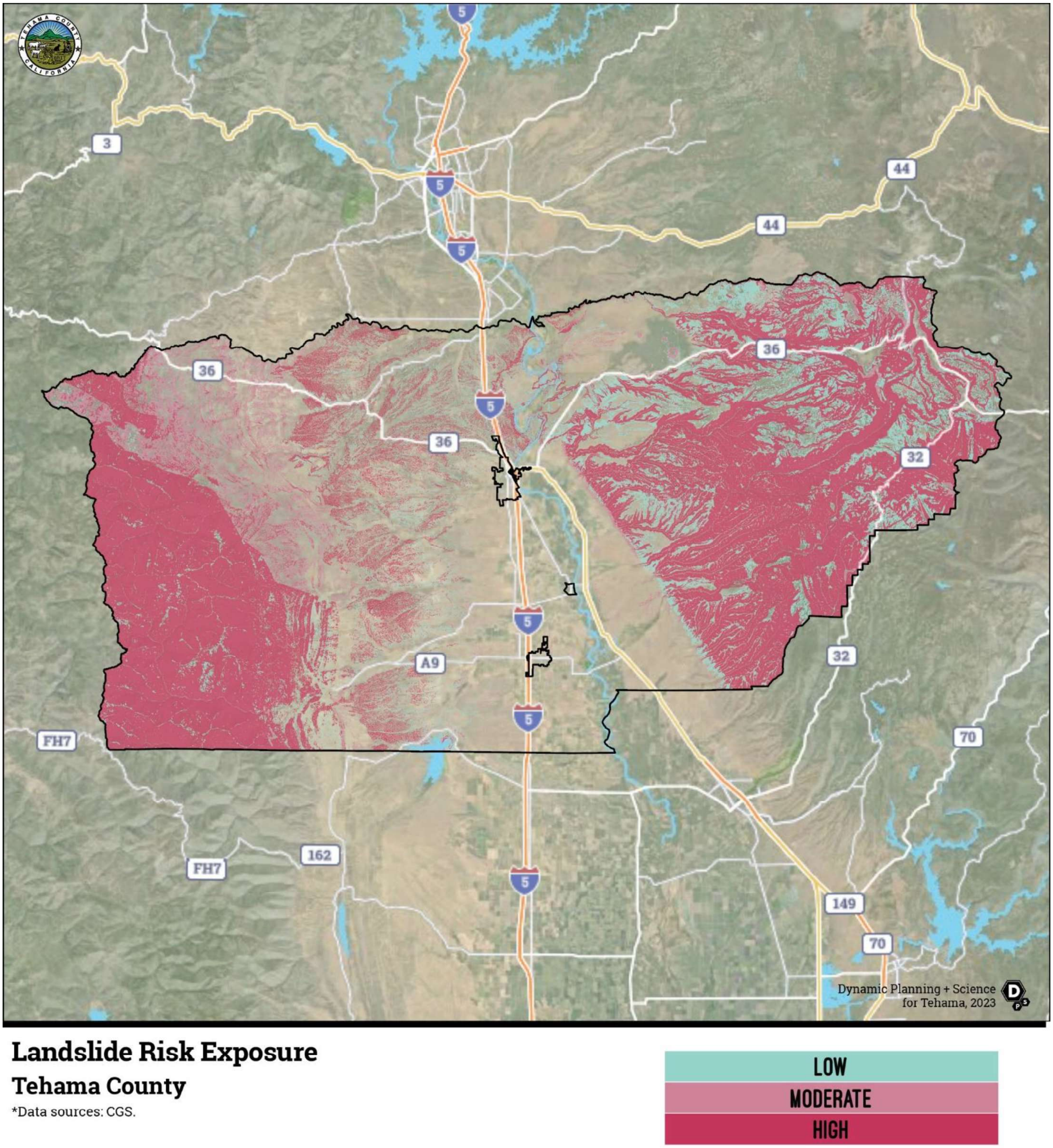


Figure 4-40: Landslide Risk Exposure

4.5.6.7 Secondary Hazards

There are some hazards that can trigger or exacerbate slope failure. Flooding, for example, can erode and undercut the toe of a slope, removing the support for that slope and causing a landslide or rockfall. Wildfires create an immediate hazard of their own and create long-term impacts by altering the soil structure, impeding its ability to absorb moisture, and destroying vegetation that binds the soil with roots and absorbs rainfall and runoff with foliage. Post wildfire, even small rainfall events can create devastating mudflows, debris flows, or landslides. Areas that are mapped currently as low to moderate risk of these hazards may have high risk after a wildfire.

4.5.6.8 Slope Failure Vulnerability Analysis

Both an exposure analysis and slope failure susceptibility assessment were conducted to evaluate the vulnerability of Tehama County to slope failures. Figure 4-41 presents a Snapshot Map of slope failure susceptibility for both population and infrastructure across the county. This analysis overlays slope failure susceptibility data with inventories outlined in A.2.1 to determine exposure. The exposure analysis identifies areas and assets most at risk due to unstable slopes or areas prone to landslides. For more information on methods, refer to Appendix A.

4.5.6.8.1 Population

An estimated 5,319 persons, or approximately 13% of the county population, are exposed to some level of slope failure susceptibility, as shown in Table 4-48. Population estimates within slope failure areas were generated by analyzing U.S Census Bureau Blocks that intersect with landslide hazard areas as delineated by California Geological Survey. Exposure values were calculated by weighting the population within each census block and track with the percentage of slope hazard areas.

Vulnerable Populations

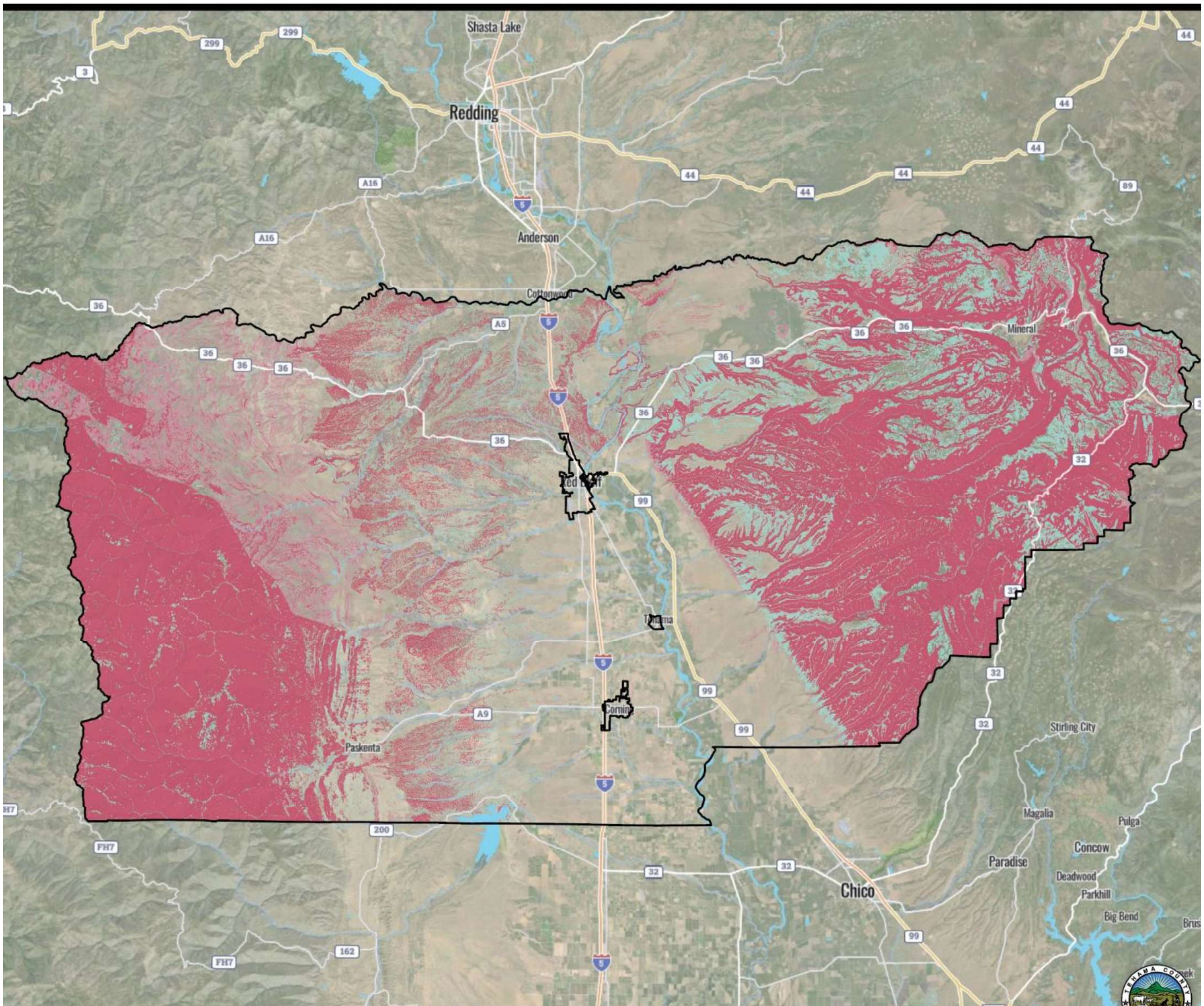
Landslide risk is greatest in the mountainous areas of the county extending into the foothills on either side of the valley floor and north of Red Bluff. As described in Section 4.3.4, these areas overlap with CDC Social Vulnerability Index (SVI) percentile rankings of between 35% and 68%, with the lowest rankings being concentrated within and north of Red Bluff. The highest rankings that overlap with areas of high landslide hazard risk are 58% and 68% in east and west halves of the county, respectively. In general, the population in these areas tends to be older, English-speaking homeowners on the upper end of the median household income. However, over much of the exposed area, up to 35% of the population is over the age of 65, the rate of renter-occupied units is up to 40%, and the poverty rate reaches up to 52%, indicating that populations that would be disproportionately impacted by a slope failure event are present.

Impacts from a slope failure may include property loss or damage, loss of access, and disruption of services, all of which can disproportionately impact seniors, people with disabilities, renters, and low-income households. Those dependent on caregivers to navigate daily life or on medical devices or services could be most impacted by disruptions caused by slope failure, warranting special attention in mitigation planning.

Table 4-48: Population Exposure to Landslide Susceptibility

	Total Population	
Unincorporated County	42,150	
Landslide Susceptibility	**Population Count**	**% of Total**
High	3,386	*8.03%*
Moderate	190	*0.45%*
Low	1,742	*4.13%*
Total	**5,319**	**12.62%**

LANDSLIDE RISK EXPOSURE **TEHAMA COUNTY**



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
3,386	8%
Count Includes:	HIGH

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
1,392	8%
Count Includes:	HIGH

PARCEL VALUE IN HAZARD AREA

	Exp. Rate**
Sum of Improvement Value $517,183,917	7%
Sum of Content Value $278,565,003	6%
Count Includes:	HIGH

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**	Count/Sum Includes:
Essential Facilities	1	5%	HIGH
Hazmat	5	3%	
High Potential Loss	2	1%	Sum of Transportation & Lifeline Linear Mileage
Transportation & Lifeline	50	7%	1,415 23%

MAP LEGEND

- LOW
- MODERATE
- HIGH

*Exposure summaries include high susceptibility only. Hazard data source: CGS.
**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

Dynamic Planning + Science for Tehama County, 2023

Figure 4-41 Tehama County - Landslide Risk Exposure Snapshot

4.5.6.8.2 Property

Table 4-49 shows the number of parcels, market value exposure, and content value exposure in the steep-slope risk areas. The predominant zoning classes within these areas are single-family, vacant, and manufactured homes. Low-income housing may be located in areas at higher risk of slope failure, which may disproportionately impact low-income property owners who cannot afford areas at lesser risk.

Table 4-49: Property Value Exposed to Landslides

	Total Parcels		Total Market Value ($)	Total Content Value ($)	Total Value ($)	
Unincorporated County	18,434		$7,780,396,144	$4,574,842,260	$12,355,238,404	
Landslide Susceptibility	**Parcel Count**	**% of Total**	**Market Value Exposure ($)**	**Content Value Exposure ($)**	**Total Exposure ($)**	**% of Total**
Low	1,001	*5.4%*	$426,367,682	$225,764,789	$652,132,471	*5.3%*
Moderate	146	*0.8%*	$64,179,553	$37,791,271	$101,970,824	*0.8%*
High	1,392	*7.6%*	$517,183,917	$278,565,003	$795,748,920	*6.4%*
Total	**2,539**	**13.8%**	**$1,007,731,152**	**$542,121,063**	**$1,549,852,215**	**12.5%**

4.5.6.8.3 Critical Facilities and Infrastructure

Several types of infrastructure are exposed to mass movements, including transportation, water, sewer, and power infrastructure. At this time, all infrastructure and transportation corridors identified as exposed to the slope failure hazard are considered vulnerable until more information becomes available. Table 4-50 summarizes the critical facilities exposed to the slope failure hazard.

Table 4-50: Critical Facility Points with Slope Failure Hazard Risk (Unincorporated County)

Critical Infrastructure - Landslide Susceptibility			
Infrastructure Type	High	Moderate	Low
Essential Facility	1	-	2
Emergency Operations Center	-	-	-
Fire Station	1	-	2
Hospital	-	-	-
Law Enforcement	-	-	-
High Potential Loss	2	1	3
Adult Residential Facility	-	-	-
Child Care Center	-	-	-
Dam	-	-	-
Historic Building	-	-	-
Power Plant	-	-	-
Real Property Asset	1	1	2
Residential Elder Care Facility	-	-	-
School	1	-	1
Transportation and Lifeline	50	-	19
Airport	-	-	-
Bridge	7	-	3
Cell Tower	2	-	5
FM Transmission Tower	2	-	-
Microwave Service Tower	37	-	10
Natural Gas Station	-	-	-
Paging Transmission Tower	1	-	-
Park	-	-	-
Substation	1	-	1
Wastewater Treatment Facility	-	-	-
Hazmat	5	1	3
Geotracker Cleanup Site	3	1	2
HWTS Active Facility	2	-	1
Grand Total	**58**	**2**	**27**

**Note: Real Property Assets are digitized insurance rolls for demonstrating value and ownership and may have overlapping points with other categories such as fire stations and law enforcement.*

Table 4-51: Critical Facilities (Linear) with Slope Failure Hazard Risk (Unincorporated County)

Lifelines (miles) - Landslide Susceptibility			
Infrastructure Type (Linear)	High	Moderate	Low
NG Pipeline	3.4	4.2	6.9
Railroad	0.4	0.0	0.9
Street	1,351.2	115.4	733.5
4WD trail	58.1	9.8	47.5
4WD trail, major	0.3	0.5	0.1
Alley	-	-	-
Cul-de-sac	0.1	-	-
Driveway	22.0	1.4	14.4
Interstate	1.5	0.1	1.6
Local road	1,133.4	79.2	583.7
Local road, major	11.0	1.3	11.3
Primary highway	14.1	3.3	15.8
Primary highway, major	-	-	-
Ramp	0.3	-	0.3
Service road	0.1	-	0.5
State/county highway	109.7	19.7	57.3
Thoroughfare, major	-	0.1	-
Walkway	0.6	-	1.1
Transmission Line	59.9	5.0	28.9
Grand Total	**1,414.9**	**124.6**	**770.2**

4.5.6.8.4 Lifelines

A significant amount of linear infrastructure (or lifelines) can be exposed to slope failure and mass movements. Table 4-51 summarizes the lifeline slope failure exposure analysis for unincorporated Tehama County. Slope failure can disrupt lifeline flow in the following ways:

- **Roads:** Access to major roads is crucial to life-safety, response, and recovery operations after a disaster event. Slope failures can block egress and ingress on roads, causing isolation for neighborhoods, traffic problems, and delays for public and private transportation. This can result in economic losses for businesses.
- **Bridges:** Slope failures can significantly impact bridges, by knocking out bridge abutments or significantly weaken the soil supporting them.
- **Power Lines:** Power lines are generally elevated above steep slopes, but the towers supporting them can be subject to slope failures. A landslide could trigger the failure of the soil underneath a tower, causing it to collapse and rip down the lines. Power and communication failures then create problems for vulnerable populations and businesses.

4.5.6.9 Future Trends in Development

As further discussed in Section 4.3.4, Tehama County's population has remained relatively stable with a mild growth rate that is significantly lower than the statewide growth rate. The unincorporated areas of the county, in particular, have seen a steady decline in the rate of growth, partially due to a decline in net migration. Tehama is a relatively rural county, with an overall population density of approximately 22 people per square mile, which is lower than California as a whole. This growth trend is expected to continue.

Although new development continues to occur across the county, local planning, zoning, building, and other development regulations work to plan for and address slope failure hazards, helping to limit exposure, reduce risk, and mitigate impacts. As discussed in Section 4.3.6, this regulatory framework includes the county's General Plan, as well as those general plans of other participating jurisdictions, that addresses land use, infrastructure improvement and expansion, and public safety, among other topics. These general plans are periodically reviewed as part of hazard mitigation capability assessments, enabling local agencies to identify potential gaps or deficiencies. Any identified needs can be integrated as mitigation actions, thereby strengthening each jurisdiction's ability to support sustainable development and manage slope failure impacts effectively.

In particular, the safety elements of these general plans establish standards and policies for the protection of the community from hazards. Much of the new development within the county could be impacted by slope failure hazards; however, Tehama County is equipped to handle future growth within landslide hazard areas. The 2009 Tehama County General Plan addresses development in areas susceptible to slope failure, and the County Code implements the grading ordinance and other protective measures.

Following the Park Fire, areas of the county are more vulnerable to increased runoff and post-fire rockfalls and debris flows. Much of the threat from debris flows exists in areas already in high or medium landslide susceptibility, and the County will focus mitigation on those high priority areas. Figure 4-42 depicts landslide prevention measures that are being enacted in areas which have recently been impacted by wildfires.

Figure 4-42: Landslide Prevention Post-Wildfire
Source: The San Francisco Gate

4.5.6.10 Slope Failure Hazard Problem Statements

As part of the mitigation action identification process, the Planning Committee for the county and for each jurisdiction identified issues and weaknesses, also called problem statements, for their respective facilities. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and slope failure hazard data. Slope failure hazard problem statements for the county are listed in Table 4-52; problem statements for all other participating jurisdictions are accessed in Volume 2 of this plan.

Identifying these common issues and weaknesses assists the Planning Committee in understand the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-52 and Table 5-6.

Table 4-52 Slope Failure Problem Statements

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-SF-TC-118	Slope Failure	Victim	PE&A - Public Education & Awareness	**Tehama County**	There is a lack of awareness of the hazards of slope failure along the Sacramento River. Erosion events forced residents to relocate their homes away from the river.	Y	ma-SF-TC-110

4.5.7 Extreme Heat Hazard Profile

Extreme heat events are periods of weather that are hotter and more humid than average at a given location and time of year. Unusually hot and humid summer days and nights have become more common since the 1960s. (Bole, et al., 2018) Climate change will increase the frequency, severity, and duration of heatwaves in coming decades. (*Id.*). These effects are amplified in urban centers such as the City of Red Bluff, with consequences for health, air quality, utilities, and transportation.

Heat has a greater toll on human health – as measured by deaths (mortality) and negative health outcomes (morbidity) – than all other natural disasters combined. (NIHHIS, 2021) In California, a record number of heat related deaths occurred in 2006, when a record-breaking heat wave between July 15 and August 1 was linked to 650 deaths and 16,000 excess emergency room visits. (California Office of Environmental Health Hazard Assessment, 2019) During this time Northern California experienced record temperature for over a week.

Heat-related death and illness are widely regarded as preventable within the public health community; despite this, extreme heat kills over 600 people in the U.S. annually. (CDC, 2021) The following populations face specific vulnerability to heat-related illness:

- Seniors aged 65+, especially those who live alone;
- Infants and children;
- Low-income households;
- Unhoused people,
- Individuals with chronic underlying medical conditions;
- Athletes; and
- Outdoor workers.

The cumulative impacts of severe heat wave events, along with longer-term small differences in seasonal average temperatures, exacerbate inequities in health outcomes among already at-risk groups. (NIHHIS, 2021) Heat impacts are distributed inequitably among low-income communities of color in the United States. On average Black and Latino households are more cost-burdened, occupy denser housing stock, and have lower access to heat-coping strategies, such as air conditioning and access to green space.

The Tehama County region is vulnerable to extreme heat and many cities and residents currently lack the adaptive capacity to cope with future increases in high heat events, even under lowered emissions scenarios. The average hottest day of the year is expected to warm anywhere from 6-10°F towards the end of the century.

Because the human body is capable of acclimating to local climate conditions, there is no single temperature that serves as a definition of extreme heat. This Plan uses the definitions set forth by Cal-Adapt (a data download interface provided by the California Energy Commission) for extreme heat events, warm nights, and heat waves, with descriptions and threshold values for the Tehama County outlined in Table 4-53.

Table 4-53: Cal-Adapt Extreme Heat Terms

Term	Cal-Adapt Definition	Threshold Value for Tehama County
Extreme Heat Day	Defined as a day in a year when the daily maximum/minimum temperature exceeds the 98th percentile of daily maximum/minimum temperatures based on observed historical data from 1961 – 1990 between April and October.	99.2°F
Warm Night	Defined as a day in April through October when daily minimum temperature exceeds the 98th historical percentile of daily minimum temperatures, based on observed data from 1961-1990 between April and October.	62.0°F
Heat Wave	Defined as 4 consecutive days or nights above the extreme heat / warm night threshold.	3 days ≥ 99.2°F or 4 nights ≥ 62.0°F

Source: Cal-Adapt Extreme Heat Days & Warm Nights Tool

Within Tehama County, geographic patterns in extreme heat are mostly influenced by topography. The county itself is landlocked and therefor does not experience the same coastal temperature gradient as many coastal counties in California do. While extreme heat days are defined by localized variation from norms, the Sacramento Valley tends to experience higher temperatures than the mountains. That being said, the ability to cope with higher temperatures in regions that normally experience them can often be greater, due to the availability of climate control which is sometimes unnecessary in the mountains.

Heat-Related Illness

The human body possesses a variety of adaptations to regulate internal temperature under warm conditions, including sweat glands, exposed skin, and walking on two legs. Above-average temperatures, even outside summer months, compromise the body's ability to internally regulate, leading to excess illness and death. **Heat-related illness (HRI)** can describe acute illness related to direct exposure to high temperatures, such as heat cramps, heat exhaustion, and heat stroke (see Table 4-54).

Table 4-54: Heat-Related Illnesses, Listed in Order of Severity

Heat-Related Illness	Symptoms	First Aid
Heat Cramps	▪ Symptoms include muscular pains and spasms, usually in the stomach, arms, and leg muscles. ▪ Usually results from heavy exertion, such as exercising during extreme heat. ▪ Although heat cramps are the least severe of all heat-related problems, they	▪ Heat cramps should be treated immediately with rest, fluids and getting out of the heat. ▪ Seek medical attention if pain is severe or nausea occurs

Heat-Related Illness	Symptoms	First Aid
	are usually the first signal that the body is having trouble coping with hot temperatures.	
Heat Exhaustion	▪ Heavy sweating ▪ Pale, clammy, moist skin ▪ Extreme weakness or fatigue ▪ Muscle cramps ▪ Headaches ▪ Dizziness or confusion ▪ Nausea or vomiting ▪ Fast and shallow breathing ▪ Fainting	▪ Rest in a cool area ▪ Sipping of water or sports drink ▪ Apply a cool, wet cloth over skin ▪ Elevating the feet 12 inches • **NOTE**: If left untreated, victim may go into heat stroke. Seek medical attention if the person does not respond to basic treatment for heat exhaustion.
Heat Stroke	▪ Flushed, hot, dry skin (no sweating) ▪ Body temperature above 103˚F ▪ Confusion or dizziness ▪ Unconsciousness ▪ Throbbing headache ▪ Rapid or strong pulse • **NOTE:** Heat stroke is the most severe heat-related illness and occurs when a person's temperature control system, which produces sweat, stops working. Heat stroke may lead to brain damage and death.	▪ Call 9-1-1 immediately ▪ Move victim to a cool, shaded area ▪ Fan the body ▪ Spray the body with water

Many chronic medical conditions are exacerbated by high temperatures, including cardiovascular disease and respiratory diseases such as asthma. Extreme heat days are associated with increases in hospital visits and EMS calls for heat-related illnesses along with cardiovascular and respiratory complications, renal failure, electrolyte imbalance, kidney stones, preterm birth, and negative fetal health outcomes. (Ebi, et al., 2018)

Warm nighttime temperatures may also reduce the body's ability to recover from extreme heat during the day, especially for people with underlying chronic ischemic conditions such as coronary heart disease.

(Sarofim, et al., 2016) The annual number of warm nights the Tehama County region is expected to increase over the next century, discussed in additional detail in this section and in Section 4.6 Climate Change Related Hazards.

Heat Stress Indicators

Humidity plays a large role in determining how hot conditions actually feel. As the air becomes saturated with moisture, the body loses its ability to shed excess heat through sweating. Warm and humid nights contributed to the fatal nature of the July 2006 heatwave in California. (Hulley, Dousset, & Kahn, 2020) A **heat index** describes what temperatures feel like to the human body, accounting for both air temperature and humidity. Figure 4-43 shows the NWS Heat Index and classification scheme, which are used to forecast heat watches, warnings, and advisories for local areas, described in Table 4-56.

HEAT INDEX CALCULATION CHART

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Source: National Weather Service.

HEAT INDEX CLASSIFICATION

Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

National Weather Service Heat Index Classifications. National Oceanic and Atmospheric Administration. Values are for shaded areas, sunny locations can increase value by up to 15°F. The **heat index** is what temperature the human body feels in relation to both humidity and temperature.

Figure 4-43: Head Index Calculation and Classification

The Heat Index was developed for shaded, light wind conditions; it does not capture hazards from exposure to direct sunlight and hot, dry winds, which may be relevant to populations who exercise or perform physical work in direct sun. The **Wet Bulb Global Temperature** (WBGT) is an indicator of heat stress for active populations that incorporates temperature, humidity, wind, solar radiation, and other weather parameters. (National Weather Service, 2022) Different heat stress indicators are useful for different applications; the WBGT may be a more useful for workplace safety or athletic programs; but the Heat Index can help reveal community-wide vulnerabilities for inactive populations who are able to seek shade during an extreme heat event.

Urban Heat Island Effect

Urbanized areas experience higher temperatures than natural landscapes, creating localized pockets of higher temperatures known as "**heat islands**". Roads and conventional building materials reflect less solar energy and absorb and re-emit more heat compared to trees and other vegetation. Heat islands can build throughout the day and worsen immediately after sunset as heat is slowly released from pavement and building material. The graph in Figure 4-44 demonstrates the impact of increased urbanization in relation to diurnal fluctuation of temperature extremes, with urban areas sometimes experiencing daytime highs 7°F greater than surrounding non-urban environments. (EPA, 2024)

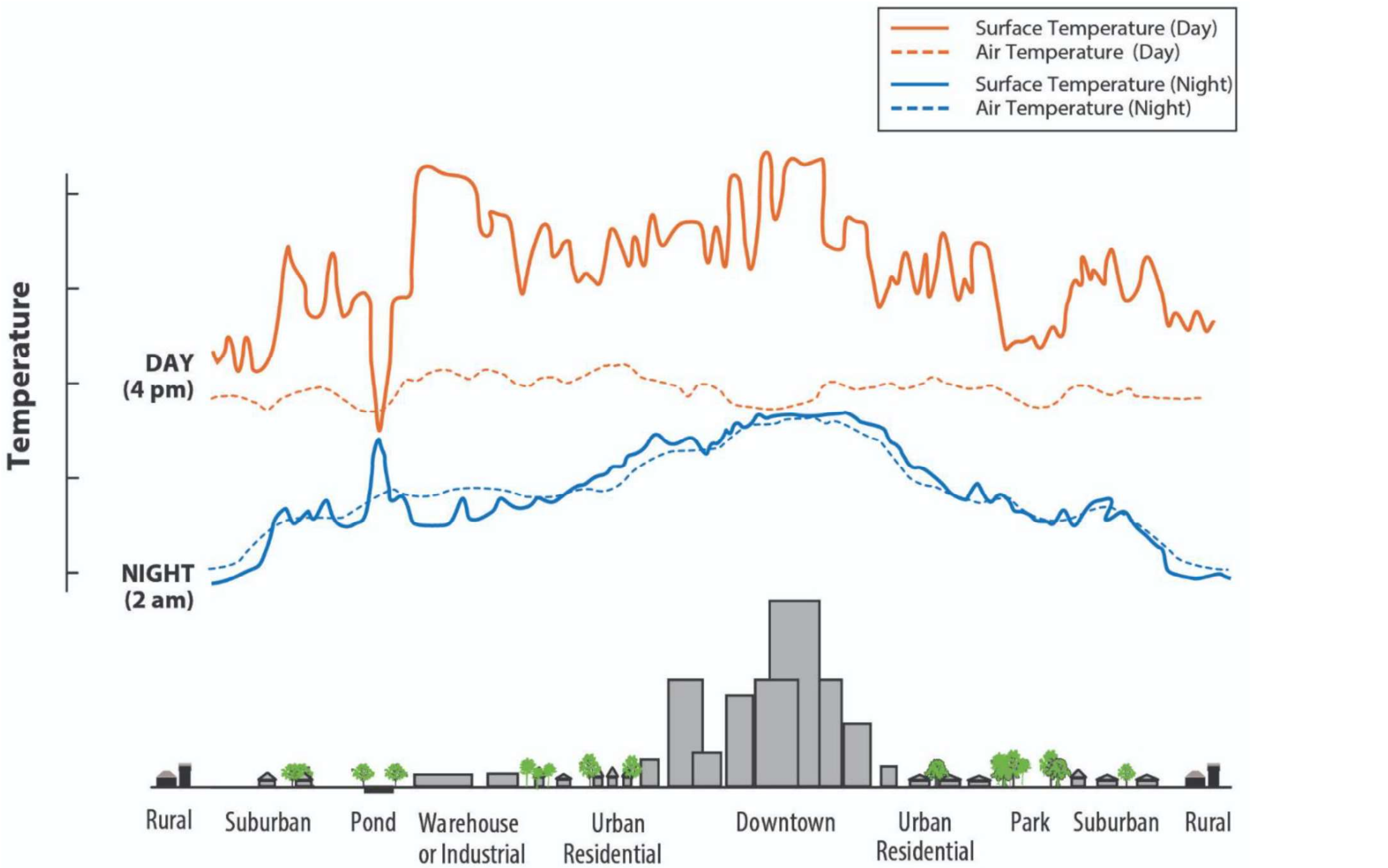


Figure 4-44: Urban heat island effect across a variety of natural and built landscape types
Source: Environmental Protection Agency

Urban heat islands disproportionately affect low-income urban populations and people of color, communities who are more likely to occupy older, higher density housing stock with lower urban forest cover and less access to air conditioning. A 2020 study of 108 urban areas across the U.S. found that neighborhoods subjected to Federal redlining policies in the first half of the 20th century, which discouraged investment in neighborhoods with high minority populations, currently experience surface temperatures ~5˚F higher than their non-redlined counterparts. (Hoffman, Shandas, & Pendleton, 2020).

Climate Change & Extreme Heat Events

Even under reduced emissions scenarios, climate change is expected to increase the frequency, intensity, and duration of extreme heat events in the Tehama County region. The emissions scenarios used as input for various climate models are the Representative Concentration Pathways (RCP), used in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) in 2014. Scenarios RCP 4.5 (lowered emissions through 2100) and RCP 8.5 (business as usual emissions through 2100). Both emissions scenarios are explored throughout this hazard profile section and are explained in additional detail in Section 4.6 Climate Change Related Hazards. The Sacramento Valley Regional Report from California's Fourth Climate Change Assessment highlights the importance of reducing heat pollution, eliminating urban heat islands, and managing exposure to heat in order to reduce the risks associated with more frequent heat waves due to climate change. (State of California, 2018)

4.5.7.1 Plans, Policies & Regulatory Environment

Very few formal regulations exist which pertain to extreme heat, except for workplace safety standards for outdoor workers. There are no state or local regulations pertaining to cooling technology standards for general residential buildings. Places of work, senior residential facilities, schools, and childcare centers are subject to state regulations for indoor air temperature standards, as described in detail below. Relevant planning documents at the local and county level are also outlined.

California Code of Regulations – Outdoor Heat Illness Prevention Standard

Title 8, Section 3395 of the California Code of Regulations establishes an Outdoor Heat Illness Prevention Standard for employers of outdoor workers. Established in 2006, it requires employers to provide water and shade access; to develop a heat illness prevention plan; and provide heat illness prevention and response training to employees. Specific procedures must be followed for temperatures exceeding 80- and 95-degrees Fahrenheit. Employers must provide shade, water, and monitor for signs of heat illness. Workers have a right to request breaks to cool off. (Cal. Code Regs. tit. 8, § 3395)

California Public Utilities Code – Section 779

Section 779 of the California Public Utilities Code prohibits utilities from terminating service due to nonpayment for those with qualifying life-threatening medical conditions.

Tehama County Cooling Center Activation & Cooling Zones

Cooling centers are activated by Tehama County Office of Emergency Services once daytime temperatures reach or exceed 106°F with coinciding nighttime temperatures of 80°F occurring for two days in a row. Exceptions may be made during PSPS events for those without power. Cooling zones are available at specific locations throughout the county anytime during normal hours of operation. These zones include libraries and the Red Bluff Community center. A list of currently available cooling zones is maintained by the Tehama County Sheriff's Office. (Tehama County Sheriff's Office, 2024)

4.5.7.2 Past Events

Although there have been no state or federal disaster declarations for extreme heat in Tehama County since the 2018 MJHMP, there have been several high heat events over the past two decades and especially in the past five years.

July 2006 California Heatwave

An extreme heat event in July 2006 over California and Nevada was directly attributed to 600 deaths statewide, 131 of which were from hyperthermia alone. (Hulley, Dousset, & Kahn, 2020) The event lasted approximately 10 days and set records across the state for daily observed minimum/maximum temperature, consecutive heat days, and statewide total energy consumption. (Edwards, et al., 2006)

September 2020 California Heatwave

A heatwave which struck California in September 2020 saw a record temperature reading for Northern and Southern California. In comparison to the 2006 event, dry conditions with high daytime temperatures helped fuel new and existing wildfires across the state. (Patel, 2020) This came on the tail end of another round of heatwaves and extreme heat days during the previous month of August. The September heatwave also is consistent with a trend towards extreme heat events occurring outside the "typical" season for California, which for the mid-20th century was May to late August. At present, extreme heat events occur beginning in March through September or October.

June 2022 North Sacramento Heatwaves

At the beginning of June 2022, Tehama County experienced a heatwave lasting three days with the City of Redding hitting 109 breaking both the daily and monthly high temperature records. Red Bluff reached 108, setting a new daily high temperature record. The Northern Sacramento Valley saw high temperatures in excess of 110 degrees during the event. On June 18, Redding and Red Bluff tied daily record high temperatures of 110 and 111 degrees respectively.

2024 Experiencing Ongoing Extreme Heat Events

July was the hottest month ever recorded for parts of California in the Sacramenta Valley. Cal OES issued statements recommending counties to open cooling centers. The valley areas within Tehama County were placed under Moderate HeatRisk by the National Weather Service.

4.5.7.3 Location

Extreme heat events affect the entirety of the planning area, with the highest temperatures being experienced in the Sacramento Valley. Urban areas are likely to experience higher peaks during heat wave events due to the urban heat island affect (See Figure 4-44).

Observed ground temperatures during extreme heat events may vary due to differences in housing density, building type, year of construction, access to air conditioning and presence of tree canopy.

4.5.7.4 Frequency & Probability of Future Events

Heat metrics are already on the rise in the Tehama County region and are expected to increase, even under reduced emissions scenarios. Figure 4-45 through Figure 4-48 depict modeled extreme heat days and warm nights for Tehama County under peak emissions 2040 scenarios (RCP 4.5) and continued (RCP 8.5) emissions scenarios through 2100. Annual occurrence of warm nights is projected to increase to a larger extent than extreme heat days, with upwards of 130 warm nights over 62˚F under RCP 8.5 compared to an average of 4 nights across the baseline period from 1961-1990. Additional climate variables, such as average annual minimum and maximum temperature, are discussed in the hazard profile for climate change.

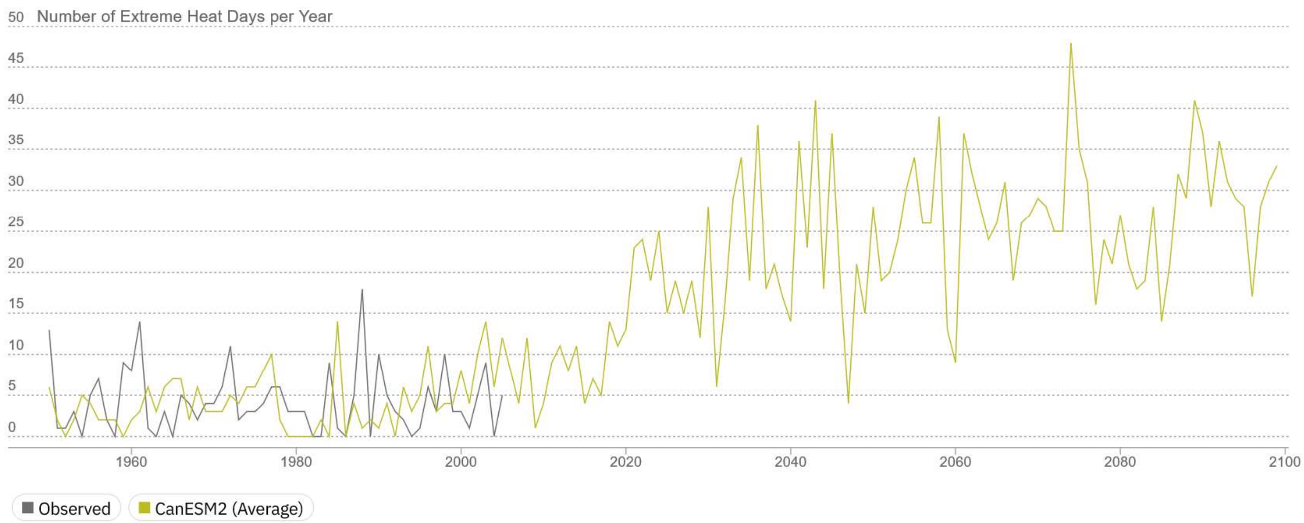


Figure 4-45: Projected increases in extreme heat days for Tehama County through 2100 (RCP 4.5).

Source: Cal-Adapt, NOAA COOP (historical), CanESM2 (modeled)

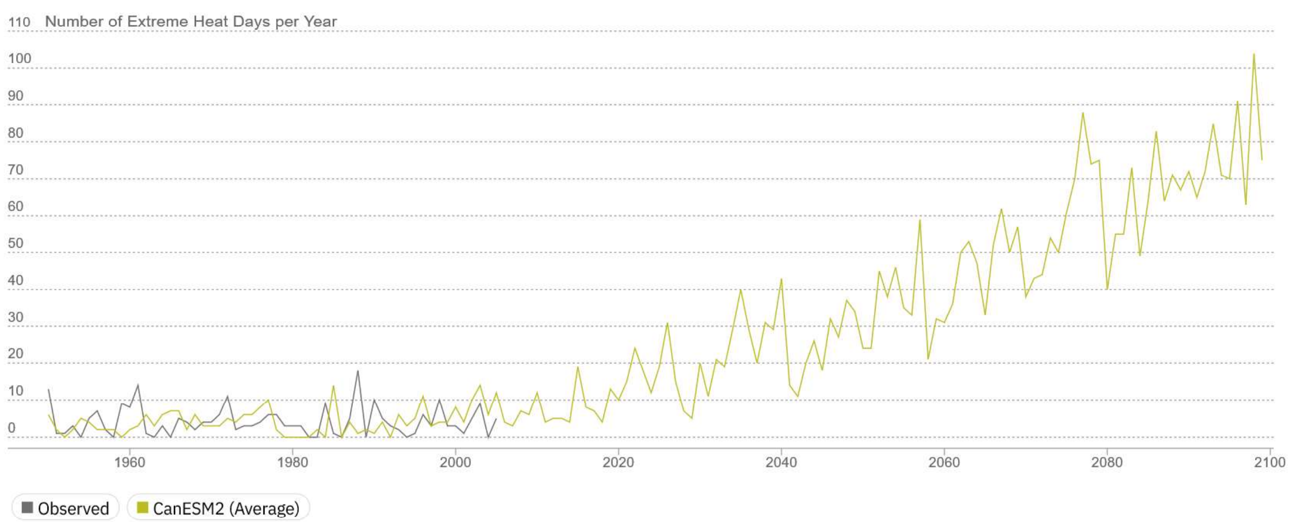


Figure 4-46: Projected increases in extreme heat days for Tehama County through 2100 (RCP 8.5).

Note shifts in Y-axis scale.

Source: Cal-Adapt, NOAA COOP (historical), CanESM2 (modeled)

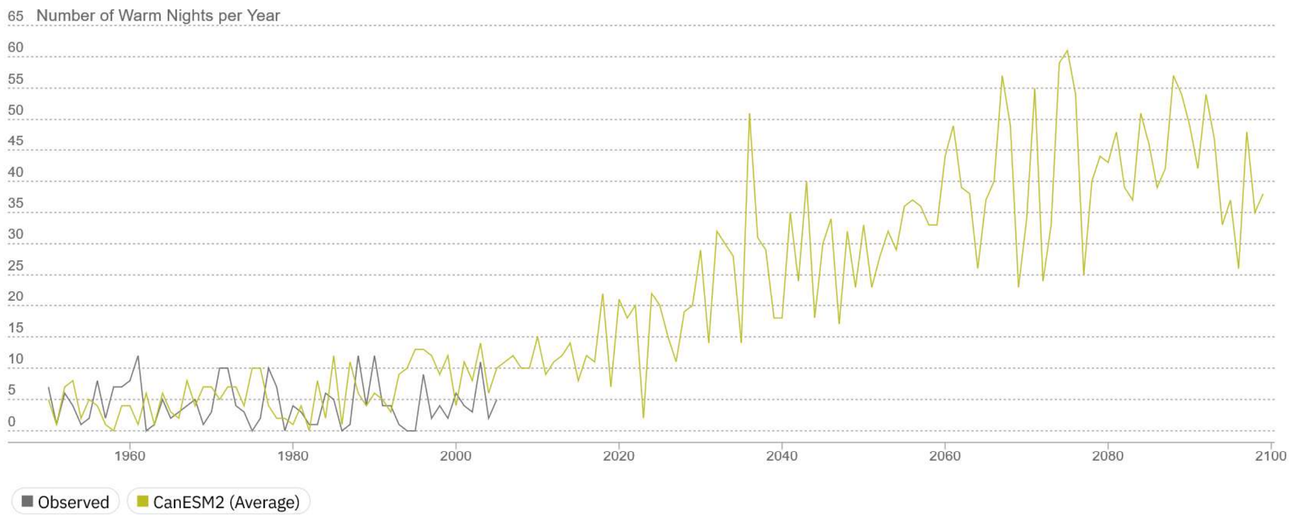


Figure 4-47: Projected increases in warm nights for Tehama County through 2100 (RCP 4.5).

Source: Cal-Adapt, NOAA COOP (historical), CanESM2 (modeled)

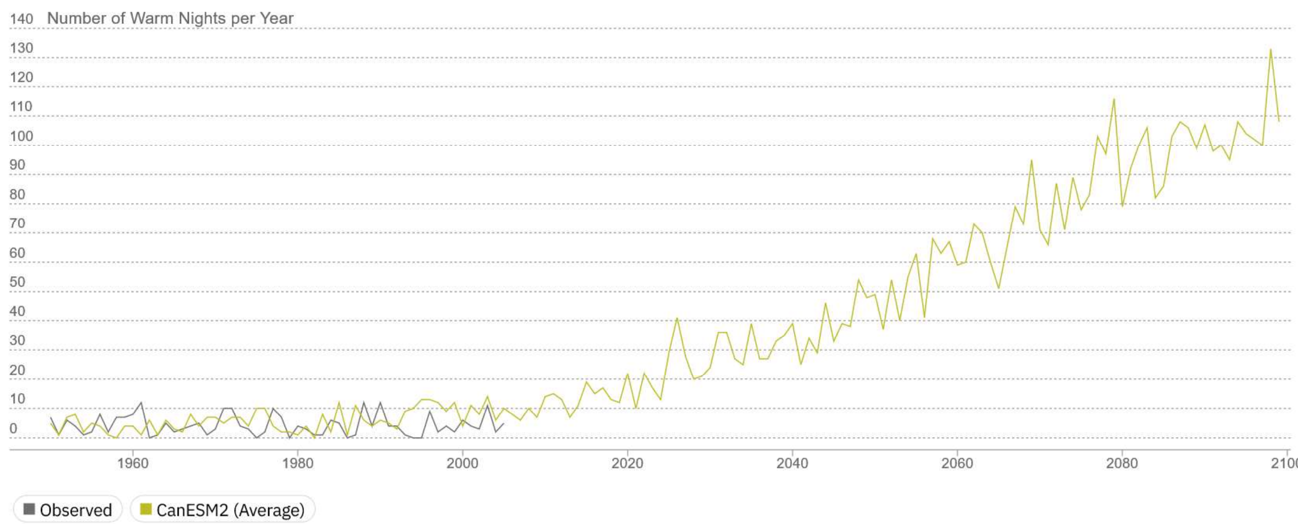


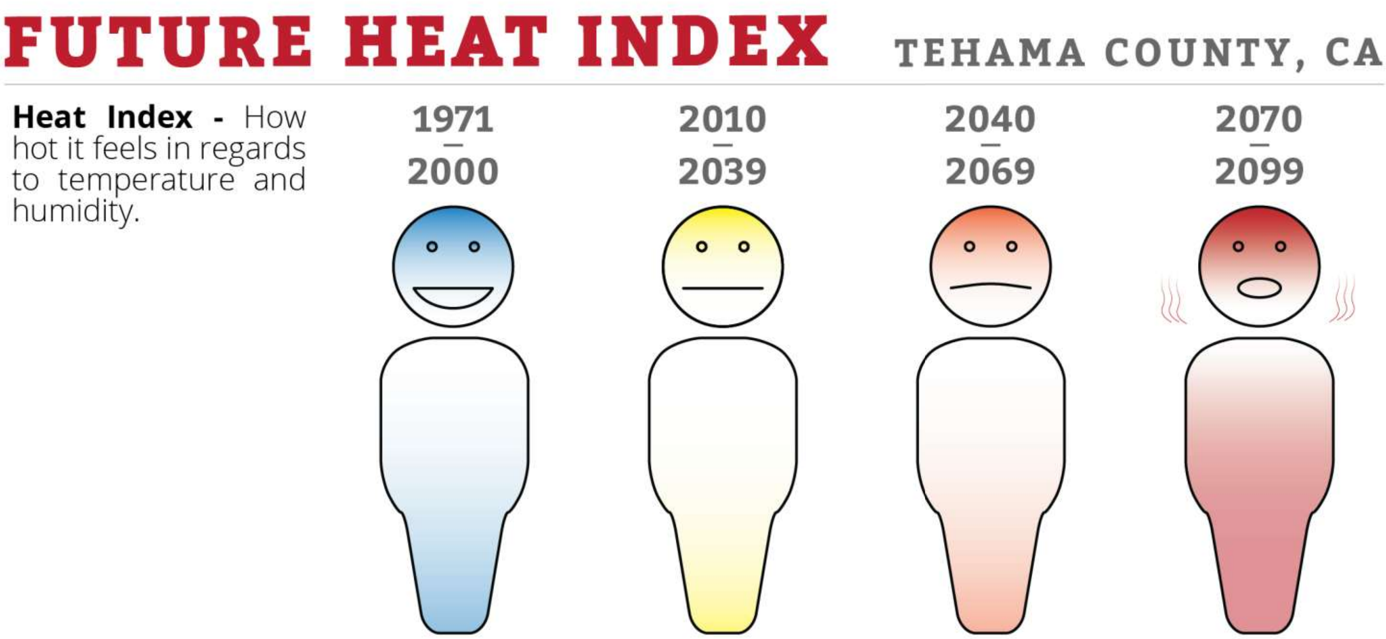
Figure 4-48: Projected increases in warm nights for Tehama County through 2100 (RCP 8.5).

Note shifts in Y-axis scale.
Source: Cal-Adapt, NOAA COOP (historical), CanESM2 (modeled)

4.5.7.5 Severity & Extent

Extreme heat is an annual occurrence in Tehama County, and climate change is causing an increase in the frequency and intensity of heat events. By mid-century 100% of Tehama County's valley residents will face at least moderate exposure to extreme heat. Some residents will be more able to adapt to a warming climate through changing behavior (i.e., adopting air conditioning); while others will face more pervasive vulnerability to heat, such as those with underlying medical conditions and seniors living alone. Increases in mortality and morbidity during extreme heat events can strain delivery of emergency services and impact overall health care system performance. Even the mountain regions of the county will face extreme heat relative to their baseline, which may be exasperated by air conditioning in homes and facilities being less common.

Past heatwaves have impacted power infrastructure in California with increases in peak residential and commercial energy usage for cooling. Existing system capacity could meet higher peak demand through the implementation of energy efficiency standards.



Threshold	1971–2000 RCP 4.5	1971–2000 RCP 8.5	2010–2039 RCP 4.5	2010–2039 RCP 8.5	2040–2069 RCP 4.5	2040–2069 RCP 8.5	2070–2099 RCP 4.5	2070–2099 RCP 8.5
≥90°F	80 Days	80 Days	96 Days	99 Days	110 Days	119Days	118 Days	**138 Days**
≥100°F	15 Days	15 Days	29 Days	32 Days	45 Days	58 Days	55 Days	**88 Days**
≥105°F	4 Days	4 Days	10 Days	11 Days	19 Days	28 Days	27 Days	**57 Days**

Days per year between the months of April and October where the heat index is greater than or equal to the thresholds above. Greenhouse Gas Representative Concentration Pathways (RCP) of both 4.5 (low) and 8.5 (high) are highlighted. Data from MACv2-METDATA UC, Merced. Accessed via climatetoolbox.org

Figure 4-49: Projected changes in annual occurrence of heat index values through 2100 (RCP 4.5 & 8.5)

4.5.7.6 Warning Time

The National Weather Service (NWS) issues heat-related alerts for local areas through HeatRisk, which assigns a numerical value ranging from 0 to 4 based on average historical conditions for a given local area and time of year as well as vulnerability of specific groups. The HeatRisk tool accounts for differences in local adaptations to climate; for example, residents of Florida are better prepared for 90 ˚F weather than residents of Alaska. Cal OES then propagates these alerts to impacted counties, as was done during the October, 2024 heat wave.

Table 4-55: NWS HeatRisk Value Definitions

HeatRisk Value	Risk of Heat Effects	Symbology
0	**Very Low**	Green
1	**Low**	Yellow
2	**Medium**	Orange
3	**High**	Red
4	**Very High**	Magenta

Table 4-56: NWS Heat Forecast Terms and Definition

Alert Type	Criteria	Duration
Excessive Heat Warning	HeatRisk (Red to Magenta) over large area	0-36 hours
Excessive Heat Watch	HeatRisk (Red to Magenta) over large area possible	12-72 hours
Heat Advisory	HeatRisk (Orange to Red) over large area	0-36 hours

4.5.7.7 Secondary Hazards

Wildfire & Air Quality

Extreme heat often coincides with conditions favorable to wildfires. Wildfires during extreme heat events can place excess health burdens on wildland firefights, impeding fire containment. Extreme heat further increases the negative effects of poor air quality from particulate as well as ozone related sensitivities. While wildfires do not always present during extreme heat events, extreme heat always increases the risk of human health impacts to poor air quality. Climate change has a long term negative effect on air quality metrics, including ozone. (State of California, 2018)

Utility Outages

High temperatures may increase peak electricity demand beyond system capacity as residents switch on AC units. Loss of power during a high heat poses a risk to human health by limiting access to air conditioning and disrupting continuous power supply for medical equipment. In California, high heat days may coincide with conditions that trigger Public Safety Power Shutoff (PSPS) events by utility providers to curb wildfire ignition risk from faulty powerline equipment, which could disrupt residential power supply for air conditioning and at-home medical equipment.

4.5.7.8 Climate Change

As described throughout this hazard profile, climate change is increasing intensity and duration of extreme heat events in Tehama County. The annual number of extreme heat days and warm nights is expected to increase by mid-century, with warm nights and average minimum temperature increasing more rapidly than extreme heat days and average maximum temperature. Additional information regarding climate change impacts to extreme heat is available in Section 4.6.

4.5.7.9 Extreme Heat Vulnerability Analysis

4.5.7.9.1 Population

The entire population of Tehama County is exposed geographically to extreme heat hazards. However, health impacts of extreme heat are distributed inequitably, with certain groups facing compounding vulnerability to extreme heat. Areas with higher populations of seniors and low-income households, and low cover of trees and green surfaces, face the highest population exposure to extreme heat hazards. Furthermore, the mountain based population within the county may be less likely to have air conditioning units installed in homes and facilities, increasing their risk to extreme heat even though their overall temperature experienced may be less than that of valley residents.

4.5.7.9.2 Property

In general, older structures are more vulnerable to the impacts of extreme heat. High temperatures can cause roofs to expand and warp and can weaken the structural integrity of buildings. Aging pipes are vulnerable to leaks or breakage during periods of increased water demand, as residents seek relief from heat by turning on sprinklers, filling pools, or using hoses.

4.5.7.9.3 Critical Facilities, Infrastructure & Lifelines

Many types of infrastructure are impacted by prolonged exposure to extreme heat including rails, roads, and aviation. High temperatures can lead to deterioration of pavement and expansion or buckling of sidewalks and roads. (Federal Highway Administration, 2013) Railroad tracks are at risk of buckling at temperatures exceeding 100˚F. (Union of Concerned Scientists, 2018)

Energy demand and grid vulnerability is expected to increase by mid-century for Northern California. (California Energy Comission, 2018) Increased energy usage and higher demand peaks can stress electricity grid system, while extreme temperatures can decrease the safe operating capacity of hardware. (US Department of Energy, 2019, p. 12)

4.5.7.9.4 Future Trends in Development

As further discussed in Section 4.3.4, Tehama County's population has remained relatively stable with a mild growth rate that is significantly lower than the statewide growth rate. The unincorporated areas of the county, in particular, have seen a steady decline in the rate of growth, partially due to a decline in net migration. Tehama is a relatively rural county, with an overall population density of approximately 22 people per square mile, which is lower than California as a whole. This growth trend is expected to continue.

Although population growth and new development continues to occur across the county, energy efficiency and worker safety regulations help address heat-related hazards by limiting exposure, and local services include providing community cooling centers. As discussed in Section 4.3.6, this regulatory framework includes the county's General Plan, as well as those general plans of other participating jurisdictions, that addresses public safety, resource conservation, and facility and infrastructure improvement and expansion, among other topics. These general plans are periodically reviewed as part of hazard mitigation capability assessments, enabling local agencies to identify potential gaps or deficiencies. Any identified needs can be integrated as mitigation actions, thereby strengthening each jurisdiction's ability to support sustainable development and manage extreme heat impacts effectively.

In particular, the conservation, open space, and safety elements of these general plans establish standards and policies for the protection of the community from extreme heat hazards by predicting community needs for cooling center and planning for mitigation measures, such as urban forestry and greening. All populations and new development within the county could be impacted by extreme heat.

California residential and building codes require residential units to have heating, but this requirement does not exist for air conditioning. The 2022 California Building Code includes provisions for energy efficiency that may help increase power grid resilience to peak demand during heat events.

4.5.7.9.5 Extreme Heat Problem Statements

As part of the mitigation action identification process, the Planning Stakeholders identified issues and weaknesses, also called problem statements, for the Tehama County facilities. Extreme heat problem statements for the city are listed in Table 4-43.

Identifying these common issues and weaknesses helps the Planning Stakeholders understand the breadth of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and the corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-43 and Table 5-6.

Table 4-57 Extreme Heat Problem Statements

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-AH-TC-116	High Heat	Threat	PRV - Prevention , PPRO - Property Protection , PE&A - Public Education & Awareness	**Tehama County**	As more households across the County elect to use indoor air conditioning, energy demand during extreme heat events could exceed peak capacity and disrupt power supply to homes, businesses, and essential services.	Y	ma-AH-CoT-105, ma-AH-CoT-111, ma-AH-CoT-112
ps-HH-TC-117	High Heat	Impact	PRV - Prevention , PE&A - Public Education & Awareness	**Tehama County**	Socially isolated seniors who lack access to air conditioning face higher rates of heat-related death and illness during extreme heat events	Y	ma-HH-TC-105, ma-HH-TC-106, ma-HH-CoT-107, ma-HH-RB-108, ma-HH-CC-109

4.5.8 Dam Failure Hazard

Dam failures in the United States typically occur in one of four ways:

- Overtopping of the primary dam structure, which accounts for 34 percent of all dam failures, can occur due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage can also cause dam failure. These account for 30 percent of all dam failures.
- Failure due to piping and seepage accounts for 20 percent of all failures. These are caused by internal erosion due to piping and seepage, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure.
- Failure due to problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks, constitutes 10 percent of all failures.

The remaining 6 percent of U.S. dam failures are due to miscellaneous causes. Many dam failures in the United States have been secondary results of other disasters, such as earthquakes, landslides, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage. The most likely disaster-related causes of dam failure in Tehama County are earthquakes, excessive rainfall and landslides. (Association of State Dam Safety Officials, 2024)

Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

4.5.8.1 Regulatory Oversight

The potential for catastrophic flooding due to dam failures led to the passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of every major dam in the country, aiming to identify and mitigate dam failure risks and protect lives and property. In California, this federal program complements state-level legislative measures, including SB 92 and SB 854, which further regulate dam safety and emergency planning.

California Senate Bill 92, passed in 2021, amended existing state laws to enhance dam safety regulations by requiring the development and submission of Emergency Action Plans (EAPs) for dams under state jurisdiction. SB 92 expanded the state's capacity to enforce compliance by authorizing the Department of Water Resources (DWR) to establish administrative penalties for dam owners failing to meet regulatory requirements.

In addition, California Senate Bill 854, enacted in 2018, increased funding and support for the Division of Safety of Dams (DSOD), ensuring that resources are in place to adequately assess, inspect, and enforce safety standards for dams across the state. SB 854 also emphasized the importance of emergency preparedness, mandating more frequent updates to EAPs and stronger coordination with local emergency management agencies.

4.5.8.1.1 California Division of Safety of Dams

The California Division of Safety of Dams (DSOD), part of the Department of Water Resources, oversees dam safety programs at the state level. In accordance with SB 92, DSOD reviews and approves the Emergency Action Plans (EAPs) required by Government Code Section 8589.5. These EAPs, grounded in DWR-approved inundation maps, outline actions for emergency situations to minimize potential loss of life and property damage. SB 854 has bolstered DSOD's resources to ensure these processes are thorough and effective, with annual inspections and additional resources allocated to enhance the frequency and depth of dam stability reviews.

When a new dam is proposed, DSOD staff inspect the site and assess design plans to ensure that the dam meets all safety requirements, particularly with respect to geologic and seismic considerations. Once construction is approved, DSOD inspects the dam annually, with roughly a third of these inspections including detailed instrumentation reviews. Under SB 854, DSOD also reviews the stability of dams based on the latest hydrologic and seismic data, ensuring all safety measures reflect California's evolving environmental risk profile.

4.5.8.1.2 U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency's capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety (U.S. Army Corps of Engineers, 1997).

4.5.8.1.3 Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) has the largest dam safety program in the United States. The FERC cooperates with a large number of federal and state agencies to ensure and promote dam safety and, more recently, homeland security. There are 3,036 dams that are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC staff inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems

- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

Every five years, an independent consulting engineer, approved by the FERC, must inspect and evaluate projects with dams higher than 10 meters (32.8 feet), or with a total storage capacity of more than 2,000 acre-feet.

FERC staff monitors and evaluates seismic research in geographic areas where there are concerns about seismic activity. This information is applied in investigating and performing structural analyses of hydroelectric projects in these areas. FERC staff also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC staff visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication *Engineering Guidelines for the Evaluation of Hydropower Projects* guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

The FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

4.5.8.2 Past Events

Although there have been no state or federal disaster declarations for dam or levee failures since the 2018 MJHMP, there have been multiple events threatening failures over the past decade.

On December 3, 2014, heavy rain showers and thunderstorms brought record rainfall and flooding issues to portions of the Central Valley and foothills. There were two berm levees which failed in Tehama County, flooding over 200 homes and damaging farms and orchards. Significant traffic delays were caused by road flooding across interior Northern California. Snow levels remained above 7500 feet, so snowfall was limited to higher Sierra peaks and Lassen Peak.

There was flooding and impacts along Highway 99 from numerous creeks overtopping their banks in addition to earthen berm or earthen levee failures. There were issues on the following creeks: Salt Creek (Overtopped at Highway 99 and Highway 36 location), Antelope Creek (Private earthen berm failure at Rancho Ave), Craig Creek (Overtopped near Craig Road and Rancho Ave), Dye Creek (Over topped and earthen berm failure between Shasta Blvd. and 62nd Ave). Highway 99 was closed from highway 36 to Aramayo Way for many hours (Wednesday evening through early Thursday morning) until the water receded and things could be cleaned up. There were 213 homes impacted from the flooding, with significant damage from water and mud. Many homes had several feet of water. Fields and orchards were also flooded. Damage to homes, bridges, fencing, crops, and beehives totaled $2.5 million. Repairs and remediation to the berms totaled $4.25 million. (Tehama County Flood Control and Water Conservation District, 2017). While these failures are not classified as dam failures, the risk of levee and embankment failure increases with comorbid events associated with dam failure, such as heavy rains. Dam failure has the potential to propagate downstream failure of other dams, levees and embankments.

In January 2019, two 30-inch outlet pipes in the Misselbeck dam located in Shasta County had been plugged with debris from the Carr Fire, forcing the lake to rise and wash over a spillway that state officials deemed unsafe. By early February 2019, water was again flowing out of the pipes, allowing the lake to drop to a safe level. The damn needs $2.1 million in repairs and litigation is pending on funding repairs.

4.5.8.3 Location

According to the National Inventory of Dams, there are 10 Dams within the boundary of Tehama County, see Table 4-58 for a listing of these dams. Most of the risk to assets from dam inundation is from dams upstream of Tehama County along the Sacramento River. The dams with mapped inundation zones as provided by California DWR and CalOES with impacts to Tehama county are listed in Table 4-60 and the related exposure analysis tables.

Table 4-58: Dams in Tehama County (NID)

Dam Name	NID ID	Owner Names	Primary Purpose	Year Completed	Hazard Potential Classification
Rye	CA00528	T.M. Cattle Company	Water Supply	1959	Low
Black Butte Reregulating	CA01226	City of Santa Clara	Other	1989	Low
Sunflower	CA01116	Frank and Vicky Dawley	Other	1976	Low
Corral	CA00527	T.M. Cattle Company	Water Supply	1959	Low
Red Bluff Diversion Dike 1	CA10181	RECLAMATION	Irrigation	1963	Low
Red Bluff Diversion Dike 2	CA10181	RECLAMATION	Irrigation	1963	Low
Red Bluff Diversion	CA10181	RECLAMATION	Irrigation	1963	Low
Orwick Dam (Blm)	CA10355	DOI BLM	Irrigation	1950	Low
Eagle Canyon Canal Diversion	CA82567	PG&E	Hydroelectric	1910	Low
Black Butte Dam	CA10102	USACE	Flood Risk Reduction	1963	High

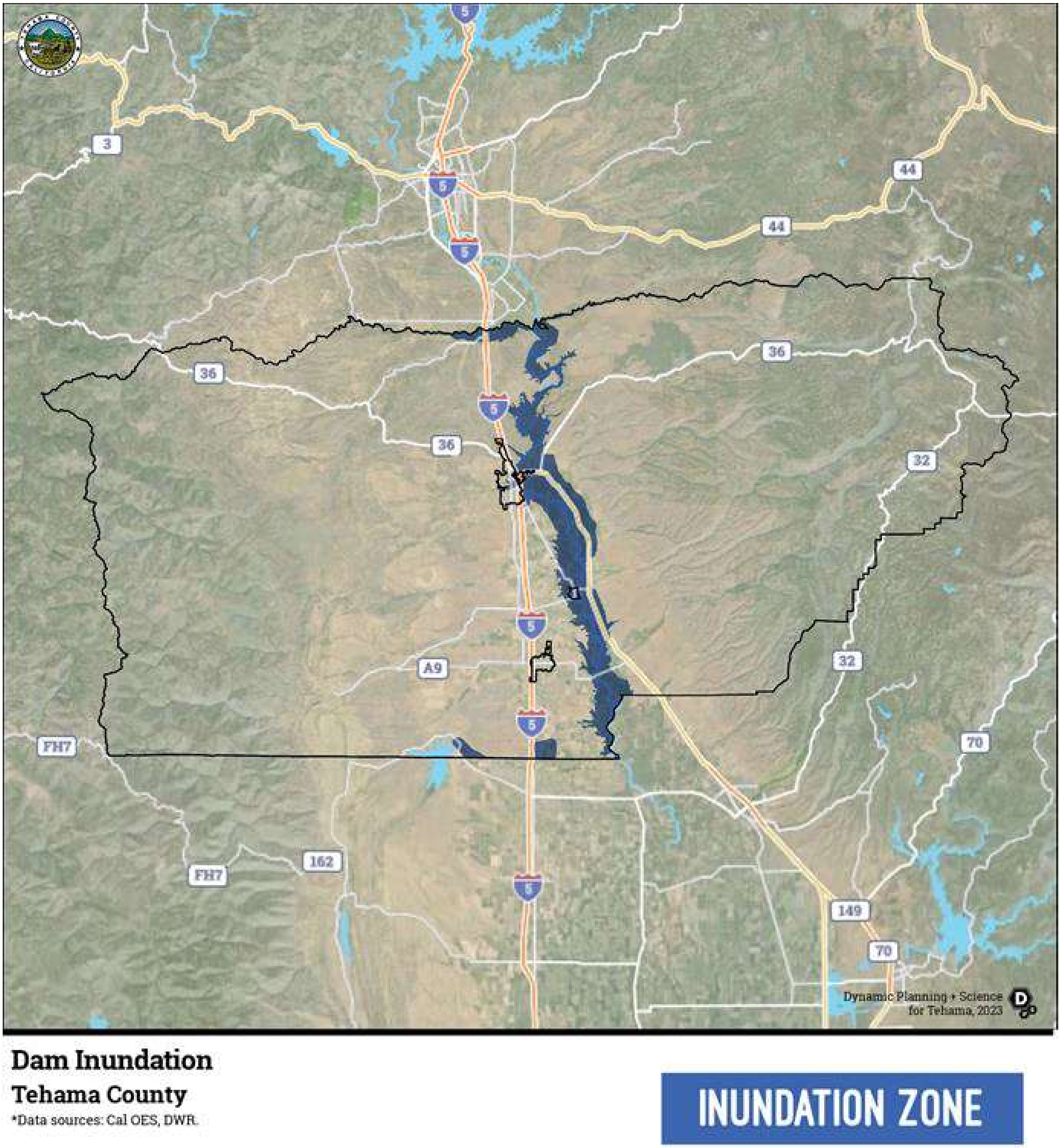


Figure 4-50: Dam Inundation Zones in Tehama County

4.5.8.4 Frequency

Dams are constructed with safety features known as "spillways" that allow water to overtop the dam if the reservoir fills too quickly. Spillway overflow events, often referred to as "design failures," result in increased discharges downstream and increased flooding potential. The "residual risk" associated with dams is the risk beyond that for which safeguards have been implemented. However, the probability of any type of dam failure is low in today's regulatory and dam safety oversight environment. Dam failure events usually coincide with events such as earthquakes, landslides and excessive rainfall and snowmelt.

4.5.8.5 Severity

Dam failure can be catastrophic to all life and property downstream. FEMA developed the classification system shown in Table 4-59 for the hazard potential of dam failures. The California Department of Water Resources (DWR) uses a classification system for dam hazard potential that aligns closely with FEMA's but has some distinctions including impacts on state-protected resources. Both systems evaluate hazard potential based on the expected loss of life and damage to property, environmental resources, and critical infrastructure. This hazard potential classification system categorizes dams based on the probable loss of human life and the impacts on economic, environmental, and lifeline interests. Improbable loss of life exists where persons are only temporarily in the potential inundation area. For instance, this hazard potential classification system does not contemplate the improbable loss of life of the occasional recreational user of the river and downstream lands, passer-by, or non-overnight outdoor user of downstream lands. It should be understood that in any classification system, all possibilities cannot be defined. High usage areas of any type should be considered appropriately. Judgment and common sense must ultimately be a part of any decision on classification. Further, no allowances for evacuation or other emergency actions by the population should be considered because emergency procedures should not be a substitute for appropriate design, construction, and maintenance of dam structures.

Table 4-59: FEMA Dam Hazard Potential Classification

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Source: Federal Guidelines for Dam Safety- Hazard Potential Classification Systems for Dams, April 2004

4.5.8.6 Warning Time

Warning time for dam failure depends on the cause of failure. In an event of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, there may be no warning time. A dam's structural type also affects warning time. Earthen dams do not tend to fail instantaneously. Once a breach is initiated, discharging water erodes the breach until the reservoir water is depleted or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach. The time of breach formation ranges from a few minutes to a few hours. Several planning partners have established protocols for warning and response to imminent dam failure in the flood warning portion of their emergency operations plans. These protocols are tied to emergency action plans created by the dam owner.

Development of Emergency Action Plans (EAPs) for all high and significant hazard potential dams for Tehama County is critical to reducing the risks of loss of life and property damage from dam failures. EAPs have been developed for dams of interest in this MJHMP. The EAP contains procedures and information to assist the dam owner in issuing early warning and notification messages to emergency management authorities. The EAP also contains inundation maps to identify the areas subject to flooding in the unlikely event of dam failure.

EAPs are critical in identifying areas downstream from dams requiring warning and evacuation in the event of dam failure. Documented cases have demonstrated that warning and evacuation time for EAPs can dramatically influence the loss of life. Loss of life can vary from 0.02 percent of the persons-at-risk when the warning time is 90 minutes to 50 percent when less than 15 minutes (Graham, 1988). Costa (85-560, 1985) reported that the average number of fatalities per dam failure is 19 times greater when there is little to no warning. Dam breach inundation studies usually assume one of two failure scenarios:

- Flows from a dam failure during "fair weather" or "sunny day" conditions with the reservoir at the normal pool level and receiving normal inflow (usually insignificant). A fair weather failure is generally considered to have the most potential for loss of human life, primarily due to the element of surprise.
- Flows from a dam failure during flood conditions or the inflow design flood. Failure during flood conditions is considered to show the upper limit of inundation and to have less potential for loss of human life because the downstream population is "on alert." The flood conditions scenario is more expensive to analyze due to the additional cost for the necessary watershed and spillway studies.

Inundation mapping shows a continuous "line of inundation" identifying the area potentially at risk in event of dam failure. It starts at the dam and continues downstream to a point where the breach flood no longer poses a risk to life and property damage, such as a large river or reservoir with the capacity of storing the flood waters. The need to consider the "domino effect" should be made on a case-by-case basis if the assumed failure of a dam would cause the failure of any downstream dams.

Important to Note: EAPs are not publicly available but are on file at the Tehama County Sheriff's Office. Information provided on flooding conditions at downstream locations will include:

- Distance downstream
- Arrival time of leading edge of flood wave
- Peak flow depth, incremental rise, or water surface elevation (as appropriate)
- Peak velocity

4.5.8.7 Secondary Hazards

Dam failure can cause severe downstream flooding, depending on the magnitude of the failure. Other potential secondary hazards of dam failure are landslides around the reservoir perimeter, bank erosion on the rivers, and destruction of downstream habitat.

4.5.8.8 Climate Change Impacts

Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures. If the hygrograph changes, then dam operators may be forced to release increased volumes earlier in a storm cycle to maintain required margins of safety. Such early releases can increase flood potential downstream. Throughout the western United States, communities downstream of dams are already experiencing increases in stream flows from earlier releases from dams. In 2017, areas of Tehama County experienced the effects of early releases from the Shasta Dam.

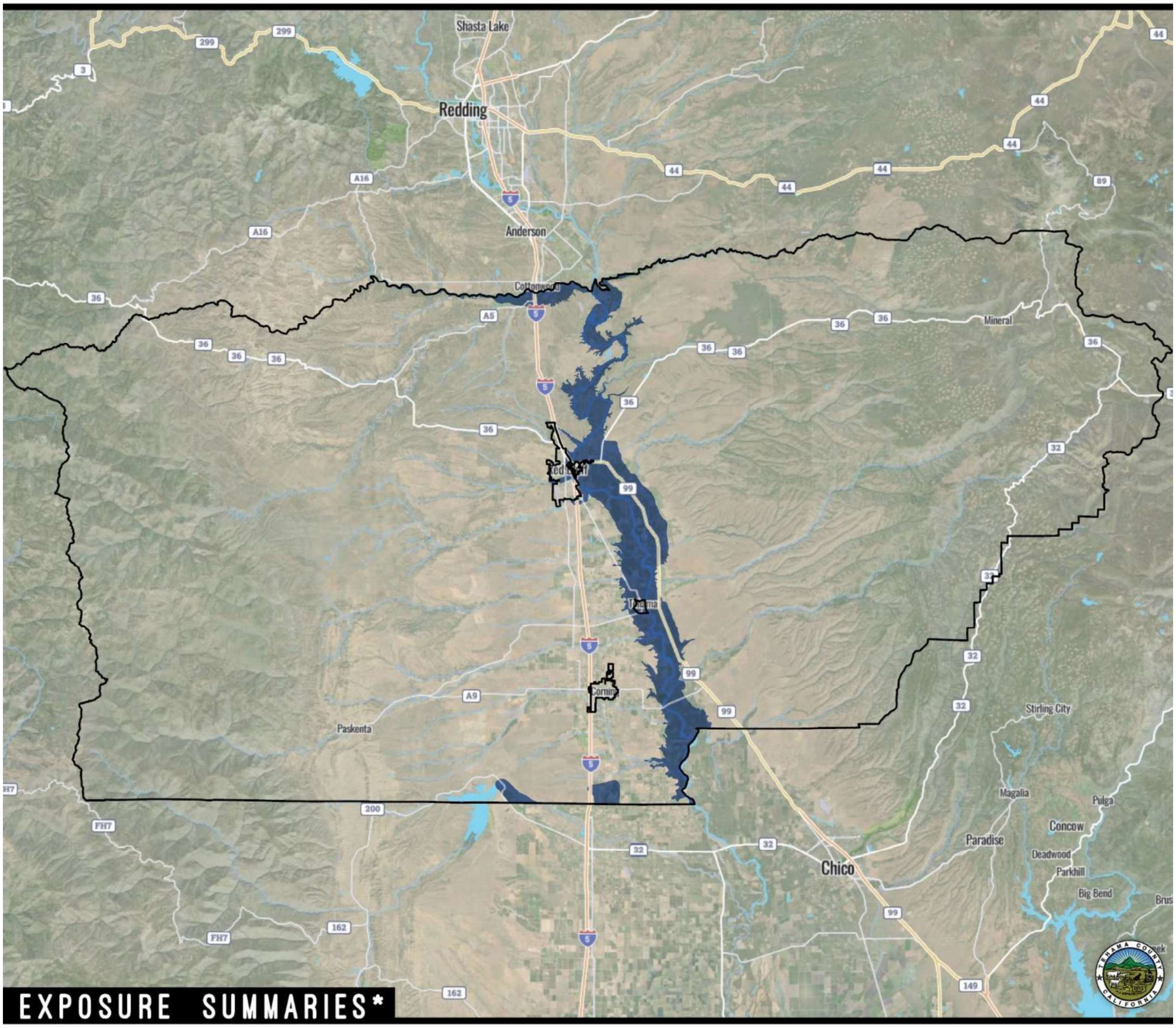
4.5.8.9 Dam Failure Vulnerability Analysis

The primary danger associated with dam failure is the high velocity flooding downstream of the dam and limited warning times for evacuation. Vulnerability varies by community and depends on the particular dam profile and the nature and extent of the failure. Vulnerable population is present directly below downstream elements of the dam, especially those incapable of escaping the area within the allowable time frame. This population includes the elderly and young who may be unable to self-evacuate from the inundation area. The vulnerable population also includes those who would not have adequate warning from a television or radio emergency warning system. Dam inundation zones created by Cal OES and California DWR were used to develop at risk populations and loss estimations for dam failure.

Dam failure exposure numbers were generated using Tehama County Assessor and parcel data. County assessor data does not include tax exempt structures, such as federal and local government buildings. All data sources have a level of accuracy acceptable for planning purposes. Figure 4-51 shows parcels, critical infrastructure and population at risk to dam inundation.

DAM INUNDATION EXPOSURE

TEHAMA COUNTY



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
13,654	32%

Count Includes: INUNDATION

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
4,909	27%

Count Includes: INUNDATION

PARCEL VALUE IN HAZARD AREA

	Value	Exp. Rate**
Sum of Improvement Value	$2,210,083,917	28%
Sum of Content Value	$1,282,430,474	28%

Count Includes: INUNDATION

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**	Count/Sum Includes:
Essential Facilities	4	18%	INUNDATION
Hazmat	42	26%	
High Potential Loss	58	41%	*Sum of Transportation & Lifeline Linear Mileage*
Transportation & Lifeline	120	18%	389 6%

MAP LEGEND

INUNDATION ZONE

*Exposure summaries include dam inundation areas. Hazard data source: DWR, Cal OES.
**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

Dynamic Planning + Science for Tehama County, 2023

Figure 4-51: Tehama County Dam Inundation Exposure Risk Snapshot

4.5.8.9.1 Population

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area within the allowable time frame. This population includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television, radio emergency warning system, have not registered with reverse 911, or do not have cell phones that can receive amber alerts. The potential for loss of life is affected by the capacity and number of evacuation routes available to populations living in areas of potential inundation. The entire population in a dam failure inundation zone is exposed to the risk of a dam failure. The estimated population living in the inundation area mapped for this risk assessment is summarized in Figure 4-51. Table 4-60 shows the population to dam failure in Tehama County.

	Total Population
Unincorporated County	42,150

Dam Inundation Zone	Population Count	% of Total
Black Butte	112	*0.27%*
Boyd No 1	34	*0.08%*
Boyd No 2	47	*0.11%*
Chester Diversion	-	*0.00%*
Macumber	28	*0.07%*
Misselbeck	472	*1.12%*
North Battle Creek	26	*0.06%*
Null	18	*0.04%*
Philbrook	-	*0.00%*
Pit No 3	4,357	*10.34%*
Pit No 6	2,936	*6.97%*
Pit No 7	2,389	*5.67%*
Round Valley	-	*0.00%*
Shasta	13,222	*31.37%*
Truett	-	*0.00%*
Whiskeytown	8,620	*20.45%*
Total*	**13,654**	**32.39%**

**Total population is not equal to sum of all dam inundation zones due to dissolved overlapping inundation areas.*

Table 4-60: Dam Failure Vulnerability Snapshot

4.5.8.9.2 Property

Vulnerable properties are those closest to the dam inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. This includes all roads, railroads and bridges in the path of the dam inundation. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

The county Assessor's parcel data was used as the basis for the inventory of current market values and content value summaries, adjusted for estimated replacement cost. Refer to Appendix A for more detailed explanation of data used in analyses. Table 4-61 shows the count of at-risk parcels and their associated building and content exposure values to dam failure.

The most vulnerable properties are those closest to the dam itself as they would experience the largest, most destructive surge of water. A total of $3,492,514,391 worth of building replacement value and contents combined are exposed to dam failure hazards within the County boundaries representing 26.6% of the total value in the unincorporated county.

Table 4-61: Parcel Values at Risk from Dam Inundation

	Total Parcels		Total Market Value ($)	Total Content Value ($)	Total Value ($)	
Unincorporated County	18,434		$7,780,396,144	$4,574,842,260	$12,355,238,404	
Dam Inundation Zone	**Parcel Count**	**% of Total**	**Market Value Exposure ($)**	**Content Value Exposure ($)**	**Total Exposure ($)**	**% of Total**
Black Butte	72	0.4%	$15,853,745	$11,370,623	$27,224,368	0.2%
Boyd No 1	0	0.0%	$0	$0	$0	0.0%
Boyd No 2	0	0.0%	$0	$0	$0	0.0%
Chester Diversion	0	0.0%	$0	$0	$0	0.0%
Macumber	0	0.0%	$0	$0	$0	0.0%
Misselbeck	2	0.0%	$898,554	$898,554	$1,797,108	0.0%
North Battle Creek	0	0.0%	$0	$0	$0	0.0%
Null	0	0.0%	$0	$0	$0	0.0%
Philbrook	0	0.0%	$0	$0	$0	0.0%
Pit No 3	1,367	7.4%	$692,147,685	$380,150,290	$1,072,297,976	8.7%
Pit No 6	878	4.8%	$418,704,364	$223,081,412	$641,785,777	5.2%
Pit No 7	615	3.3%	$293,983,159	$155,980,978	$449,964,137	3.6%
Round Valley	0	0.0%	$0	$0	$0	0.0%
Shasta	4,825	26.2%	$2,190,327,579	$1,268,474,670	$3,458,802,249	28.0%
Truett	0	0.0%	$0	$0	$0	0.0%
Whiskeytown	3,213	17.4%	$1,566,679,475	$895,918,034	$2,462,597,509	19.9%
Dam Inundation Area*	**4,909**	**26.6%**	**$2,210,083,917**	**$1,282,430,474**	**$3,492,514,391**	**28.3%**

4.5.8.9.3 Critical Facilities

Critical Facilities at risk to dam inundation are on file with the County and for national security purposes can only be accessed through Tehama County's Sheriff's Office. As a general note, low-lying areas are vulnerable to dam inundation, especially transportation routes. This includes all roads, railroads, and bridges in the flow path of water. The most vulnerable critical facilities are those in poor condition that would have difficulty withstanding a large surge of water. Utilities such as overhead power lines and communication lines could also be vulnerable. Loss of these utilities could create additional compounding issues for emergency management officials attempting to conduct evacuation and response actions. GIS analysis determined that 224 of the planning area's critical facilities are in a mapped dam inundation area, as summarized in Table 4-62 and Table 4-63.

Table 4-62: Critical Infrastructure Points in Dam Inundation Zones

Infrastructure Type	TOTAL FEATURE COUNT	Black Butte	Boyd No 1	Boyd No 2	Chester Diversion	Macumber	Misselbeck	North Battle Creek	Null	Philbrook	Pit No 3	Pit No 6	Pit No 7	Round Valley	Shasta	Truett	Whiskeytown
Essential Facility	4	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	2
Emergency Operations Center	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fire Station	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	1
Hospital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Law Enforcement	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
High Potential Loss	58	3	-	-	-	-	-	-	-	-	18	17	14	-	55	-	33
Adult Residential Facility	12	-	-	-	-	-	-	-	-	-	8	7	7	-	12	-	11
Child Care Center	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1
Dam	4	2	-	-	-	-	-	-	-	-	2	2	2	-	2	-	2
Historic Building	1	-	-	-	-	-	-	-	-	-	1	1	1	-	1	-	1
Power Plant	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Real Property Asset	23	-	-	-	-	-	-	-	-	-	6	6	3	-	23	-	9
Residential Elder Care Facility	3	-	-	-	-	-	-	-	-	-	1	1	1	-	3	-	2
School	11	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	7
Transportation and Lifeline	120	14	-	-	-	-	-	4	-	-	34	22	20	-	103	-	57
Airport	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bridge	94	6	-	-	-	-	-	3	-	-	27	16	16	-	85	-	48
Cell Tower	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
FM Transmission Tower	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microwave Service Tower	7	5	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Natural Gas Station	7	2	-	-	-	-	-	-	-	-	1	-	-	-	5	-	2
Paging Transmission Tower	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Park	7	-	-	-	-	-	-	1	-	-	4	4	2	-	7	-	5
Substation	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Wastewater Treatment Facility	2	-	-	-	-	-	-	-	-	-	2	2	2	-	2	-	2
Hazmat	42	-	-	-	-	-	-	-	-	-	9	6	-	-	42	-	27
Geotracker CleanupSite	7	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	4
HWTS Active Facility	35	-	-	-	-	-	-	-	-	-	9	6	-	-	35	-	23
Grand Total	**224**	**17**	**-**	**-**	**-**	**-**	**-**	**4**	**-**	**-**	**61**	**45**	**34**	**-**	**204**	**-**	**119**

**Real Property Assets are digitized insurance rolls for demonstrating value and ownership and may have overlapping points with other categories such as fire stations and law enforcement.*

Table 4-63: Miles of Critical Infrastructure (Linear) in Dam Inundation Zones

Infrastructure Type (linear)	TOTAL DAM EXPOSURE	Black Butte	Boyd No 1	Boyd No 2	Chester Diversion	Macumber	Misselbeck	North Battle Creek	Null	Philbrook	Pit No 3	Pit No 6	Pit No 7	Round Valley	Shasta	Truett	Whiskeytown
NG Pipeline	15.9	3.4	-	-	-	0.0	-	0.1	-	-	6.2	4.4	2.9	-	12.0	-	8.6
Railroad	15.4	2.0	-	-	-	-	0.0	-	-	-	1.1	0.9	0.5	-	13.3	-	6.4
Street	328.4	19.7	-	-	-	0.0	-	0.1	0.1	-	83.4	54.7	31.4	-	305.8	-	188.0
4WD trail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4WD trail, major	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alley	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cul-de-sac	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Driveway	12.3	1.4	-	-	-	-	-	-	-	-	1.0	0.6	0.1	-	10.9	-	6.5
Interstate	5.7	1.3	-	-	-	-	-	-	-	-	1.6	1.6	1.6	-	4.4	-	2.0
Local road	237.5	13.0	-	-	-	0.0	-	0.1	0.1	-	63.9	42.6	22.4	-	222.7	-	141.4
Local road, major	4.8	-	-	-	-	-	-	-	-	-	1.0	0.3	-	-	4.8	-	2.1
Primary highway	18.8	-	-	-	-	-	-	-	-	-	0.7	0.1	0.0	-	18.8	-	13.5
Primary highway, major	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1
Ramp	1.8	-	-	-	-	-	-	-	-	-	0.3	0.3	0.3	-	1.8	-	0.5
Service road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
State/county highway	42.7	4.0	-	-	-	0.0	-	0.0	0.0	-	10.2	4.5	2.2	-	37.7	-	17.2
Thoroughfare, major	4.7	-	-	-	-	-	-	-	-	-	4.7	4.7	4.7	-	4.7	-	4.7
Walkway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transmission Line	29.7	0.7	-	-	-	0.3	0.3	0.3	0.1	-	4.6	1.9	1.0	-	27.8	-	8.7
Grand Total	**389.4**	**25.8**	**-**	**-**	**-**	**0.4**	**0.3**	**0.5**	**0.1**	**-**	**95.3**	**61.9**	**35.8**	**-**	**358.9**	**-**	**211.8**

* Miles of exposure

4.5.8.9.4 Environment

The environment would be vulnerable to a number of risks in the event of dam failure. The inundation could introduce foreign elements into local waterways, resulting in destruction of downstream habitat and detrimental effects on many species of animals, especially endangered species. The extent of the vulnerability of the environment is the same as the exposure of the environment.

4.5.8.9.5 Future Trends in Development

As further discussed in Section 4.3.4, Tehama County's population has remained relatively stable with a mild growth rate that is significantly lower than the statewide growth rate. The unincorporated areas of the county, in particular, have seen a steady decline in the rate of growth, partially due to a decline in net migration. Tehama is a relatively rural county, with an overall population density of approximately 22 people per square mile, which is lower than California as a whole. This growth trend is expected to continue.

Although new development continues to occur across the county, local land use and floodplain management regulations work to plan for and address dam and levee failure hazards, helping to limit exposure, reduce risk, and mitigate impacts. As discussed in Section 4.3.6, this regulatory framework includes the county's General Plan, as well as those general plans of other participating jurisdictions, that addresses land use, infrastructure improvement and expansion, and public safety, among other topics. These general plans are periodically reviewed as part of hazard mitigation capability assessments, enabling local agencies to identify potential gaps or deficiencies. Any identified needs can be integrated as mitigation actions, thereby strengthening each jurisdiction's ability to support sustainable development and manage dam and levee failure impacts effectively.

Much of the new development within the county could be impacted by dam or levee failure hazards. Land use within the planning area is guided by general plans adopted under California's General Planning Law. The safety element of these general plans establishes standards and strategies to protect communities from various hazards. While dam failure is not currently addressed as a standalone hazard in the safety elements, flooding is comprehensively covered. Municipal planning partners have implemented robust policies to ensure sound land use in identified flood hazard areas. Notably, many regions susceptible to severe impacts from dam failure overlap with mapped flood hazard zones. Consequently, flood-related policies in the general plans contribute to mitigating risks associated with dam failure for future developments in the planning area.

In 2007, Governor Arnold Schwarzenegger signed a legislative flood package into law, comprising Assembly Bills 5, 70, 156, 162, and Senate Bills 5 and 17. This legislative package aims to protect lives and property, promote responsible local planning, and reduce liability for flood-related damages. Subsequent amendments to the Water Code and Government Code introduced new requirements for flood hazard planning. As a result, portions of Tehama County were designated within the "Sacramento-San Joaquin Valley" as defined by Water Code Section 9602, subjecting them to additional agency requirements. This designation encompasses lands along the Sacramento or San Joaquin Rivers, their tributaries, connected areas, adjacent lands, overflow basins, or regions susceptible to overflow. Consequently, much of southern Tehama County falls within this area and must incorporate provisions related to the Central Valley Flood Protection Plan.

Since the 2018 plan, there have been significant legislative developments impacting dam safety and flood management:

- **Senate Bill 92 (2017)**: Enacted on June 27, 2017, SB 92 mandates that owners of state-regulated dams, except those classified as low hazard, prepare Emergency Action Plans (EAPs) based on dam breach inundation maps. These EAPs are essential for emergency preparedness and must be updated every 10 years or sooner if significant modifications occur to the dam or downstream developments.

- **Senate Bill 854 (2018)**: Passed on June 27, 2018, SB 854 amended California Water Code Section 6161, clarifying requirements for dams with existing EAPs as of March 1, 2017. It stipulates that if the EAP lacked inundation maps for all critical appurtenant structures, dam owners must submit a schedule to the Division of Safety of Dams (DSOD) to complete these maps.

These legislative measures underscore the state's commitment to enhancing dam safety and flood management. They necessitate that local jurisdictions, including Tehama County, integrate these requirements into their planning processes to ensure comprehensive hazard mitigation and community safety.

4.5.8.9.6 Drought Hazard Problem Statements

As part of the mitigation action identification process, the Planning Stakeholder for the county and for each jurisdiction identified issues and weaknesses, also called problem statements, for their respective assets. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and Dam Inundation data. Dam Inundation problem statements for the county are listed in Table 4-64; problem statements for all other participating jurisdictions are accessed in Volume 2 of this plan.

Identifying these common issues and weaknesses assists the Planning Committee in understanding the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and the corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-64 and Table 5-6.

Table 4-64 Dam Failure Problem Statements

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-DF-TC-1	Dam Failure	Victim	ES , PE&A	**Tehama County**	There is often limited warning time for dam failure. These events are frequently associated with construction methodology and or severe weather, which limits predictability of dam failure and compounds flood risk. Protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.	N	ma-DF-RB-71, ma-DF-TC-22, ma-DF-CoT-102

Problem No.	Hazard	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Climate Change Impact	Related MA
ps-DF-TC-4	Dam Failure	Impact	ES	**Tehama County**	Mapping that estimates inundation depths for federally regulated dams is already required and available; however, mapping for non-federal-regulated dams is needed to better assess the risk associated with failure of these facilities. Also, access to inundation zones is not readily available to residents area wide.	N	ma-DF-TC-23, ma-DF-RB-71, ma-DF-TC-22

4.6 Climate Change Related Hazards

Climate change refers to any distinct change in measures of climate lasting for a long period of time, more specifically major changes in temperature, rainfall, snow, or wind patterns. Climate change may be limited to a specific region or may occur across the whole Earth. Climate change may result from:

- Natural factors, such as changes in the sun's energy or slow changes in the Earth's orbit around the sun;
- Natural processes within the climate system, such as changes in ocean circulation; or
- Human activities that change the atmosphere's make-up and the land surface, such as burning fossil fuels, cutting down forests, planting trees, or building developments in cities and suburbs.

Changes in extreme weather and climate events, like heatwaves and droughts, are the primary way that most people experience climate change. Human-induced climate change has already increased the number and strength of these extreme events. Over the last 50 years, much of the United States has seen increases in prolonged periods of excessively high temperatures, heavy downpours, severe floods, and droughts. (United States Environmental Protection Agency, 2021)

The effects of climate change are varied and include extremes in precipitation and temperature. Slower average increases in temperature, precipitation, and sea-level rise can result in compounding impacts, such as ocean acidification, increases insect outbreaks, and shifts in biological patterns, to name a few. (Food and Agriculture Organization of the United Nations, 2014).

Table 4-65: Climate Change-Related Hazards and Cross-References in MJHMP

Climate Change Related Hazard	Reference in MJHMP
Drought	Section 4.5.5 (Drought Hazard Profile)
Extreme Heat	Section 4.5.7(Extreme Heat Profile)
Flood	Section 4.5.1 (Flood Hazard Profile)
Landslides and Debris Flows	Section 4.5.6 (Slope Hazard Profiles)
Extreme Weather	Section 4.5.4 (Extreme Weather Hazard Profile)
Wildfire	Section 4.5.1 (Wildfire Hazard Profile)

California is already experiencing the impacts of climate change, including prolonged drought, increased coastal flooding and erosion, and tree mortality. The state has also seen increased average temperatures, more extreme heat days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, a decreased summertime fog of 33 percent, and both snowmelt and rainwater running off sooner in the year. (Cal OES, 2018) Long term trends in fog depict a decline of some 12 to 20 percent in California from 1900 through 2070. Climate experts suggest that warmer temperatures resulting from climate change create conditions where air fails to reach cool enough temperatures necessary for the production of fog. Warmer temperatures are simultaneously able to evaporate any fog which is able to form. (Grantham, Teodore; University of California, Berkeley, 2018)

The intensity of extreme weather events is also increasing. Increased extreme weather events and resulting hazards, such as heatwaves, wildfires, droughts, and floods, are already being experienced. (Leah Fisher, Sonya Ziaja, 2018, p. 22) The discussion within this section is provided as supplemental to related hazards as shown in Table 4-65 as well as in each related hazard's discussion in Section 4.5.

Emissions and Climate Change Modeling

Climate change impacts will vary depending on the amount of greenhouse gas (GHG) emissions and atmospheric GHG concentrations may change over time. Various climate models explore a range of emission pathways globally. There are six representative GHG emission pathways, called Representative Concentration Pathways (RCPs). The two most used representative pathways include a moderate scenario (RCP4.5), which incorporates stabilizing GHG emissions through 2050, and a high-end (RCP8.5), which maintains a fossil fuel-intensive, "business-as-usual" emission pathway. These pathways are described in the Fifth Assessment Report from the IPCC (AR5). (IPCC, 2014) The Sixth Assessment Report (AR6) introduces Shared Socio-economic Pathways (SSPs), these are globally relevant in navigating impact assessments, but the current models available within climate tools such as those from Cal-Adapt and the Climate Toolbox utilize RCPs. (IPCC, 2022)

Discussions in this MJHMP focus on the moderate RCP 4.5 emissions scenario and the high emissions RCP 8.5 scenario to consider both the ramifications of a worst-case scenario for adaptive planning and to consider how curbing emissions might reduce the most dramatic consequences. (OPR Planning and Investing for a Resilient California, p. 19) Emissions pathways (RCPs) only demonstrate the level of greenhouse gases present in the environment at projected timelines. The RCPs are used in tandem with Global Climate Models (GCM) to estimate future climate metrics, such as extreme heat day occurrence rate and changes in evapotranspiration. (Cal-Adapt, 2021)

4.6.1.1 Policies, Plans, and Regulatory Environment

Successful efforts to address the challenges of climate change begin at the local level and include the implementation of environmentally sustainable practices designed to meet present and future energy needs.

2019 California Green Building Standards

Tehama County has adopted the 2018 California Green Building Standards, also known as the CALGreen Code. The CALGreen Code establishes regulations for green building for both nonresidential and residential construction. Topics covered in the regulations include planning and design, energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and environmental quality. The code also includes voluntary measures for residential and nonresidential buildings and health facilities.

California Sustainable Communities and Climate Protection Act of 2008

The Sustainable Communities and Climate Protection Act of 2008 (Sustainable Communities Act, SB 375, Chapter 728, Statutes of 2008) looks to reduce GHG emissions through coordinated transportation and land use planning with the goal of more sustainable communities. Regional targets are established for GHG emissions reductions from passenger vehicle use by the sustainable communities strategy (SCS) established by each metropolitan planning organization (MPO). The SCS is an integral part of regional transportation plans (RTP) and contains land use, housing, and transportation strategies to meet GHG reductions targets.

2018 California's Fourth Climate Change Assessment

California's Fourth Climate Change Assessment promotes actionable science that serves the growing needs of state and local-level decision-makers from a diverse number of sectors. The Fourth Assessment provides information in a number of ways. Regional reports summarize climate impacts and adaptation needs around the state as a resolution useful for local decision-makers. Statewide impacts are summarized in the Statewide Summary Report, as well as reports on Tribal and Indigenous Communities, Climate Justice, and California's Ocean and Coast. The Technical Reports are the foundation of the Fourth Assessment and include climate projections and analyses of expected impacts in various sectors across the state. California's Fifth Climate Change Assessment is currently in development.

2020 California Adaptation Planning Guide (APG)

California has been taking action to address climate change for over 20 years, focusing on both GHG reduction and adaptation. The California Adaptation Planning Guide (APG) provides guidance and support for communities addressing the unavoidable consequences of climate change. The 2020 APG presents an updated, step-by-step process that communities can use to plan for climate change.

California Senate Bill 379: General Plan Safety Element and Climate Adaption

California Senate Bill 379 requires all cities and counties to include climate adaptation and resiliency strategies in the Safety Elements of their General Plans upon the next revision, beginning January 1, 2017. The bill requires the climate adaptation update to include a set of goals, policies, and objectives for their communities based on the vulnerability assessment, as well as implementation measures, including the conservation and implementation of natural infrastructure that may be used in adaptation projects.

California Senate Bill 1000: General Plan Safety and Environmental Justice Elements

Senate Bill 1000 requires local governments to include an Environmental Justice element in General Plans. It has four basic requirements, whether those requirements are combined into a single Environmental Justice element or distributed throughout other existing elements, including:

- Identifying disadvantaged communities;
- Incorporating policies to reduce the environmental health impacts that adversely affect residents in disadvantaged communities;
- Incorporating policies to include residents of disadvantaged communities in decision-making processes; and
- Incorporating policies that prioritize improvements and projects in disadvantaged communities.

4.6.1.2 Past Events

Climate change has never been directly responsible for any declared disasters. Past flooding, wildfire, extreme weather, and drought disasters may have been exacerbated by climate change, but it is difficult to make direct connections to individual disasters. Hazard profiles for flood, wildfire, extreme weather, and drought include information on past events that show an increase in occurrences in many instances, especially considering wildfire, extreme heat, and drought events.

Climate change is an on-going hazard, and many communities are already experiencing the effects. Other effects may not be seriously experienced for decades or may be avoided altogether by mitigation actions taken today.

4.6.1.3 Location

The effects of climate change are not limited by geographical borders; the entire county is subject to various effects of climate change which may differ by location. Each jurisdiction explored impacts of climate change related hazards specific to that jurisdiction. For example, municipalities bordering the Tehama County will experience increased wildfire impacts, while central parts of the county may face increased flood dangers from the Sacramento River.

4.6.1.4 Frequency and Probability of Future Occurrences

California's Fourth Climate Change Assessment (2018) delineates how climate change may impact and exacerbate natural hazards in the future, including wildfires, extreme heat, floods, drought, and levee failure:

- Climate change is expected to lead to increases in the frequency, intensity, and duration of extreme heat events and heat waves in Tehama County and the rest of California, which are likely to increase the risk of mortality and morbidity due to heat-related illness and exacerbation of existing chronic health conditions. Those most at risk and vulnerable to climate-related illness are the elderly; individuals with chronic conditions such as heart and lung disease, diabetes, and mental illnesses; infants; the socially or economically disadvantaged; and those who work outdoors.
- Higher temperatures will melt the Sierra snowpack earlier and drive the snowline higher, resulting in less snowpack to supply water to California users.
- Droughts are likely to become more frequent and persistent in the 21st century.
- Intense rainfall events, periodically ones with larger than historical runoff, will continue to affect California with more frequent and more extensive flooding.
- Storms and snowmelt may coincide and produce higher winter runoff from the landward side, while accelerating sea-level rise will produce higher storm surges during coastal storms. (California's Fourth Climate Change Assessment, 2018)

Warmer weather, reduced snowpack, and earlier snowmelt can be expected to increase wildfire through fuel hazards and ignition risks. These changes can also increase plant moisture stress and insect populations, both of which affect forest health and reduce forest resilience to wildfires. An increase in wildfire intensity and extent will increase public safety risks, property damage, fire suppression and emergency response costs, watershed and water quality impacts, vegetation conversions, and habitat fragmentation. Climate change is also predicted to increase frequency and probability of various hazards. Climate change impacts on frequency and severity are discussed in other hazard profiles.

4.6.1.5 Severity and Extent

The impacts of climate change on Tehama County can most accurately be modeled using The Representative Concentration Pathways (RCPs) and Global Climate Models (GCMs) discussed earlier in this chapter. The current and projected changes in average annual maximum temperature are discussed in this section. The same modeling was also completed for Extreme Heat metrics and can be found in Section 4.5.7.

Current and Projected Average Maximum Temperatures Under RCP 4.5 and 8.5 Scenarios

Overall, temperatures in California are projected to rise by 5.6°F under an RCP 4.5 scenario and by 8.8°F under an RCP 8.5 scenario by the end of this century. (Bedsworth, 2018, p. 23) Figure 4-52 and Figure 4-53 illustrate the average maximum annual temperature for Tehama County from observed historical recordings through 2100 projections under the RCP 4.5 and RCP 8.5 scenarios, respectively. These projections make use of the CanESM2 GCM, which is considered a "moderate" or "average" Global Climate Model. (Cal-Adapt, 2023)

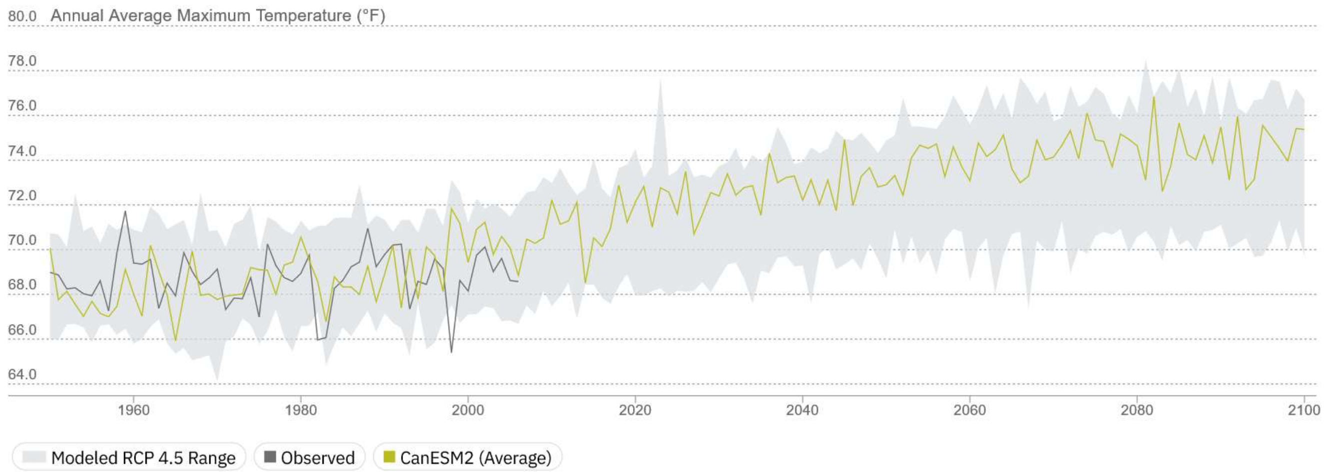


Figure 4-52 Annual Average Maximum Temperature (RCP 4.5 Scenario)
Source: cal-adapt.org

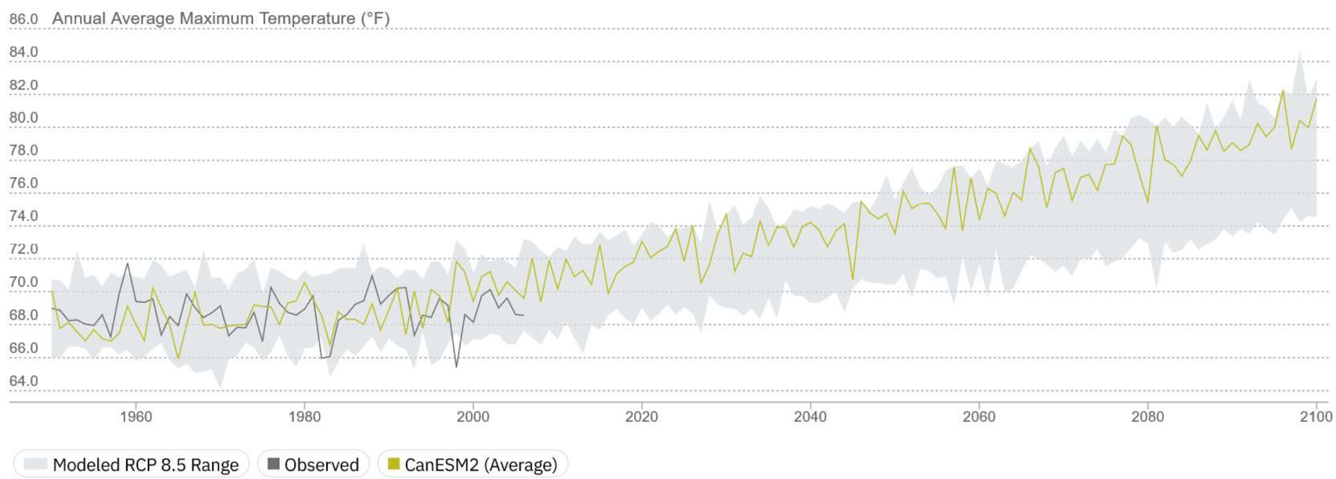


Figure 4-53 Annual Average Maximum Temperature (RCP 8.5 Scenario)
Source: cal-adapt.org

4.6.1.6 Warning Time

As this section has described, many existing hazards could be intensified as a result of climate change, decreasing warning times and exacerbating impacts. Warning times are discussed under the various other hazards. Other climate change impacts are more long-term. Scientists have high confidence in predicting the rise in global temperatures and have reached a consensus on the future impacts of climate change and the time frame in which they will occur.

4.6.1.7 Secondary Hazards

Secondary hazards of climate change include flood, extreme weather, drought, wildfire, sea-level rise, extreme heat, and heavy rain events. Climate change will increase the frequency at which extreme weather events occur. Secondary hazards of climate change that will have the greatest impact on Tehama County include flood, drought, extreme heat and extreme weather. Many of these impacts are discussed in other hazard profiles.

4.6.1.8 Vulnerability Assessment

Vulnerabilities to Climate Change impacts for Tehama County have been identified and assessed in individual hazard profiles for related hazards. For a complete list of related hazards and their associated vulnerability assessments, refer to Table 4-65.

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Section 5. Mitigation Strategy

The mitigation strategy for Tehama County and other participating jurisdictions is essential for reducing vulnerabilities and enhancing community resilience to hazards. This approach focuses on actions that minimize risks, aiming to lower mortality, injuries, property damage, impacts on critical facilities, and environmental degradation associated with hazard events. The strategy serves as a comprehensive framework for hazard mitigation, embedding the critical outcomes of the planning process into a cohesive action plan. By detailing specific mitigation actions, including policy recommendations and physical projects, the strategy provides a structured path to address vulnerabilities. For successful implementation, each action should identify responsible parties, necessary resources, and ensure alignment with existing plans and regulations. This compatibility with current planning mechanisms enhances the effectiveness and integration of hazard mitigation efforts, promoting a safer, more resilient future for Tehama County and its neighboring jurisdictions.

The hazard mitigation plan stakeholders and individual jurisdictions conducted the hazard mitigation planning process through typical problem-solving, including the following steps:

1. Estimate impacts (Vulnerability Assessments)
2. Describe problems (Problem Statements)
3. Assess existing resources (Capabilities Assessments)
4. Develop goals and objectives to address impacts and problems (Goals and Objectives)
5. Determine what mitigation can be done with available resources and develop community-appropriate actions (Mitigation Action Plans)

5.1 Identifying Problems

During the development of mitigation actions, stakeholders in the hazard mitigation plan, along with individual jurisdictions, identified specific areas of concern and assessed the potential impacts of each prioritized hazard on the planning region. "Problem statements" were created to describe the effects or consequences of these hazards on community assets within these areas, ensuring that the chosen mitigation actions are customized to address the unique challenges each jurisdiction faces under different hazard scenarios.

Problem statements are found at the conclusion of each hazard profile in Section 4.5 and in the jurisdictional annexes of Volume 2. These statements are also available as part of the Mitigation Action Support Tool (MAST), which is summarized in STEP 3: Develop Mitigation Strategy, and available through mitigatehazards.com. Additionally, problem statements are referenced in the county-wide Mitigation Action Plan found in Section 5.6 (Table 5-6) as well as in the action plans in each jurisdiction's annex.

5.2 Identifying Benefits

Mitigation actions have a wide range of community benefits for increasing hazard resilience, which are framed by the goals of this MJHMP in Section 5.5. Benefits generated from the county-wide Mitigation Action Plan in Section 5.6.2, and from the action plans in participating jurisdictions' individual Volume 2 annexes, can generally be categorized as either governmental or community.

Governmental benefits support the community by safeguarding public infrastructure and essential facilities. This includes protections for vital lifelines like roads, water and sewage pipelines, and communication lines, as well as critical community facilities such as schools, hospitals, care centers, and fire stations. Community benefits are directed toward assisting the public more directly, offering advantages like reduced insurance costs, educational programs, awareness campaigns, and shared-cost projects.

Benefits are largely shaped by first identifying the problem, then by defining goals, and finally by structuring the most efficient and cost-effective action plan to address the identified problems and achieve the stated goals, as illustrated in Figure 5-1.

Figure 5-1: Process to Mitigation Project Benefits

5.3 Mitigation Alternatives

Hazard mitigation plan stakeholders reviewed and refined mitigation actions, considering various implementation alternatives both county-wide and for individual participating jurisdictions. The Steering Group conducted multiple reviews of specific hazard-related problem statements and developed potential mitigation actions for further deliberation.

This section outlines FEMA's six broad categories of mitigation, which provided a foundation for discussing alternative mitigation actions. The stakeholders selected the most efficient and cost-effective actions by evaluating vulnerability and risk, reviewing capability assessments, and reaching a consensus on the best approaches to address identified issues and meet established goals. FEMA's six mitigation categories are:

- Prevention (PRV)
- Property Protection (PPRO)
- Public Education and Awareness (PE&A)
- Natural Resource Protection (NRP)
- Emergency Services (ES)
- Structural Projects (SP)

PREVENTION (PRV)

Preventative activities keep hazard problems from getting worse and are typically administered through government programs or regulations addressing building and land development. Preventative actions are particularly effective in reducing a community's future vulnerability in areas where development has not yet occurred or where capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning ordinances
- Building codes
- Riverine or fault zone setbacks
- Open space preservation
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvements programming

LOCAL PRV ALTERNATIVES

- Establish ingress/ egress standards for future development.
- Maintain detention basins.
- Conduct detailed studies and mapping of floodplains for the Sacramento River and its tributaries, targeting problematic floodplains.
- Update and distribute wildfire risk mapping for Tehama County.
- Amend or revise water conservation regulations for landscape design for commercial and residential development with the goal of limiting outdoor watering.

PROPERTY PROTECTION (PPRO)

Property protection measures involve the modification, relocation, or removal of existing buildings and structures to help them better withstand the forces of a hazard. Examples include:

- Building elevation
- Retrofitting (e.g., seismic design techniques, etc.)
- Safe rooms, shutters, shatter resistant glass
- Insurance
- Critical facilities protection

LOCAL PPRO ALTERNATIVES

- Provide homeowners with easily accessible resources for mitigating the risk of wildfire around their homes.
- Implement additional fuel reduction projects around populated communities and WUI areas.
- Encourage privately owned critical facilities (e.g., churches, hotels, other gathering facilities) to evaluate the ability of the buildings to withstand localized hazards and address any deficiencies identified.
- Identify and harden critical lifeline systems (i.e., critical public services such as utilities and roads) to meet "Seismic Design Guidelines and Standards for Lifelines" or equivalent standards, such as American Lifelines Alliance (ALA) guidance.
- Use flexible piping when extending water, sewer, or natural gas service.
- Strengthen and retrofit non-reinforced masonry buildings and non-ductile concrete facilities that are particularly vulnerable to ground shaking.
- Install shutoff valves and emergency connector hoses where water mains cross fault lines.
- Continue to incentivize drought-tolerant landscape design.

PUBLIC EDUCATION & AWARENESS (PE&A)

Public education and awareness activities advise community members and elected officials about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Measures to educate and inform the public include:

- Outreach projects, including neighborhood and community outreach
- Hazard mapping
- Materials library
- Speaker series/ demonstration events
- Real estate disclosures
- School children educational programs
- Hazard expositions

LOCAL PE&A ALTERNATIVES

- Educate homeowners on reducing the risk of wildfire on their property, including understanding their localized wildfire risk.

- Distribute public education materials relating to natural hazards, as well as emergency notifications in both English and Spanish.
- Partner with local water purveyors in their public education and conservation campaigns in both English and Spanish.
- Improve information on floodplain management, earthquake preparedness, wildfire mitigation and preparedness, and other hazards on participating jurisdictions' websites.
- Distribute National Flood Insurance Program and floodplain development information in county libraries for access by the public.
- Focus a public education program around neighborhoods with egress/ingress issues and narrow roads.
- Improve interactive hazard mapping resources available to the public.
- Educate the public on the importance of drought-tolerant landscaping, low flow indoor fixtures, and other water savings techniques to better withstand periods of drought.
- Offer agricultural disaster training and networking opportunities for farmers and agricultural regulatory agencies.

NATURAL RESOURCE PROTECTION (NRP)

Natural resource protection activities reduce the impacts of hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes, and sand dunes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Erosion and sediment control
- Floodplain protection
- Vegetation management (e.g., fire resistant landscaping, fuel breaks)
- Watershed management
- Wetland and habitat preservation/restoration

LOCAL NRP ALTERNATIVES

- Protect and restore wetlands, riparian areas, and natural buffers from flooding.
- Complete vegetation management projects as prescribed in Tehama East/Tehama West CWPP.
- Encourage and incentivize drought-tolerant landscape design.
- Support vital groundwater initiatives through Groundwater Sustainability Agency of Tehama County

EMERGENCY SERVICES (ES)

Although not typically considered a mitigation technique, emergency services do help minimize the impacts of a hazard event on people and property. These measures are actions commonly taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems
- Sandbag staging for flood protection
- Identification/ construction of evacuation routes
- Installing temporary shutters on buildings for wind protection

LOCAL ES ALTERNATIVES

- Install back up power generators for fire stations, pump houses, emergency shelters, and cooling centers.
- Develop a website for vulnerable populations to register information such as where the individual in question lives, medications, restrictions, etc. Map registrants or tie information to Tehama Alert system.
- Focus capital improvements on evacuation or emergency access routes needing attention.
- Construct or improve egress for wildfire emergencies in wildland-urban interface (WUI) areas.

STRUCTURAL PROJECTS (SP)

Structural mitigation projects are intended to lessen the impacts of a hazard by modifying the environment and natural progression of a hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Utility facility/ infrastructure upgrades
- Stormwater detention/ retention facilities
- Seismic retrofits

LOCAL SP ALTERNATIVES

- Increase the capacity of existing hospitals through retrofits or upgrades, such as isolation wings.
- Improve water supply and delivery systems to be more resilient during times of drought.
- Construct and develop alternative water supplies to augment single sources of water delivery.
- Construct rainwater catchment systems to recharge groundwater in government rights-of-way.
- Install water monitoring devices and drought-tolerant landscaping on government-owned facilities.
- Improve stormwater drainage capacity; construct or improve stormwater basins county-wide to accomplish 100-year protection.
- Construct, install, and maintain warning gauges on local dams as the opportunity or need arises.
- Culvert replacements and enhancements to reduce flood risk.

5.4 Capabilities & Adaptive Capacity Assessment

This section examines Tehama County's planning, regulatory, administrative, technical, financial, educational, outreach, and other capabilities to address known issues and weaknesses in mitigating profiled hazards. Volume 2 of this plan includes a capabilities assessment for each participating jurisdiction as part of its annex. For more information on the regulatory environment surrounding each priority hazard, refer to the hazard-specific profiles in Section 4.5 and the jurisdictional annexes.

Capabilities assessments include considerations of a community's adaptive capacity for climate change, as outlined in the Cal OES 2020 California Adaptation Planning Guide. Adaptive capacity is the existing ability for a community or region to moderate climate change impacts. Assessing adaptive capacity includes analysis of policies, plans, programs, funding, and staffing capacity. (Cal. Adaptation Planning Guide, 2020, p. 94)

The tables in this section explore various local planning and regulatory mechanisms, administrative and technical capacity, financial capabilities, and education and outreach initiatives. The columns in each table represent deeper dives into the following questions:

- Is the mechanism or capability existing and currently used? (Column 1, Status)
- Has the mechanism or capability already been integrated into hazard mitigation planning efforts? (Column 2, Current Mitigation Use)
- Is there a future opportunity for the mechanism or capability to be incorporated, expanded, or improved upon in regard to mitigation planning? (Column 3, Future Opportunity)

The capabilities assessment is based on color coding to quickly identify which mechanisms and capabilities are adequate, need improvement, or could be integrated with hazard mitigation planning efforts. Tables include a legend explaining how each of the three questions is answered according to the color indicated: green, yellow, or orange.

5.4.1 Planning & Regulatory Capabilities

The information in Table 5-1 is used to align mitigation actions with the existing planning and regulatory capabilities of Tehama County. Planning and regulatory tools commonly used by local jurisdictions to implement hazard mitigation activities include building codes, land use and subdivision regulations, floodplain management policies, and other municipal policy and planning documents.

Table 5-1: Planning and Regulatory Capabilities

CAPABILITY ASSESSMENT LEGEND

Status	Current Mitigation Use	Future Opportunity
Currently in use or present.	Used widely for mitigation.	Opportunity to expand and integrate.
(Sort of) Seldomly used or limited presence.	Limited use in mitigation planning.	Limited opportunity to expand and integrate.
(No) Not present or available.	Not used in mitigation planning.	No opportunity to expand or integrate.

Resources for Hazard Risk Reduction	HMP Integration: Status	HMP Integration: Current Mitigation Use	HMP Integration: Future Opportunity	Notes / Additional Detail
Planning and Regulatory Capabilities				
Construction and Future Development Regulations				
Building Codes				2022 California Building Codes (California Code of Regulation, Title 24). Title 15 Code of Ordinances
BCEGS Rating	UNKOWN	UNKOWN	UNKOWN	
Public Protection (ISO Class)	UNKOWN	UNKOWN	UNKOWN	
Hazard-Related Development Standards				See Title 9, 15, 17 in Code of Ordinances
Zoning Ordinance				See Title 17 in Code of Ordinances
Hazard-Specific Ordinance				See Title 15.52 in Code of Ordinances General Plan
Growth Management Ordinance				See CH 16, 17 in Code of Ordinances General Plan
Air Quality Control				Tehama County Air Pollution Control District's Rules and Regulations

Hazard Reduction Programs (Annually Conducted)				
Capital Improvements Program (CIP) or Plan				Tehama County PW Project List
Erosion/Sediment Control Program				Title 9.43.330 Code of Ordinances
Hazard-Related Public Outreach Program				Tehama Alert and Tehama 211
Stormwater Management Program (Annual Inspections)				
Seismic Safety Program (Non-structural)				CH 8 of General Plan; Policy SAF-4.4. The County shall incorporate seismic and geologic hazards mitigation measures into County ordinances and procedures
Earthquake Modernization Plan (Building Safety)				2022 California Building Codes (California Code of Regulation, Title 24).
Hazard Plans				
General Plan Safety Element				General Plan Chapter 8
Site Plan Review Requirements				Title 17 of Zoning Ordiance
General Plan Environmental Justice Element	N/A	N/A	N/A	
Community Wildfire Protection Plan (CWPP)				Tehama East and Tehama West CWPP Update 2020
Economic Development Plan				General Plan
Floodplain Management Plan				Floodplain management Regulations - Title 15.52 Code of Ordinances
Watershed Management Plan				Tehama East and Tehama West Assessment and Management Plan
Emergency Operations Plan				Tehama County Emergency Operations Plan
Climate Action Plan				Climate Change and Health Profile Report Tehama County
Climate Vulnerability Assessment				Caltrans Statewide Vulnerability Assessment
Forest and Water Resource				Climate Adaptation Framework
Ground Water Management Planning / Plans				Groundwater Sustainablilty Plan General Plan

National Flood Protection Program (NFIP)				
Floodplain Management Regulations				Floodplain management Regulations - Title 15.52 Code of Ordinances
Flood Insurance Education and Technical Assist.				Tehama County Flood Control website
Flood Insurance Study				Effective Date 09/29/2011 - 06103CV000A
Elevation Certificates				Elevation Certificate
Flood Hazard Mapping / Re-Mapping				FEMA Floodplain layer
Community Rating System (CRS)	N/A	N/A	N/A	County Does Not Participate in FEMA's CRS program

5.4.2 Administrative & Technical Capabilities

The information in Table 5-2 is used to align mitigation actions with the existing administrative and technical capabilities of Tehama County, such as staff expertise and warning systems.

Table 5-2: Administrative and Technical Capabilities

CAPABILITY ASSESSMENT LEGEND

Status	Current Mitigation Use	Future Opportunity
Currently in use or present.	Used widely for mitigation.	Opportunity to expand and integrate.
(Sort of) Seldomly used or limited presence.	Limited use in mitigation planning.	Limited opportunity to expand and integrate.
(No) Not present or available.	Not used in mitigation planning.	No opportunity to expand or integrate.

Resources for Hazard Risk Reduction	MJHMP Integration: Status	MJHMP Integration: Current Mitigation Use	MJHMP Integration: Future Opportunity	Notes / Additional Detail
Administrative and Technical				
Community Planning and Development Services				
Community Planner				Kristen Maze
Planner/Engineer (Land Development)				Will Pike
Engineer/Professional (Construction)				Jessica Pecha
Planner/Engineer/Scientist (Natual Hazards)				Robert Brownfield
Transportation Planner				Ashley Fox
Resiliency Planner				None at this time
Building Code Official (Full time or Augmented)				John Stover
Floodplain Administrator				Justin Jensen

Resources for Hazard Risk Reduction	MJHMP Integration: Status	MJHMP Integration: Current Mitigation Use	MJHMP Integration: Future Opportunity	Notes / Additional Detail
Fire Marshal				Brian Wright
Dedicated Public Outreach Personnel				Carissa Crawford
GIS Specialist and Capability				David Bliss
Emergency Manager				Daniella Harris
Full-Time Building Official				Ed Griego
Dedicated Grant Manager, Writer, or Specialist				None at this time
Other	N/A	N/A	N/A	
Warning Systems/Services				
General				County wide Alerts, News, and Notices Tehama Alert
Flood				County wide Alerts, News, and Notices Tehama Alert
Wildfire				County wide Alerts, News, and Notices Tehama Alert
Geological Hazards				County wide Alerts, News, and Notices Tehama Alert

5.4.3 Financial Capabilities

Table 5-3 identifies the financial tools or resources that Tehama County currently has access to for potentially funding mitigation activities.

Table 5-3: Financial Capabilities

CAPABILITY ASSESSMENT LEGEND

Status	Current Mitigation Use	Future Opportunity
Currently in use or present.	Used widely for mitigation.	Opportunity to expand and integrate.
(Sort of) Seldomly used or limited presence.	Limited use in mitigation planning.	Limited opportunity to expand and integrate.

(No) Not present or available.	Not used in mitigation planning.	No opportunity to expand or integrate.

Resources for Hazard Risk Reduction	MJHMP Integration			Notes / Additional Detail
	Status	Current Mitigation Use	Future Opportunity	
Fiscal Capabilities				
Financial Resources for Hazard Mitigation				
Levy Taxes for Specific Purposes				Limited by Prop 218
Utilities Fees				Limited by Prop 218
Benefit assessments				
Community Development Block Grants				
System Development Fee				
General Obligation Bonds to Incur Debt				
Special Tax Bonds to Incur Debt				
Withheld Spending in Hazard-Prone Areas				
Stormwater Service Fees				
Capital Improvement Project Funding				

5.4.4 Education & Outreach Capabilities

Table 5-4 lists Tehama County's capabilities for public education and outreach, as well as those of community organizations that communicate hazard risks, to help inform mitigation actions.

Table 5-4: Education and Outreach Capabilities

CAPABILITY ASSESSMENT LEGEND

Status	Current Mitigation Use	Future Opportunity

Currently in use or present.	Used widely for mitigation.	Opportunity to expand and integrate.
(Sort of) Seldomly used or limited presence.	Limited use in mitigation planning.	Limited opportunity to expand and integrate.
(No) Not present or available.	Not used in mitigation planning.	No opportunity to expand or integrate.

Resources for Hazard Risk Reduction	MJHMP Integration: Status	MJHMP Integration: Current Mitigation Use	MJHMP Integration: Future Opportunity	Notes / Additional Detail
Education / Outreach Capabilities				
Education/Outreach Resources				
Website Dedicated to Hazard Topics				Tehama Alert
Dedicated Social Media				Facebook
Local Citizen Groups That Communicate Hazard Risks	N/A	N/A	N/A	
Hazard Info. Avail. at Library/ Planning Desk	N/A	N/A	N/A	
Annual Public Safety Events				National Night Out, County Departments attend every year.
Ability to Field Public Tech. Assistance Requests	N/A	N/A	N/A	
Public Safety Newsletters or Printed Outreach				Tehama County Sheriff press releases
Community Emergency Response Team (CERT)				Tehama County CERT. Webpage on Facebook and Sheriff's website.
Fire Safe Councils				Tehama-Glenn Fire Safe Council
Firewise	N/A	N/A	N/A	
Storm Ready	N/A	N/A	N/A	
Resource Conservation Districts				Tehama County Resource Conservation District

Resources for Hazard Risk Reduction	MJHMP Integration			Notes / Additional Detail
	Status	Current Mitigation Use	Future Opportunity	
Other	N/A	N/A	N/A	

5.4.5 Capability & Adaptive Capacity Opportunities

The capabilities assessment offers ample opportunity for Tehama County to consider strengthening its capabilities and adaptive capacity; however, reflections in this section are meant to be examples, not an exhaustive list of next steps. Prioritized opportunities for the county to increase capabilities and adaptive capacity are shown as mitigation actions in Section 5.6.2.

The capabilities assessment identifies several opportunities to incorporate a hazard mitigation planning perspective into other county policies, plans, and regulations, including updates to development requirements for wildfire and flood based on recent lessons learned and using neighboring jurisdictions as a guide. Specifically, there is an opportunity to update requirements around weed abatement, development siting, emergency access routes, and defensible space and fuel breaks.

Related to adaptive capacity, Tehama County's General Plan being over fifteen years old. There is an opportunity to update these plans and look more in-depth at the prioritized climate vulnerabilities and adaptation strategies discussed in this MJHMP.

Since the last MJHMP update, Tehama County has significantly enhanced its capacity for long-term hazard mitigation projects through the increased involvement of the CAL FIRE Tehama-Glenn Unit in regional wildfire mitigation efforts. With CAL FIRE's expanded role, including additional planning resources and expertise dedicated to hazard mitigation and emergency preparedness, the county is better positioned to address wildfire risks and other hazards. Strengthening collaboration with Cal Fire, alongside fostering relationships across city departments, will be crucial for effectively coordinating FEMA HMA-eligible infrastructure projects that align with the goals and objectives of this MJHMP.

5.4.6 Federal & State Funding Opportunities

The federal and state funding opportunities listed in Table 5-5 are provided as opportunities to leverage and increase Tehama County's capabilities and adaptive capacity. This includes the FEMA HMA grant program, described in more detail in Section 6.3.2.3, as well as other national and state programs. This list serves as a resource and is not exclusive or exhaustive.

Table 5-5: Federal and State Funding Opportunities

Agency / Program Name	Potential Programs / Grants
Federal Funding Opportunities	
FEMA HMA and Other Programs	FEMA HMA grant programs include: ▪ Hazard Mitigation Grant Program (HMGP): fema.gov/hazard-mitigation-grant-program ▪ Building Resilient Infrastructure and Communities (BRIC) Program: fema.gov/grants/mitigation/building-resilient-infrastructure-communities ▪ Flood Mitigation Assistance (FMA) Program: fema.gov/flood-mitigation-assistance-grant-program ▪ See Section 6 for FEMA / HMA grant details. For more information on current grants visit fema.gov/hazard-mitigation-assistance • Other FEMA funding opportunities include: ▪ Assistance to Firefighters Grant (AFG) Program: Grants for firefighting resources, fire prevention and safety, and staffing for adequate response. fema.gov/welcome-assistance-firefighters-grant-program ▪ Fire Prevention and Safety (FP&S) Program: Grants to enhance the safety of the public and firefighters and administered as part of the AFG Program. FP&S Grants are offered to support projects that cover fire prevention and safety activities and research and development activities. fema.gov/fire-prevention-safety-grants ▪ Emergency Management Performance Grants (EMPG): Grants for equipment such as back-up generators. fema.gov/emergency-management-performance-grant-program Regional Catastrophic Preparedness Grant Program (RCPGP): Grants for housing, logistics, and supply chain management encouraging innovative regional solutions to issues related to catastrophic incidents. fema.gov/regional-catastrophic-preparedness-grant-program The Flood Mitigation Assistance Swift Current (Swift Current) effort provides funding to mitigate buildings insured through the National Flood Insurance Program (NFIP) after a major disaster declaration following a flood-related disaster event to reduce risk against future flood damage. https://www.fema.gov/grants/mitigation/learn/flood-mitigation-assistance/swift-current

Agency / Program Name	Potential Programs / Grants
U.S. Department of Energy Programs	Energy Efficiency and Conservation Block Grant Program: Provides funding for weatherization and development of codes and to ensure energy efficiency and restoration of older homes. energy.gov/eere/wipo/energy-efficiency-and-conservation-block-grant-program
Office of State and Community Energy Programs (SCEP)	The Office of State and Community Energy Programs (SCEP) is part of a concerted effort at the DOE to extend the capacity and capability of states, tribes, local governments, schools, and community-serving organizations to implement high-impact, self-sustaining clean energy projects that center the needs of low-income and disadvantaged communities. SCEP does this through the management and oversight of over $16 billion in formula grants, competitive grant awards, consumer rebate grants, and technical assistance. https://www.energy.gov/scep/slsc/explore-scep-funding-technical-assistance-opportunities
U.S. Department of Agriculture (USDA) Programs	USDA offers a variety of programs to help farmers, ranchers, communities, and businesses that have been hard hit by natural disaster events. Below you'll find available FSA programs; visit farmers.gov for additional USDA programs that can help agricultural producers recover. https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program
U.S. Bureau of Reclamation (BOR) Programs	BOR has annual funding available through the WaterSMART grant program, including for: ▪ Water Reclamation and Reuse ▪ Drought Resiliency Project ▪ Water and Energy Efficiency Grant For more information, visit usbr.gov/watersmart/
State Funding Opportunities	
California Department of Housing and Community Development (HCD) Programs	Community Development Block Grants (CDBG) include: ▪ Community Development (CD) ▪ Economic Development (ED) ▪ Neighborhood Stabilization Program (NSP) ▪ Disaster Recovery Initiative (DRI) ▪ Emergency Solutions Grant (ESG) Program: Funds projects that serve homeless individuals and families with emergency housing and supportive services or that provide homelessness prevention assistance. The Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act of 2009 places new emphasis on assisting people to quickly regain stability in permanent housing after experiencing a housing crisis or homelessness. hcd.ca.gov/fa/esg/index.html

Agency / Program Name	Potential Programs / Grants
	For more information on current grants visit https://www.hcd.ca.gov/grants-and-funding
Cal OES Programs	**Email Notifications:** Get notified immediately via email when a new Competitive Funding Opportunity (CFO) or Public Meeting Notice is released by Cal OES Grants Management? Join the Cal OES Grants Management Mailing List. LIST OF GRANTS HERE: https://www.caloes.ca.gov/office-of-the-director/policy-administration/finance-administration/grants-management/search-for-grants/
California Water Resources Control Board Programs	The Division of Financial Assistance (DFA) has the lead in administering the State Water Resources Control Board's financial assistance programs. These programs include loan and grant funding for construction of drinking water treatment and distribution systems, municipal sewage conveyance and treatment systems; water recycling facilities; remediation for underground storage tank releases and groundwater contamination; technical assistance for small communities; nonpoint source pollution control projects; interim water, and operation and maintenance/Administrator support for small, disadvantaged community water systems; and drought support for individual households. DFA coordinates closely with the Division of Administrative Services, Office of Chief Counsel, Division of Drinking Water, Division of Water Quality, and the Regional Water Quality Control Board, as well as other State, federal, local, and nongovernmental organizational partners. DFA administers the Operator Certification Program, which oversees the certification of all wastewater treatment plant and drinking water treatment plant and distribution system operators in California. For more information visit: https://www.waterboards.ca.gov/water_issues/programs/grants_loans/
California Department of Transportation (CalTrans) Programs	Caltrans' Local Assistance Program oversees more than one billion dollars annually available to over 600 cities, counties and regional agencies for the purpose of improving their transportation infrastructure or providing transportation services. This funding comes from various Federal and State programs specifically designed to assist the transportation needs of local agencies. Annually, over 1,200 new projects are authorized through the Local Assistance Program of which approximately 700 are construction projects. https://dot.ca.gov/programs/local-assistance

Agency / Program Name	Potential Programs / Grants
California Community Emergency Response Team (CERT) Program Manager Course	There are over 450 CERT programs in California. The State CERT Administrator provides technical support and CERT updates to programs in California. https://www.caloes.ca.gov/office-of-the-director/operations/planning-preparedness-prevention/community-emergency-response-team/
California Residential Mitigation Program	The California Residential Mitigation Program (CRMP): Established to carry out mitigation programs to assist California homeowners who wish to seismically retrofit their houses. californiaresidentialmitigationprogram.com/ ▪ Earthquake Brace + Bolt (EBB) Program: Developed as part of the California Residential Mitigation Program to help homeowners lessen the potential for damage to their houses during an earthquake by offering eligible homeowners up to a $3,000 incentive to seismically retrofit their homes. earthquakebracebolt.com/
California Air Resources Board (CARB) Incentives, Grants, and Credit Programs	These programs have hundreds of millions of dollars in grants available over the next several years to reduce emissions from on- and off-road vehicles and equipment. arb.ca.gov/ba/fininfo.htm
California Department of Water Resources (DWR) Grants and Loans	Agency offers a variety of grants and loans related to integrated regional water management, flood mitigation, water conservation and efficiency, environmental restoration, groundwater, water quality, and water supply. water.ca.gov/Work-With-Us/Grants-And-Loans

5.5 Mitigation Goals

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR § 201.6(c)(3)(i)). The hazard mitigation plan stakeholders established a set of goals for this plan, based on review of Tehama County's goals from the previous MJHMP, goals from other participating jurisdictions' MJHMPs, and goals from the state-wide hazard mitigation plan. The hazard mitigation plan stakeholders also considered the preliminary risk assessment and public outreach results. Ultimately, the stakeholders determined to adopt similar goals to the State of California Hazard Mitigation Plan.

Goals discussed in this section describe the desired impacts of mitigation actions. These goals form the basis for the County's Mitigation Action Plan and specific mitigation projects. The process, resulting in a robust mitigation strategy, consists of four steps: 1) setting goals; 2) considering mitigation alternatives; 3) identifying strategies or "actions"; and 4) developing a prioritized action plan.

A mitigation strategy is considered effective when goals and plan action objectives are achievable. Actions were prioritized based on their ability to achieve multiple goals. The goals on the following page were developed by the MJHMP stakeholders to guide mitigation planning for this planning cycle.

MITIGATION GOALS

#1. Reduce Risk

Significantly reduce risk to life, community lifelines, the environment, property, and infrastructure by planning and implementing whole-community risk reduction and resilience strategies.

#2. Build Capacity and Capability:

Build capacity and capabilities to increase disaster resilience among historically underserved populations, individuals with access and functional needs, and communities disproportionately impacted by disasters and climate change.

#3. Incorporate Equity into Mitigation Planning:

Incorporate equity metrics, tools, and strategies into all mitigation planning, policy, funding, outreach, and implementation efforts.

#4. Use Best Available Data

Apply the best available science and authoritative data to design, implement, and prioritize projects that enhance resilience to natural hazards and climate change impacts.

#5. Plan Integration:

Integrate mitigation principles into laws, regulations, policies, and guidance to support equitable outcomes to benefit the whole community.

#6. Reduce Barriers to Mitigation:

Significantly reduce barriers to timely, efficient, and effective hazard mitigation planning and action.

5.6 County-Wide Mitigation Action Plan

Mitigation actions were developed based on consensus among hazard mitigation plan stakeholders members about hazard mitigation goals and priorities, risk assessment results, current capabilities, and mitigation alternatives. Most importantly, the newly developed mitigation actions acknowledge updated risk assessment information outlined in Section 4.

The Mitigation Action Plan (Table 5-6) establishes specific, county-wide mitigation actions for Tehama County that are tailored to the vulnerabilities and capabilities identified in this plan. Each participating jurisdiction also developed mitigation actions tailored to their unique vulnerabilities and capabilities, found in the jurisdictional annexes in Volume 2. Some mitigation actions support the ongoing activities of partner agencies and stakeholders, while others are intended to be completed when funding is available. Mitigation actions will be reviewed annually and updated as appropriate.

All county-wide and jurisdiction-specific mitigation actions are available as part of the Mitigation Action Support Tool (MAST), which is summarized in STEP 3: Develop Mitigation Strategy, through the project website. This web-based format allows for regular updating and easy sorting by hazard and other parameters. Figure 5-2 illustrates management of mitigation actions using MAST.

Figure 5-2: Mitigation Action Support Tool (MAST) Details

5.6.1 Prioritization

Implementing mitigation actions can be overwhelming for any local jurisdiction or agency, especially with limited staffing and fiscal resources; thus, prioritizing actions is necessary to focus efforts. To ensure this MJHMP realistically reflects available resources, mitigation actions are prioritized by considering a cost/benefit review, public input, and hazard mitigation plan stakeholder's support.

5.6.1.1 Cost/Benefit Review

Mitigation actions must be prioritized according to a cost/benefit review of proposed projects. (44 CFR §201.6(c)(3)(iii)) The benefits of potential projects were weighed against estimated costs as part of the mitigation action prioritization process. In this MJHMP, a less formal and less costly cost/benefit analysis approach was used since some projects may not be implemented in the near term, and associated costs and benefits could change dramatically in the meantime. Consequently, the cost/benefit review conducted does not meet FEMA HMGP or BRIC grant program requirements.

Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of potential mitigation projects. Cost and benefit ratings were defined as follows:

- **High Cost:** Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (e.g., bonds, grants, and fee increases).
- **Medium Cost:** The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- **Low Cost:** The project could be funded under the existing budget. The project is, or can be, part of an ongoing existing program.
- **High Benefit:** Project will provide an immediate reduction of risk exposure for life and property.
- **Medium Benefit:** Project will have a long-term impact on the reduction of risk exposure for life and property or will not provide an immediate reduction in the risk exposure for property.
- **Low Benefit:** Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit-cost ratios (e.g., high over high, high over medium, medium over low) are considered cost-beneficial and are prioritized accordingly. For many of the strategies identified in this Mitigation Action Plan or those of other participating jurisdictions, additional financial assistance may be sought under the HMGP or BRIC programs, both of which require detailed cost/benefit analyses. These analyses will be performed on projects at the time of application using the required FEMA cost/benefit model. For projects not seeking financial assistance from grant programs that require detailed analysis, the jurisdiction may reserve the right to define "benefits" according to parameters that meet the goals and objectives of this MJHMP.

5.6.1.2 Public Input

A 17-question community survey was distributed by Tehama County and other participating jurisdictions across their websites and social media, through partner email blasts and social media postings, and during public outreach events. Planning Stakeholders assisted in distributing the survey to a wide audience, including underserved and vulnerable populations such as agricultural workers.

A total of 142 responses to the community survey were received between November 2023 and November 2024, and the results were used to ensure that the priorities in this plan match those of the residents and other community members. The results of the survey heavily influenced the prioritization of mitigation actions and are summarized in Figure 5-3.

As a result of the feedback received from the survey, the priority levels of various mitigation actions were adjusted; some were moved from medium to high priority, or vice versa. Several jurisdictions added public outreach and education to their mitigation actions in response to survey emphasis on the same, and which indicated a lack of evacuation preparedness across the county. The survey results also included a high response rate supporting mitigation actions that address critical facilities and utility and road infrastructure concerns, including providing emergency backup power during extended power outages. This led to an increased emphasis and prioritization on such projects in the mitigation strategy.

Figure 5-3: Public Survey Results Summary

The complete survey results summary can be found in Appendix B of this MJHMP.

5.6.2 Mitigation Actions

Table 5-6 lists county-wide mitigation actions for Tehama County, and each participating jurisdiction developed unique mitigation actions targeting their unique priorities and vulnerabilities, located in the jurisdictional annexes in Volume 2. Mitigation actions for all participating jurisdictions are also available in MAST. Every action identifies the overall mitigation goal being addressed, responsible party, time frame, potential funding source, implementation steps, and needed resources.

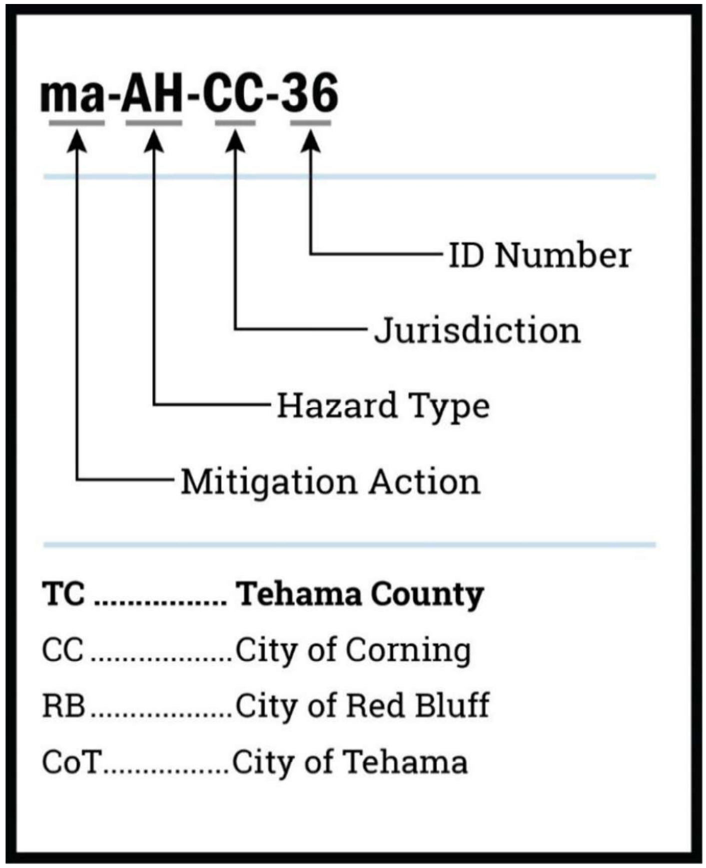

Figure 5-4 Mitigation Action Code Key

Mitigation actions detailed in Table 5-6, the Volume 2 annexes, and MAST contain new actions developed for this plan update as well as old actions that were yet to be completed from the previous MJHMPs. See Section 2 for an overview of progress under the previous MJHMPs, including completed, ongoing or pending, and deleted actions. The detail provided in MAST and captured in Table 5-6 meets the regulatory requirements of FEMA and DMA 2000.

As a living document, hazard problem statements and mitigation activities will be updated through MAST on a regular basis and as appropriate. A distinct identification number was assigned to each mitigation action for easy reference and management. As demonstrated in Figure 5-4, identification numbers use four sets of alphanumeric characters based on the unique attributes of the subject action, including the type of hazard being mitigated.

Important Note: Recognizing that new needs and priorities may arise as a result of a disaster or other circumstances, the hazard mitigation plan stakeholders reserve the right to support new and edit existing actions as necessary, so long as the actions conform to the overall goals of this plan.

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Table 5-6: County-Wide Mitigation Action Plan

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-DF-TC-22	Dam Failure	PRV	Ongoing	2018	Tehama County	Integrate dam inundation zones into reverse 911 / Everbridge / Tehama Alert system.	Tehama County Flood Control and Water Resources	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	General Fund	Medium	ps-DF-TC-1, ps-DF-RB-2, ps-DF-CoT-3, ps-DF-TC-4, ps-DF-RB-5, ps-DF-CoT-6, ps-DF-CoT-7
ma-DF-TC-23	Dam Failure	PRV , PPRO	Ongoing	2018	Tehama County	Develop Emergency Action Plans for non-regulated dams.	Tehama County Flood Control and Water Resources	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	HMGP / BRIC	High	ps-DF-TC-4, ps-DF-RB-5, ps-DF-CoT-6
ma-DR-TC-24	Drought	PRV , PE&A , NRP	Ongoing	2018	Tehama County	Continue to develop and promote water conservation programs.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Ongoing	Project	General Fund	Low	ps-DR-TC-15, ps-DR-CC-16, ps-DR-RB-17, ps-DR-CoT-18
ma-DR-TC-25	Drought	SP	Ongoing	2018	Tehama County	Construct passive aquifer recharge facilities / infrastructure	Tehama County Flood Control and Water Resources	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	Hazard Mitigation Grant Program (HMGP)	High	ps-DR-TC-9, ps-DR-CC-10, ps-DR-TC-11, ps-DR-CC-12, ps-DR-RB-13, ps-DR-CoT-14
ma-DR-TC-26	Drought	SP	Ongoing	2018	Tehama County	Construct additional monitoring wells for ground water monitoring	Tehama County Flood Control and Water Resources	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	General Fund	Medium	ps-DR-TC-9, ps-DR-CC-10, ps-DR-TC-11, ps-DR-CC-12, ps-DR-RB-13, ps-DR-CoT-14, ps-DR-TC-20, ps-DR-CC-21
ma-DR-TC-27	Drought	PE&A	Ongoing	2018	Tehama County	Provide more information to residents on ground water and the effects of wells on water futures.	Tehama County Flood Control and Water Resources	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	5-10 Years	Project	General Fund , Pre-Disaster Mitigation Grant Program (PDM)	Low	ps-DR-TC-19, ps-DR-TC-20, ps-DR-CC-21

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-DR-TC-30	Drought	PRV , NRP	Ongoing	2018	Tehama County	Identify communities that may have water shortages in drought years and identify potential solutions.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	3-5 Years	Project	General Fund	Medium	ps-DR-TC-8
ma-EQ-TC-114	Earthquake	PRV - Prevention , PPRO - Property Protection	Ongoing	2024	Tehama County	Retrofit Unreinforced Masonry Buildings	Tehama County Public Works	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	3-5 Years	Project	HMGP / BRIC , EMPG , General Fund	High	ps-EQ-CC-24, ps-EQ-RB-25, ps-EQ-TC-119
ma-EW-TC-18	Extreme Weather	SP	Ongoing	2018	Tehama County	High Wind, Heavy Rain: Construct Back Up power infrastructure for Critical Facilities including Public Works and shelters identified on County Sheltering Plan	Tehama County Public Works	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	EMPG , Pre-Disaster Mitigation Grant Program (PDM)	Medium	ps-EW-TC-83, ps-EW-CC-84, ps-EW-CoT-85, ps-EW-TC-90, ps-EW-CC-91, ps-EW-CoT-92
ma-EW-TC-19	Extreme Weather	ES	Ongoing	2018	Tehama County	High Wind, Heavy Rain: Construct / enhance communication and networking at Red Bluff Community Center.	Tehama County Public Works	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	General Fund	Medium	ps-EW-TC-86, ps-EW-CC-87, ps-HH-CoT-88, ps-EW-TC-90, ps-EW-CC-91, ps-EW-CoT-92
ma-EW-TC-28	Extreme Weather	PE&A	Ongoing	2018	Tehama County	High Wind: Educate residents on the possibilities of high winds when substantial improvements are conducted.	Tehama County Building and Safety	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	General Fund	High	ps-EW-TC-79, ps-EW-CC-80, ps-EW-RB-81, ps-EW-CoT-82, ps-EW-TC-93, ps-EW-CC-94, ps-EW-RB-95, ps-EW-CoT-96
ma-EW-TC-31	Extreme Weather	PRV	Ongoing	2018	Tehama County	High Wind, Heavy Rain: Assist Residential Care Facilities to have staff trained on evacuation procedures.	Tehama County Public Guardian/ Administrator, Tehama County Health Services Agency	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	1-3 Years	Project	General Fund , Pre-Disaster Mitigation Grant Program (PDM)	Medium	ps-EW-TC-79, ps-EW-CC-80, ps-EW-RB-81, ps-EW-CoT-82

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-FL-TC-10	Flood	PRV	Ongoing	2018	Tehama County	Formally survey high water marks to establish historic flooding depths.	Tehama County Flood Control and Water Resources	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Annually	Project	Staff Time , General Fund	Low	ps-FL-TC-44, ps-FL-CC-45
ma-FL-TC-11	Flood	SP , PRV , PPRO	Ongoing	2018	Tehama County	Inform Residents of impacts that could be caused by re-routing drainage features and importing fill into floodplains. I.e. No Adverse Impact concept for neighbors and other adjacent properties.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Ongoing	Project	General Fund	Medium	ps-FL-TC-38, ps-FL-CoT-39
ma-FL-TC-115	Flood	PRV - Prevention	Ongoing	2024	Tehama County	Amend Section 15.52.230 of the County Floodplain Management Regulations to adopt the currently effective FIRMs and FIS reports and all subsequent amendments, as well as best available data from other sources.	Tehama County Planning Department	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	1-3 Years	Project	General Fund , Staff Time	Medium	ps-FL-TC-30, ps-FL-TC-35, ps-FL-TC-42, ps-FL-TC-50
ma-FL-TC-12	Flood	SP , PRV , PPRO	Ongoing	2018	Tehama County	Continue to encourage residents to clear vegetation and maintain drainage / tributaries.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	Ongoing	Project	General Fund	Medium	ps-FL-TC-70, ps-FL-CC-71, ps-FL-RB-72, ps-FL-CoT-73
ma-FL-TC-13	Flood	PRV , PPRO	Ongoing	2018	Tehama County	Provide assistance to residents for flood proofing wellheads in areas of known flood risk.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Ongoing	Project	FMA , DWR	Low	ps-FL-TC-40, ps-FL-CoT-41
ma-FL-TC-14	Flood	PE&A	Ongoing	2018	Tehama County	Construct or improve flood control infrastructure to protect residents and property surrounding Salt Creek.	Tehama County Flood Control and Water Resources	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	5-10 Years	Project	Flood Mitigation Assistance Grant Program (FMA)	Medium	ps-FL-TC-47
ma-FL-TC-16	Flood	PRV , PPRO	Ongoing	2018	Tehama County	Construct flood control infrastructure to protect residents and property surrounding Antelope Creek in the Dairyville Area.	Tehama County Flood Control and Water Resources	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	Flood Mitigation Assistance Grant Program (FMA)	High	ps-FL-TC-48

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-FL-TC-17	Flood	PRV	Ongoing	2018	Tehama County	Conduct drainage improvements to Jewett Creek between Kirkwood and Margarette Road.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	1-3 Years	Project	Flood Mitigation Assistance Grant Program (FMA)	Medium	ps-FL-TC-52, ps-FL-TC-58, ps-FL-CC-59
ma-FL-TC-21	Flood	PE&A	Ongoing	2018	Tehama County	Install gauges on flashy and creeks and provide real-time data to county website.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	1-3 Years	Project	General Fund , Pre-Disaster Mitigation Grant Program (PDM)	Low	ps-FL-TC-31, ps-FL-CC-32, ps-FL-RB-33, ps-FL-CoT-34, ps-FL-TC-53, ps-FL-CC-54, ps-FL-RB-55, ps-FL-CC-62
ma-FL-TC-5	Flood	SP	Ongoing	2018	Tehama County	Make gauge information readily available on water levels and educate public on readings i.e. what does gauge elevations mean in a localized area.	Tehama County Flood Control and Water Resources	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	1-3 Years	Project	HMGP / Pre-Disaster Mitigation Grant Program (PDM)	Low	ps-FL-TC-35, ps-FL-RB-36, ps-FL-CoT-37
ma-FL-TC-6	Flood	PPRO	Ongoing	2018	Tehama County	Continue outreach program to provide information needed to increase awareness and modify actions to reduce flood damage, encourage flood insurance coverage and protect natural functions of floodplains.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Ongoing	Project	General Fund , Staff Time	Low	ps-FL-CC-32
ma-FL-TC-7	Flood	PRV	Ongoing	2018	Tehama County	Develop flood hazard areas beyond FEMA regulatory flood zones.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Ongoing	Project	DWR	Low	ps-FL-TC-42, ps-FL-CC-43, ps-FL-TC-46
ma-FL-TC-9	Flood	PRV , PPRO	Ongoing	2018	Tehama County	Rehab and improve Deer Creek and Elder Creek levees to provide 100-YR flood protection.	Tehama County Flood Control and Water Resources	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	1-3 Years	Project	FMA	Medium	ps-FL-TC-30
ma-HH-TC-105	High Heat	PRV - Prevention , PPRO - Property Protection , PE&A - Public Education & Awareness	Ongoing	2021	Tehama County	Increase public awareness and education surrounding the signs / symptoms of heat related illness, individual risk factors, treatment, and preventative strategies.	Tehama County Planning Department	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Ongoing	Project	HMGP / BRIC , EMPG , General Fund	Medium	ps-HH-TC-117

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-HH-TC-106	High Heat	PRV - Prevention , PE&A - Public Education & Awareness	Ongoing	2021	Tehama County	Secure backup power facilities for community-based Cooling Centers.	Tehama County Planning Department	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	HMGP / BRIC , EMPG , General Fund	High	ps-HH-TC-117
ma-SF-TC-110	Slope Failure	PE&A - Public Education & Awareness	Ongoing	2024	Tehama County	Conduct Community Outreach Campaign for Slope Failure Along the Sacramento River	Tehama County Public Works	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Ongoing	Project	HMGP / BRIC , EMPG , General Fund	Medium	ps-SF-CoT-99, ps-SF-RB-98, ps-SF-RB-100, ps-SF-TC-118
ma-WF-TC-1	Wildfire	PRV	Ongoing	2018	Tehama County	Continue to review and implement CWPP Mitigation Actions with HMGP.	Tehama County RCD / CAL FIRE Tehama Glenn Unit	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Annually	Project	HMGP / Pre-Disaster Mitigation Grant Program (PDM)	Medium	ps-WF-TC-104, ps-WF-TC-105, ps-WF-TC-106, ps-WF-TC-107, ps-WF-TC-108, ps-WF-TC-109
ma-WF-TC-2	Wildfire	PRV , PPRO	Ongoing	2018	Tehama County	Implement fuel reduction measures around Critical Facilities such as schools and other gathering facilities.	CAL FIRE Tehama Glenn Unit	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	Ongoing	Project	PA Post Disaster Mitigation Funding.	Low	ps-WF-TC-102, ps-WF-CoT-103
ma-WF-TC-29	Wildfire	PE&A , PRV , PPRO	Ongoing	2018	Tehama County	Increased or enhanced real estate disclosures for wildfire risk in Tehama County	Tehama County Building and Safety	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	General Fund	Low	ps-WF-TC-101, ps-WF-TC-104
ma-WF-TC-3	Wildfire	PRV	Ongoing	2018	Tehama County	Develop defensible space program for disabled / unable residents.	CAL FIRE Tehama Glenn Unit / Tehama RCD	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	Ongoing	Project	HMGP / Pre-Disaster Mitigation Grant Program (PDM)	High	ps-WF-TC-104, ps-WF-TC-110, ps-WF-RB-111

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-WF-TC-4	Wildfire	SP	Ongoing	2018	Tehama County	Construct / expand water supply for hydrants in rural residential areas.	Tehama County Public Works	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	Assistance to Firefighters Grant Program (AFG); Fire Prevention and Safety (FP&S)	Medium	ps-WF-TC-104
ma-WF-TC-99	Wildfire	PRV	Ongoing	2018	Tehama County	Conduct fuel reduction efforts on Railroad property.	Tehama County CDF Fire Department	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	3-5 Years	Project	Hazard Mitigation Grant Program (HMGP)	Medium	ps-WF-CoT-116

Note: As a living document, project descriptions and actions in Table 5-6 will be modified to reflect current conditions over time in MAST.

Section 6. Implementation & Maintenance

It is important that this MJHMP becomes a convenient and readily usable tool for Tehama County and the other participating jurisdictions to ensure effective implementation and reduce hazard impacts for the community. This section discusses incorporation of the MJHMP into existing planning mechanisms and continued public engagement, in addition to adopting, implementing, monitoring, evaluating, and updating the MJHMP so that it remains relevant.

6.1 Plan Adoption

To comply with DMA 2000, the Tehama County Board of Supervisors officially adopted the Tehama County Multi-Jurisdictional Hazard Mitigation Plan on **DATE TBD**. Similarly, other participating jurisdictions adopted Volume 1 of the plan as well as their respective annex in Volume 2. The adoption of the plan in its entirety recognizes each participating jurisdictions' commitment to reducing the impacts of natural hazards within the planning area. Copies of all adoption records are provided at the end of the Executive Summary.

6.2 Plan Implementation

Over time, implementation strategies for mitigation actions will become more detailed as individual projects are planned and funding is secured. MAST will be extremely useful to update and revise actions along the way and to plan for future updates during the next MJHMP cycle. In conjunction with the progress report processes, implementation strategy worksheets are used as plan of record tools for updates. Each worksheet outlines individual steps and resources needed to complete a given mitigation action. The following are considerations for developing future implementation strategies:

- **Use processes that already exist.** Take advantage of the tools and procedures identified in the capabilities assessment in Section 5.4. Using familiar planning mechanisms that are already being applied will give the implementation phase a strong initial boost.
- **Update work plans, policies, and procedures.** Incorporating hazard mitigation concepts and activities into work plans, policies, or procedures can help integrate the MJHMP into daily operations. These changes can include how major development projects are reviewed in hazard-prone areas or can ensure that hazard mitigation is considered in capital improvement projects.
- **Revise job descriptions.** Working with department or agency heads to revise job descriptions to include hazard mitigation-related duties, including designating a "mitigation lead" within a department, can further institutionalize hazard mitigation with little financial expenditure or programmatic overhaul.

6.2.1 Ongoing Hazard Mitigation Planning Team (OHMPT)

The Hazard Mitigation Planning Team oversaw the development of the plan and made recommendations on key elements, including the plan maintenance strategy. The Planning Team for this update recommended that an oversight committee, referred to herein as the Ongoing Hazard Mitigation Planning Team (OHMPT), should have an active role and be involved in key elements of the plan maintenance strategy. The new OHMPT should strive to include representation from the hazard mitigation plan stakeholders and participating jurisdictions, as well as other stakeholder groups and members of the public in the planning area. Keeping this OHMPT intact will also jump-start future updates.

The OHMPT will review annual progress reports from participating jurisdictions and develop a county-wide report that specifically covers unincorporated areas to provide input to the Tehama County Board of Supervisors and, as appropriate, elected officials of other participating jurisdictions on possible improvements or action steps to be considered at the next update. Completion of the individual jurisdiction progress reports is the responsibility of each participating jurisdiction. These annual reports will also be released to the media and posted online for public review. It will be the OHMPT's role to help identify revisions and issues to be addressed by future plans.

6.3 Monitoring, Evaluating & Updating the Plan

This section describes the schedule and process for monitoring, evaluating, and updating the MJHMP. The Mitigation Action Support Tool (MAST) has been developed for participating jurisdictions to use as a primary resource for updating and monitoring mitigation actions.

6.3.1 Schedule

Monitoring the progress of mitigation actions will continue through the five-year period between adoption of this plan and the next update effort. The newly formed OHMPT will meet annually, at a minimum, to monitor implementation and develop updates as necessary. The team's meeting schedule will be posted online, and meetings will be open to the public.

The MJHMP will be updated every five years, as required by DMA 2000, and the update process will begin at least one year prior to the plan's expiration. However, should a significant disaster occur within Tehama County, the OHMPT shall reconvene within 30 days of the disaster to review and update the plan as appropriate. The Tehama County Board of Supervisors will adopt any written updates as a DMA 2000 requirement.

6.3.2 Process

The OHMPT will coordinate with the responsible jurisdictions, departments, agencies, and other organizations identified for each mitigation action to assess the effectiveness of actions and make modifications as appropriate. The responsible parties will monitor and evaluate progress on the implementation of mitigation actions and report to the OHMPT annually. MAST will assist managers of specific mitigation activities and projects in conveniently reporting their current status and assessing the efficacy of actions.

Information from the mitigation leads within responsible departments and agencies will be used to monitor mitigation actions and contribute to the annual evaluation of the plan. In evaluating the MJHMP's effectiveness, the following questions will be considered:

- Has the nature or magnitude of hazards affecting the planning area changed?
- Are there new hazards that have the potential to impact the planning area?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the MJHMP?
- Should additional local resources be committed to address identified hazards?

Future updates to the plan will account for any new hazard vulnerabilities, special circumstances, or new information or methodologies that become available. Issues that arise or updates made during the interim monitoring and evaluating period will be incorporated into the next update of the MJHMP, and the questions identified above will remain valid during its preparation.

6.3.2.1 Mitigation Action Support Tool (MAST) Updates

Hazard problem statements and mitigation activities will be updated through the MAST application developed specifically for Tehama County and the other participating jurisdictions to ensure this MJHMP remains a living document. MAST will continue to be available on mitigatehazards.com

MAST is a web-based interactive tool that enables multiple users to search, view, enter, and update mitigation actions, ideas or projects, and other information. MAST provides jurisdictional staff and plan reviewers, such as FEMA and Cal OES, access to valuable mitigation information that can be leveraged by future planning or other risk reduction efforts. Users can update the status of their mitigation projects throughout the planning lifecycle. MAST will also improve each jurisdiction's ability to apply for FEMA's HMA grant programs, including the initial grant application processes through Cal OES (Figure 6-1).

Figure 6-1: MAST Elements and Cal OES Grant Applications

6.3.2.2 Continuing Public Involvement

During the five-year update cycle, county staff will involve the public through various workshops, meetings, and other feedback mechanisms. Information on upcoming public events related to the MJHMP or solicitation for comments will be announced via multiple mediums, including local news outlets and on the Tehama County and mitigatehazards.com websites. An electronic copy of the current MJHMP document will be accessible through the county website as well as at the Tehama County Courthouse. The Hazard Mitigation Planning Team will, as much as practicable, incorporate the following concepts into its public outreach strategy to ensure continued public involvement in the planning process:

- Work with public service clubs, e.g., the Red Bluff Sunset Rotary Club and Tehama County Library.
- Collaborate with faith-based organizations.
- Create story ideas for media outlets, such as newspapers, local radio, and TV.
- Distribute emails and mailers to residents about hazard mitigation updates.
- Post meeting announcements around the community, e.g., at city halls, community centers, coffee houses, grocery stores.
- Educate and collaborate with insurance and real estate professionals.
- Distribute information to students and parents through K-12 schools.

- Participate in existing local community events, e.g., Red Bluff Farmers Market, Tehama County Career Fair, and Red Bluff National Night Out.
- Continue to use the project and participating jurisdictions' websites as distribution points for hazard mitigation information.

6.3.2.3 Federal Hazard Mitigation Assistance Monitoring

It is important to monitor funding opportunities that can be leveraged to implement mitigation actions identified in this MJHMP. FEMA's Hazard Mitigation Assistance (HMA) Program is the catalyst that drives increased understanding of hazards and supports proactive community action to reduce impacts and losses. To support this vision, FEMA funds three grant programs under HMA: Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) Program, and Building Resilient Infrastructure and Communities (BRIC) Program.[8] Per FEMA:

- **HMGP** assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration;
- **BRIC** provides funds for hazard mitigation planning and projects on an annual basis; and
- **FMA** provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis.

HMGP funding is generally 15% of the total amount of federal assistance provided to a state, territory, or federally recognized tribe following a major disaster declaration. BRIC and FMA funding depends on the amount congress appropriates each year for those programs. The HMGP supports cost-effective, post-disaster projects and is the longest-running mitigation program among FEMA's three grant programs. A 2019 study by the National Institute of Building Sciences (NIBS) Multi-Hazard Mitigation Council has shown that every federal dollar spent on mitigation saves six dollars in response and recovery costs. (National Institute of Building Sciences, 2019, p. 116)

MAST will be extremely useful in applying for FEMA and Cal OES funding. Figure 6-1 demonstrates how easily MAST information translates to Cal OES Notice of Interest (NOI) forms and federal grant sub application requests.

Following a disaster, Cal OES and Tehama County officials, in a joint effort with FEMA, will perform Preliminary Damage Assessments (PDA) of areas that sustained damage. Through the FEMA Regional Office, Cal OES then submits the information collected along with an overall damage estimate to request a declaration from the President. A Presidential Major Disaster Declaration triggers availability of HMGP funds for eligible communities at the request of a state, territory, or tribe's Governor or Tribal Leader.

[8] In August of 2020, the BRIC program replaced FEMA's Pre-Disaster Mitigation (PDM) grant program.

Figure 6-2 shows a timeline of how projects should be developed and administered by a local government and FEMA under the HMGP program following a disaster event. HMGP grant recipients have 36 months from the close of the application period to complete projects. For more information on the HMGP project development process, visit the FEMA and Cal OES websites.

Figure 6-2: HMGP Timeline

6.3.2.4 Incorporation Into Other Planning Mechanisms

For the MJHMP to be truly successful, the recommendations and underlying principles herein should be incorporated into community planning and regulatory mechanisms, such as capital improvement plans and budgeting; building, subdivision, and zoning codes; general plans; and regional plans. Integration into a variety of departments at the county and participating jurisdictions, as well as at external governmental agencies, provides an opportunity to network and highlight mitigation activities and opportunities at all levels of government.

Each participating jurisdiction's process for integration will vary and is discussed more specifically in its individual annex. The commitment to ongoing implementation meetings for the next five years will be essential to keeping this MJHMP relevant and at the forefront of planning processes. Some jurisdictions have ongoing updates that have already begun to incorporate data from the plan. For Tehama County, information from this MJHMP will be incorporated into such planning mechanisms as:

- **Tehama County General Plan:** The MJHMP provides information that will be incorporated into the Safety, Land Use, Conservation, and other elements of the county's General Plan when it is next updated. In particular, the county will update the Safety Element of their General Plan to incorporate the MJHMP following adoption, in compliance with Assembly Bill 2140. Specific risk and vulnerability information from this MJHMP will assist in identifying areas where development may be at risk to potential hazards, which in turn will be incorporated into these long-range planning mechanisms. For example, the county may consider identifying less dense or intense future land uses in proximity to hazard areas.
- **Tehama County Development Codes and Ordinances:** Appropriate development regulations can increase resilience against natural disasters, and the MJHMP provides detailed information to enable the county to make better decisions on appropriate codes and ordinances, such as the Tehama County Building Code and Zoning Ordinance. Further, some mitigation actions in this plan

directly recommend new or updates to existing development regulations as mitigation for identified hazard risks.

- **Tehama County Climate Action Plan:** The MJHMP includes detailed climate vulnerability information that can be a useful first step in developing a climate action plan.
- **Tehama County Resource and Other Management Plans:** The MJHMP provides information that will be included in updates to or the development of management plans for water resources, floodplains, stormwater drainage, wildfire protection, or other resources or areas. Examples include the Tehama County Integrated Regional Water Management Plan, Tehama East and Tehama West Assessment and Management, and Tehama East and Tehama West CWPP. While the process for updating these types of plans will vary by type, the hazard data and asset inventory developed for this MJHMP will be used in other mechanisms along with exposure and damage estimation information.

6.3.3 Responsibilities

With the adoption of this plan, Tehama County, other participating jurisdictions, the hazard mitigation stakeholders, and the Hazard Mitigation Planning Team will be jointly and severally responsible for aspects of plan implementation, maintenance, and progress. The participating jurisdictions and the planning team will continue to:

- Act as a forum for hazard mitigation issues;
- Disseminate at-home hazard mitigation ideas and activities to community members and solicit public input;
- Coordinate mitigation projects with external agencies, as appropriate;
- Ensure hazard mitigation risk assessments and maps remain a consideration for decision-makers; and
- Report on plan progress and recommended changes.

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Appendix A. Analysis Methodology

TEHAMA COUNTY
MULTI-JURISDICTIONAL
HAZARD MITIGATION PLAN

A vulnerability assessment was conducted using Geographic Information Systems (GIS) for each of the priority hazards identified by the Planning Committee. Several sources of data are necessary to conduct a vulnerability analysis. This appendix presents an outline of the data inputs, processing steps, and outputs used to create the vulnerability analysis results presented in the Multi-Jurisdictional Hazard Mitigation Plan (MJHMP). The analysis methodology is presented first, followed by an overview of the analysis data.

A.1. Natural Hazard Exposure

The natural hazard exposure analysis (see C. Natural Hazard Exposure in Figure A - 5) is an inventory of population, parcels, critical facilities, and other assets within each natural hazard area. As shown in Figure A - 1, the presence of a structure inside a natural hazard area (the flood zone in this example) qualifies that structure as exposed to the natural hazard.

Figure A - 1: Natural Hazard Overlay

The total counts of parcels, people, facilities, and assets and the sum of values within the planning area which could be exposed to a hazard event are referred to as the “exposure” in this plan. A natural hazards overlay was developed to reflect the combination of many known natural hazard spatial footprints. The spatial overlay method enables summarization of building values, parcel counts, population exposure, and critical facility exposure within a hazard’s geographic extents (see C. Natural Hazard Exposure in Figure A - 5). The input data is used to evaluate exposure for wildfire, flood, dam inundation, earthquake, and landslide.

A.1.1. Damage Estimation with Hazus

FEMA’s Hazus software was implemented to conduct a detailed loss estimation for flood, earthquake, and dam inundation. Hazus is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. Hazus uses GIS technology to estimate physical, economic, and social impacts of disasters. For purposes of this planning effort, Hazus was used to generate damage estimations due to possible earthquakes and flooding. The estimated damage and losses provided by the Hazus Software provide the ability to understand possible widescale damage to buildings and facilities. Figure A - 2 provides a visual simplification of the Hazus Software flood modeling parameters.

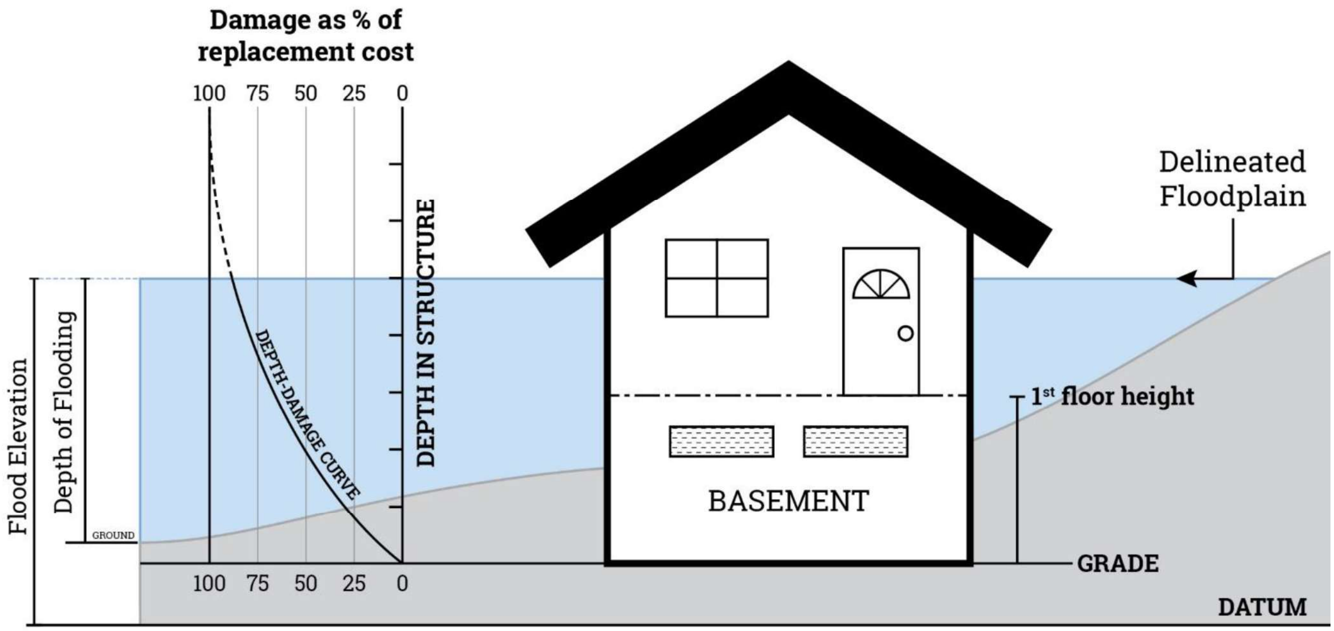

Figure A - 2: Flood Depth and Damage Curves

In the hypothetical geography shown in Figure A - 3, even though both structures are exposed to flooding, it is expected that the structure with a first-floor height below the depth of flooding will receive significantly more damage than the structure with a first floor height above the expected water depth. Note that not all building data contains first floor height, and first floor height is an example of the type of field utilized by Hazus in calculating damage estimates.

Figure A - 3: Hazus Damage Estimations

The example in Figure A - 4 represents hypothetical damage estimations for buildings that undergo an earthquake shaking scenario. Building attributes such as construction type and number of stories change the relationship of the building damage curve to the ground shaking event.

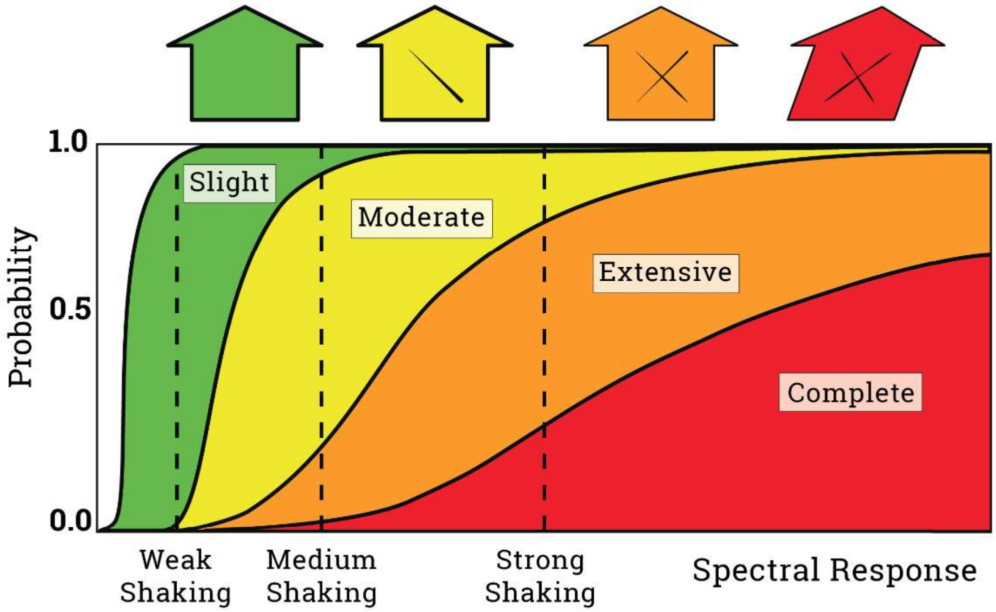

Figure A - 4: Earthquake Shaking Potential and Damage Probability

Hazus is a FEMA product with highly detailed documentation provided on the analysis steps and algorithms performed against the input data and associated scenarios in the process of obtaining loss estimates. The explanation in this appendix section is simplified. Refer to the full documentation and technical manuals from FEMA for greater explanation on Hazus specifics.

Refer to

A.1.2. Distinguishing Results – Natural Hazard Exposure Analysis vs Hazus Results

Table and chart references throughout the hazard mitigation plan are explicitly called out for Hazus results as "Damage Estimates". There are expected differences in the results between estimations of Natural Hazard overlays and detailed Hazus results. Snapshot tables and Natural Hazard Exposure sections do not contain Hazus estimates.

A.2. Analysis Data

A.2.1. Assets, Value, and Population

A.2.1.1. Parcels

County-provided parcel geometry was joined with County Assessor data. Centroids were created to represent parcels at a single location. Fields required by Hazus that were not present in the parcel data provided were given default values based on the mapped use-codes of each parcel. Earthquake building design level attribution was based on year built (where the default was 1972) and building code adaptation chronology. Improved parcels were chosen for the parcels dataset by a query of improvement value presence, building area, and use-code descriptors. Where building area values were present, a replacement cost of **$330 per square foot** was used in place of assessed structure values.

A.2.1.2. Asset Insurance Schedules

County and jurisdictional insurance schedules were used in developing Real Property Asset data with valuations and structural data for analyses. These assets were utilized in vulnerability exposure analysis. The tabular data were geocoded, and quality checked for building placement. This data is presented in the exposure analysis as "Real Property Assets" and in Hazus results as government and emergency occupancy categories. There is some overlap with Real Property Asset data and the other critical infrastructure classifications.

A.2.1.3. Population

Population input data for analyses consisted of 2020 Census Blocks. These were then processed through GIS modeling in order to break down the proportional population for smaller units of area in relation to natural hazards and corrected for 2021 ACS estimates.

A.2.1.4. Critical Infrastructure

Critical facilities and transportation/lifeline typically include hospitals, fire stations, police stations, storage of critical records, and similar facilities. These data came from a collection of sources, including but not limited to: county GIS, county and local jurisdiction insurance data, CDSS, CEC, FCC, Hazus, USACE, NBI, FEMA, and NPS. All data sources have a level of accuracy acceptable for planning purposes.

Table A - 1 offers a complete list of Critical Infrastructure data used in the analysis.

A.2.1.5. Hazus Inputs

Hazus data inputs include hazard scenario data and detailed building data. The GIS team conducted a Level 2 analysis utilizing user-defined buildings with refined building characteristic parameters as inputs for the damage estimation calculations (see Figure A - 2 and Figure A - 4). Countywide building data were used as inputs in this level 2 analysis update. The customized user defined building dataset allows for more accurate results for damage estimation based upon detailed building characteristics.

Note: FEMA's Hazus software utilizes different user defined building information inputs to develop loss estimates depending on the hazard module. The Hazus flood and earthquake modules use fragility curves based upon the user's definition of building characteristics, including but not limited to:

- **Area**
- **Year Built**
- **Construction Type**
- **Number of Stories**
- **First Floor Height**
- **EQ Design Level**
- **Occupancy Type (Residential, Government, etc.)**
- **Building Values**

Defaults were used for missing fields and values based on use-code and other available information for that input.

A.2.2. Natural Hazard Data

A.2.2.1. Earthquake Shaking

The CGS two percent chance – 50-year probability map was used as a qualitative guide in selecting an earthquake epicenter-based ShakeMap scenario for analyses. The M6.7 Battle Creek earthquake scenario and ShakeMaps were used in this plan's analyses.

Earthquake Scenario MMI Shaking Intensity

M6.7 Battle Creek

Intensity	MMI	Description/Damage
I-Not felt	0-1	Not felt except by a very few under especially favorable conditions.
II-Weak	1-2	Felt only by a few persons at rest, especially on upper floors of buildings.
III-Weak	2-3	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.

IV-Light	3-4	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V-Moderate	4-5	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI-Strong	5-6	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII-Very strong	6-7	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII-Severe	7-8	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX-Violent	8-9	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X-Extreme	9-10	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS Scenario MMI Grid

A.2.2.2. Dam Inundation Zones

Dam inundation zone GIS data were provided by Cal OES and DWR. These represent the estimated flood extent in the event of dam failure for individual dams.

Dam Inundation Area

Hazard	Description
Inundation Area	Dam Inundation maps for the State of California are required by California Government Code Section 8589.5(b). DWR Dam Breach Inundation studies are used for inundation sourcing for dams with published inundation areas.

Source: Cal OES, DWR

A.2.2.3. Flood Zones

The input parameters for Hazus analysis of Flood damage estimates included depth grids created with the FEMA Flood Zone DFIRM data. 100-YR and 500-YR floodplains were scenarios used to analyze the exposure to inputs as depicted in Figure A - 5. The 100-YR floodplain is comprised of the floodway and flood fringe.

FEMA Flood Hazard

Hazard	Flood Zone	Description
100-YR Flood [SFHA]	Subtype: Floodway	A "Regulatory Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Communities must regulate development in these floodways to ensure that there are no increases in upstream flood elevations.
	SFHA outside Floodway	The land area covered by the floodwaters of the base flood is the Special Flood Hazard Area (SFHA) on NFIP maps. The SFHA is the area where the National Flood Insurance Program's (NFIP's) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.
500-YR Flood [non-SFHA]	Subtypes: 0.2% Annual Chance, Protected by Levee	Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones.

Source: FEMA MSC DFIRM

A.2.2.4. Landslide Susceptibility

GIS layer with geographic boundaries defining the likelihood of deep-seated landslides. Underlying geology and slope angle are used in the creation of this layer by the California Geological Society. Low, Medium, and High landslide classes were chosen as summary classes for this plan.

Landslide Susceptibility

Hazard	Native Class	Description
Low	1-5	These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weaker rocks.
Medium	6-7	Very high landslide susceptibility, classes VIII, IX, and X, includes moderate and steep slopes in hard rocks and weak rocks.
High	8-10	Very high landslide susceptibility, classes VIII, IX, and X, includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks.

Source: CGS Susceptibility to Deep-Seated Landslides in California

A.2.2.5. Wildfire Hazard Severity

A Composite of LRA and SRA delineations as available June 2023 during Cal Fire data transitioning and development of new layer. Does not include all 2011 LRA recommendations and is prior to development of April 1 2024 Cal Fire product.

Wildfire Severity Zones

Hazard	Native Class	Description
Moderate	Moderate	Classification of a zone as moderate, high or very high fire hazard is based on a combination of how a fire will behave and the probability of flames and embers threatening buildings.
High	High	
Very High	Very High	

Source: Cal Fire FHSZ (SRA & LRA) – LRA SRA Composite from Cal Fire Data Download accessed June 2023

A.2.3. Methodology Overview

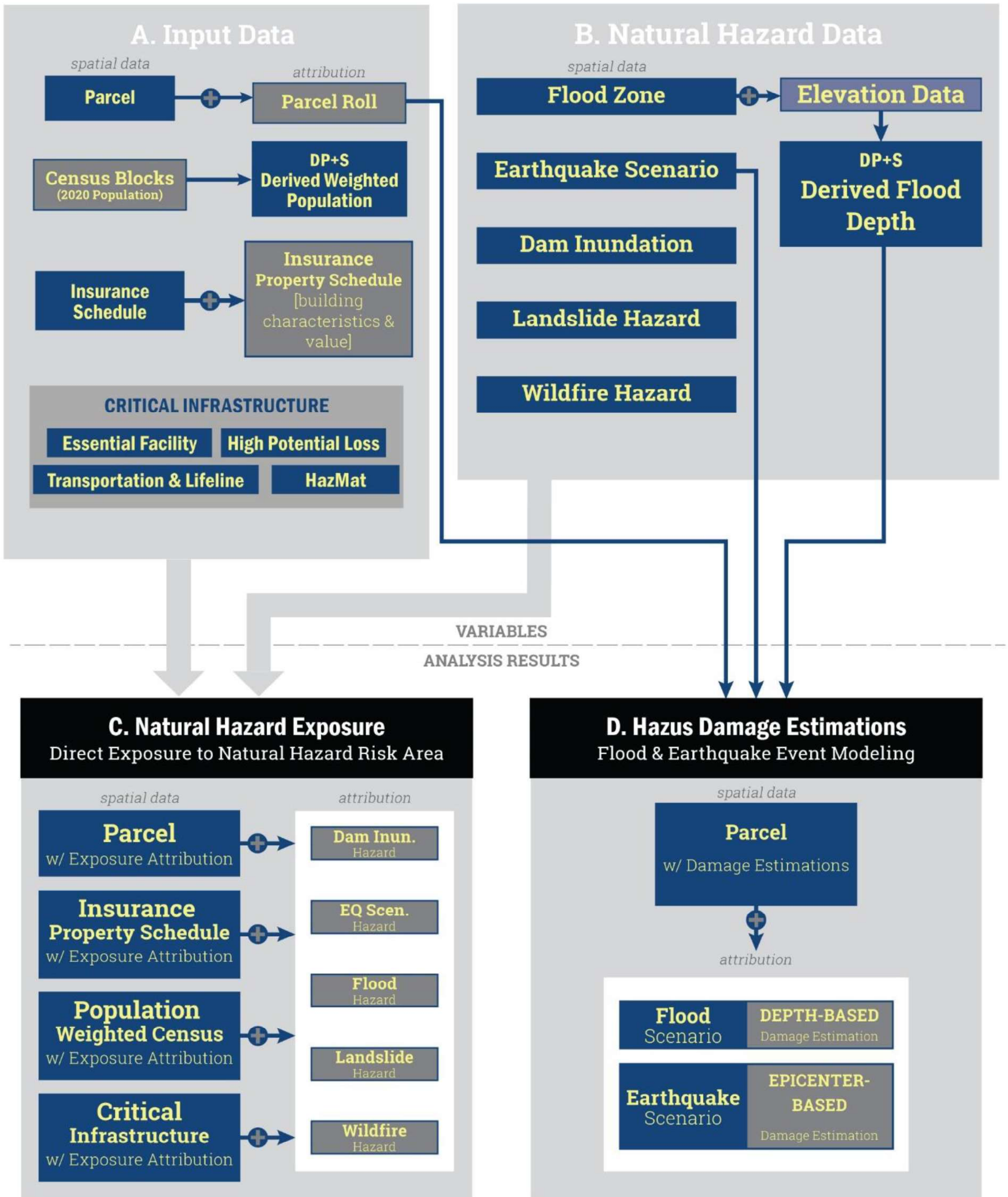

Figure A - 5: Data Analysis Methodology

A.2.4. Data Dictionary

Table A - 1: GIS Data Dictionary

Dataset	Data Steward	Notes
Jurisdictional/Municipal Boundaries	Census/County	Census used for QA and Cartographic purposes for County.
Aerial Imagery	USDA	NAIP to be used unless a better local dataset is available
County Boundary	County	From Tehama Transportation, Census data used as supplement
Standard Elevation Model	NED, County	Have elevation from 2017 HMP
GNIS	USGS	For cartographic purposes
Stream	NHD+	For cartographic purposes
Water	NHD+	For cartographic purposes
Parcel Geometry	County	From Tehama Transportation
Parcel Roll	County	Attributes needed: APN, Improvement Value, Land Value, Total Assessed Value, Market Value, Number of stories, First floor height, Structure Floor Area (in square feet), Use Code (and lookup table if needed: residential, industrial, commercial, education, etc), Year Built, Construction Type (wood frame, masonry,etc), Foundation Type (slab on grade, stemwall, etc), Address, EQ Design Level
Emergency Operations Center	2023	Manual placement.
Fire Station	Hazus	Hazus 2023
Hospital	Hazus	Hazus 2023
Law Enforcement	Hazus	Hazus 2023
Adult Residential Facility	CDSS	2023 CDSS Data Geocoded
Child Care Center	CDSS	2023 CDSS Data Geocoded
Dam	USACE NID, DWR	NID
Historic Building	NPS	From National Park Service database
Historic Site	NPS	From National Park Service database
Power Plant	Hazus	Hazus 2023
Real Property Asset	County	From previous planning efforts - 2017 Insured Asset Role data development and QAQC efforts, combined with legacy plan data for uncategorized assets.
Residential Elder Care Facility	CDSS	2023 CDSS Data Geocoded
School	CDE	2023 CDE Update file download Merged private and public
Airport	Hazus	Hazus 2023
Bridge	NBI	National bridge inventory Updated for 2023 plan
Cell Tower	FCC, HIFLD	FCC database
FM Transmission Tower	FCC, HIFLD	FCC database
Microwave Service Tower	FCC, HIFLD	FCC database
NG Pipeline	CEC	2019 Data last available download

NG Station	CEC	2019 Data last available download
Paging Transmission Tower	FCC, HIFLD	FCC database
Park	County	3rd party source data can be supplemented by local data per availability.
Railroad	Esri	2017 HMP
Streets	Esri	2017 HMP
Substation	CEC	2023 CEC Update
Transmission Line	CEC	2023 CEC Update
Wastewater Treatment Facility	Hazus	Hazus 2023
HWTS Active Facility	DTSC	Active facilities from DTSC dataset accessed 2023
Geotracker CleanupSite	Geotracker	Geotracker 2021 dataset
Census Block	US Census Bureau	2020 Census
Census Block Group	US Census Bureau	2020 Census
Avalanche	DPS	100m sq is the area, min slope derived from foot based NED is 28 degrees max is 44 degrees
Dam Inundation	DWR	DWR Inundation zones
EQ Scenarios 1-X	USGS	EQ1 Is Battlecreek 6.7
Flood Hazard	FEMA	Same NFHL as last run dated 05/29/2012 LOMR Effective Date.
Landslide Susceptibility	CGS	CGS Susceptibility layer converted to polygon and reclassified.
Shake Potential	USGS, CISN	For cartographic purposes
Wildfire Hazard Severity Zone	CalFire	LRA and SRA Composite. Pre April 2024, does not include 2011 LRA recommendations.
Fault Zone Requiring Investigation	CGS	Zone of required investigation
EQ Fault Zones	CGS	For cartographic purposes
Fire Perimeter Calfire	NIFC/CalFire	Statewide for burn peremiters 2000-2019 (Geomac Archive) plus additional form CalFire
Fire Regime MFRI	USGS	https://www.landfire.gov/NationalProductDescriptions13.php
Qfaults	USGS	For cartographic purposes

Appendix B. Process Documentation

TEHAMA COUNTY
MULTI-JURISDICTIONAL
HAZARD MITIGATION PLAN

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Planning Process Documentation Appendix

Table of Contents

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Planning Committee Meeting Documentation

Appendix B.1

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TEHAMA COUNTY
HAZARD MITIGATION PLAN

Meeting Agenda:

Tehama County, California

Mulit-Jurisdictional Hazard Mitigation Plan 2023 Update

Large Gathering Meeting #1

Monday, June 12th, 2023, 10:00 a.m. – 12:00 p.m.

Meeting Objectives

- **Executive Overview**
  - Welcome and Introductions
  - Polling Icebreakers
  - Background & Mitigation 101
- **The Planning Process**
  - Project Schedule
  - Website Review
- **Hazard Mitigation Funding Opportunities**
- **2018 HMP Review & Discussion**
  - Recent Success Stories
  - What's Changed
- **Outreach**

NOTES

TEHAMA COUNTY | HAZARD MITIGATION PLAN

PC Meeting 1 Agenda

PC Meeting 1 In Person Attendance

Mulit-Jurisdictional Hazard Mitigation Plan 2023 Update Kick-Off Meeting
Monday, June 12th, 2023, 10:00 a.m. – 12:00 p.m.

Sign In Sheet

Name	Email	Title	Agency
Bob Farias	bob.farias@fire.ca.gov	Tehama County Fire Chief	CAL FIRE
Patti Carter	Patti.carter@ssvems.com	RDMHS Reg. 3	Sierra-Sacramento Valley EMS Agency
Jennifer Johnson	Jennifer.Johnson@ssvems.com	RDMHS Reg 3	" " "
Laurianne Griffin	Laurianne.Griffin@fire.ca.gov	AGPA	CALFIRE/TehCoFire
Remy Gill	remy.gill@water.ca.gov	engineer	CA DWR
Levi Warr	Levi.Warr@water.ca.gov	Senior Engineer	CA DWR
Carolyn Steffan	csteffan@cityoftehama.us	City Clerk/Admin	City of Tehama
GARRETT DUNN	gdunn@blm.gov	REDDING ARCATA ZONE FMO	BLM
Ruth Ann Rowen	ruth.rowen@dignityhealth.org	Emergency Management Coordinator HPP coordinator	SECH - Tehama HPP
Tom Tomlinson	ttomlinson@corning.org	Corning Fire chief	Corning Fire
Lauri Dilworth	ldilworth@co.tehama.ca.gov	Senior REHS	T.C. Dept of Environmental Health
Mike Bachmeyer	mbachmeyer@rbfd.org	Fire Chief	Red Bluff Fire
GERRY MAGANA	Gerry.magana@fire.ca.gov	Deputy Chief	Cal Fire/TCFD

PAGE 1 of 3

PC Meeting 1 Sign In 1

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mulit-Jurisdictional Hazard Mitigation Plan 2023 Update Kick-Off Meeting
Monday, June 12th, 2023, 10:00 a.m. – 12:00 p.m.

Sign In Sheet

Name	Email	Title	Agency
Brian Wright	Brian.Wright@fire.CA.gov	Battalion Chief Fire Marshal	CAL FIRE Tehama County Fire
GABRIEL HYDRICK	GHYDRICK@CO.TEHAMA.CA.GOV	CAO	TEHAMA COUNTY
JIM RICHARDSON	Jim_Richardson@nps.gov	PARK SUPERINTENDENT	NATIONAL PARK SERVICE
Matt Shobash	mshobash@rbfd.org	Div Chief	Red Bluff Fire
RScott Miller	smiller@cityofredbluff.org	Pub. Works Director & Airport Mgr	City of Red Bluff

PAGE 2 of 3

PC Meeting 1 Sign In 2

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mulit-Jurisdictional Hazard Mitigation Plan 2023 Update Kick-Off Meeting
Monday, June 12th, 2023, 10:00 a.m. – 12:00 p.m.

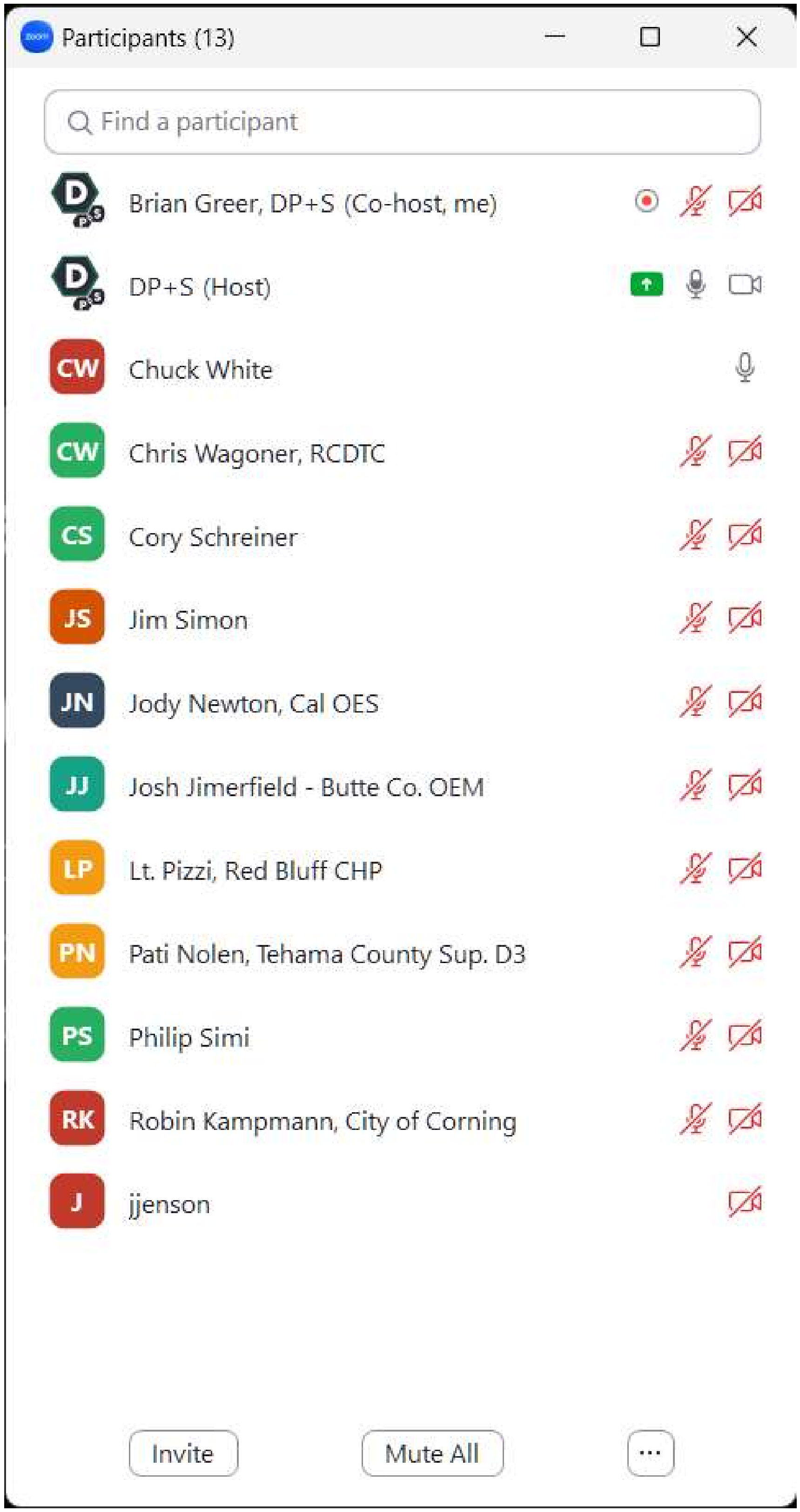
Sign In Sheet

Name	Email	Title	Agency
Brian Wright	Brian.Wright@fire.CA.gov	Battalion Chief Fire Marshal	CAL FIRE Tehama County Fire
GABRIEL HYDRICK	GHYDRICK@CO.TEHAMA.CA.GOV	CAO	TEHAMA COUNTY
JIM RICHARDSON	Jim_Richardson@nps.gov	PARK SUPERINTENDENT	NATIONAL PARK SERVICE
Matt Shobash	mshobash@rbfd.org	Div Chief	Red Bluff Fire
R Scott Miller	smiller@cityofredbluff.org	Pub. Works Director & Airport Mgr	City of Red Bluff

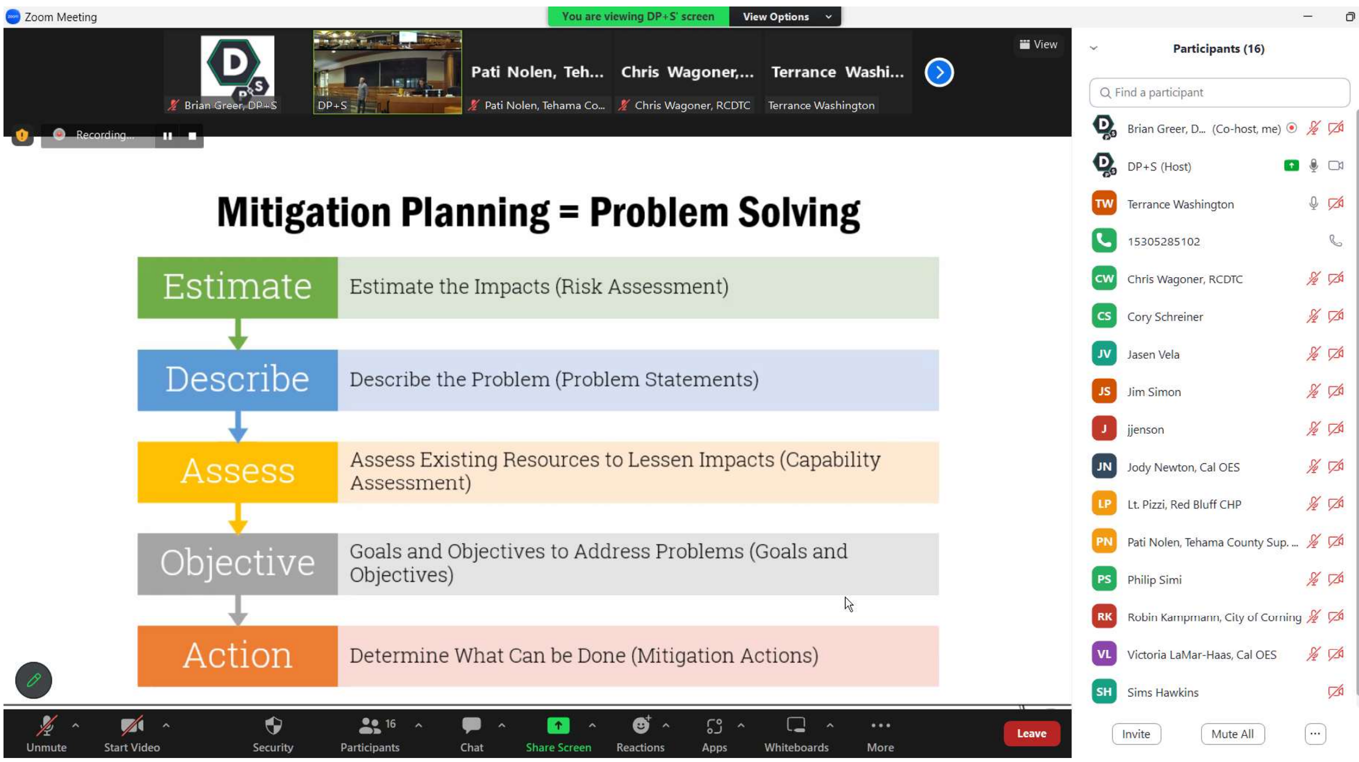
PAGE 3 of 3

TEHAMA COUNTY | HAZARD MITIGATION PLAN

PC Meeting 1 Sign In



PC Meeting 1 Zoom Attendance



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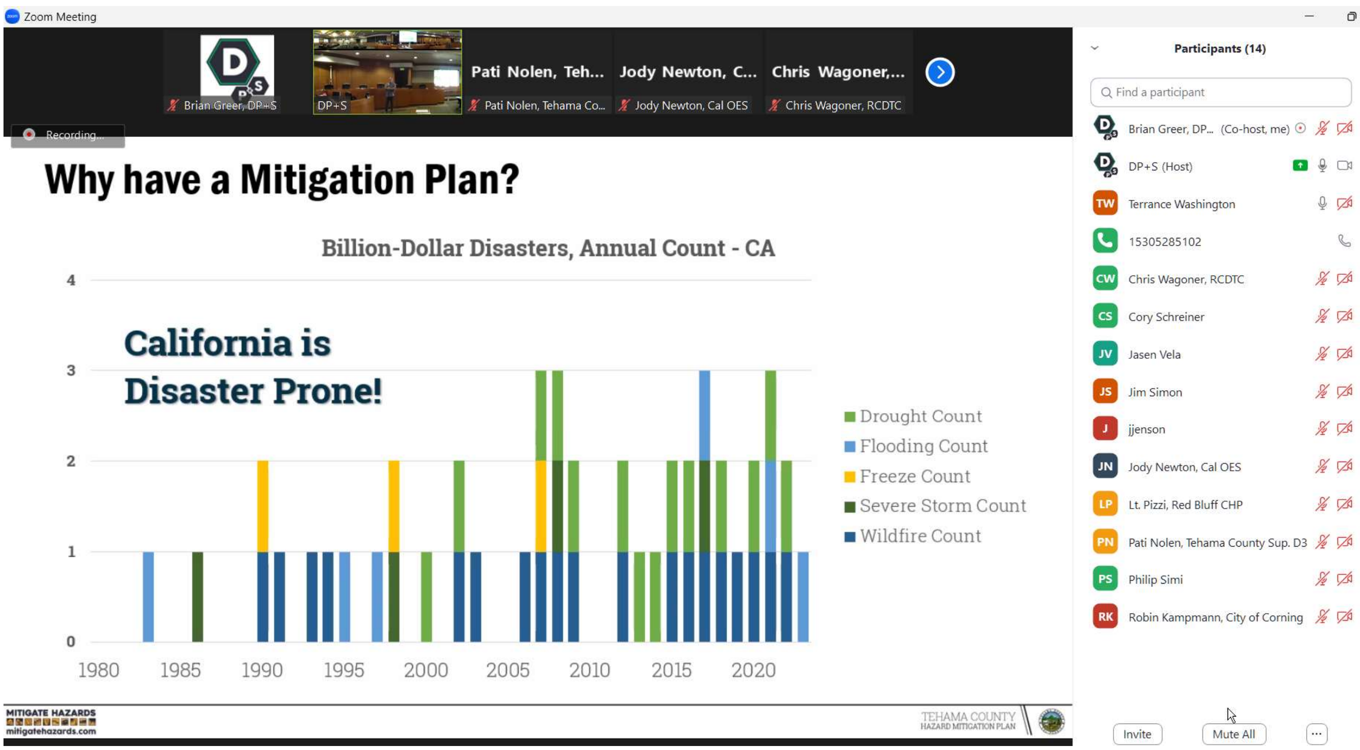


PC Meeting 1 Zoom

City of Corning Meeting Notes

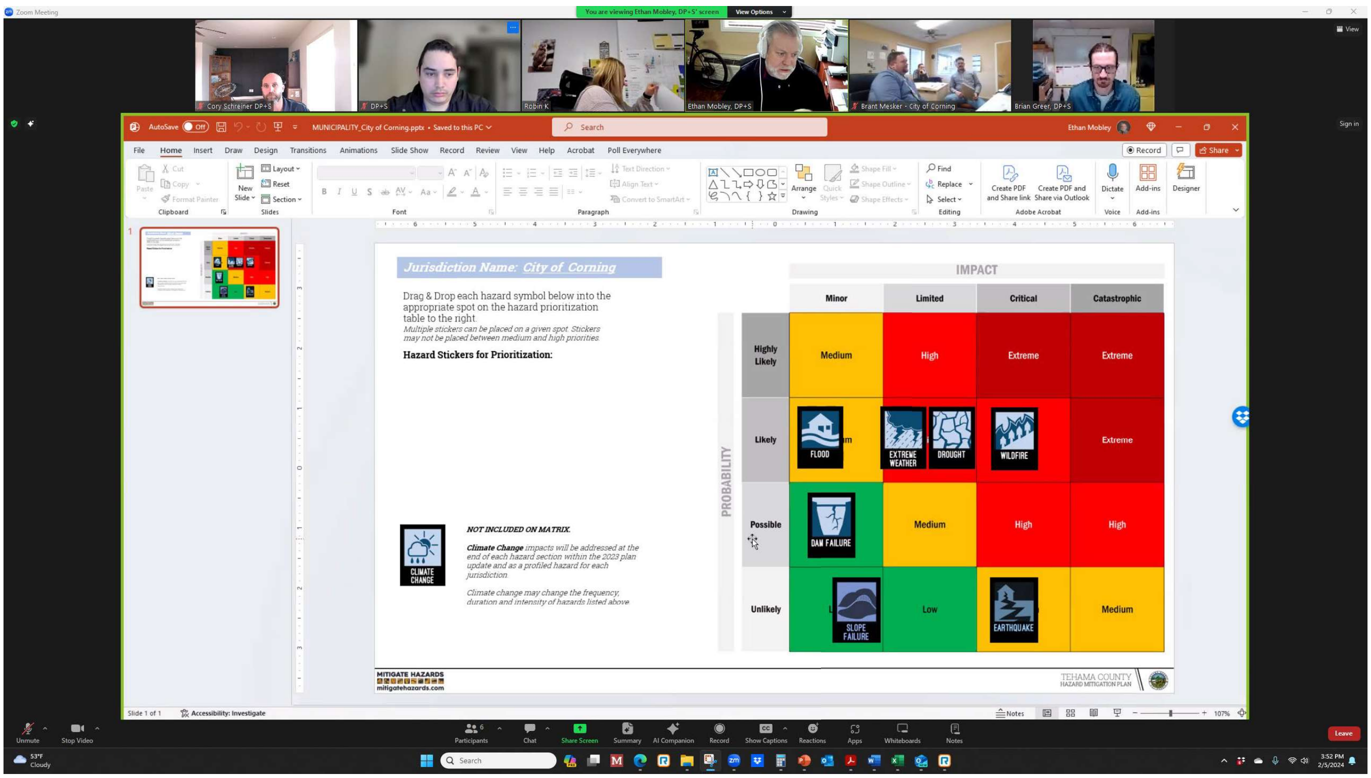
Dynamic Planning + Science met with the City of Corning to review areas of concern, local issues, and mitigation action items. The City Manager, Public Works and Building Officials joined the meeting.

DP+S reviewed the hazard risk matrix to catch the jurisdiction up. After some discussion about the group agreed to write hazard profiles for flood, earthquake, drought, wildfire and extreme weather. Concerns were raised about areas flooding due to blocked drains from debris and unreinforced masonry buildings located in the city. Some of these buildings are located in downtown Corning and would cause long-term economic damage.

Next DP+S reviewed areas of concern for local hazards including drought, wildfire, extreme weather, flood and earthquake. Reducing fuel for the olive orchard was a concern to prevent further damage after a disaster. The City of Corning has a large olive processing facility used to create olive oil. It is vital for the area's economy and gives Corning the nickname of the Olive City. Removing septic tanks for the mobile home park located south of the I-5 was discussed to remove nitrates from getting into the soil. Once nitrates get into the soil groundwater becomes undrinkable unless it is removed, and the water is no longer suitable for agricultural uses. Flooding occurs on the Blackburn-Moon ditch and will become worse with future development. The ditch needs to be expanded to improve water flow and prevent future flooding. It was suggested to increase outflow or build another drainage ditch.

After reviewing areas of concern DP+S reviewed the city's previous hazard mitigation action table. Half of the mitigation actions were discontinued due to not being realistic. The city kept mitigation items for flooding due to issues from the Blackburn Moon ditch and the Jewett creek. Obtaining backup generators remains a goal for the city of Corning.

Break Out Meeting 2 Corning Meeting Summary



Break Out Meeting 2 Corning Zoom Attendance

Quick recap

The team also focused on the need for flood mitigation actions and potential collaborations and scheduled a follow-up meeting to discuss mitigation strategies further.

Summary

County Dry Wells and Wildfire Risk Discussion

The meeting discussed the issue of dry wells in the county, with Jenson mentioning that around 300 wells have gone dry since 2014. The causes of dry wells, including agricultural companies and the cannabis industry, were also discussed. The issue of wildfires and the changing wildfire season was also brought up. The group decided to keep the risk of landslide in the possible category.

Watershed Protection and Dam Safety

DP+S and Justin Jenson discussed the differentiation between minor and major events and the need for mitigation strategies. DP+S suggested consulting with Kathryn from the resource conservation district on watershed protection, and the potential for applying for grant funding to protect watersheds and tributaries, especially in the context of wildfires.

Other Hazards

The breakout meeting briefly touched upon the topic of extreme weather events, such as high winds, significant rain, and fog, and the structural stability of the Shasta Dam. The team acknowledged the unlikely possibility of the dam failing, but highlighted the importance of planning for transportation issues. The conversation ended with the risk of smaller dams and impoundments in flood risk areas. The team also reviewed past earthquakes in the County and suggested updating the earthquake plan based on USGS data.

Grant Funding, Mitigation Actions, and Flooding Issues

DP+S initiated a discussion about success stories, mitigation actions, and next steps of the participants. DP+S highlighted the importance of understanding participants' needs to help them secure grant funding for their projects. DP+S also acknowledged the success of Carolyn from the City of Tehama in obtaining mitigation grants.

Justin Jenson raised a concern about localized flooding issues caused by non-native grass overgrowth in creeks, which is costly and time-consuming to remove. The conversation ended with Justin explaining the complexities of the removal process due to endangered species present in these areas.

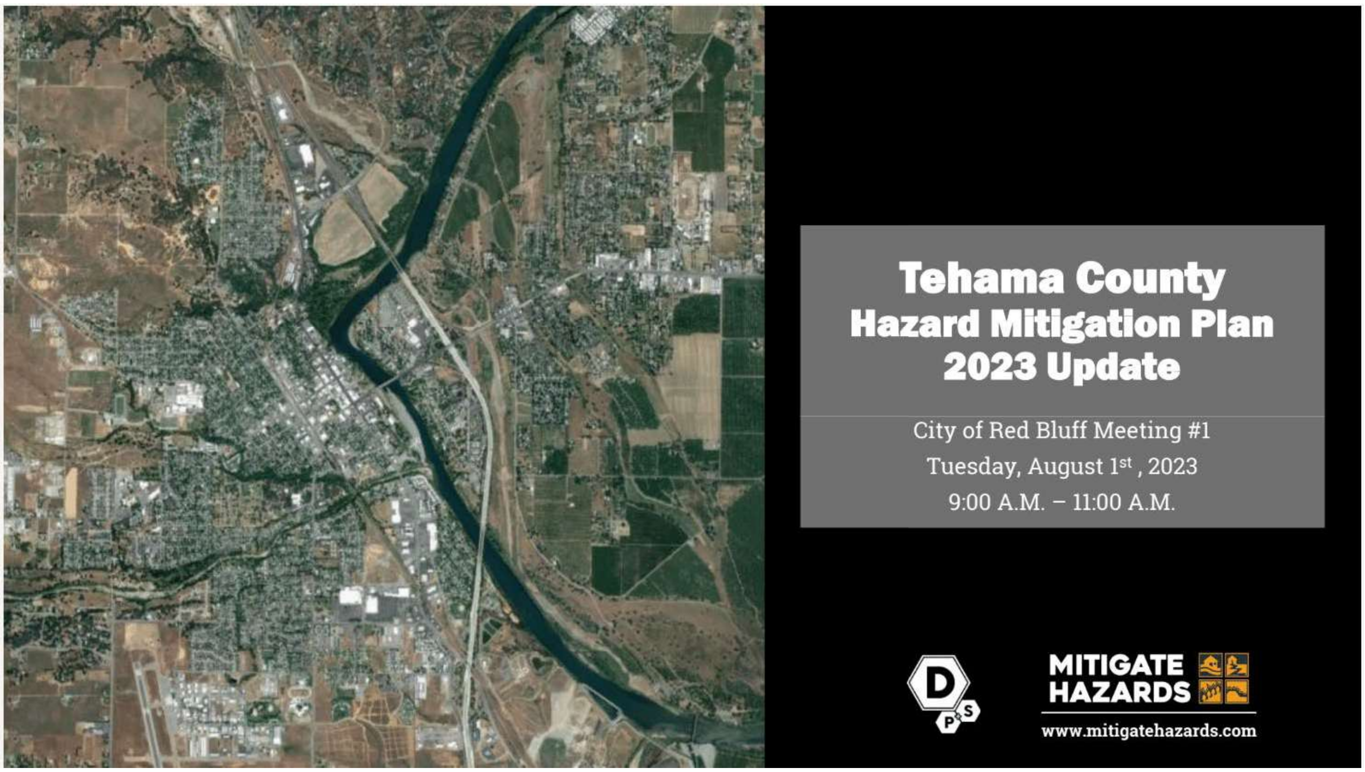
Flood Mitigation Plan and Collaboration

The meeting focused on the need for flood mitigation actions and potential collaborations. DP+S proposed to collaborate with Justin's team to revise and present the flood mitigation actions to the group. Kathryn highlighted the importance of the RCD being more active in the mitigation plan. The team also discussed the recent Presidential disaster declaration for Southern California storms and the funding opportunities it presents. They emphasized the need to balance flood control with other areas of focus in future plans. A follow-up meeting was scheduled to discuss mitigation strategies further, with a goal to finalize the mitigation plan by April 20th. They also mentioned a potential flood control project and potential funding of 3 to 5 million dollars.

Break Out Meeting 2 Tehama County Meeting Summary 1

Next Steps

DP+S will work with Justin offline to edit and update the flood mitigation actions.
DP+S will reach out to Kathryn and Justin for one-on-one training sessions.
DP+S will organize a larger group meeting to discuss the mitigation plan and the FEMA grant program.



Break Out Meeting Red Bluff 1 Info Slide

Break Out Meeting Tehama 1 Info Slide

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Meeting Agenda:

Tehama County, California

Mulit-Jurisdictional Hazard Mitigation Plan 2023 Update

Planning Committee Meeting #2

Monday, August 7th, 2023, 11:00 a.m. – 1:00 p.m.

Meeting Objectives

- **Welcome and Introductions**
- **Meeting # 1 recap**
- **Risk Assessment / Community Vulnerability Review**
  - Demographics & Vulnerable Populations
  - Abbreviated Hazard Profiles
  - Complete Risk Matrix Exercise
- **Discuss Areas of Concern (AOC's)**
  - Preview Risk Assessment Mapping Platform (RAMP)
- **Review Outreach Progress & Next Steps**

Important Links

Project Webpage: mitigatehazards.com/monroviahmp/

Website Username/Password: **Tehama2023**

Meeting Polling: www.pollev.com/dynamicplanning

Pollev:

PC Meeting 2 Agenda 1

PC Meeting 2 In Person Attendance

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mulit-Jurisdictional Hazard Mitigation Plan 2023 Update
Planning Committee Meeting #2
Monday, August 7th, 2023, 11:00 a.m. – 1:00 p.m.

Sign In Sheet

Name	Email	Title	Agency
JOEY HOWARD	JOEY.HOWARD@FIRE.CA.GOV	BATTALION CHIEF	CAL FIRE
Laurie Griffin	Laurianne.Griffin@fire.ca.gov	AGPA	TehCoFire/CALFIRE
Carolyn Steffan	csteffan@cityoftehama.us	City Clerk/Administrator	City of Tehama
Gerry Magnus	gerry.magnus@fire.ca.gov	Deputy Chief	CAL FIRE/TCFD
Ruth Ann Rowen	ruth.rowen@dignityhealth.org	EM coordinator HPP coordinator	St Elizabeth Comm. Hospital
JESSICA RISKE Gomez	jriskegomez@tehamartpa.org	Deputy Dir. Transportation	Public Works
DANIELLE HARRIS	DHARRIS@TEHAMASO.ORG	SGT TCSO	TCSO
RON WARNER	RONSPLCE@ATT.NET	FORMER MAYOR	City of Corning
ANDY HOUGHTBY	AHOUGHTBY@TEHAMASO.ORG	OES/LT	TCSO
Tom Tomlinson	ttomlinson@corning.org	Corning Fire chief	Corning Fire
Tom Brenton	tbrenton@tehama.ca.us	EH	Director
ANGELA FORD	angelaford@co.tehama.ca.us	Office Man	Building dept
Christine McClintock	cmcclintock@tcanimals.org	AG/Animal Services	Shelter Manager

PAGE 1 of 2

TEHAMA COUNTY | HAZARD MITIGATION PLAN

PC Meeting 2 Sign In 1

TEHAMA COUNTY
HAZARD MITIGATION PLAN

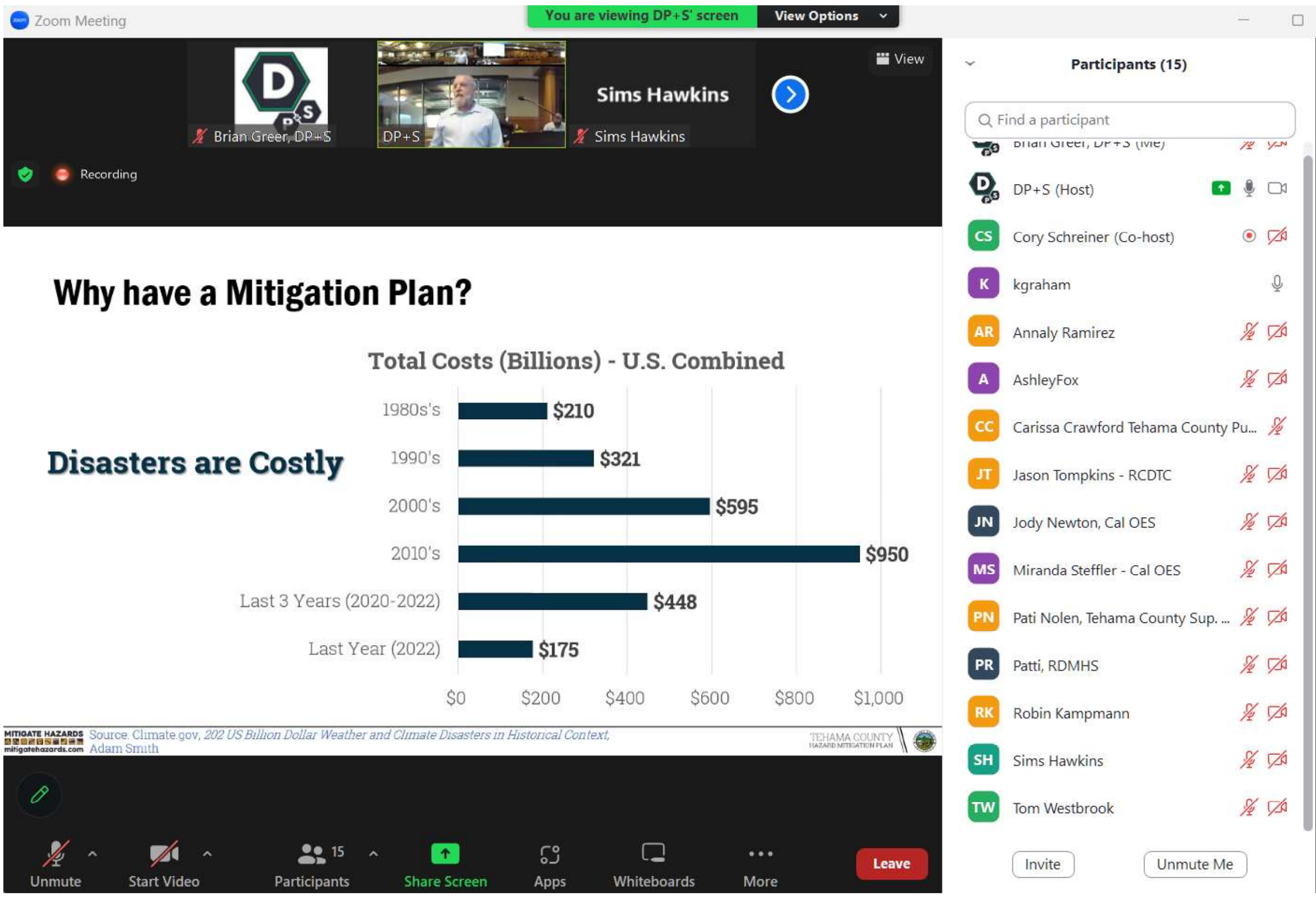
Mulit-Jurisdictional Hazard Mitigation Plan 2023 Update
Planning Committee Meeting #2
Monday, August 7th, 2023, 11:00 a.m. – 1:00 p.m.

Sign In Sheet

Name	Email	Title	Agency
Minnie Sagan	msagan@tehsa.net	Pit Director	TCHSA PIT
Doni Rulofson	drulofson@tehamaag.net	Ag. Commissioner	Ag/Animal
Jim Richardson	jim_richardson@nps.gov	Park Superintendent	National Park Service
Jon Barrett	Jbarrett@tehamacountyrcd.org	District Manager	Tehama RCD
Kathryn Raeder	kraeder@tehamacountyrcd.org	Forestry Project Specialist	Tehama RCD
Jim Simon	jsimon@tcpw.ca.gov	Director of Public Works	Tehama Co
R Scott Miller	smiller@cityofredbluff.org	PW Director & Airport Mg.	CoRB
Michael Bachmeyer	mbachmeyer@rbfd.org	Fire Chief	CoRB
Brian Wright	brian.wright@fire.ca.gov	Fire Marshal	CAL FIRE/TCFD

PAGE 1 of 2

PC Meeting 2 Sign In 2



PC Meeting 2 Zoom Attendance

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Meeting Agenda:

Tehama County, California

Mulit-Jurisdictional Hazard Mitigation Plan 2023 Update

Planning Committee Meeting #3

Wednesday November 8th, 2023, 11:00 a.m. – 1:00 p.m.

Meeting Objectives

- **Welcome and Introductions**
  ~ 5 minutes
- **Meeting # 1-2 recap**
  ~ 10 minutes
- **RAMP User Tutorial**
  ~ 60 minutes
  - Explore Risk Assessment Mapping Platform (RAMP)
  - Quiz Bowl!
- **Light Lunch**
  ~15 minutes
- **The Nexus between RAMP and Mitigation Strategy**
  ~10 minutes
- **Public Outreach Assistance**
  ~10 minutes
- **Next Steps**
  ~ 5 minutes
  - Refine Hazard Problem Statements
  - Mitigation Success Stories
  - Drafting HMP

Important Links

Project Webpage: mitigatehazards.com/tehamamjhmp/

Website Username/Password: **Tehama2023**

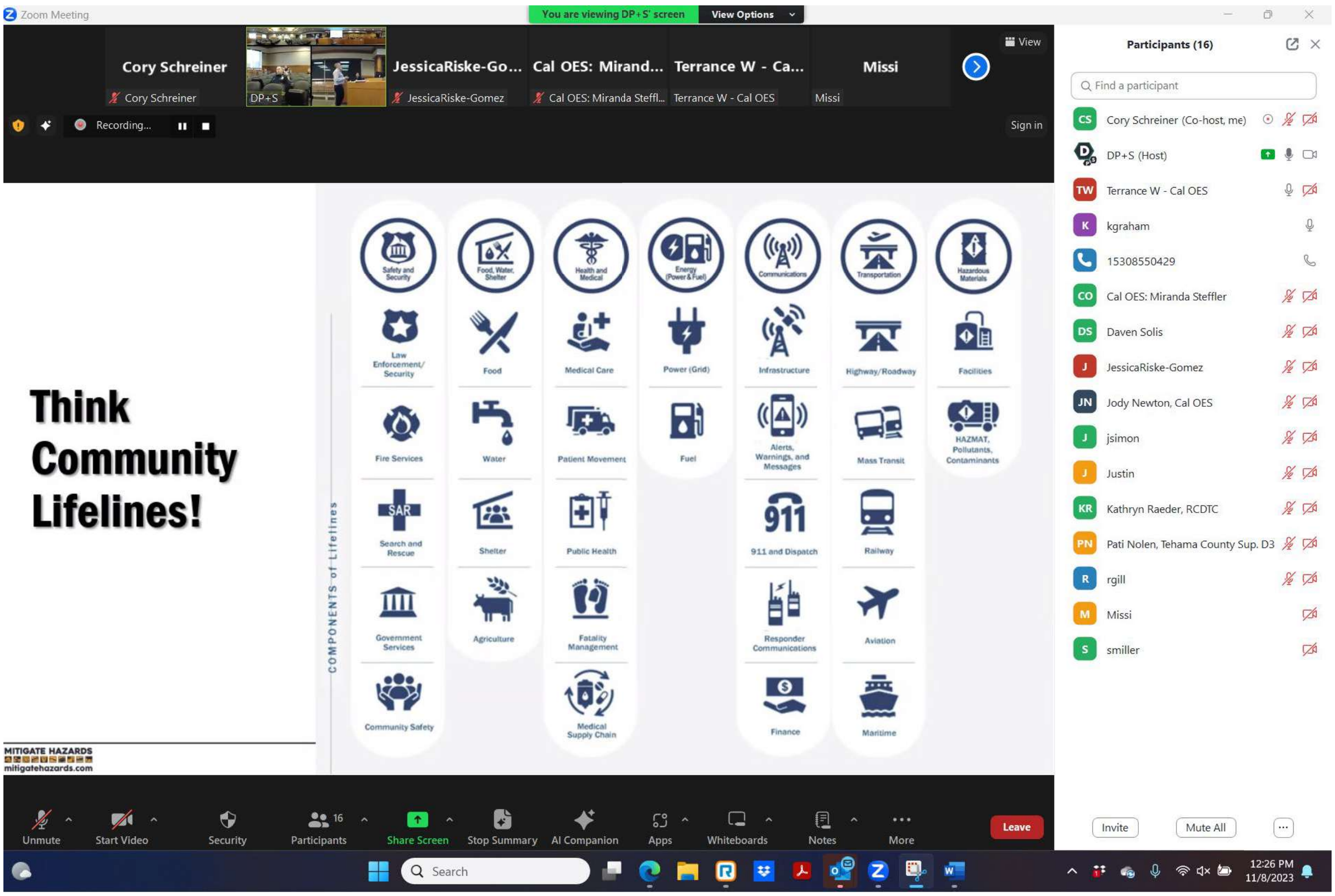
Meeting Polling: www.pollev.com/dynamicplanning

Pollev:

PC Meeting 3 Agenda 1

PC Meeting 3 In Person Attendance 2

PC Meeting 3 In Person Attendance



PC Meeting 3 Zoom Attendance

Tehama's RAMP Quiz Bowl!

Instructions

Risk Assessment Mapping Platform (RAMP) was developed to provide stakeholders with an interactive way to explore the County's natural hazard risk landscape. The following quiz will test your ability to use RAMP to answer real-world questions about the exposure of population, parcels, and critical infrastructure to hazards like earthquake, landslide, dam failure, and more.

Navigate to **https://mitigatehazards.com/Tehama/RAMP3** to access the web platform.

FINAL SCORE: ______ out of 10

1. What is the estimated population in Tehama County living within the Avalanche Slope Hazard?
2. What is the estimated population within the City of Tehama living within Dan Inundation Zones?
3. What is the estimated population within the City of Red Bluff living within the 100-year flood zone?
4. County wide, how many parcels are identified within very-high wildfire severity zones?
5. County wide, how much property value is exposed within the 100-year floodplain?
6. County wide, how much property value is exposed within both the very high wildfire hazard and landslide risk? (Hint: use two property filters to answer this question!)
7. How many miles of lifeline are in the very strong shake zone from the M6.7 Battle Creek Scenario?
8. How many Fire stations are in the very strong shake zone from the M6.7 Battle Creek Scenario? Bonus Point: What is the address of one of them?
9. How many of the following types of facilities are located within a very high wildfire severity zone:

Child Care Center	
Adult Residential Facility	
School	
Real Property Asset	
Power Plant	

10. How many Residential Elder Care Facility are located within Red Bluffs' 100-yr flood risk layers?
11. How many bridge points are located within Corning's Flood Risk Layers?
12. What are the names of the HWTS facilities located within City of Tehama's Flood Risk Layers?

PC Meeting Ramp Quiz 1

TEHAMA COUNTY
HAZARD MITIGATION PLAN

www.fema.gov/hazard-mitigation-grant-program

Meeting Agenda

Tehama County, California

Multi-Jurisdictional Hazard Mitigation Plan 2023 Update

Planning Committee Meeting #4

Tuesday February 27th, 2024, 11:00 a.m. – 1:00 p.m.

Meeting Objectives

- **Welcome and Introductions** *~ 5 minutes*
- **Mitigation Meeting Recap** ~ 5 *minutes*
- **Hazard Perceptions: Risk Matrix Prioritization** *~ 10 minutes*
- **Hazard Problem Statement Review** *~ 20 minutes*
- **Light Lunch** *~15 minutes*
- **Public Initial Survey Results ~10 minutes**
  - Review Survey Results
- **Mitigation Strategy ~ 25 minutes**
  - Overview of Mitigation Alternatives
- **Mitigation Builder Exercise ~ 25 minutes**
- **Next Steps ~ 5 minutes**
  - Submit Mitigation Actions
  - Review Draft

Important Links

Project Webpage: mitigatehazards.com/tehamamjhmp/

Website Username/Password: Tehama2023

Meeting Polling: www.pollev.com/dynamicplanning

Pollev:

PC Meeting 4 Agenda 1

Greetings Tehama County HMP Stakeholders,

The fourth meeting (of 4 total) of the Tehama County Hazard Mitigation Plan (HMP) stakeholders will take place IN PERSON on Wednesday, February 7th, 2024, from 11:00pm – 1:00 P.M at the Board of Supervisors Chambers located at 727 Oak Street in Red Bluff. The focus of this meeting is to review the past mitigation action items, learn how to develop new/additional mitigation action items, discuss breakout sessions, and finally, discuss funding opportunities available.

We strongly encourage in-person attendance at this meeting. Refreshments, snacks, and an engaging assortment of facilitated group exercises will be served. If you cannot attend in person, a Zoom meeting link has been offered below. We cannot offer the same interaction if you decide to attend virtually via Zoom.

Virtual Option:

____

DP+S is inviting you to a scheduled Zoom meeting.

Join Zoom Meeting

https://us02web.zoom.us/j/82183071457

Meeting ID: 821 8307 1457

One tap mobile

+17193594580,,82183071457# US

+16694449171,,82183071457# US

Thank you, everyone, for your time and effort on this project thus far; we look forward to seeing you soon.

Tehama County HMP Team

PC Meeting 4 Email Invite

PC Meeting 4 In Person Attendance

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Multi-Jurisdictional Hazard Mitigation Plan 2023 Update
Planning Committee Meeting #4
Tuesday February 27th, 2024, 11:00 a.m. – 1:00 p.m.

Sign In Sheet

Name	Email	Title	Agency
Carolyn Steffan	csteffan@cityoftehama.us	cityclerk/administrator	City of Tehama
DANIELLE HARRIS	DHARRIS@TEHAMASO.ORG	SGT/OES TCSO	TEHAMA COUNTY SHERIFF'S OFFICE
Matthew Shobash	mshobash@rbfd.org	Div Chief	Red Bluff Fire
Mike Bachmeyer	mbachmeyer@rbfd.org	Fire Chief	RBFD
Tom Tomlinson	ttomlinson@corning.org	Corning City Fire Chief	Corning City Fire
ANDY HOUGHTBY	AHOUGHTBY@TEHAMASO.ORG	LT	TEHAMA S.O.
MARK MOYER	mmoyer@rbfd.org	DIV 2	RBFD
Kale Graham	KGraham@corning.org	Building official	Corning
Gerry Magana	gerry.magana@fire.ca.gov	Tehama/County Fire Deputy Chief	TCFD/Cal Fire.
Justin Kingsley	JKingsley@RBFD.org	Red Bluff Fire D-3	RBFD
JOEY HOWARD	JOEY.HOWARD@FIRE.CA.GOV	ASSISTANT CHIEF	TCFD/CALFIRE
Jan Barrett	jbarrett@tehamacountyrcd.org	District Manager	RCDTC
Monty Smith	monty.smith@fire.ca.gov	Fire Chief	CALFIRE/TCFD

PAGE 1 of 2

TEHAMA COUNTY | HAZARD MITIGATION PLAN

PC Meeting 4 In Person Sign In 2

Multi-Jurisdictional Hazard Mitigation Plan 2023 Update
Planning Committee Meeting #4
Tuesday February 27th, 2024, 11:00 a.m. – 1:00 p.m.

Sign In Sheet

Name	Email	Title	Agency
Laurianne Griffin	Laurianne.Griffin@fire.ca.gov	AGPA	Tehama Co Fire/ CAL FIRE
Olivia Silvera	olivia.silvera@tchsa.net	Health Educator	TC Public Health
Brant	Mesker	City manager	City of Corning
Elijah	Stanley	Director of Public Works	City of Corning

PAGE 2 of 2

PC Meeting 4 In Person Sign In

Mitigation Alternatives
Tehama County HMPC Meeting #4

To narrow mitigation alternatives for inclusion in the HMP, FEMA's six broad categories of mitigation alternatives will be used as part of the mitigation strategy. Each FEMA category is described below. Please review the category descriptions and bullet examples below.

PREVENTION (PRV):

Preventative activities are intended to keep hazard problems from getting worse and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred, or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning ordinances;
- Building codes;
- Open space preservation;
- Floodplain regulations;
- Stormwater management regulations;
- Drainage system maintenance;
- Capital improvements programming; and
- Riverine / fault zone setbacks.

PROPERTY PROTECTION (PPRO):

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Building elevation;
- Critical facilities protection;
- Retrofitting (e.g., wind proofing, flood proofing, seismic design techniques, etc.);
- Safe rooms, shutters, shatter-resistant glass; and
- Insurance.

PC Meeting 4 Mitigation Alternatives Handout 1

PUBLIC EDUCATION AND AWARENESS (PE&A):

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects including neighborhood and community outreach;
- Speaker series / demonstration events;
- Hazard mapping;
- Real estate disclosures;
- Materials Library;
- School children educational programs; and
- Hazard expositions.

NATURAL RESOURCE PROTECTION (NRP):

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes, and sand dunes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management;
- Vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.);
- Erosion and sediment control;
- Wetland and habitat preservation and restoration;

EMERGENCY SERVICES (ES):

Although not typically considered a "mitigation" technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems;
- Construction of evacuation routes;
- Sandbag staging for flood protection; and
- Installing temporary shutters on buildings for wind protection.

STRUCTURAL PROJECTS (SP):

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Stormwater diversions / detention / retention infrastructure;
- Utility Upgrades
- Seismic Retrofits
- New Construction Standards

PC Meeting 4 Mitigation Alternatives Handout 2

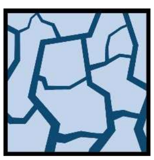
TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of the City of Corning's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

Remember that mitigation projects should provide:

- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-DR-MO-23 **Hazard** Drought	**Description** Prolonged periods of drought, exacerbated by the region's Mediterranean climate, significantly diminish the annual recharge of local groundwater basins. This reduction in recharge adversely impacts the city's water sustainability over he past six years, meeting demand for municipal and regional agricultural remains difficulty due to mandated state water cuts. The frequency and intensity of these droughts, coupled with increasing water demands and climate change projections, present a critical challenge for water resource management in Corning. Economic losses continue to mount from decreased tourism and damage to the regions wine industry.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

PC Meeting 4 Mitigation Exercise Handout Corning 1

TEHAMA COUNTY
HAZARD MITIGATION PLAN

6. Secondary Departments/ Agencies

7. Estimated Cost

☐	**Low** The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
☐	**Medium** The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
☐	**High** Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).

8. Estimated Benefit

☐	**Low** Long-term benefits of the project are difficult to quantify in the short term.
☐	**Medium** Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.
☐	**High** Project will provide an immediate reduction of risk exposure for life and property.

9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Corning 2

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of the City of Corning's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

Remember that mitigation projects should provide:

- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-EQ-MF-35 **Hazard** Earthquake	**Description** As of 2022, 1,834 (62%) of Corning's housing units were built prior to 1980. Homes designed prior to this "benchmark" year in the state building code face greater risk of damage and collapse under strong shaking scenarios. Concerns continue to be raised about unreinforced masonry homes.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Corning 3

TEHAMA COUNTY
HAZARD MITIGATION PLAN

7. Estimated Cost

- ☐ **Low**
  The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
- ☐ **Medium**
  The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
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- ☐ 5%
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10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Corning 4

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of the City of Corning's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

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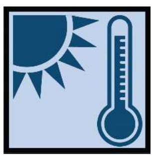
Problem Statement		
	**ID** ps-EH-MS-25 **Hazard** Extreme Heat	**Description** Year-round electricity demand in Corning is projected to increase with rising temperatures. Demand surges coinciding with extreme heat events could strain power infrastructure, leading to rolling blackouts throughout the region.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Corning 5

TEHAMA COUNTY
HAZARD MITIGATION PLAN

7. Estimated Cost

- ☐ **Low**
  The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
- ☐ **Medium**
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9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Corning 6

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of the City of Corning's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

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- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-EQ-MF-35 **Hazard** Flood	**Description** During heavy rain events streets flood creating hazardous conditions for commuters and residents, with floods typically resulting from overflow from the surrounding hills. At times, debris and sediment clog storm drains causing flooding in areas not in a flood zone.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
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2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Corning 7

TEHAMA COUNTY
HAZARD MITIGATION PLAN

7. Estimated Cost

☐	**Low** The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
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10. Potential Grant Source

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11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
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12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Corning 8

Mitigation Action Builder Exercise

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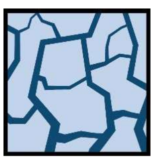	**ID** ps-DR-MO-23 **Hazard** Drought	**Description** Prolonged periods of drought, exacerbated by the region's Mediterranean climate, significantly diminish the annual recharge of local groundwater basins. This reduction in recharge adversely impacts the city's water sustainability over the past six years, meeting demand for municipal and regional agricultural remains difficulty due to mandated state water cuts. The frequency and intensity of these droughts, coupled with increasing water demands and climate change projections, present a critical challenge for water resource management in Red Bluff. Economic losses continue to mount from decreased tourism and damage to the regions wine industry.

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- ☐ ES – Emergency Services
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2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

PC Meeting 4 Mitigation Exercise Handout Red Bluff 1

TEHAMA COUNTY
HAZARD MITIGATION PLAN

6. Secondary Departments/ Agencies

7. Estimated Cost

- ☐ **Low** The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
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- ☐ Project
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- ☐ 5%
- ☐ n/a

10. Potential Grant Source

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- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

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- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
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12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Red Bluff 2

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

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- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	ID ps-EQ-MF-35 **Hazard** Earthquake	**Description** As of 2022, 82.9% of Red Bluff's housing units were built prior to 1980 with 32.4% being built before 1950. Homes designed prior to the 1980 "benchmark" year in the state building code face greater risk of damage and collapse under strong shaking scenarios. Concerns continue to be raised about unreinforced masonry homes.

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- ☐ PPRO – Property Protection
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2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Red Bluff 3

TEHAMA COUNTY
HAZARD MITIGATION PLAN

7. Estimated Cost

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- ☐ FMA
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11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Red Bluff 4

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of the City of Red Bluff's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

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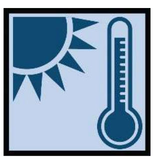
Problem Statement		
	**ID** ps-EH-MS-25 **Hazard** Extreme Heat	**Description** Year-round electricity demand in Red Bluff is projected to increase with rising temperatures. Demand surges coinciding with extreme heat events could strain power infrastructure, leading to rolling blackouts throughout the region. Residents are concerned about increasing the amount of cooling centers for vulnerable populations.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Red Bluff 5

TEHAMA COUNTY
HAZARD MITIGATION PLAN

7. Estimated Cost

☐	**Low** The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
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- ☐ Planning
- ☐ 5%
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10. Potential Grant Source

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- ☐ BRIC
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- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
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12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Red Bluff 6

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

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- ✓ Reductions in repetitive losses over time

Problem Statement

	**ID** ps-EQ-MF-35 **Hazard** Flood	**Description** During heavy rain events streets flood creating hazardous conditions for commuters and residents, with floods typically resulting from overflow from the surrounding hills. Recent floods caused damage to adult and childcare facilities in the city with erosion occurring on the Sacramento Riverbanks.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
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2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Red Bluff 7

TEHAMA COUNTY
HAZARD MITIGATION PLAN

7. Estimated Cost

- ☐ **Low**
  The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
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- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Red Bluff 8

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of the City of Tehama's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

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- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-DR-MO-23 **Hazard** Drought	**Description** Prolonged periods of drought, exacerbated by the region's Mediterranean climate, significantly diminish the annual recharge of local groundwater basins. This reduction in recharge adversely impacts the city's water sustainability over the past six years, meeting demand for municipal and regional agricultural remains difficulty due to mandated state water cuts. The frequency and intensity of these droughts crippled the city's agriculture base causing catastrophic losses in the area.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

TEHAMA COUNTY | HAZARD MITIGATION PLAN

PC Meeting 4 Mitigation Exercise Handout Tehama City 1

TEHAMA COUNTY
HAZARD MITIGATION PLAN

6. Secondary Departments/ Agencies

7. Estimated Cost

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8. Estimated Benefit

- ☐ **Low** Long-term benefits of the project are difficult to quantify in the short term.
- ☐ **Medium** Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.
- ☐ **High** Project will provide an immediate reduction of risk exposure for life and property.

9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Tehama City 2

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of the City of Tehama's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

Remember that mitigation projects should provide:

- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-EQ-MF-35 **Hazard** Earthquake	**Description** As of 2022, 70.5% of the city of Tehama's housing units were built prior to 1980. Homes designed prior to this "benchmark" year in the state building code face greater risk of damage and collapse under strong shaking scenarios. Concerns continue to be raised about unreinforced masonry homes.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Tehama City 3

7. Estimated Cost

☐	**Low** The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
☐	**Medium** The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
☐	**High** Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).

8. Estimated Benefit

☐	**Low** Long-term benefits of the project are difficult to quantify in the short term.
☐	**Medium** Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.
☐	**High** Project will provide an immediate reduction of risk exposure for life and property.

9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Tehama City 4

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of the City of Tehama's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

Remember that mitigation projects should provide:

- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	ID ps-EH-MS-25 **Hazard** Extreme Heat	**Description** Year-round electricity demand in Tehama is projected to increase with rising temperatures. Demand surges coinciding with extreme heat events could strain power infrastructure, leading to rolling blackouts throughout the region.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Tehama City 5

TEHAMA COUNTY
HAZARD MITIGATION PLAN

7. Estimated Cost

☐	**Low** The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
☐	**Medium** The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
☐	**High** Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).

8. Estimated Benefit

☐	**Low** Long-term benefits of the project are difficult to quantify in the short term.
☐	**Medium** Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.
☐	**High** Project will provide an immediate reduction of risk exposure for life and property.

9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Tehama City 6

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of the City of Tehama's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

Remember that mitigation projects should provide:

- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-EQ-MF-35 **Hazard** Flood	**Description** During heavy rain events streets flood creating hazardous conditions for commuters and residents, with floods typically resulting from overflow from the surrounding hills. At times, debris and sediment clog storm drains causing flooding in areas not located in a flood zone.

1. Mitigation Alternative Type

☐ PRV - Prevention
☐ PPRO – Property Protection
☐ PE&A – Public Education & Awareness
☐ NRP – Natural Resource Protection
☐ ES – Emergency Services
☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

☐ 1-3 years
☐ 3-5 years
☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Tehama City 7

TEHAMA COUNTY
HAZARD MITIGATION PLAN

7. Estimated Cost

☐	**Low** The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
☐	**Medium** The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
☐	**High** Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).

8. Estimated Benefit

☐	**Low** Long-term benefits of the project are difficult to quantify in the short term.
☐	**Medium** Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.
☐	**High** Project will provide an immediate reduction of risk exposure for life and property.

9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Tehama City 8

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of Tehama County's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

Remember that mitigation projects should provide:

- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-DR-MO-23 **Hazard** Drought	**Description** Prolonged periods of drought, exacerbated by the region's Mediterranean climate, significantly diminish the annual recharge of local groundwater basins. This reduction in recharge adversely impacts the city's water sustainability over the past six years, meeting demand for municipal and regional agricultural remains difficulty due to mandated state water cuts. Increased well drilling has helped meet demand but caused sinkholes to develop throughout the County. Some commercial and homes suffer from property damage due to sinking elevations. Concerns are being raised about critical infrastructure being damaged elevation changes.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

PC Meeting 4 Mitigation Exercise Handout Tehama County 1

TEHAMA COUNTY
HAZARD MITIGATION PLAN

6. Secondary Departments/ Agencies

7. Estimated Cost

- ☐ **Low**
  The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
- ☐ **Medium**
  The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- ☐ **High**
  Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).

8. Estimated Benefit

- ☐ **Low**
  Long-term benefits of the project are difficult to quantify in the short term.
- ☐ **Medium**
  Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.
- ☐ **High**
  Project will provide an immediate reduction of risk exposure for life and property.

9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Tehama County 2

TEHAMA COUNTY
HAZARD MITIGATION PLAN

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of Tehama County's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

Remember that mitigation projects should provide:

- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-EQ-MF-35 **Hazard** Earthquake	**Description** Unreinforced masonry homes are located throughout the County. Residents are concerned about damage to their property from earthquakes. Recent increased activity on the San Andreas fault line has placed residents on edge. Finding sources of funding to retrofit homes remains a problem for the County.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Tehama County 3

TEHAMA COUNTY
HAZARD MITIGATION PLAN

7. Estimated Cost

☐	**Low** The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
☐	**Medium** The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
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9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

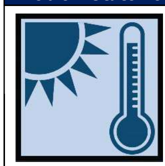
PC Meeting 4 Mitigation Exercise Handout Tehama County 4

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of Tehama County's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

Remember that mitigation projects should provide:

- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-EH-MS-25 **Hazard** Extreme Heat	**Description** Year-round electricity demand in Tehama County is projected to increase with rising temperatures. Demand surges coinciding with extreme heat events could strain power infrastructure, leading to rolling blackouts throughout the region.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Tehama County 5

7. Estimated Cost

☐	**Low** The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
☐	**Medium** The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
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☐	**High** Project will provide an immediate reduction of risk exposure for life and property.

9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Tehama County 6

Mitigation Action Builder Exercise

Instructions: Read the following problem statement describing a specific aspect of Tehama County's vulnerability to one or more natural hazards. Then, design a mitigation action which reduces the long-term impact of this problem.

Remember that mitigation projects should provide:

- ✓ Long-term reductions of specific hazard vulnerability
- ✓ Cost-effective solutions (benefits outweigh costs)
- ✓ Reductions in repetitive losses over time

Problem Statement		
	**ID** ps-EQ-MF-35 **Hazard** Flood	**Description** Recent atmospheric rivers have caused flooding on key arteries running through the County. At times, the I-5 and SR-99 were impassable due to flood waters and debris. After each flood road integrity diminishes creating potholes and uneven pavement.

1. Mitigation Alternative Type

- ☐ PRV - Prevention
- ☐ PPRO – Property Protection
- ☐ PE&A – Public Education & Awareness
- ☐ NRP – Natural Resource Protection
- ☐ ES – Emergency Services
- ☐ SP – Structural Projects

2. Title

3. Description

4. Responsible Party

5. Timeframe

- ☐ 1-3 years
- ☐ 3-5 years
- ☐ 5-10 years

6. Secondary Departments/ Agencies

PC Meeting 4 Mitigation Exercise Handout Tehama County 7

7. Estimated Cost

	Low The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program).
	Medium The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
	High Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).

8. Estimated Benefit

	Low Long-term benefits of the project are difficult to quantify in the short term.
	Medium Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.
	High Project will provide an immediate reduction of risk exposure for life and property.

9. HMA Activity Type

- ☐ Project
- ☐ Planning
- ☐ 5%
- ☐ n/a

10. Potential Grant Source

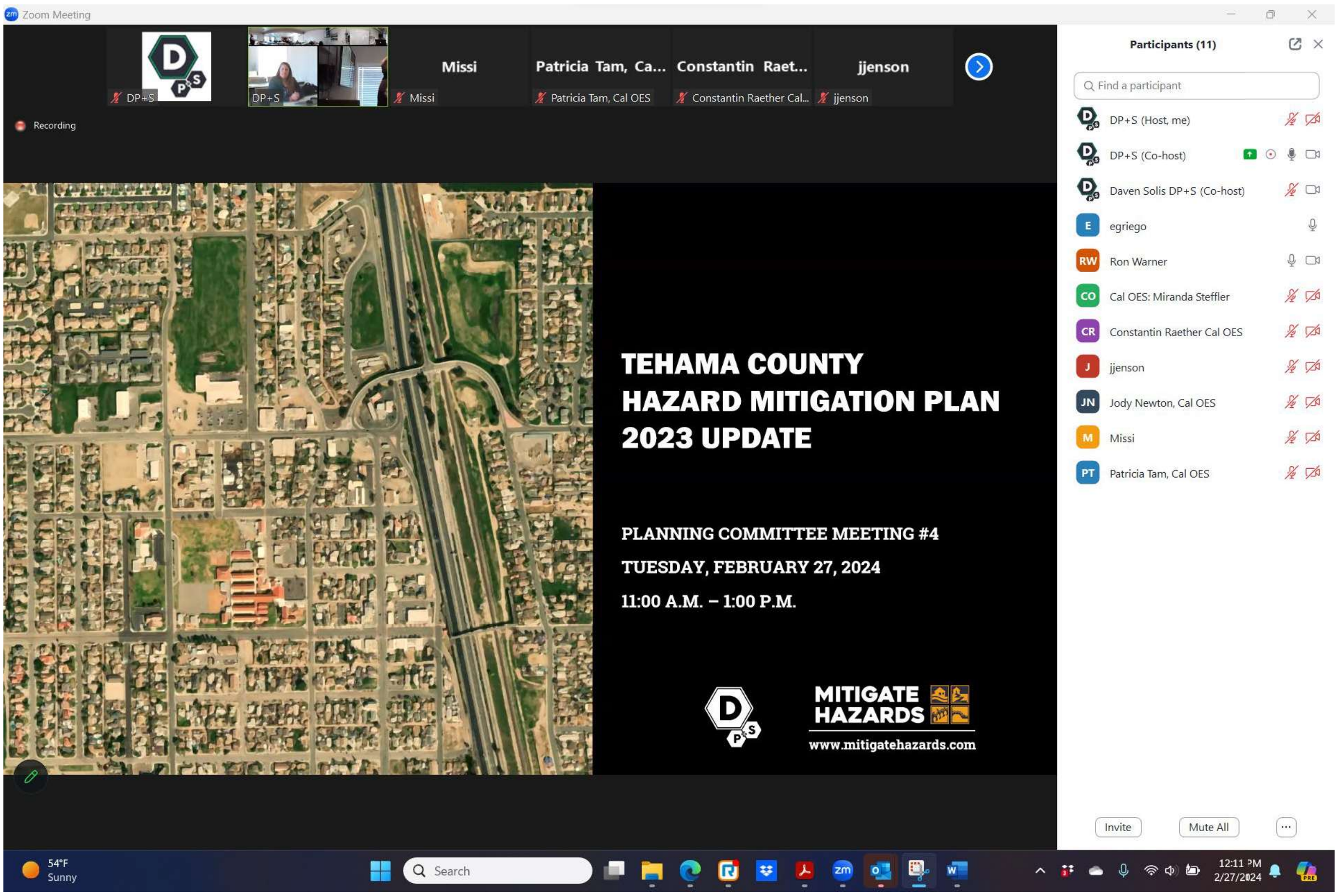
- ☐ Post-Disaster HMGP
- ☐ BRIC
- ☐ FMA
- ☐ Other
- ☐ n/a

11. Potential Local Match

- ☐ General Fund
- ☐ Department Fund
- ☐ In-Kind Labor
- ☐ In-Kind Service
- ☐ Other

12. Financial and Administrative Barriers – please describe, if any

PC Meeting 4 Mitigation Exercise Handout Tehama County 8



PC Meeting 4 Zoom Attendance

Public Notice & Press Release Documentation

Appendix B.2

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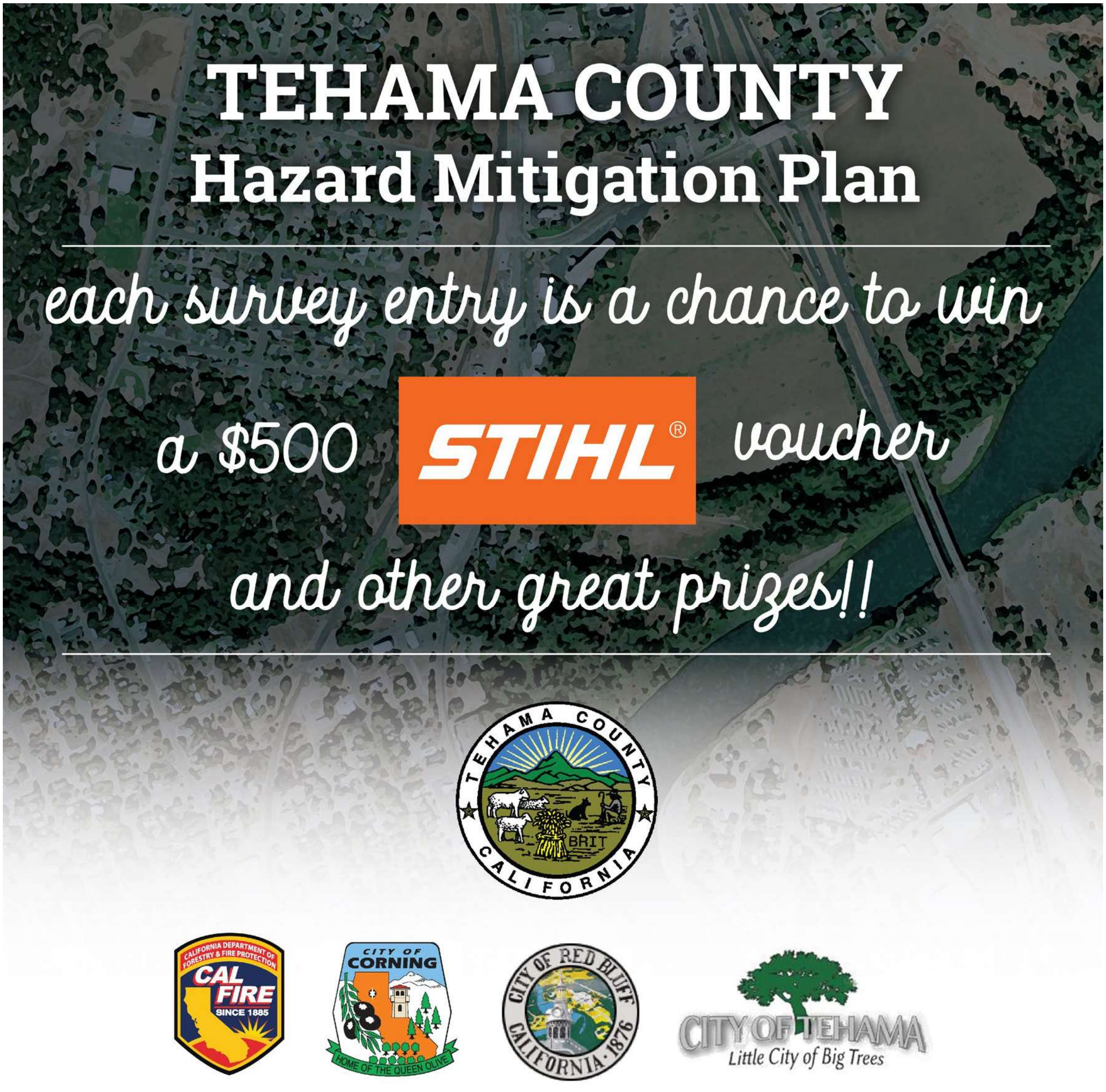


MJHMP Survey Flyer

MJHMP Survey Flyer 2

Subject: Media Package for Tehama County's Hazard Mitigation Plan Update

Dear Tehama County Hazard Mitigation Plan Stakeholder,

I hope this email finds you well. I am writing to provide you with details about the media package we have developed for Tehama County's Hazard Mitigation Plan (HMP) update.

Purpose of the Media Package: Our primary goal is to engage and inform the public about the HMP update and encourage their participation in the public survey. We believe that a well-informed community is vital for effective risk reduction for residence of your community.

Content of the Media Package:

1. **Social Media Graphics:**
    - We have designed an eye-catching graphic specifically for use on various social media platforms, i.e. Facebook, Twitter, Instagram, etc. Each participating jurisdiction can do their part to spread information on their various social media platforms.
    - These graphics highlight key aspects of the HMP update and prominently feature the link to the public survey using a QR code or link to the project webpage.
    - The designs are optimized for high visibility and engagement, making them ideal for sharing and promoting community involvement.

    Link for Social Media Graphic:

    Social Media Banner.pdf

2. **Printable Letter-Sized Poster:**
    - Alongside the digital content, we have created a letter-sized poster that can be easily printed and displayed in public spaces.
    - The poster design mirrors the social media graphics for consistency in messaging and visual appeal.
    - It includes a QR code that directly links to the HMP survey, allowing for easy access by scanning with a smartphone.
    - Please let us know if you would like printed media delivered to your location. We will send FedEx print packages if requested.

    Link for Letter Sized Poster:

    Social Media Banner-Social Image - w QR.jpg

3. **Press Release:**
    - The official press release about the HMP update, the update process and goals, and survey information to distribute to news media.

Media Package Email Part 1

Link for Small Article:

Press Release.docx

Distribution and Usage:

- Cal Fire will be hanging printed material across various locations in Red Bluff and beyond. If you have suggested locations, please let Laurianne or myself know.
- Cal Fire will be coordinating media releases on County/City Facebook pages. Please try to release messaging on your own social media pages as well.
- We suggest disseminating printed materials across your public buildings, such as libraries, community centers, and local businesses.
- The versatile design of the materials allows for broad usage, ensuring maximum reach and engagement.

We are confident that this media package will effectively promote the public survey and contribute significantly to the success of Tehama County's HMP update. We look forward to your feedback and any additional suggestions you might have.

Please feel free to reach out if you have any questions or need further information.

- -

Gerry Magaña
Deputy Chief- Tehama Glenn Unit
604 Antelope Blvd., Red Bluff, CA 96080
(530)528-5101 Office

Media Package Email Part 2

FACEBOOK GROUP PAGES

Tehama County Facebook pages:

https://www.facebook.com/groups/150776118956412/

https://www.facebook.com/groups/402171377361874/

City of Red Bluff

https://www.facebook.com/downtownredbluff/

https://www.facebook.com/p/City-of-Red-Bluff-City-Hall-100064490034929/

City of Corning

https://www.facebook.com/groups/1454289944831124/

City of Tehama

https://www.facebook.com/groups/922789052042370/

Media Package Email Part 3

Tehama County's Hazard Mitigation Plan Update

Tehama County staff and key stakeholders are updating the current Hazard Mitigation Plan (HMP). The goal of the planning effort is to revisit natural hazard information and update to account for changes in population and occurrences of natural disasters in the planning area. This effort is two-fold; it assists in reduction of repetitive damages to community infrastructure and the county will maintain eligibility for grants under Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance program.

The county's hazard mitigation plan provides a formal explanation of prevalent hazards within the county and how hazards may affect communities differently. Most importantly, the mitigation strategy presented in the plan responds to the known vulnerabilities within each community and provides prescriptions or actions to achieve the greatest reduction of natural hazard risk. The result of this planning effort could save lives, reduce injury and property damage, and protect the environment in the event of a natural hazard within the county.

"The MJHMP Update will serve as a blueprint for reducing property damage and saving lives from the effects of future natural disasters in our community," says Gerry Magaña, Deputy Chief- Tehama Glenn Unit

The planning effort includes analysis of natural hazards within unincorporated county areas and the incorporated areas of Red Bluff, Corning, and the City of Tehama. In addition, the planning effort is assisting each fire protection district within the county, as well as Cal Fire, to understand wildfire vulnerabilities for the communities they protect.

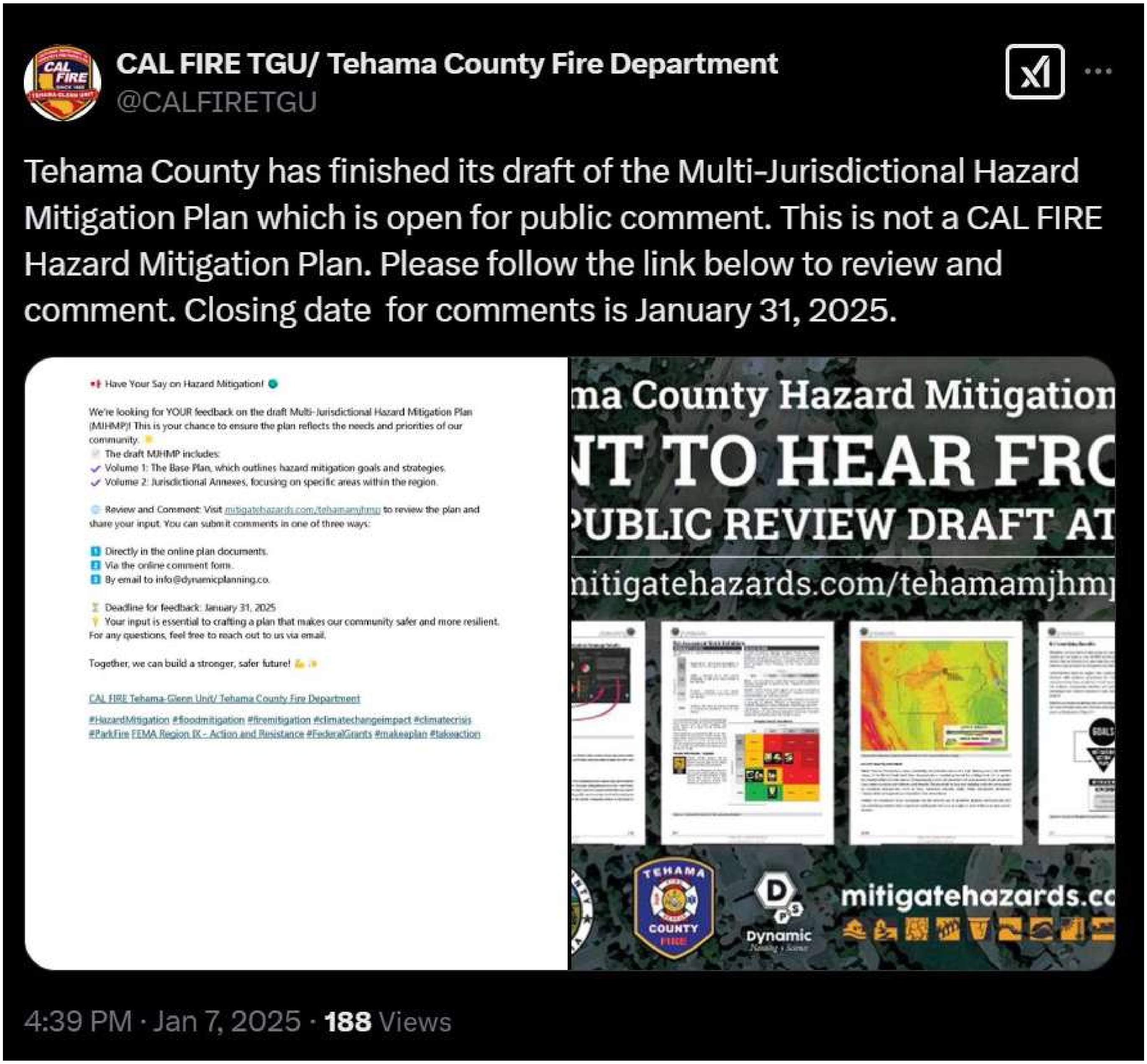
Over the coming months the county stakeholders will finalize newly developed mitigation action strategies based upon stakeholder and public consensus.

Survey responders will be entered to win a grand prize of a $500 Stihl power tool voucher redeemable at any Stihl dealership in Tehama County. For more information on the planning effort or the survey please visit https://mitigatehazards.com/tehamamjhmp/

Press Release Part 1

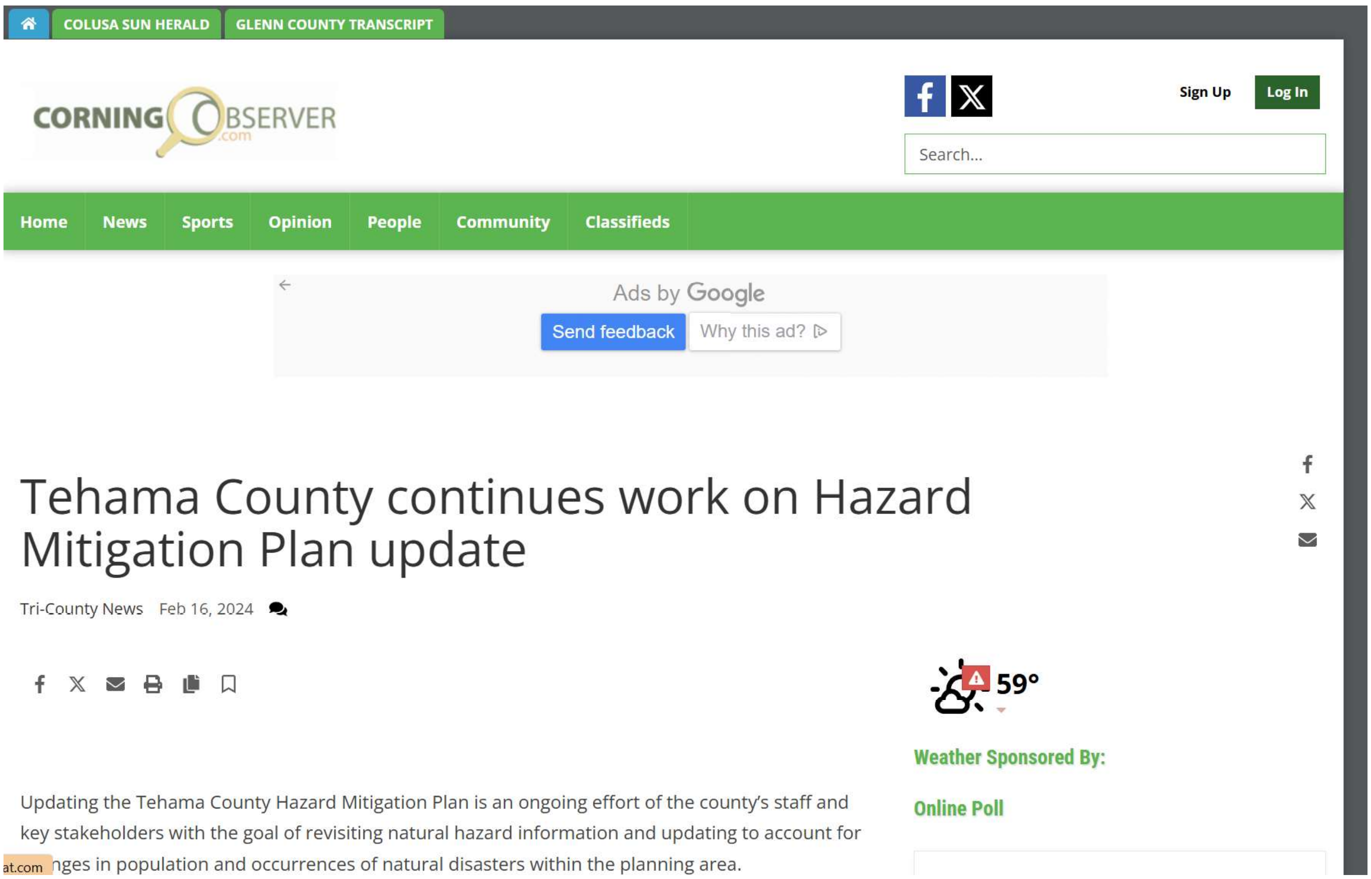
Press Release Part 2

CAL FIRE Facebook Post



CAL FIRE X Post

City of Corning Website Post



COLUSA SUN HERALD | GLENN COUNTY TRANSCRIPT

CORNING OBSERVER .com

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Tehama County continues work on Hazard Mitigation Plan update

Tri-County News Feb 16, 2024

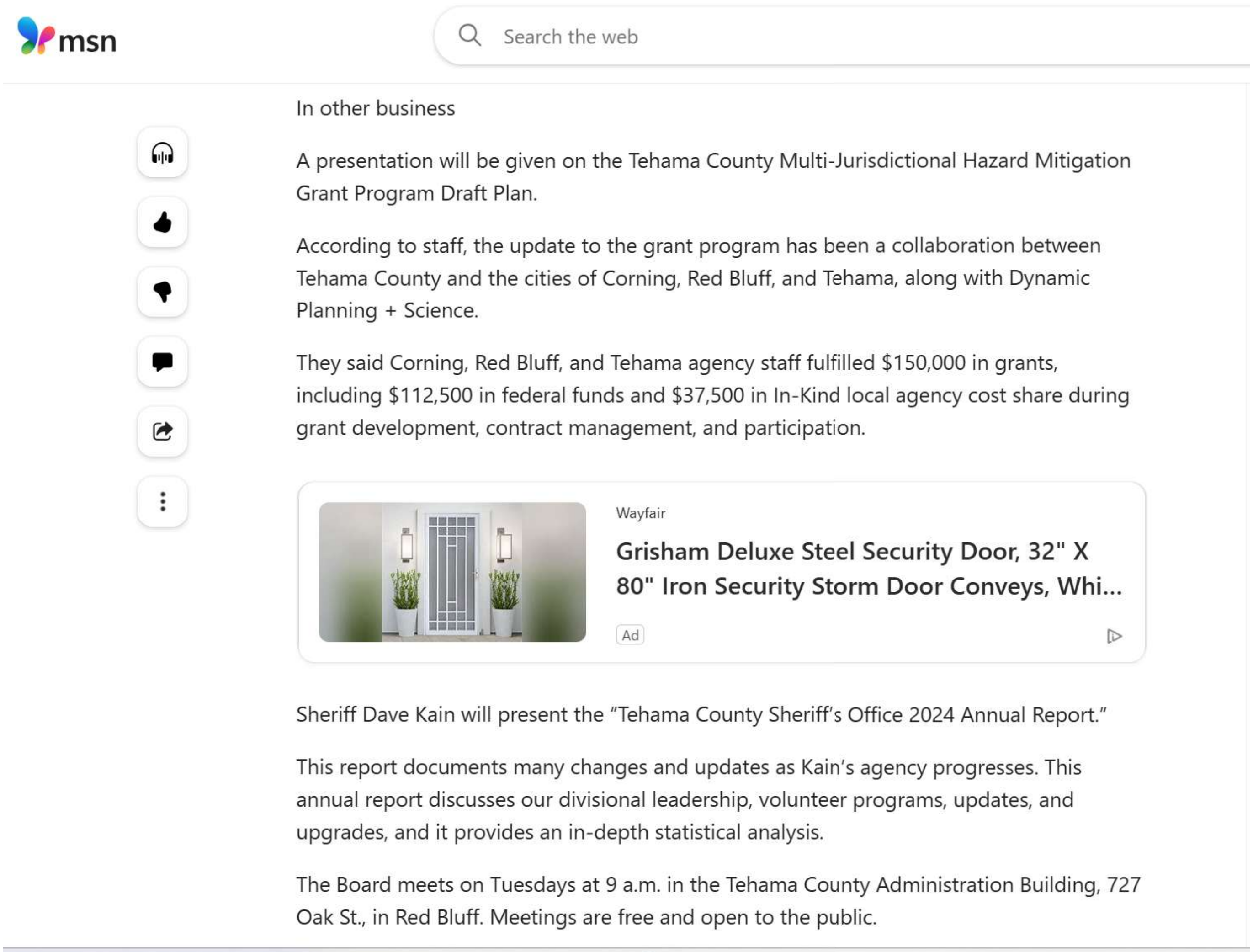
59°

Weather Sponsored By:

Online Poll

Updating the Tehama County Hazard Mitigation Plan is an ongoing effort of the county's staff and key stakeholders with the goal of revisiting natural hazard information and updating to account for at.com nges in population and occurrences of natural disasters within the planning area.

Corning Observer Website Post



msn

Search the web

In other business

A presentation will be given on the Tehama County Multi-Jurisdictional Hazard Mitigation Grant Program Draft Plan.

According to staff, the update to the grant program has been a collaboration between Tehama County and the cities of Corning, Red Bluff, and Tehama, along with Dynamic Planning + Science.

They said Corning, Red Bluff, and Tehama agency staff fulfilled $150,000 in grants, including $112,500 in federal funds and $37,500 in In-Kind local agency cost share during grant development, contract management, and participation.

Sheriff Dave Kain will present the “Tehama County Sheriff’s Office 2024 Annual Report.”

This report documents many changes and updates as Kain’s agency progresses. This annual report discusses our divisional leadership, volunteer programs, updates, and upgrades, and it provides an in-depth statistical analysis.

The Board meets on Tuesdays at 9 a.m. in the Tehama County Administration Building, 727 Oak St., in Red Bluff. Meetings are free and open to the public.

MSN HMP Post

Tehama County Evacuation Routing Study

CLICK HERE TO DOWNLOAD DRAFT REPORT

EVACUATION AND EMERGENCY RESOURCES

- Tehama County Hazard Mitigation Plan 2023
- Tehama County Public Interactive Map Viewer

TC Safety Project Website Posting

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Survey & Results Documentation

Appendix B.3

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Tehama County

Hazard Mitigation Plan

Public Survey Summary 2024

HMP Public Survey Part 1

Brief Summary

A sixteen-question community survey was distributed by the County via several online platforms. The results of the survey are used to ensure that the hazard mitigation priorities of the County match those of the residents and community members. The response rate for the survey has been successful, in large part due to comprehensive efforts at distributing the survey widely and ensuring its ease of access. The following is a brief summary of responses.

Total Survey Responses

141

- **Property at risk?** Approximately 96% of participants believe their property is vulnerable to a natural disaster event.
- **Hazards experienced?** Respondents have experienced the following hazards:
    - Earthquake (39.3%)
    - Wildfire (50%)
    - Severe Weather (e.g., heavy rain, high heat, high wind) (82.1%)
    - Flooding (37.9%)
    - Drought (56.4%)
    - Landslide / Slope Failure (2.9%)
    - Dam / Levee Failure (5%)
    - None of the above. (10.7%)
- **Prepared to evacuate?** Most respondents felt prepared (42.5%) or only somewhat prepared (31.9%) about the dangers of natural hazards in the area. 25.5% of respondents felt uninformed.
- **Perceived threats? Top perceived high threat hazards responses included:**
    - Wildfire was considered a high (33.5%) or very high (35%) threat
    - Extreme heat considered a high (36.4%) or very high (34.3%) threat
    - Drought considered a high (34.3%) or very high (12.1%) threat
    - Severe weather considered a high (36.4%) or very high (12.1%) threat
- **What actions have you taken for your home or property to reduce risk of damage or injury from potential disasters? top responses included:**
    - Purchased insurance (87.1%)
    - Removed vegetation to create defensible space (83.6%)
    - Secured backup power supply (65%)
    - Registered for Code Red Emergency Alerts (58.6%)
    - Created an evacuation plan and/or emergency kit for my household (54.3%)
- **What kind of insurance policies, if any, do you have to protect your home or property? top responses included:**
    - Home insurance (91.8%)
    - Renters insurance (8.2%)
    - Flood insurance (17.9%)
    - Earthquake insurance (12.7%)
    - Wildfire insurance (21.6%)

HMP Public Survey Part 2

- **What barriers do you face in taking action to reduce your property's risk to natural hazards/disasters? Top three responses included:**
    - Lack of funds (57.3%)
    - I need help with certain physical tasks (29.8%)
    - I don’t feel like my property is high enough risk (22.6%)
- **Which of the following incentives would encourage you to protect your home to withstand the impacts of possible hazards?** Top three responses:
    - Insurance premium discounts (75.6%)
    - "Rebate" programs or reimbursement of upfront costs (64.1%)
    - Labor assistance for installation of improvements (55.7%)
- **Which of the following actions do you believe the County should focus on to reduce disruption of services, increase safety, and strengthen the community? Top three responses included:**
    - Update existing infrastructure (e.g., sewer, stormwater/drainage systems, bridges and roadways) (74.3%)
    - Improve the damage resistance of utilities (e.g., electricity, communications, water/wastewater facilities) (67.9%)
    - Conduct vegetation management (i.e., disking, grazing, landscape restoration) in open space areas to reduce wildfire risk to neighboring homes (62.1%)

Additional Questions and Comments from Respondents

At the end of the survey, respondents were able to provide any additional questions or comments that they had regarding hazard mitigation and community protection against natural disasters. There were 35 different responses. These responses included compliments, questions, and comments indicating recommendations and challenges to mitigation. Below is a representative list of many comments and recommendations.

1. Infrastructure and Facilities
    a. On Mill Creek in Los Molinos, the gravel load is increasing, raising the creek bed. Although River Ave floods periodically, it is possible we may lose the end of the road to erosion and not be able to access our property. We also wonder if Hidden Harbors could be cut off as well. I also wonder if the overflow channels of Mill Creek should have some vegetation removal to improve flood water runoff in a high flow event. Also, the erosion on the west side of the Sacramento River right next to the train trestle (in the town of Tehama) should be evaluated. It is starting to cut behind the rock abatement which could undermine the trestle and Aramayo Way. Oil tankers are also left parked for weeks on Woodland Ave and Gyle Road, which could be an issue for hazard waste management within the area.
    b. Lake California needs a road that is safe to drive on for the 2000+ people that live in the community. A road that doesn't flood every time it rains. A road that doesn't require two permanent signs with lighting to warn the road is flooded and encourages/ok's it paying tax members to drive through deep flooded water when it rains, without the ability to see the lines or shoulders of the roadway while flooded. This same road is so narrow that semi trucks and buses dip over the yellow line into oncoming traffic to make sharp turns. This includes county trucks pulling heavy equipment! Buses and Semi's must do this to even make the initial turn to get onto Lake California Drive from Main st/Bowman Rd in Cottonwood Also there is also

HMP Public Survey Part 4

only one entrance/exit to the community so in the event of a wildfire we will be forced to shelter in our community as the fire burns.

c. Lake Calif. absolutely needs electrical lines encased or buried rather than on poles and some additional emergency exit roads, even leasing from ranchers so a gravel road for emergencies could be available. Something affordable and needed NOW.
d. Cleanup river park red bluff.

2. Emergency Preparedness and Communications
   a. Everyone should have their own personal plan, but where are the designated SRA's emergency evacuation centers/areas in Tehama County for those that don't. Do we have mutual aid with animal disaster organizations like NVADG, Red Rover or HSUS?
   b. Lake California is a community with over 1000 homes and 3000 residents yet there is only 1 road to get in and out of the community. It had been blocked by downed power lines and, preventing any access to emergency services. If there is a large- scale fire, flood, or earthquake and the road becomes inaccessible, it will be extremely detrimental to the safety of every resident. The county may be held liable if they continue to ignore the residents' requests to improve this situation.
   c. Provide more information on emergency action plans and locations that can be accessed by the public in the event of an emergency.

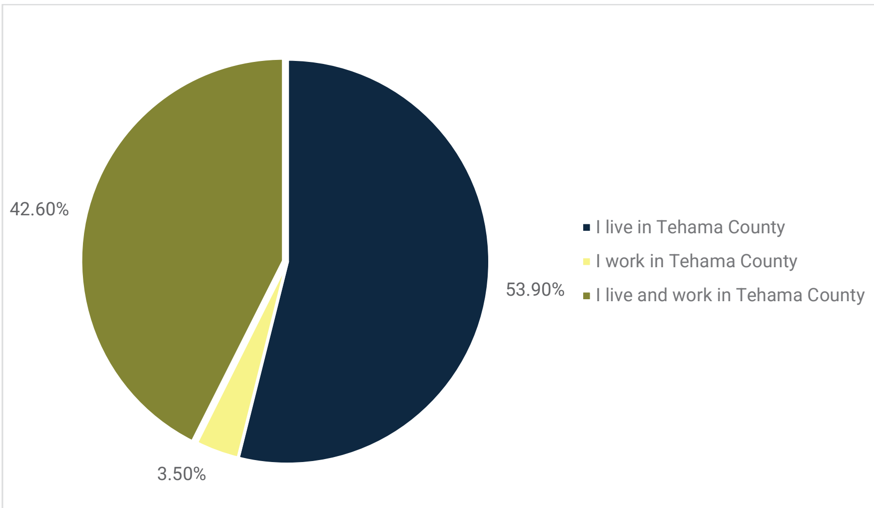
3. Development and Regulations
   a. The products that homeowners need to make their homes more resistant to damage are very expensive. To replace the wood products used in construction (wood siding, wood decks & patios) is the biggest hindrance to everyone in California.
   b. Make large property owners reduce the wildfire fuel in the property.

HMP Public Survey Part 5

Question-by-Question Summary

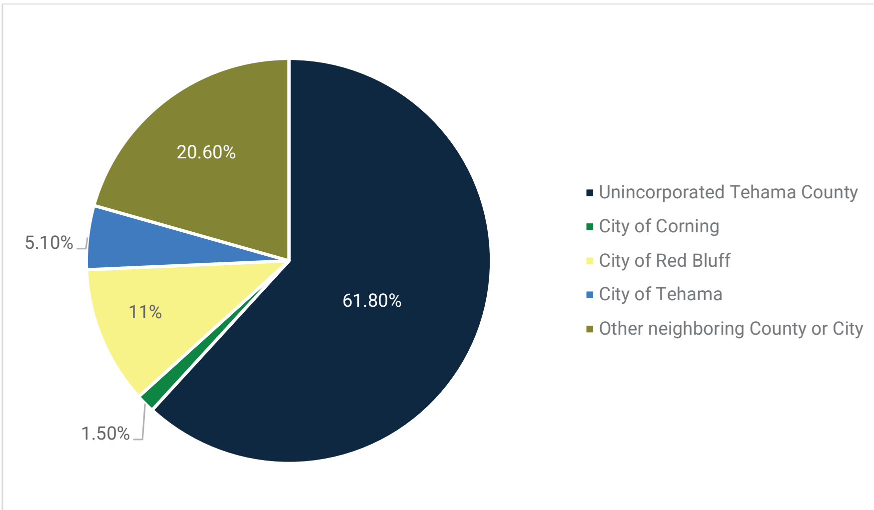
Question 1: Do you live or work in Tehama County?

This pie chart shows the percentage of respondents living and/or working in Tehama County.

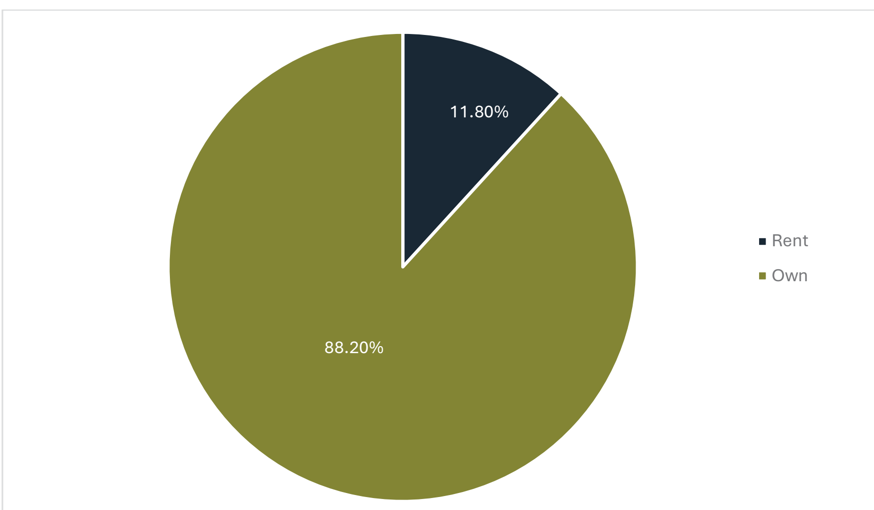


HMP Public Survey Part 6

Question 2: Where do you live and/or own property?

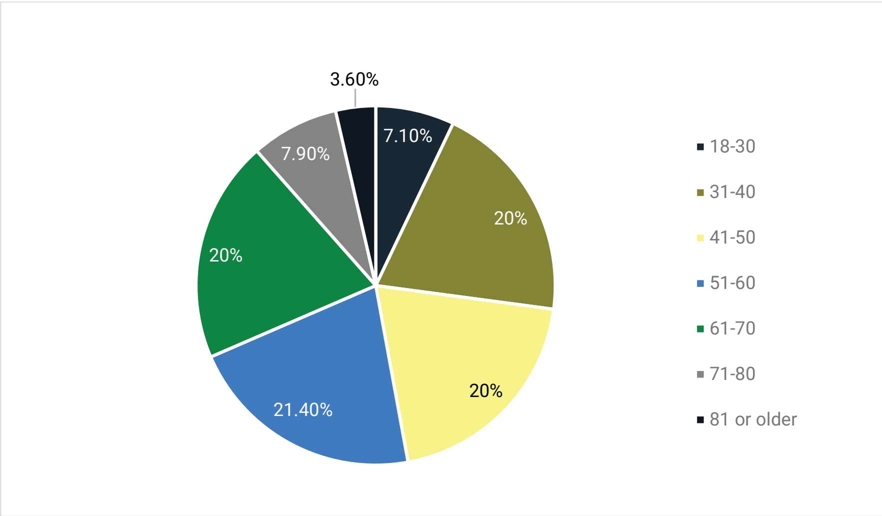


Question 3: Do you rent or own your home?

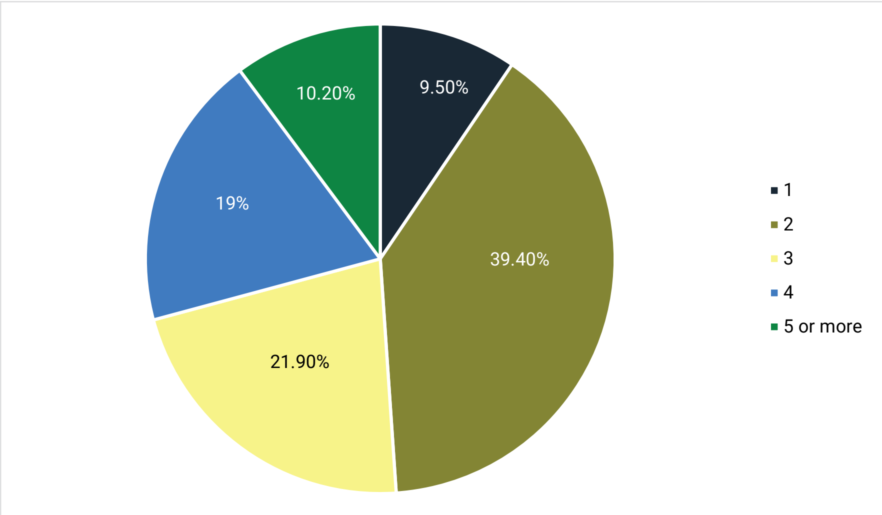


HMP Public Survey Part 7

Question 4: What is your age range?

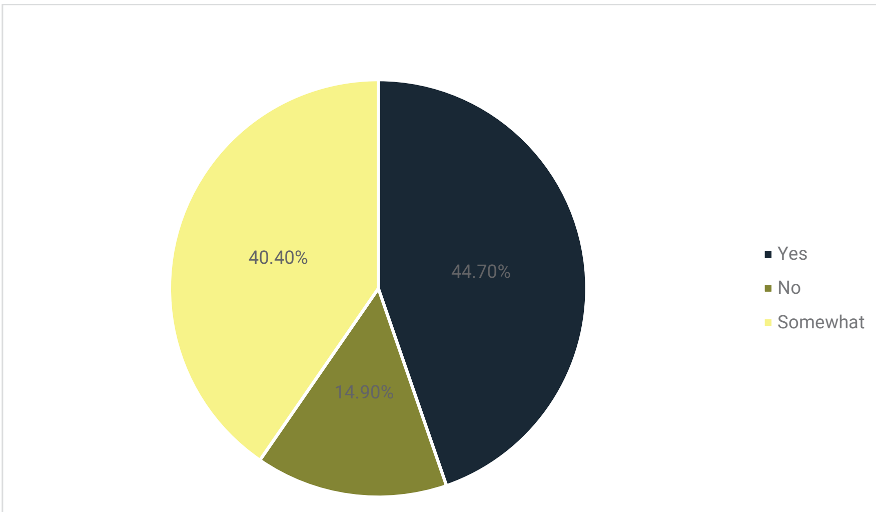


Question 5: How many individuals currently live in your household?

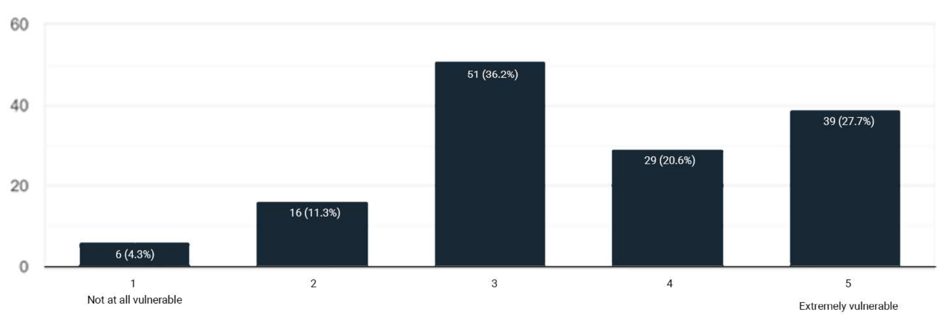


HMP Public Survey Part 8

Question 6: Do you feel well informed about the dangers of natural disasters in this area?

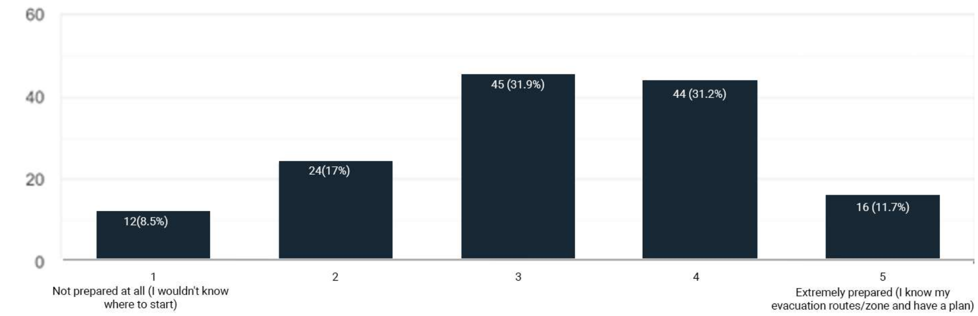


Question 7: In your opinion, how vulnerable do you believe your property/home is to damage from a natural disaster event?

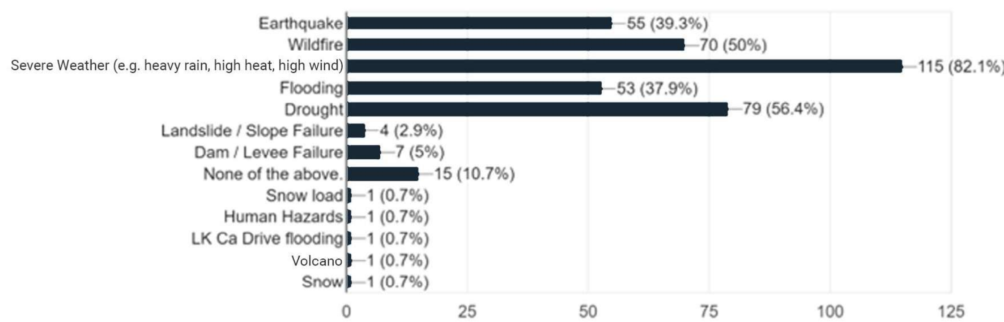


HMP Public Survey Part 9

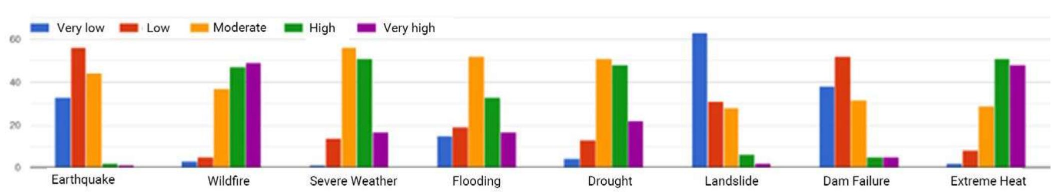
Question 8: How prepared is your household or business to evacuate during an emergency event?



Question 9: Which of the following types of events have you or someone in your household experienced in Tehama County in the last 20 years? (Check all that apply)

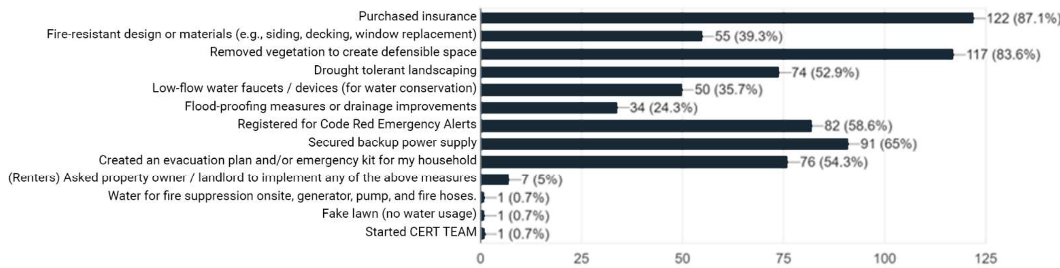


Question 10: Rate your perception of how high a threat each hazard below poses to you or someone in your household. (Pick one per row)

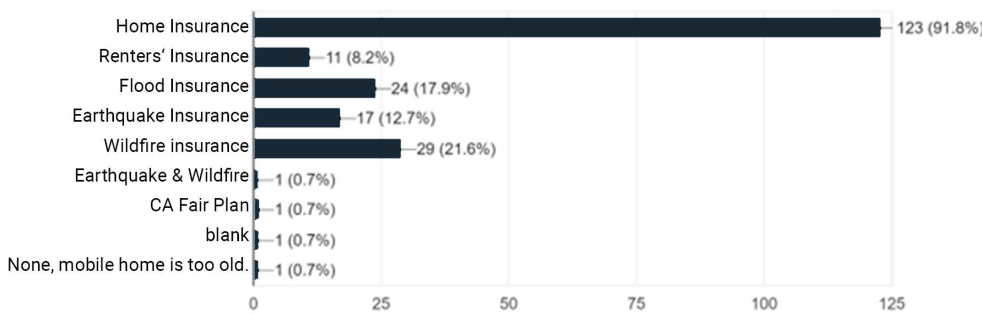


HMP Public Survey Part 10

Question 11: What actions have you taken for your home or property to reduce risk of damage or injury from potential disasters? (Check all that apply)

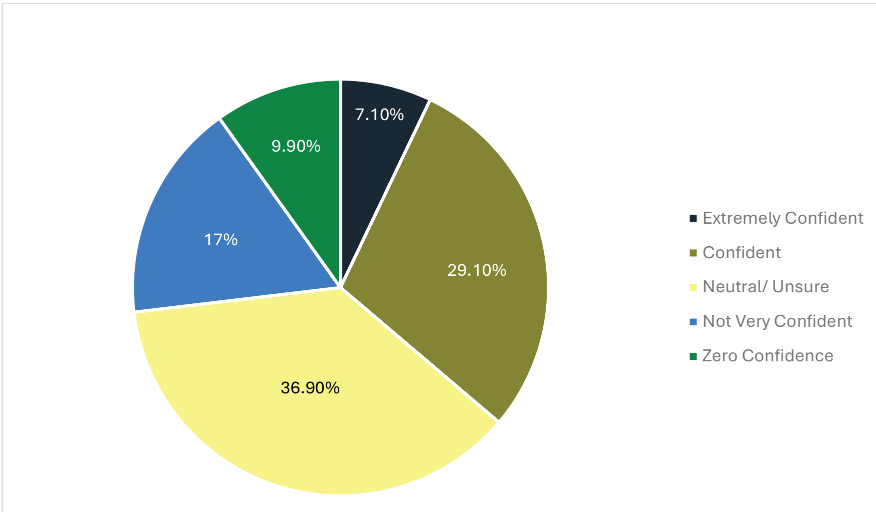


Question 12: What kind of insurance policies, if any, do you have to protect your home or property? Check all that apply.

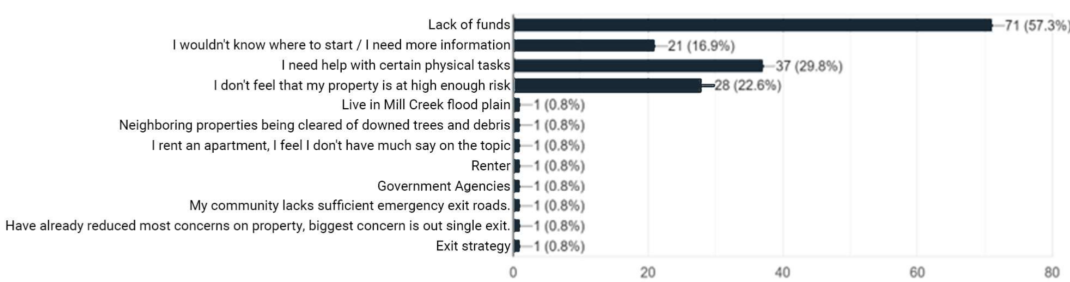


HMP Public Survey Part 11

Question 13: How confident do you feel about your financial preparedness to handle unexpected expenses during a disaster or emergency situation?

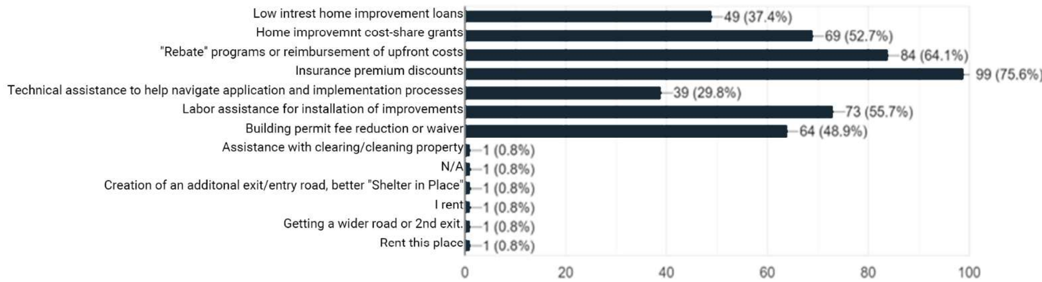


Question 14: What barriers, if any, do you face in taking action to reduce your property's risk to natural hazards/disasters? Check all that apply.

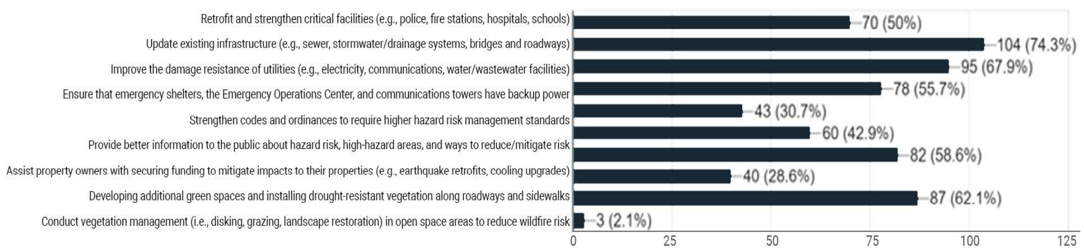


HMP Public Survey Part 12

Question 15: Which of the following incentives would encourage you to protect your home to withstand the impacts of possible hazards? (Check all that apply)



Question 16: Which of the following actions do you believe the County or Municipality should focus on to reduce disruption of services, increase safety, and strengthen the community’s resiliency? (Check all that apply)



HMP Public Survey Part 13

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Mitigation Strategy Prioritization Process Documentation

Appendix B.4

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MAST Interface

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Website Documentation

Appendix B.5

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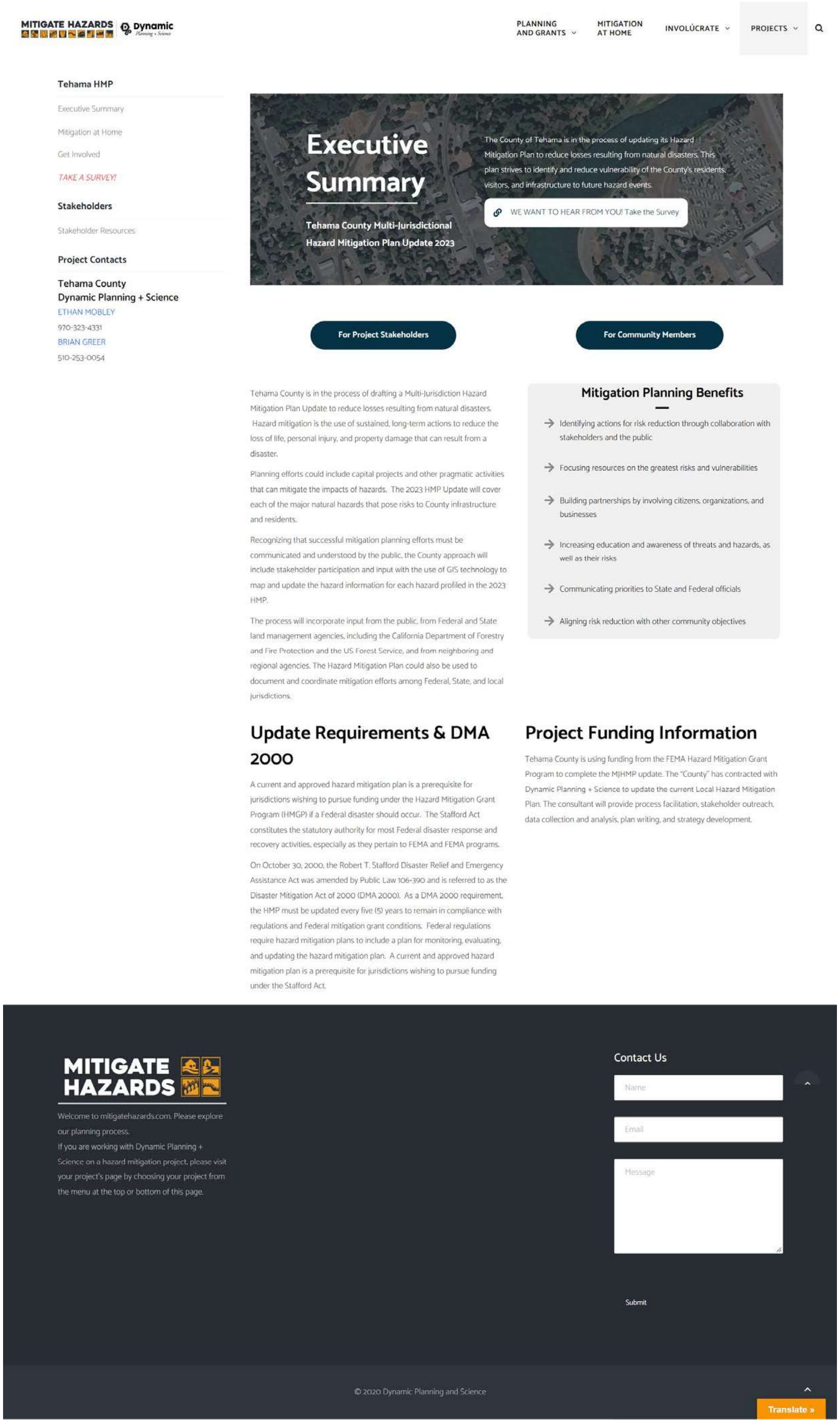
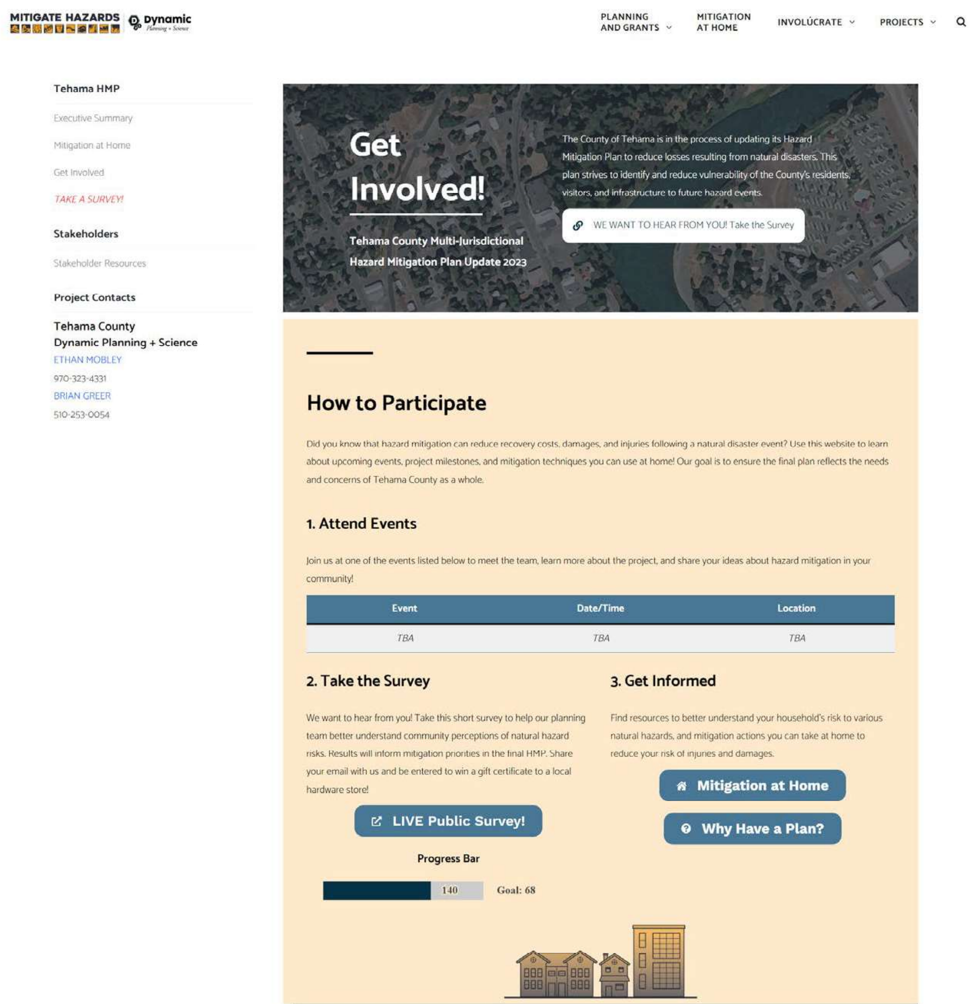
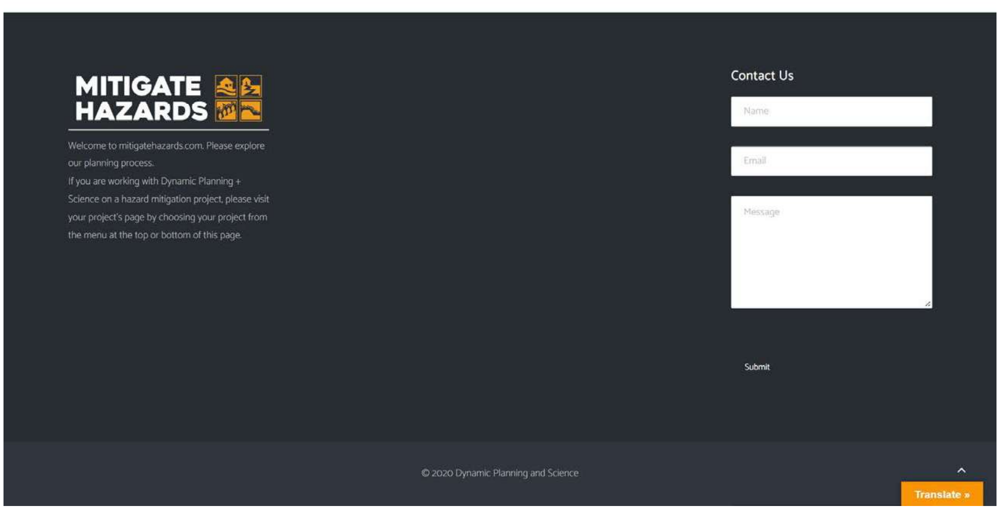
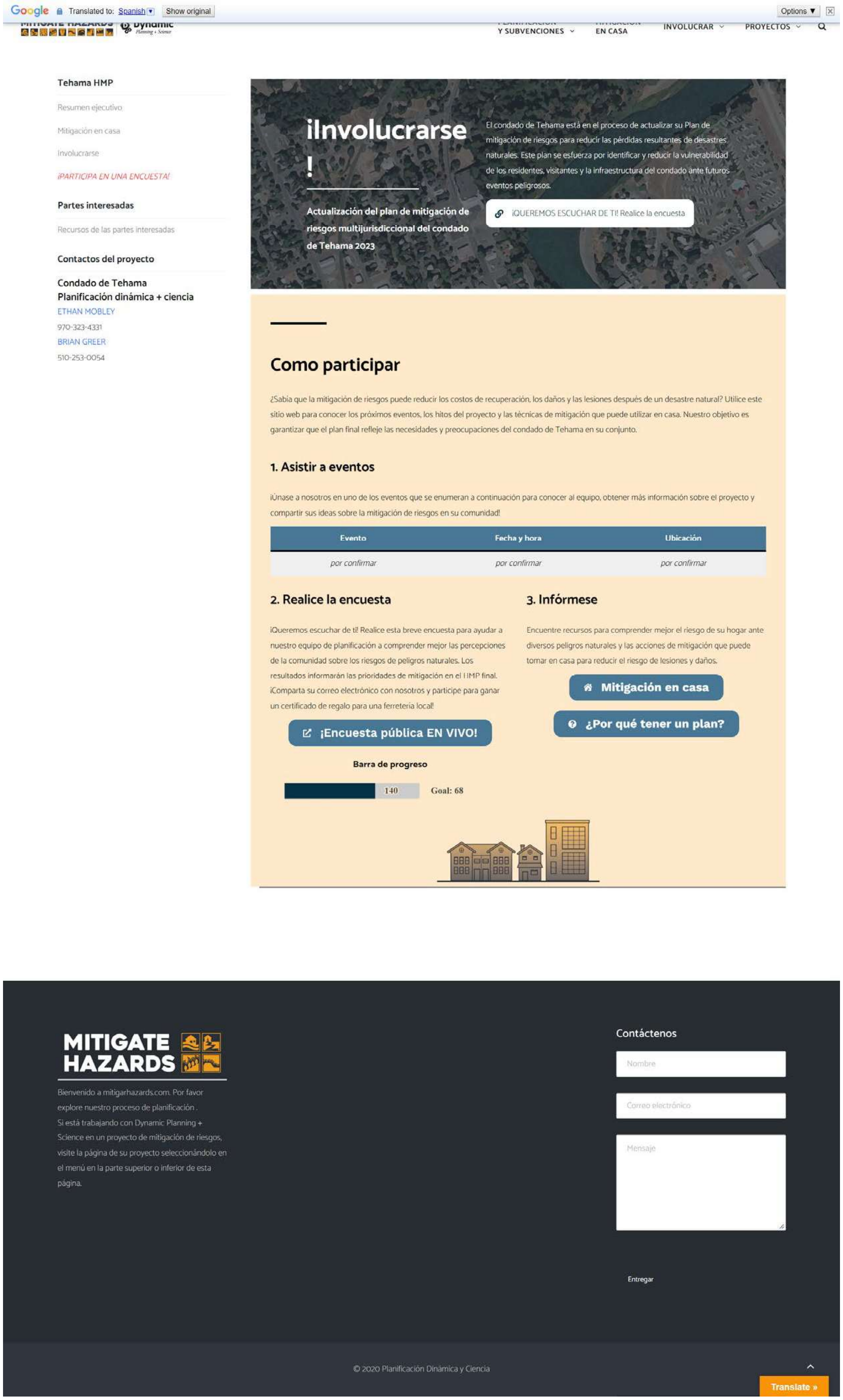


Executive Summary

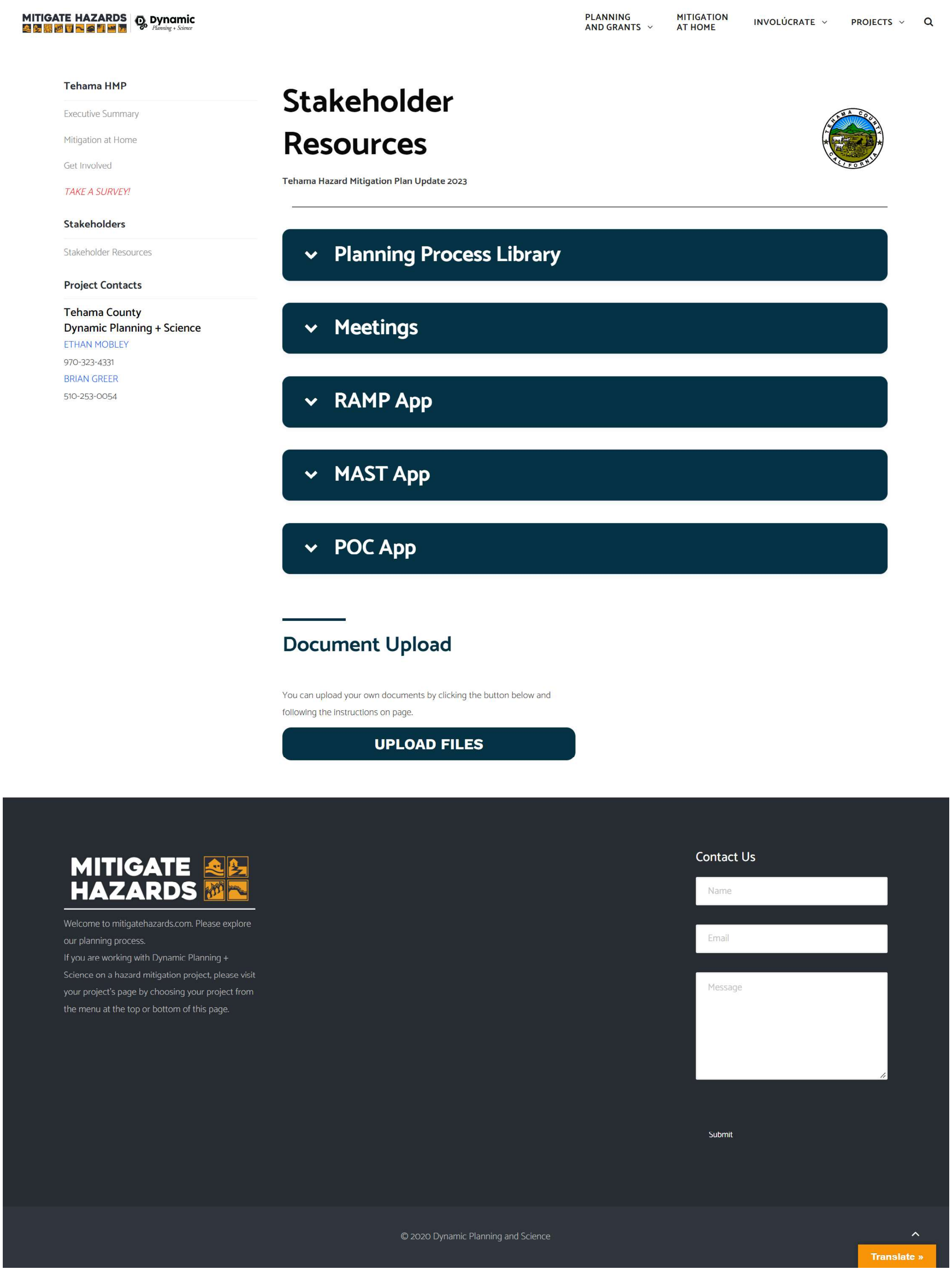




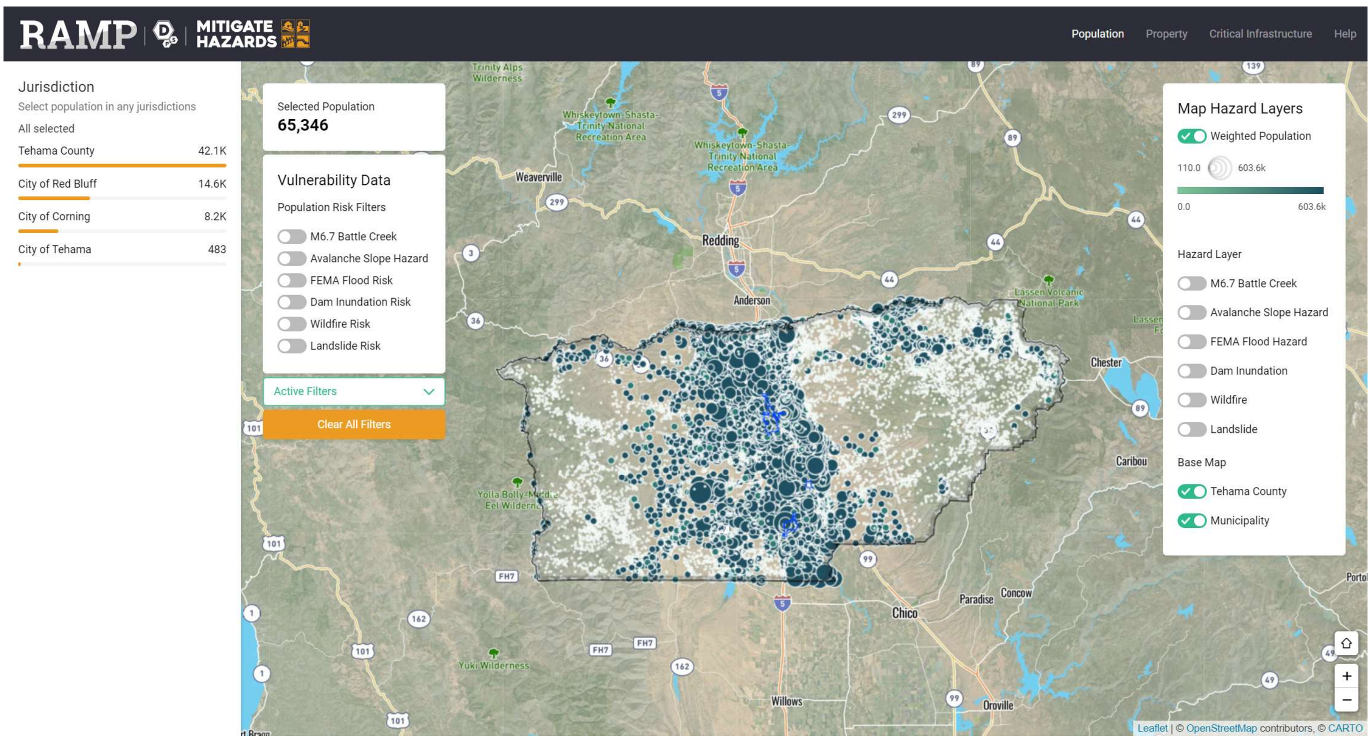
Get Involved



Get Involved Spanish



Stakeholder Resources


RAMP
MITIGATE HAZARDS
Population
Property
Critical Infrastructure
Help
Jurisdiction
Select population in any jurisdictions
All selected
Tehama County 42.1K
City of Red Bluff 14.6K
City of Corning 8.2K
City of Tehama 483
Selected Population
65,346
Vulnerability Data
Population Risk Filters
M6.7 Battle Creek
Avalanche Slope Hazard
FEMA Flood Risk
Dam Inundation Risk
Wildfire Risk
Landslide Risk
Active Filters
Clear All Filters
Map Hazard Layers
Weighted Population
110.0
603.6k
0.0
603.6k
Hazard Layer
M6.7 Battle Creek
Avalanche Slope Hazard
FEMA Flood Hazard
Dam Inundation
Wildfire
Landslide
Base Map
Tehama County
Municipality
Redding
Anderson
Weaverville
Chester
Chico
Paradise
Willows
Oroville
Leaflet | © OpenStreetMap contributors, © CARTO

RAMP App

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