DRAFT FOR REVIEW AS OF JANUARY 2025

Lake County Multi-Jurisdictional Hazard Mitigation Plan

2025

TEAM ACKNOWLEDGMENTS

The development of the Lake County Multi-Jurisdictional Hazard Mitigation Plan was made possible through the collaboration and efforts of many. Their input and expertise have been integral to the creation of this plan. We acknowledge the following individuals and organizations for their contributions:

Planning Committee

Michael Reynolds	*Auditor-Controller's Office*
Lauren Berlinn	*Sheriff/Lake County OES*
Ron Ladd	*City of Lakeport*
Adeline Leyba	*City of Clearlake*
David Fromer	*District 1*
Russ Cremer	*District 2*
Rob Young	*District 3*
David Brown	*District 4*
Jessica Fitzgerald	*District 5*

Planning Team

Adeline Leyba	*Public Works Director, City of Clearlake*
Leah Sautelet	*Emergency Services Manager, Lake County OES*
Mark Roberts	*Senior Planner, City of Clearlake*
Ron Ladd	*Public Works Director, City of Lakeport*

Technical Support & Consultants

Andrea Davis	*The Resiliency Initiative*
Faith Newton	*The Resiliency Initiative*
Lori Bundick	*The Resiliency Initiative*

Special Thanks

We appreciate the residents, business owners, community organizations, and new jurisdictions who contributed to the development of this plan. Your input through public meetings, surveys, and workshops was vital in addressing Lake County's unique needs. The involvement of new jurisdictions has strengthened our regional approach to hazard mitigation. This plan reflects our collective efforts and lays the groundwork for a safer, stronger, and more unified region. We encourage continued participation from Tribal governments and special districts in future planning to build a more resilient Lake County.

RESOLUTION ADOPTING 2025 LAKE COUNTY HAZARD MITIGATION PLAN

(The text of the resolution will replace this page after review and approval by Cal OES and FEMA, and adoption by the Board of Supervisors.)

Table of Contents

OES' mission is to **enhance the resilience of Lake County** (the Operational Area) in the face of disaster through activities focused on ***mitigation***, *preparation, response & recovery*.

CHAPTER ONE: Introduction

1.1 About the Plan

The Lake County Sheriff's Office of Emergency Services ("Lake County OES," "Sheriff's OES," or "OES") is the lead agency for local emergency management for the County of Lake as defined by the Lake County Board of Supervisors (BOS) in Chapter 6, Article I of the Lake County Code.

Lake County OES holds the responsibility to develop, update and exercise County emergency management plans including the Emergency Operations and Hazard Mitigation Plans (the EOP and HMP).

While the Lake County's HMP, last updated and approved by FEMA in December 2023, has historically remained single-jurisdiction, efforts by the governing bodies of the County and of both incorporated cities, Lakeport and Clearlake, led to the development of this multi-jurisdictional hazard mitigation plan.

The overall Plan follows federal, state and local requirements and guidance and is part of the County's ongoing efforts to increase community resiliency and to guide the Operational Area in reducing physical, economic and environmental impacts from natural disasters through specified actions.

In recognition of the historical impacts of severe and compounding disasters, including a series of wildfires since 2015, the Board of Supervisors added

"Developing and maintaining a high standard of Disaster Prevention, Preparedness and Recovery, in collaboration with all community stakeholders" to its Vision 2028 Priorities Statement in May 2021[1].

Lake County OES led the 2025 Lake County Multi-Jurisdictional Hazard Mitigation Plan development in close coordination with the City of Clearlake, the City of Lakeport and a team of consultants retained to author the annexes for each city, together called the Project Team. This new, multi-jurisdiction plan geographically encompasses the unincorporated areas within Lake County's boundaries and both cities (hereinafter referred to as the Planning Area). It is acknowledged that the local tribal governments also maintain a separate multi-jurisdictional tribal mitigation plan and may decide to join the Lake County plan in the future.

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." A three-year, congressionally-mandated independent study to assess potential cost savings from mitigation activities provided evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation prevents $6 in future losses, in addition to saving lives and preventing injuries (National Institute of Building Science Natural Hazard Mitigation Saves: 2017 Interim Report).

This 2025 Plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR §201.6) and finalized October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act, DMA, or DMA 2000). The Act emphasizes the need for mitigation plans and more coordinated mitigation planning and implementation efforts. Regulations set forth establish requirements that local hazard mitigation plans must meet for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288).

This planning effort also follows FEMA's 2023 Plan Preparation Guidance. Planning efforts result in a Multi-Jurisdictional HMP that details potential hazards, risks and mitigation goals/objectives. It will be used to guide County and City efforts to protect life and property and enhance resiliency to disaster through local land use policy, mitigation activities and efforts.

[1] https://www.lakecountyca.gov/164/Vision

1.2 What's New or Updated

The 2023 Lake County HMP reduced the plan size from close to 1,000 pages to less than 200. The opinion of the Hazard Mitigation Planning Committee (HMPC) and feedback from the public is that the Plan would be more useful and likely to be read if it were more concise. This 2025 update focuses on enhancing the readers' ability to use the Plan. Higher-level information is removed (i.e., extended explanations of what each hazard is), and the hazard profiles now include the vulnerability assessment, keeping the reader's attention and ability to see "the whole picture" of each hazard.

For the 2025 Multi-Jurisdictional Plan, the previous HMPC reconvened and continues to oversee the review, update and development of this Base Plan and each Annex. The Plan was revised to expand the Planning Area and updated processes, evolving into the 2025 MJHMP Base Plan. Effort was made to increase the visual appeal of the Plan by incorporating additional photographs and charts. This effort led to an increase in page count while maintaining concise, usable information.

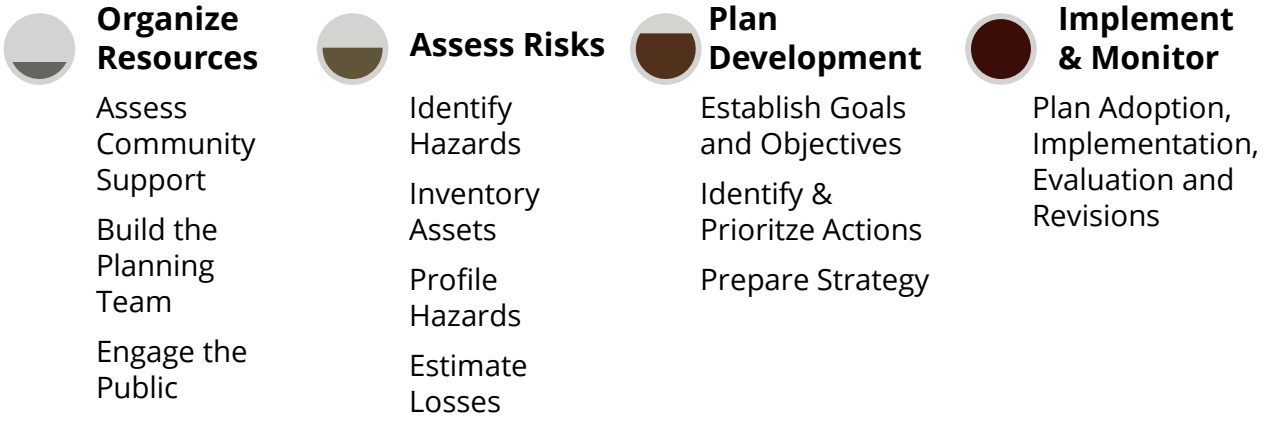
1.2.1 Mitigation Action Review

The 2023 HMP included 74 mitigation activities and their current status is highlighted in Figure 1. Hazard mitigation efforts will continue to build Lake County's resilience in the face of disaster. Greater detail and new mitigation actions are outlined in *CHAPTER SIXTEEN: Mitigation Strategies*. Mitigation actions for additional jurisdictions are reviewed and detailed in each jurisdictional annex.

Figure 1: Mitigation Action Overview

1.3 Planning Process

The MJHMP provides historical data in relation to local disasters, examines future disaster possibilities and creates an actionable strategy by methodically detailing the planning process, including four steps:



1.4 Organizing Resources

1.4.1 Official Recognition, Planning Team Established

The Lake County Board of Supervisors (BOS) approved a Resolution establishing the Hazard Mitigation Planning Committee (HMPC) comprised of County Departments, Incorporated Cities, Tribal Nations, Fire Districts, Special Districts and other governmental partners, members of the public, and stakeholders including local, regional, state, tribal and federal agencies in 2023.

To include public representation on the HMPC, Lake County OES opened one seat per Supervisorial District and requested Letters of Intent from interested parties. A notice requesting Letters of Intent from the general public (to fill one seat per Supervisorial District) was posted at the courthouse, online (social media, website), in the press (*Record-Bee* and *Lake County News*), on the radio (paid advertisement on three local stations), County Library branches, and disseminated by e-mail to stakeholders. Four letters were received before the deadline, and one was received the following day. On November 1, 2022, the BOS approved the HMPC.

This HMPC built upon the previous plan update and guided the 2025 Multi-Jurisdictional Hazard Mitigation Plan project. The Lake County Office of Emergency Services (OES) chairs the committee and organizes all facets of the planning process in coordination with both cities and their consultants.

Table 1: List of Planning Committee Members and Agency/Group Represented

Name	Title	Representing
Michael Reynolds	Emergency Event Fiscal Manager	Auditor-Controller
Lauren Berlinn	Sheriff's Public Information Officer	Sheriff OES
Ron Ladd	Public Works Superintendent	City of Lakeport
(To be decided)		Tribal Nations[2]
Adeline Leyba	Public Works Director	City of Clearlake
David Fromer	Individual	District 1
Russ Cremer	Individual	District 2
Rob Young	Individual	District 3
David Brown	Individual	District 4
Jessica Fitzgerald	Individual	District 5

The official HMPC mission is to *approve a comprehensive and coordinated update to the current Hazard Mitigation Plan by ensuring the process followed is complete, concise and accurately represents the varying needs and characteristics of the Operational Area.* Each committee member received the same instructions:

- Arrive on time. At least 6 HMPC members must be present to carry out business. Missing meetings may increase the number of meetings necessary to complete this project.
- You are here as a representative of a subset of the population. To that end, input/suggestions should not represent your personal viewpoint but the reasonable voice of the population you represent.
- Follow the current topic/agenda.
- You will receive information and instructions necessary to determine if the working group has successfully completed its task(s)/phase.
- Your role is to agree (approve) their progress as presented or not. If not, provide direction on what is missing.
- Decisions will be made by 2/3 vote.

[2] The representative from Robinson Rancheria who held this position during the 2023 Plan Update is no longer employed at the Rancheria. Efforts to replace this representative are underway and awaiting Tribal Council decision.

Table 2: Hazard Mitigation Planning Committee Meetings

Meeting Type	Meeting Topic	Meeting Date(s)	Meeting Location(s)
HMPC Meeting #1	1) Committee Expectations & Roles 2) MJHMP Update Overview 3) Phase 1 – Organize Resources 4) Phase 2 – Assess Risks and Profiling Hazards	October 23, 2024	Emergency Operations Center, Lakeport & via Zoom
HMPC Meeting #2	1) MJHMP Progress Status Update 2) MJHMP Update Draft – Hazard Profiles 3) MJHMP Mitigation Actions	November 20, 2024	Via Zoom
HMPC Meeting #3	1) MJHMP Progress Status Update 2) MJHMP Update Draft 3) Plan Implementation	December 12, 2024	Via Zoom
HMPC Meeting #4	1) MJHMP Update Draft 2)Public Survey Results 3)Public Review Period	January 30, 2025	Via Zoom
HMPC Meeting #5	1) Public Review Period 2) Plan Adoption	February TBD, 2025	Via Zoom

Table 3: Public Information Sessions

Meeting Type	Meeting topic	Meeting Date	Meeting Locations
Public Session #1	1) Introduction to the Multi-Jurisdictional Hazard Mitigation Plan 2) Update Process 3) Hazard Identification 4) Public Engagement	September 23, 2024	Clearlake City Hall and via Zoom
Public Session #2	1) Introduction to the Multi-Jurisdictional Hazard Mitigation Plan 2) Update Process 3) Hazard Identification 4) Public Engagement	September 24, 2024	Lakeport City Hall and via Zoom

Meeting Type	Meeting topic	Meeting Date	Meeting Locations
Public Session #3	1) Introduction to the Multi-Jurisdictional Hazard Mitigation Plan 2) Update Process 3) Hazard Identification 4) Public Engagement	September 30, 2024	Via Zoom
Public Session #4	1) Introduction to Presenters, Hazard Mitigation Plan and Update Process 2) Mitigation Actions 3) Assess Risks & Capabilities	December 12, 2024	Via Zoom
Public Session #5	1) MJHMP Plan Review 2) Public Review Period 3) Plan Adoption	February TBD, 2025	Via Zoom

Planning activities were convened under the direction of Lake County OES in coordination with each participating jurisdiction, collectively known as the Planning Team. An inter-departmental working group supported the Base Plan update in phases. Each phase consisted of working group activities, a public information session and an HMPC meeting.

While efforts proceeded jointly, information that was tracked and analyzed pertinent to each additional jurisdiction is included in the annexes.

All who attended the Planning Committee meetings were encouraged to participate in the process. Table 4 shows a list of individuals, their affiliation and the number of meetings or public information sessions they attended.

Table 4: Participation

Name	Department/ Organization	HMPC	Public Information Sessions	Working Group	Contributions
Rob Howe	Sheriff's OES			X	Oversight
Gavin Wells	Sheriff's OES			X	Oversight
Leah Sautelet	Sheriff's OES	X	X	X	Facilitated
Matthew Rothstein	Administration			X	Tree Mortality and Various

Name	Department/ Organization	HMPC	Public Information Sessions	Working Group	Contributions
Lon Sharp	Information Technology			X	Maps
Mireya Turner	Community Development			X	Review, Mitigation Actions
Mary Claybon	Community Development				Review, Mitigation Actions
Lars Ewing	Public Services			X	Review, Mitigation Actions
Terre Logsdon	Administration			X	Review, Mitigation Actions
Willie Sapeta	Lake County Fire Protection District | Fire Chiefs Association			X	Review, Mitigation Actions
Glen March	Public Works			X	Review, Mitigation Actions
Robin Borre	Special Districts			X	Review, Mitigation Actions
Various	City of Lakeport			X	Review
Pawan Upadhyay	Water Resources Department			X	Review, Mitigation Actions
Dana Hueners	Community Development Department			X	Review, Mitigation Actions. NFIP & CRS
Katherine Vanderwall	Agricultural Department			X	Review
Linda Rosas-Bill	Water Resources Department			X	Review, Mitigation Actions
Angela DePalma-Dow	Water Resources Department			X	Review, Aquatic Hazards, Mitigation Actions
Rachel Dillman-Parsons	Department of Social Services			X	Review
Ron Ladd	City of Lakeport	X			Review
Adeline Leyba	City of Clearlake	X			Review

Name	Department/ Organization	HMPC	Public Information Sessions	Working Group	Contributions
Dave Fromer	District 1 Representative	X			HMPC, Review
Russel Cremer	District 2 Representative	X			HMPC, Review
Rob Young	District 3 Representative	X			HMPC, Review
David Brown	District 4 Representative	X			HMPC, Review
Jessica Fitzgerald	District 5 Representative	X			HMPC, Review
Lauren Berlinn	Sheriff's Office	X			HMPC, Review
Michael Reynolds	Auditor/Controller	X			HMPC, Review
Tammy Alakszay	American Red Cross				
Izzy Konopa	Caltrans District 1			X	
Ryan Aylward & James White	National Weather Service	X		X	Weather Stats, Review
Daren Dalrymple	PG&E			X	PG&E Stats, Review

Stakeholders from County Departments, both Cities, Special Districts, Utilities, state and federal agencies connected to Lake County, community organizations including homeowner associations, councils, fire-wise community representatives and others, non-profit and faith-based providers, including agencies who work with seniors, AFN[3] and minority communities were invited and encouraged to participate in the entire planning process through regular invitations and updates. OES utilized its Operational Area Emergency Coordinators Group (comprised of over 150 individuals/agencies with a role in disasters and special populations within the County). See Table 5: Operational Area Contacts for a list of agencies in addition to

[3] AFN refers to individuals with "access and functional needs".

County of Lake Departments and their populations served, and Figure 2 for an example of one such invitation.

Table 5: Operational Area Contacts (Excluding County Departments)

Contact	Agency	Population/Jurisdiction Served
	Cal OES[4] Tribal Affairs Division	Lake County Tribal Governments
	Clearlake Gleaners	Food Distribution (low income)
	Clearlake Senior Center	Seniors / Clearlake Area
	Lake County Fair Admin Office	County
	Middletown Tribal Council	Tribal Government
	United Way	NGO
Alan Flora	City of Clearlake	Incorporated City
Ana Santana	Lake County Office of Education	Bilingual Families & Students
Anthony Arroyo	Habemetolel of Upper Lake	Tribal Government
Beck Blair	Cal OES	Lake & Mendocino County
Ben Cromwell	Robinson Rancheria	Tribal Government
Ben Ray	Big Valley Band of Pomo Indians	Tribal Government
Benjamin Murphy	Cobb Area Water	Utility Provider
CEO	Lake County Fair	Fairgrounds
Charles Russ	Hidden Valley Lake Association	Homeowners Association
Chief Ciancio	Northshore Fire Protection	Fire Service – North
Chief Joe Huggins	Kelseyville Fire	Fire Service – Kelseyville area
Chief Mike Wink	CAL FIRE	Fire Service
Chief Reitz	Lakeport Fire District	City – fire service
Chief Ryan	CAL FIRE	Fire Service
Chief Willie Sapeta	Lake County Fire Protection District	Fire Service & EMT
Christi Scheffer	Paratransit	Transportation for seniors and residents with disabilities
Christina Harrison	Habemetolel Pomo Of Upper Lake	Tribal Government
Dale Stoebe	Lakeport Police Department	City / law enforcement
Dana Lewis	People Services	Disabled / Countywide
Daniella Santana	Habemetolel Pomo of Upper Lake (Environmental Protection)	Tribal Government
Daren D. PG&E	Pacific Gas & Electric	Electric Customers
Dean Eichelmann	Lake County Health Services	Public Health
Deborah Smith	Red Cross	Disaster Services / County

[4] California Governor's Office of Emergency Services (Cal OES)

Contact	Agency	Population/Jurisdiction Served
DeeDee Cose	People Services	Independent living / disabled
Dianna Mann	Clearlake Oaks Water District	Clearlake Oaks area
Dino Beltran	Koi Nation	Tribal Government
Donna Davis	AT&T	Utility
Donovan Lee	Pacific Gas & Electric	Lake County customers
Doug Fee	Red Cross	Disaster Services / County
Drena Belger	Redwood Coast Regional Center	Developmental disability, or who are at risk for disabilities, and their families.
Executive Committee	Habemetolel Band of Pomo Indians	Tribal Government
Frank Aebly	US Forest Service	Forest land
General Manager	Hidden Valley Lake	Gated community
Georgett	Lake County Chamber of Commerce	County businesses
Hannah Davidson	Hidden Valley Lake Community Services District	Utility serving gated community
Interim Fire Chief Larry Thompson	Lake Pillsbury Fire Protection District	Fire Service
Izzy Konopa	Cal Trans	County Highways
Janine Citron Smith	Lake County Hospice	Death/dying support for individuals and their families
Jennifer Reed	Yolo County Flood Control District	Indian Valley Dam operator
Jeremy Moore	Mendocino Community Health Clinic	Med facility serving low income
Jimmie Tillman	Lake County Hospice	Death/dying support for individuals and their families
John Drago	Hidden Valley Lake	Homeowners Association
Karl Parker	Lake Links	Transportation for elderly, disabled and low income
Kathleen Zontos	NOAA / National Weather Service	Meteorology
Kevin Ingram	City of Lakeport	City
Kevin Thompson	Lake County Tribal Health	All County Medical / low income & tribal populations & seniors/elders
Kristin Sicke	Yolo County Flood Control District	Indian Valley Dam & Cache Creek Dam Operator
Kristina Schell	Rocky Point Care Center	Skilled Nursing Facility

Contact	Agency	Population/Jurisdiction Served
L. Thomas	Lake County Tribal Health	All County Medical / low income & tribal populations & seniors/elders
Laura Sullivan	Redwood Community Services	AFN[5]
Laurie Hutchison	Fire Safe Lake County	Residents
Lori Price	County Public Works / Roads	All
Mathias Wakefield	Cal DSS	Social service partner
Mike Shaver	Middletown Rancheria	Tribal Government
Mike Wink	CAL FIRE	Fire Service – State lands
Monique Ferguson	Bayberry, Inc.	Skilled Nursing Facility
Morgan Fox	North Coast EMS	Emergency Medical
Morgen Jarus	Sutter Health	Local hospital
Nicholas Walker	City of Lakeport	Incorporated city
Nick Widmer	Red Cross	Disaster Services
Patricia Franklin	Scotts Valley Band of Pomo Indians	Tribal Government
Patrick Teahan	Lake County Paratransit	Paratransit
Paul Duncan	CAL FIRE	South County Fire Service
Raul Espinosa	Lakeport Post Acute	Skilled Nursing
Richard Goldfarb	Red Cross	Disaster Services / County
(To be designated)	Lake County Office of Education	School Districts / students
Robyn Bera	North Coast Opportunities	NGO – serving disaster victims and other vulnerable populations in the County & workforce development
Ron Lee	Redwood Coast Regional Center	AFN
Rosemary Cordova	Callayomi Water District	Utilities
Ryan Aylward	NOAA / NWS Eureka	Meteorology – County
S. Villalobos	Cal Water	Lucerne Area water
Sam Gaytan	Lake County Paratransit	Transportation
Sarah Ryan	Big Valley Band of Pomo Indians	Tribal Government
Shannon Banks	Northshore Fire Protection District	

[5] AFN refers to individuals with “access and functional needs”.

Contact	Agency	Population/Jurisdiction Served
Shannon Kimbell-Auth	American Red Cross	Disaster prevention and preparedness; unhoused communities
Shawn Swatosh	Mediacom	Cable TV / Internet Provider
Sherry Constancio	California Department of Water Resources	Lake County
Sherry Treppa	Habemetolel Band of Pomo Indians	Tribal Government
Shirell Naidu	California Department of Social Services	
Sorhna Li	Scotts Valley Band of Pomo Indians	Tribal Government
T. Azevedo	Nor Cal United Way	NGO serving vulnerable populations in Lake County
T. Hobbs	Clearlake Police Department	City – incorporated law
Tammy Alakszay	Red Cross	Disaster Services
Tiffany Gibson	North Coast Opportunities	NGO – serving disaster victims and other vulnerable populations in the County & workforce development
Tracy Cline	Clear Lake Environmental Research Center (CLERC)	NGO
Wanda Gray	Paratransit	Transportation for seniors and residents with disabilities
William Marcks	Forest Service	Mendocino National Forest / Fire Service

Figure 2: Example Stakeholder Invitation to Participate in the Hazard Mitigation Planning Process from October 1, 2024

Subject: Lake Op Area - Hazard Mitigation Information

Good morning,

Please find the attached press release that was disseminated last week announcing the kick-off of the Multi-Jurisdictional Hazard Mitigation Plan project.

Additional Jurisdictions Invited
As the County and both cities have historically maintained individual single-jurisdiction plans, this multi-jurisdictional plan will establish the foundation for additional jurisdictions to join in. Regulations and Guidance changed in April 2023, and all adjoining jurisdictions must now develop their own annex to the base plan. Any Tribe, special district, or other local jurisdiction that would like more information should contact Leah.sautelet@lakecountyca.gov.

Public Information
Please share the attached News Release and PI Session flyer as you are able. Social media posts to share can be located at www.facebook.com/lakecountyOES and at https://www.lakesheriff.com/about/oes/HMP

Funding Opportunity
Attached is information about a Hazard Mitigation Grant Program webinar today at 2:00 PM.

Thank you,

Leah Sautelet
Emergency Services Manager
Lake County Sheriff's Office of Emergency Services (OES)
Post Office Box 489 | Lakeport, CA 95453

In addition to the above, additional efforts to engage with Tribal Governments were conducted. Multiple contacts were made to identify an appropriate Tribal liaison on the Planning Committee as the previous representative was not available. Figure 3 shows an invitation to local tribal leaders to attend a tribal-specific hazard mitigation and emergency management discussion. Four representatives attended the meeting held in October 2024.

Figure 3: Invitation to Tribal Leaders

Dear Tribal Leaders,

On behalf of the Lake County Office of Emergency Services, I am writing to extend an invitation for a collaborative opportunity on October 24, 2024 at the County Emergency Operations Center.

Tentative Agenda Topics:

- **Hazard Mitigation Plan** – Lake County OES / The Resiliency Initiative
  Lake County is starting a transition from single-jurisdiction to a multi-jurisdictional hazard mitigation plan in coordination with both Cities. In addition to a brief project overview, discussion will include:
  - Changes to mitigation planning since April 2023
  - Tribal participation (now or in the future)
  - Hazards, risks and mitigation actions
  - Planning Committee

- **County Emergency Management** - Lake County OES
  Brief overview of OES including what we do in blue skies and during emergency/disasters. Information provided to Tribes, how to maintain correct contacts and what we can do to improve/enhance emergency management collaboration between jurisdictions.
  - Situational Awareness
  - Public Information Channels
  - Needs/Ideas/Opportunities

- **Evacuation Plan** – Lake Area Planning Council / The Resiliency Initiative
  While this is not an OES project, the same consultants working with APC on this plan are also working with OES on the hazard mitigation plan. They will offer an overview of their project and open discussion.

- **State Emergency Management** – Cal OES (Tentative)
  To date, this is unconfirmed, but we have extended an invitation to the Cal OES Tribal Contact Representative to provide an overview of Cal OES functions and how they work with Tribes and FEMA.

- **Tribal Emergency Management** - Roundtable Discussion (either standalone or in conjunction with each topic above, or both)

This would be ideal for a Council member, Tribal Administrator, Facilities Manager and/or person responsible for emergency management functions and who has authority to speak on behalf of Tribe. We have space for each Tribe to send up to two representatives. While we will have slides for presentations this is intended to be an open dialogue, not a classroom/formal setting.

Details:
October 24, 2024
10:00 – 11:30 AM
1375 Hoyt Lakeport, CA

Please let me know if you plan to attend. Lack of response may cancel the date. I will send a calendar invite once responses are received. And I am open to any questions ahead of time and/or specifics you'd like to hear more about.

Thank you,

Leah Sautelet
Emergency Services Manager
Lake County Sheriff's Office of Emergency Services (OES)
Post Office Box 489 | Lakeport, CA 95453

1.5 Assess Community Support

Lake County, Clearlake, and Lakeport conducted a survey to gather feedback and support for hazard mitigation actions for the 2025 MJHMP. The survey was open for one month from December 05, 2024, through January 05, 2025. The survey was available to Lake County via:

- Social Media
- E-mail Distribution
- Public Information Session
- Project Websites

Survey responses assisted staff in determining mitigation hazards and mitigation action types that need to be prioritized within the 2025 Mitigation Actions. The full survey results can be found in Attachment 1: Public Input Survey Results.

Key Findings:

- Overall, "Wildfire" was the #1 ranking 43 times, and "Severe Weather: Extreme Heat" was the #2 ranking 21 times.
- Each hazard type was included in the top five ranking at least once throughout the responses.
- The top-responded mitigation project types were Emergency Services, Vegetation management, and Prevention.
- To the question, "Prior to receiving this survey, were you aware of your County's and/or City's Hazard Mitigation Plan (HMP)?", 59% of the respondents were unaware.

The survey results and comments maintained that wildfire is still the highest concern among all jurisdictions in Lake County.

1.6 Engage the Public

The Planning Team acknowledges the importance of valuable input, participation and active engagement of the stakeholders: government agencies, public and private sector organizations and the general public (individuals).

Public input was sought at the outset of planning for this update. The Planning Team actively worked to reach as many community members as possible, utilizing multiple methods, including:

- Public Information Sessions held at various locations around the County and online.
- A dedicated webpage: www.lakesheriff.com/about/oes/hmp
- County Library

- Press Releases (featured on local radio/news outlets)
- Public information boards in various locations including the County Courthouse.
- Social media outreach (www.facebook.com/lakecountyoes) and often shared by the County of Lake and Lake County Sheriff's Office social media accounts.

The update was discussed at the October Disaster Council meeting. Disaster Council is an advisory body to the Board of Supervisors and open to the public, meeting twice per year.

Figure 4: Hazard Mitigation Planning Joint Press Release

NEWS RELEASE

FOR IMMEDIATE RELEASE
September 27, 2024

Contact: Leah Sautelet
OES Manager

Hazard Mitigation Planning

LAKE COUNTY, CA – In coordination with the City of Lakeport and the City of Clearlake, Lake County Office of Emergency Services (OES) has begun the 2024-2025 Lake County Multi-Jurisdictional Hazard Mitigation Plan project. Lake County OES, the City of Lakeport, and the City of Clearlake have hired The Resiliency Initiative (TRI) consulting firm to support the updating process.

About the Plan
Hazard mitigation plans provide community members and officials with information regarding the community's hazards and outline the long-term strategy to reduce disaster-related losses. FEMA requires state, local, tribal, and territorial governments to have approved and adopted hazard mitigation plans to be eligible for certain types of non-emergency disaster assistance, including mitigation projects. FEMA must approve these plans every five years to maintain eligibility.

Previously, Lake County, the City of Lakeport, and the City of Clearlake each had their own local hazard mitigation plan (LHMP). The LHMPs for the City of Lakeport and the City of Clearlake were last updated in 2018 and currently require updating. Lake County updated its LHMP in 2023. After thorough discussion, the leadership of these jurisdictions determined it would better serve the community needs to combine the plans into a multi-jurisdictional hazard mitigation plan (MJHMP). This MJHMP would encompass all three jurisdictions and satisfy the updating requirement for the City of Lakeport and the City of Clearlake.

Public Participation Encouraged
Public input is vital to designing an MJHMP that accurately reflects the community's needs. To begin the update process, Lake County OES, the City of Lakeport, and the City of Clearlake plan to host three public information sessions. These sessions are co-sponsored by the Lake Area Planning Council (Lake APC), which is currently preparing a wildfire evacuation and preparedness plan. The sessions will provide the public with information regarding both projects and solicit public input.

The 2025 MJHMP final draft was provided for a public review and comment period from February 3 to February 28, 2025.

Edits, additions, and other considerations provided by the public, stakeholders and County staff were incorporated into the final submission draft. In addition to grammar and stylization suggestions, the core public comments incorporated into the plan include:

- To be updated based on the public review period.

1.7 Integration and Coordination with Other Planning Efforts

Understanding other planning efforts within the Planning Area is vital for a complete hazard mitigation plan and to not duplicate efforts. Throughout the update process the following were consulted, reviewed, referenced and evaluated:

- Community Wildfire Protection Plan: This county-wide document includes a prioritized wildfire mitigation project list, information on threats facing Lake County, and local agencies engaged in wildfire education and suppression activities.
    - Used mainly for the narrative of the hazard profile and referenced for mitigation actions.
- California State Hazard Mitigation Plan: reduces and eliminates potential risks and better prepares communities for disaster resilience.
    - Used for almost all hazard profiles and to reference the type of information included within the entire plan.
- Lake County General Plan: developed to integrate existing plans, the protection of the County's natural resources, economic development, and housing opportunities.
    - Community profiles were adapted from the General Plan in the 2025 Update.
- City of Clearlake Hazard Mitigation Plan: reduces the impacts of natural hazards to the citizens, property, and critical infrastructure to the City.
    - Referenced for the Base Plan and incorporated into the City Annex.
- City of Lakeport Hazard Mitigation Plan: protects the people and property from the effects of natural disaster and hazard events in the City and Planning Area.
    - Referenced for the Base Plan and incorporated into the City Annex.
- County of Lake (OES) Emergency Operations Plan and Annexes: provides direction and support for County-wide events of a catastrophic nature.

    - Referenced but not specifically incorporated except for adding to some hazard profiles and aligning the efforts of the planning team with pre-identified hazard information.
- Lake County Quagga and Zebra Mussel Prevention Plan: to prevent the introduction and establishment of invasive mussels in Lake County waterbodies.
    - Reviewed this plan to complete the hazard profile during the 2025 Update.
- Coordinated Public Transportation Plan: Lake County (April 2021): Updated human services transportation plan specific to Lake County.
    - Referenced this plan and included demographic information including for AFN/seniors and transportation concerns reflected in the 2025 Update.
- National Flood Insurance Program (NFIP): The requirements of the NFIP, the local ordinances that require additional 1' of freeboard above the Base Flood Elevation (BFE) as determined by the NFIP Flood Insurance Rate Maps (FIRM), and California Building Codes were consulted when completing sections about NFIP compliance.
- California's Exposure to Volcanic Hazards: provides a broad perspective on the state's exposure to volcanic hazards by integrating volcanic hazard information with geospatial data on at-risk populations, infrastructure, and resources.
    - Reviewed and referenced volcano and geothermic gas data reflected in the hazard prolife 2025 update.

County Departments have and will continue to reference and integrate the Hazard Mitigation Plan into other planning mechanisms as appropriate. As the HMP is updated and reviewed annually, the information will be provided to all County Departments at routine/monthly Director's meeting.

This includes but is not limited to:

- County Administration – updating the Community Wildfire Protection Plan (CWPP)
    - Less referenced as it is simultaneously being updated and was previously not updated since the early 2000's. The HMP Update will be useful in future CWPP updates as it includes current information for the wildfire profile and mitigation actions.
- Community Development Department – updating, at a minimum, the Lake County General Plan.

    - For AB2140 compliance this plan will need to be referenced within the General Plan and adopted into the safety element. The County, at the time of this writing, is in the process of updating its General Plan. A key element of this update is to incorporate the MJHMP by reference.
- County Public Services – updating the Master Trails/Parks and Recreational plan(s).
    - Mitigation actions are aligned with this plan, which will be updated to incorporate new details from this Update.

The previous single-jurisdiction HMP iterations are available for use and inclusion into other planning elements. How they were incorporated specifically is unknown in part due to staff changes and in part because other Departments/Agencies do not report to Lake County OES and therefore would not have known to notify OES of the plan's use.

1.8 Integrating Climate Change

The HMPC decided to fully integrate climate change into the plan during the 2023 Update, rather than treat it as a standalone hazard. Climate change concerns, projections and expectations factor into all phases of development and each hazard profile. The annual report from the American Meteorological Society (AMS) released in early 2023 that compiles the leading science about the role of climate change in extreme weather acknowledges that climate change drove unprecedented heat waves, floods, and droughts in 2021 and 2022. Those heat waves, floods, and droughts will continue to increase in frequency and intensity, as well as impact other ecological systems in Lake County. No change is noted for the 2025 Plan.

CHAPTER TWO: Hazards of Concern

2.1 Disaster Declarations

Since the date the 2023 Hazard Mitigation Plan was written, Lake County experienced two additional disasters (highlighted in yellow in Table 6 below. A comprehensive list of historical disasters, with the addition of those occurring since the last Plan Update, is included in Table 6.

Table 6: Lake County Disaster Declarations

Year-Mo	Description	State Declaration	Federal Declaration
2024-September	Boyles Fire	X	FMAG
2024 - February	Late January, Early February Winter Storm (Severe Weather)	X	
2023 – February	Late February Low Elevation Snow and Extreme Cold (Severe Weather)	X	
2023 - January	Atmospheric River (Severe Weather)	X	X
2022-May	Tree Mortality	Local	
2021 – October & Ongoing	Drought	X	
2021-September	Cache Fire (Wildfire)	DR 4619	X
2020-March	COVID-19 (Pandemic)	DR-4482-CA	X
2020-September	August Complex Fire (Lightning)	X	
2020-August	LNU Lightning Complex Fire (Lightning)	DR-4558	X
2019-February	Atmospheric River (Severe Weather)	4434	
2019 - October	Kincaid Fire (Wildfire)		
2018 – July	Mendocino Complex Fire (Wildfire)	DR-4382	X
2018 – June	Pawnee Fire (Wildfire)	5244	
2018 – July	Steele Fire (Wildfire)	X	
2017 – February	California Severe Winter Storms (Severe Weather)	(DR-4301 & 4308) FM-5145	X
2016 – August	Clayton Fire (Wildfire)	FM-5145	
2015 – August	Valley Fire and Butte Fire (Wildfire)	DR-4240	X
2015 – September	Valley Fire (Wildfire)	FM-5093	X
2015 – July	Rocky Fire (Wildfire)	FM-5093	
2014 – January	California Drought (Drought)	FM-5004	
2012 – August	Wye Fire (Wildfire)	FM-5004	
2006 - June	2006 June Storms (Severe Weather)	DR 1646	

Year-Mo	Description	State Declaration	Federal Declaration
2005/ 2006	2005/06 Winter Storms (Severe Weather)	DR-1628	X
2003 – January	State Road Damage (Severe Weather)	GP 2003	
2001 – January	Energy Emergency (Economic)	GP 2001	
1998 – February	1998 El Nino Floods (Severe Weather)	DR-1203	
1997 – January	1997 January Floods (Severe Weather)	DR-1155	
1996 – August	Lake County Fire (Wildfire)	DC-96-03	
1995 – March	California Severe Winter Storms	DR-1046	
1995 – January	1995 Severe Winter Storms (Severe Weather)	DR-1044	
1987 – September	1987 Fires (Wildfire)	GP	X
1986 – February	1986 Storms (Severe Weather)	DR-758	
1985 - July	Hidden Valley Lake Fire (Wildfire)	FM-2055	
1983 – December	Winter Storms (Severe Weather)	DR-677	
1980 – April	Severe Storms/Flood	X	
1979 – May	Gasoline Shortage (Economic)	X	
1977 – January	1977 Drought (Drought)	EM-3023	
1972 – July	1972 Freeze (Severe Weather)	X	
1970 – May	1970 Freeze (Severe Weather)	X	
1970 – January	1970 Northern California Flooding (Severe Weather)	DR 283	
1964 –December	1964 Late Winter Storms (Severe Weather)	DR-183	
1963 –February, April	1963 Floods and Rains (Severe Weather)	DR-145	
1963 – February	1963 Floods (Severe Weather)	X	
1958 - April	1958 April Storms and Floods (Severe Weather)	DR-52	
1958 – February	1958 February Storms and Floods (Severe Weather)	CDO 58-03	
1955 – December	1955 Floods (Severe Weather)	DR-47	X
1950 – November	1950 Floods (Severe Weather)	OCD 50-01	

2.2 Hazard Identification

The 2023 HMP and 2025 MJHMP Hazards Lists and public survey results were reviewed with the working group, at public sessions, and with the HMPC. Our intent was to:

- Identify hazards not previously included
- Remove hazards that are no longer relevant
- Agree on a complete list of hazards that could affect Lake County

Results from this process, ranked by perceived importance, are included in Table 7.

Table 7: Hazards for 2025 Inclusion Ranking

Hazard	Included in 2023 Update?	Include in 2025 Plan?
Drought & Water Shortage	Yes	Yes
Wildfire	Yes	Yes
Earthquake	Yes	Yes
Severe Weather: Storms (Heavy Rain, Wind, Snow, Freeze)	Yes	Yes
Epidemic/Pandemic/Vector Borne Disease Hazards	No	No
Severe Weather: Extreme Heat	Yes	Yes
Aquatic Biologic Hazards: Invasive Species	Yes	Yes
Flood	Yes	Yes
Tree Mortality	No	Yes
Climate Change	Yes	Yes
Landslide & Debris Flows	No	No
Levee Failure	Yes	Yes
Geothermal Concerns (Seismic, Environmental)	No	No
Hazardous Materials Transportation	No	No
Oil Spills	No	No
Seiches	No	No
Terrorism	No	No
Agriculture Hazards (i.e. insect pests/smoke taint)	Yes	Yes
Air Pollution	No	No
Dam Failure	Yes	Yes
Volcano and Geothermal Gasses	No	Yes
Avalanche	No	No
Coastal Flooding/Erosion, Sea Level Rise	No	No
Radiological Accidents	No	No
Subsidence	Yes	Yes
Tsunami	No	No

The HMPC reviewed the 2023 Lake County Hazard Mitigation Plan, and considered input from public sessions, working group meetings and the community survey to identify hazards of concern. The only identified change was to add *Volcano and Geothermal Gasses* as a hazard into the 2025 Plan.

- The 2025 MJHMP update includes the addition the jurisdictional annexes for the City of Clearlake and the City of Lakeport. The hazard profiles for each jurisdiction are aligned to this Base Plan. Clearlake and Lakeport Annexes *Chapter Two: Hazards of Concern* identify the hazards for each jurisdiction, and Chapters Five through Fifteen outline the unique concerns and differences between the Base Plan profile and the jurisdictions' profile.
- Non-Natural Hazards were again omitted from the 2025 Plan. It is possible that further exploration of these may be included in future plan updates; however, the County developed a Threat and Hazard Identification Risk Assessment (THIRA) in 2024 that assesses natural and manmade hazards and threats in detail.

Because the 2023 Plan was completed so recently, the following considerations remain for reference in the MJHMP:

The HMPC reviewed the 2018 Lake County Hazard Mitigation Plan, considered input from public sessions, working group meetings and the community survey to identify hazards of concern. While the hazards are generally the same as the 2018 Plan, some changes were made:

- **Severe weather, previously multiple hazards, will now be two hazards**.

  The National Weather Service's Eureka Office input during a HMPC meeting ultimately settled the discussion: extreme heat should be its own category, as it differs greatly in its effects and appropriate mitigation actions, and all others could be covered by storms (rain, snow, freeze, wind). NWS and group discussion led to combination of two previously used flood categories (100/500 year and Localized/Storm water). Lake County does not have major rivers or other terrain that would suggest a vast difference between these flood categories.

- **Tree Mortality as a standalone hazard**
  Tree Mortality was not included in the previous plan as its own hazard but was since declared a local emergency. Contributors weighed leaving it as its own category, vs. discussing it in relation to other topics, such as drought. Ultimately, it was maintained as a standalone hazard. Measures to address the issue of the multi-species bark beetle infestation could not be satisfyingly combined with other disaster-types.

- **Aquatic Biologic Hazards – one hazard**
  Previously, there were two separate and specific hazards: quagga mussel and cyanobacterial bloom. Recognizing the evolving research, dedication and impacts, the HMPC combined the separate hazards into a single category.
- **Landslide and Debris Flows**
  In the previous HMP, Landslide and Debris Flows were a profiled hazard. For this Updated HMP, because the land susceptible to this hazard is in remote and undeveloped locales, the risk of this natural hazard is reduced and does not constitute a full profile. Landslide and Debris Flow as a secondary hazard are covered in *CHAPTER FIVE: Wildfire* and *CHAPTER THIRTEEN: Severe Weather | Heavy Rains, Snow & Storms*.
- **Climate Change**
  Climate change is more robustly included throughout the plan and is not a standalone hazard. It should be noted that this does not mean *less* information is included in the Plan Update, but rather, climate change is detailed in Chapter 1.8 and referenced within each hazard profile.
- **Non-Natural Hazards**
  After much discussion, the HMPC elected not to include non-natural hazards. The following were either removed or not considered: Hazardous Materials Transportation, Energy Shortage, Dam Failure (other than in relation to a natural hazard refer to *CHAPTER ELEVEN: Dam Failure*); and Industrial Accidents/Activities.

2.2.1 Priority

The HMPC prioritized hazards according to their:

Geographic Extent

- Limited: Less than 10% of Planning Area
- Significant: 10-50% of Planning Area
- Extensive: 50-100% of Planning Area

Probability of Future Occurrences

- Highly Likely: 90-100% chance of occurrence in the next year or happens every year.
- Likely: Between 10-89% chance of occurrence in the next year or has a recurrence interval of 10 years or less.
- Occasional: Between 1-9% chance of occurrence in next year or has a recurrence interval of 11 to 100 years.
- Unlikely: Less than 1% chance of occurrence in next 100 years or has recurrence interval of greater than every 100 years.

Magnitude/Severity

- Catastrophic: More than 50% of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths.
- Critical: 25-50% of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability.
- Limited: 10-25% of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable, do not result in permanent disability.
- Negligible: Less than 10% of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid.

Significance

- Low: minimal potential impact
- Medium: moderate potential impact
- High: widespread potential impact

Climate Change Impact

- Low: Climate change is not likely to increase the probability of this hazard.
- Medium: Climate change is likely to increase the probability of this hazard.
- High: Climate change is very likely to increase the probability of this hazard

Table 8 summaries the results from this process and whether the hazard is considered a priority hazard for the Planning Area.

Hazards determined as a "priority" for the county are profiled. Hazards not profiled following this process include:

- **Subsidence** – While this is a possibility, it is limited in geographic extent, unlikely to occur and limited in magnitude.
- **Epidemic/Pandemic/Vector-Borne Disease Hazards** - In discussing this hazard with the Health Services Director, no activities were identified that could mitigate the County's risk of epidemic/pandemic/vector-borne disease hazards. The Department has strategic plans and best practices sufficiently covering the "burdens 9 B1.b 28 of disease". This is supported by the Lake County Public Health Officer. During public comment, it was further noted that established mitigation activities are routinely done by Public Health (through surveillance, public education, and implementation of vaccination/medical countermeasures) and, significantly, through

coordination with the Vector Control District's mosquito control activities that are tailored to respond to vector-borne disease surveillance in humans and wildlife. Therefore, this hazard is not addressed further within this plan update with specific activities or trainings/exercises at this time.

Table 8: Hazard Identification Table

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence	Priority Hazard
Aquatic Biological Hazards: Invasive Species	Extensive	Likely	Limited	High	High	Yes
Dam Failure	Limited	Occasional	Limited	Medium	Low	Yes
Drought and Water Shortage	Extensive	Likely	Critical	High	High	Yes
Earthquake	Extensive	Likely	Critical	High	Low	Yes
Epidemic/ Pandemic/Vector -Borne Disease Hazards	Extensive	Likely	Limited	High	Low	No
Flood	Extensive	Occasional	Limited	High	Medium	Yes
Landslide and Debris Flows	Significant	Occasional	Limited	Medium	Medium	No
Levee Failure	Significant	Likely	Limited	Medium	Medium	Yes
Severe Weather: Extreme Heat	Extensive	Highly Likely	Critical	Medium	High	Yes
Severe Weather: Heavy Rains, Snow, Storms, and High Winds	Extensive	Highly Likely	Limited	Medium	Medium	Yes
Subsidence	Limited	Unlikely	Negligible	Low	Medium	No
Tree Mortality	Extensive	Highly Likely	Critical	High	High	Yes
Volcano	Significant	Unlikely	Critical	High	Low	Yes
Wildfire	Significant	Highly Likely	Critical	High	High	Yes

CHAPTER THREE: Profiling Lake County

3.1 Lake County at a Glance

The County of Lake is in northern California, approximately 127 road miles north of San Francisco, 126 road miles northwest of Sacramento, and 80 road miles east of the Pacific Ocean. With a total surface area of 68 square miles (43,000 acres), Lake County's Clear Lake is the largest natural freshwater lake entirely within the geographic boundaries of California. The county's defining feature, Clear Lake has more than 100 miles of shoreline and sits at an elevation of 1,326 feet above sea level. Lake County has a mixture of rugged mountains, rolling hills, and broad valleys. Public lands comprise just over half of the County's acreage. Elevations range from approximately 640 feet to 7,046 feet above sea level.

3.2 Planning Area Communities

Established in 1861, Lake County is governed by a five-member Board of Supervisors elected to four-year staggered terms. The County encompasses 1320 square miles and is divided into five supervisorial districts. Clear Lake is centered within the County, creating greater transportation time between communities and the two incorporated cities. General fund discretionary revenues are derived from a variety of sources; property taxes being the largest source.

Lake County's population increased 7 out of 11 years between 2010 and 2021, and by 1,271 in the unincorporated areas since the last plan update. Community Development is committed to preserving farmland, historic sites and buildings, economic development, and ensuring codes and ordinances address the hazards Lake County may face in the years ahead. For more on this, refer to *Section 16.1 Capabilities*.

The Planning Area for this plan includes the unincorporated areas of Lake County and two incorporated cities (Clearlake and Lakeport).

- **Clearlake** (Population 16,481): Clearlake is a city in Lake County, California, located at the southeast shore of Clear Lake at an elevation of 1,417 feet. Clearlake became an incorporated city on November 14, 1980.
- **Lakeport** (Population 5,135): Lakeport is an incorporated city and the county seat of Lake County, California. Lakeport is 125 miles northwest of

Sacramento and is on the western shore of Clear Lake, at an elevation of 1,355 feet. Lakeport became and incorporated city April 30, 1888.

Unincorporated communities with a population over 1,000 included in the Planning Area are:

- **Clearlake Oaks** (Population 2,194): Began as a lakefront subdivision in the 1920s and is located on the east shore of Clear Lake, adjacent to Highway 20.
    - **Community:** A variety of single-family housing, lodging, restaurants and retail shops. Two County parks, two campgrounds and a boat launch facility.
    - **Public Facilities & Services:**
        - The Clearlake Oaks County Oaks Water District provides municipal water and sewer services within the community. Water sources include a combination of groundwater and surface water supplies from Clear Lake and its tributaries.
        - One elementary school (Konocti Unified School District)
    - **Points of Interest:** Sulphur Bank Mine (an inactive mercury mine that is a U.S. Environmental Protection Agency superfund clean-up site), adjacent vineyards and wineries.
- **Clear Lake Riviera** (Population 4,408): Originally developed in the 1960s, it has grown substantially and is located east of Kelseyville on Highway 281 north of its intersection with Highway 29.
    - **Community:** Primarily residential with a developing commercial area that provides groceries, restaurants and real estate offices. Limited public lake access through a small restaurant and RV park on Konocti Bay.
    - **Public Facilities & Services:**
        - Water is provided by the Mount Konocti Mutual Water Company (within the subdivision). Properties outside of the subdivision obtain water directly from Clear Lake or from individual wells.
        - One elementary school (Kelseyville Unified School District). Additional schools are in the nearby town of Kelseyville (approximately 10-12 miles away).
    - **Points of Interest:** The Konocti Hills Golf Course loops through the eastern side of the subdivision. Konocti Harbor Resort and Spa is also nearby.

- **Cobb Mountain (Boggs Lake/Cobb/Loch Lomond)** (Population 1,628): Cobb is located in a small valley at the foot of Cobb Mountain, northwest of

Middletown along Highway 175 and Bottle Rock Road. Predominantly rural dominated by pine forests, mountain resorts and hot springs. Impacted heavily by the 2015 Valley Fire.

  - **Community:** This area is comprised of scattered resort developments and several older residential subdivisions. Land outside of the existing residential subdivisions is generally highly constrained, and therefore not conducive to subdivision to smaller residential lots.
    - Commercial services include a grocery store, gas station, post office, golf courses and several restaurants.
  - **Public Facilities & Services:**
    - Existing development and land divisions are characterized by very small water systems and on-site sewage disposal systems.
    - The communities are served by both the Kelseyville and Middletown Unified School Districts.
  - **Points of Interest:** Boggs Mountain State Demonstration Forest, Calpine Geothermal Facilities nearby.
- **Hidden Valley Lake** (Population 7,500): A master-planned gated community, started in 1968, on the northeast of Middletown on Highway 29 within the area of Coyote Valley.
  - **Community:** Adjacent to a human-made lake (Hidden Valley Lake) that offers boating, camping, fishing, and swimming activities. The Hidden Valley Lake Golf Course, and the Hidden Valley Lake community pool are also within the community. The community is dominated by single family housing but does contain some commercial and light industrial uses.
  - **Public Facilities & Services:**
    - Water supply is derived from three community wells developed and maintained by the Hidden Valley Lake Community Services District (CSD), which also provides wastewater service to most of the properties within the Hidden Valley Lake Subdivision. Historically, new developments have been annexed into the CSD. Groundwater is the primary water source for both residential and commercial water users. Coyote Valley is within the Upper Putah Creek Watershed. CSD also provides recycled water to the Hidden Valley Lake Golf Course.
    - The Coyote Valley Elementary school serves HVL and is part of the Middletown Unified School District.

    - **Points of Interest:** Stone House museum (California Registered Landmark), Hidden Valley Lake, Hidden Valley Lake Golf Course.

- **Kelseyville** (Population 3,657): Once known as the "Pear Capitol of the World", located at the western base of Mt. Konocti between Highway 29 and Clear Lake, remains an agricultural hub in Lake County for pears, walnuts and grapes.
    - **Community:** A mix of residential, commercial and farm/horse/ag properties including migrant worker housing. Also, home to the only shelter for victims of domestic violence.
    - **Public Facilities & Services:**
        - Water is provided by the Kelseyville County Waterworks District No. 3 through its two wells. Groundwater provides the primary water source for municipal and agricultural water users.
        - Kelseyville Unified School District operates two elementary schools, one middle and one high school.
    - **Points of Interest:** Historic Downtown, Clear Lake State Park and County parks are nearby.
- **Lower Lake** (Population 1,065): Lower Lake is located at the intersection of Highways 29 and 53 near the south shore of Clear Lake.
    - **Community:** contains some of the County's prime historic structures along its Main Street and other areas within the community.
    - **Public Facilities & Services:**
        - The community is served by the Konocti Unified School District which operates one elementary school and two high schools located within Lower Lake.
        - Water is provided by the Lower Lake County Waterworks District No.1. Groundwater is the primary source of supply for both residential and agricultural water users.
        - Wastewater service is provided by the Lake County Sanitation District (LCSD), which connects to a regional wastewater treatment plant in Clearlake.
    - **Points of Interest:** Main Street, Lower Lake Historical Schoolhouse Museum, Anderson Marsh State Historic Park (Historic structures and over 1,000 acres of natural open space. This park serves as a wildlife sanctuary and contains a wealth of cultural resources.)
- **Lucerne** (Population 2,674): Located on the north shore of Clear Lake along Highway 20. Established in the 1920s, Lucerne was originally a planned community. However, due to difficulties caused by the Great Depression,

planned aspects were set aside and development occurred in a relatively haphazard fashion.

  - **Community:** Revitalization efforts focus on the establishment of the Promenade to stimulate the visitor economy and otherwise return to its original planned concepts.
  - **Public Facilities & Services:**
    - Lucerne is served by the Lucerne Elementary School District (one elementary school), and the Upper Lake School Districts for middle and high school.
    - Water is provided by the California Water Service Company. Water is supplied via a combination of groundwater and surface water supplies from Clear Lake and its tributaries. Lucerne is within the Shoreline Water Inventory Unit.
    - Wastewater service is provided by the Lake County Sanitation District which operates a treatment facility north of Lakeport.
  - **Points of Interest:** Alpine County Park, Historic Castle, Lucerne Harbor boat launch, promenade.

- **Middletown** (Population 725): Middletown received its name for being located midway between Lower Lake and Calistoga. Middletown developed during the late 1800s as a destination for Bay Area visitors, primarily due to the presence of mineral springs in the area and mining activities (mercury). In the early 1900s, a fire destroyed most of the original town.
  - **Community:** The town is developed with numerous small shops fronting Highway 29. For the most part, the community is surrounded by livestock ranches and vineyards. The Geysers Geothermal Fields are located to the west.
  - **Public Facilities & Services:**
    - The Middletown Unified School District has three elementary schools, one middle school, one high school, two community day schools, and one continuation school. The community is also served by a charter school.
    - Water is provided by the Callayomi County Water District, which operates two main domestic water supply wells and one standby well. Groundwater serves as the primary source of water for the community. Middletown is located in Upper Putah Water Inventory Unit.
    - Wastewater service is provided by the Lake County Sanitation District (LACOSAN), which operates a small treatment facility west of Middletown along Highway 175.

    - **Points of Interest:** Downtown, nearby mineral springs, Central Park (a 100-acre trailside park), Geysers Geothermal Fields and Visitors Center.
- **Nice** (Population 2,407): Located on the north shore of Clear Lake along Highway 20, Nice's first subdivision was built in 1922.
    - **Community:** In addition to residential development, Nice has retail shops, RV parks, and campgrounds. The community also has three parks, the H.V. Keeling Park, Hinman Park, and the Nice Community Beach.
    - **Public Facilities & Services:**
        - Served by the Upper Lake Unified School District.
        - Water service is provided by the Nice Mutual Water Company. Municipal water sources include a combination of groundwater and surface water supplies.
        - Wastewater service is provided by the Lake County Sanitation District, which operates a treatment facility north of Lakeport.
    - **Points of Interest:** Keeling Park (including a baseball field, dog park and walking trail), Hinman Park, and the Nice Community Beach.
- **Upper Lake** (Population 1,250): Named for its location along the upper arm of Clear Lake, along Highway 20, Upper Lake was established in the 1860s. In 1924, most of its downtown was destroyed by a fire. A small downtown area was rebuilt after that fire. Today, this downtown area is being revitalized and targeted at community commercial and tourism-oriented commercial uses.
    - **Community:** It contains a number of historic buildings. In the 1930s, most of the Clear Lake arm near Upper Lake was drained for agricultural land, protected by levees. These levees have degraded over time, and efforts are underway to restore much of this area back to wetlands through the Middle Creek Restoration Project. Upper Lake is the main access point into the Mendocino National Forest, which starts approximately 3.5 miles north of the community.
    - **Public Facilities & Services:**
        - Served by the Upper Lake Unified School District.
        - Water service is provided by the Upper Lake County Water District through the operation of two groundwater wells. Upper Lake is within the Middle Creek Water Inventory Unit.
        - Wastewater service is provided by the Lake County Sanitation District, which operates a treatment facility north of Lakeport.
    - **Points of Interest:** Downtown, historic buildings, Mendocino National Forest, Upper Lake Park

Other smaller communities include:

- **Blue Lakes*:*** Located within a narrow valley adjacent to Highway 20, the area contains several resorts, a residential subdivision and a mobile home park.
- **Glenhaven:** Located west of Clearlake Oaks on Highway 20 adjacent to Clear Lake, Glenhaven was subdivided and developed during and after the 1920s. Has a post office and summer resorts.
- **Lake Pillsbury Area:** A remote recreational area located within the Mendocino National Forest in the northern portion of Lake County, it contains a subdivision, gravel airstrip and campgrounds. Scott's Dam, completed in 1918, forms the lake. Access via dirt roads can be limited access during inclement weather. Limited services are provided by a small store and resort.
- **Soda Bay:** Located on the south side of Clear Lake, near Kelseyville Riviera on Soda Bay Road. Offers small resorts, campgrounds and RV parks and is minutes from Clear Lake State Park. In the late 1800s, Soda Bay's mineral springs were so popular that large resorts were constructed to provide lodging for the hundreds of thousands of visitors that were drawn there for their touted healing qualities. Subdivisions were recorded in Soda Bay in the 1920s, as electricity became more widely available and roads throughout the County were improved.
- **Spring Valley:** Located several miles east of Clearlake Oaks, off Highway 20 and comprised of a large residential subdivision, convenience store.

Figure 5: Map of Lake County Cities, Towns, Communities, and Highways

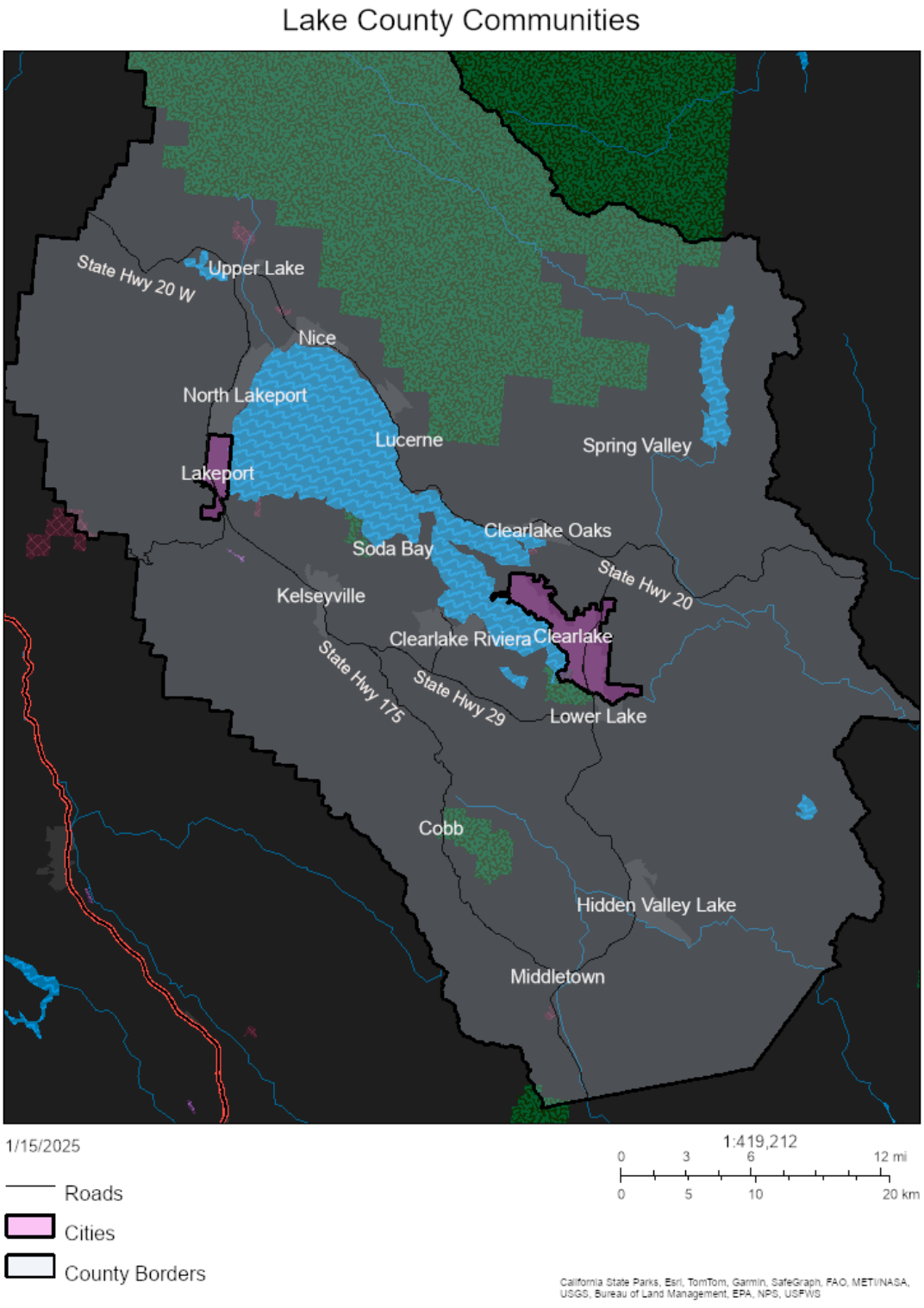


Figure 6: Lake County, California

3.3 Geography and Climate

Lake County's topography is diverse. Its southern portion is California foothill country, with rolling hills and level valleys. The central portion is dominated by the Clear Lake depression. The northern sector of Lake County is mostly rugged mountains. Elevations range from approximately 600 feet, where Putah Creek crosses the southeastern county boundary, to 7,046 feet at Snow Mountain on the eastern boundary. Much of the terrain in headwater areas, especially in the northern sector, is quite steep.

Due to this topographical diversity, microclimates in Lake County widely vary. Overall, the County typically experiences warm, dry summers and cool winters with moderate precipitation. The climate in Lake County varies widely due to changes in topography. Based on weather measurements taken 4 miles southeast of Clearlake, the Clear Lake basin has an average annual low and high temperature of 43°F and 71°F, respectively. The highest official recorded temperature in the county is 114°F and the lowest recorded low is 6°F, with temperatures typically ranging from a low in the 30s in the winter to a high in the 90s in the summer. Historic rainfall records show an annual normal rainfall for Clear Lake is 29.86 inches, Middletown is 42.60 inches, and 39.59 inches at Upper Lake.

Although relatively infrequent, snowfall can occur in the winter months; typically, it is limited to higher elevations. When snowfall does occur in lower elevations, it

usually dissipates by midday. The County tends to experience relatively light winds due to the sheltering effect of the surrounding mountains. During the winter, winds can be more variable in their direction. Lake County occasionally receives marine air from the Pacific Ocean that helps to temper the climate.

3.4 History

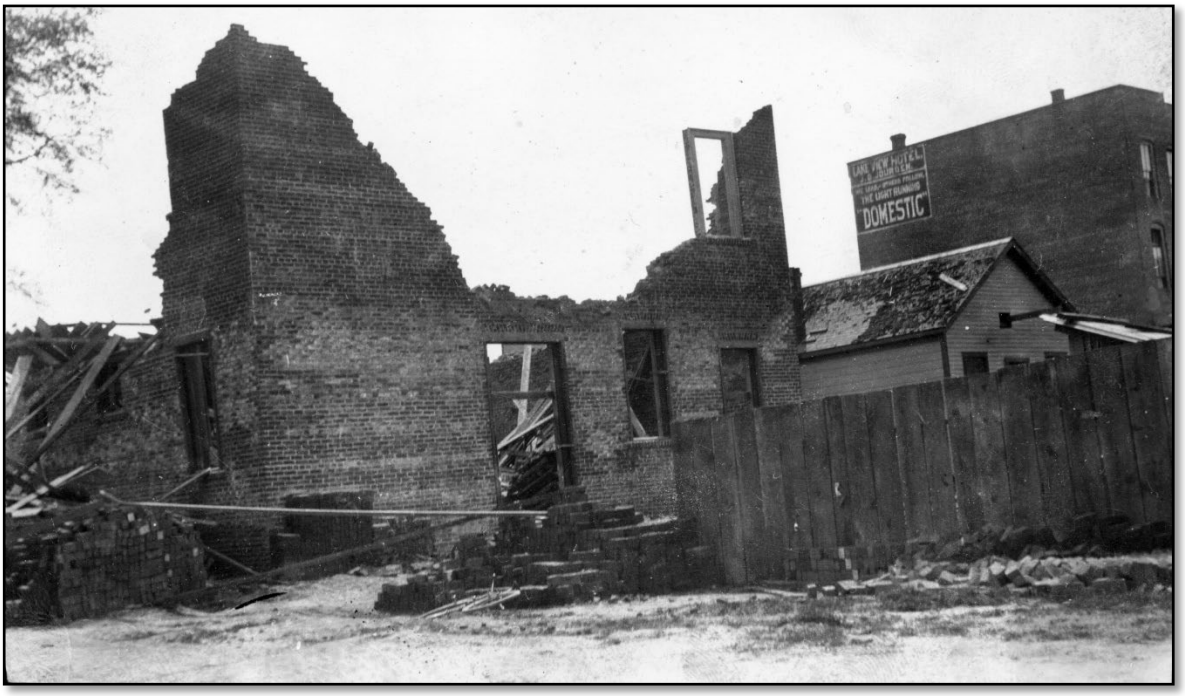
Clear Lake is as central to Lake County's past as its present. Scientific evidence has demonstrated Clear Lake is at least 450,000 years old, and may be the oldest lake in North America. The Lake County region took shape from volcanic action. Thousands of years ago, a landslide that blocked the broad valley's drainage west into the Russian River created Clear Lake's current form. Water levels rose until a new outlet was found; Cache Creek, which drains eastward into the Sacramento River.

For over 10,000 years, indigenous peoples (mainly Pomo, Wintun, Wappo, and Lake Miwok Indians) were hunting, fishing, collecting plants for food, medicine, and trade as well as stewarding the land in the Clear Lake basin. The lake yielded an abundance of fish and shellfish, as well as tule reeds from which food, clothing, boats, dwellings, and household items were (and are) made. Tribes in what was to become Lake County also were (and are) stewards of the land who used fire to generate new growth, reduce pests, and reduce the chance of large uncontrolled wildfires by burning off dry grasses and brush on a regular basis, which allowed the fire-adapted vegetation to regenerate and help keep the landscape open. However, in 1850, the US government passed the Act for the Government and Protection of Indians, which outlawed intentional burning in California – even before it was a state.

There are seven federally recognized Tribal Nations historically associated with Lake County: the Elem Indian Colony of Pomo Indians of the Sulphur Bank Rancheria, Koi Nation of Northern California, Middletown Rancheria of Pomo Indians of California, Big Valley Band of Pomo Indians of the Big Valley Rancheria, Scotts Valley Band of Pomo Indians of California, Habematolel Pomo of Upper Lake, California, and the Robinson Rancheria Pomo Indians of California.

In the 1850's, the first European families found their way to Lake County; the earliest of these settlers lived near what is now the community of Kelseyville. Farming and ranching were rapidly established, and toll roads began climbing over the mountains in the 1860's, bringing settlers in increasing numbers. Lake County was established in 1861, comprised of land formerly a part of Napa County.

Figure 7: Possible 1906 Earthquake Damage (Lakeport)



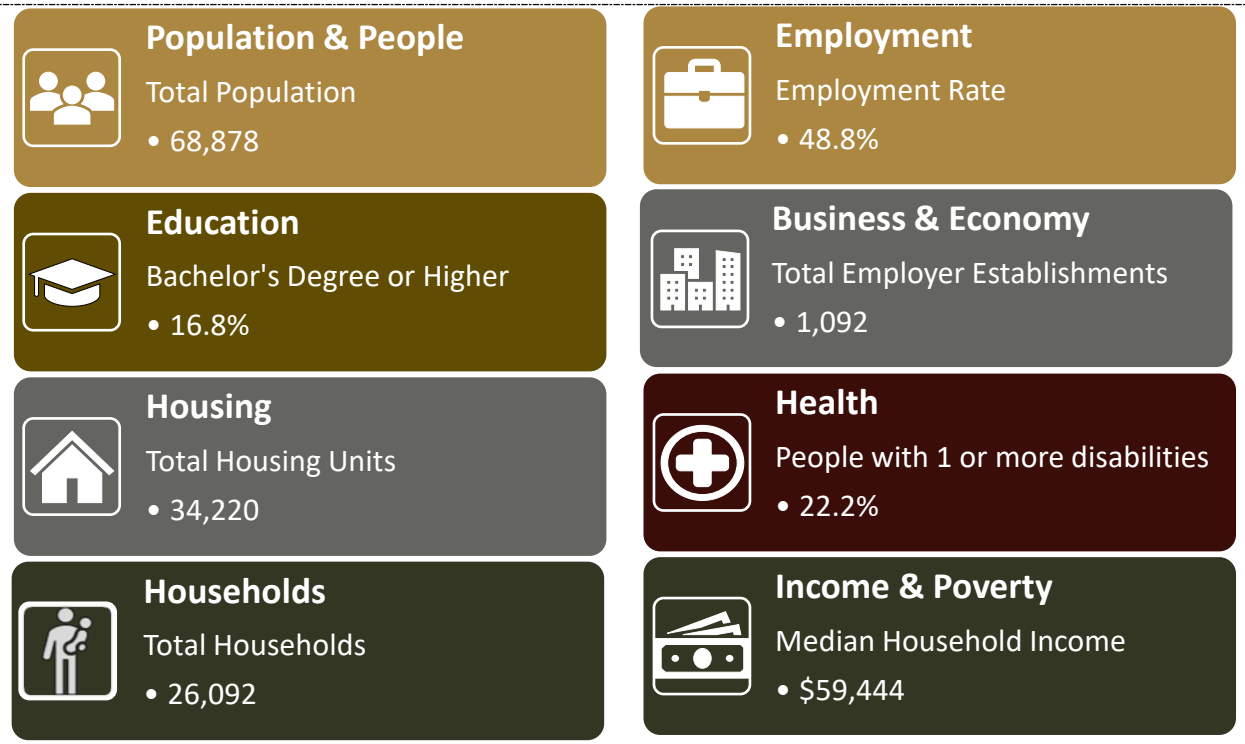
Favorable soils and climate led to cultivation of a variety of fruits in the 1860s, and fruit production became the dominant agricultural activity following introduction of the Bartlett pear in 1885. Borax was discovered in Lake County in 1856, and sulfur was obtainable in large quantities. Commercial operations for these minerals continued until rich deposits of cinnabar (mercury ore) were found. By 1856, Lake County's mercury mines formed the fourth largest source of supply in North America. This continued during their 40–50-year span of active production. Lumbering was also central during the last few decades of the 19th century. Lumbering and mining have since significantly declined.

The tourism industry has become an enduring and critical economic base. Early resorts were built around mineral springs well before the turn of the 20th century. The resort industry gained great import as travel from metropolitan areas became more accessible. Lake County offers exceptional opportunities for water-based and outdoor recreation.

3.5 Population and Demographics

This demographic profile provides a comprehensive overview of Lake County's population characteristics. By analyzing key demographic indicators such as age distribution, household composition, income levels, education, and employment trends, it offers valuable insights into the county's social and economic landscape.

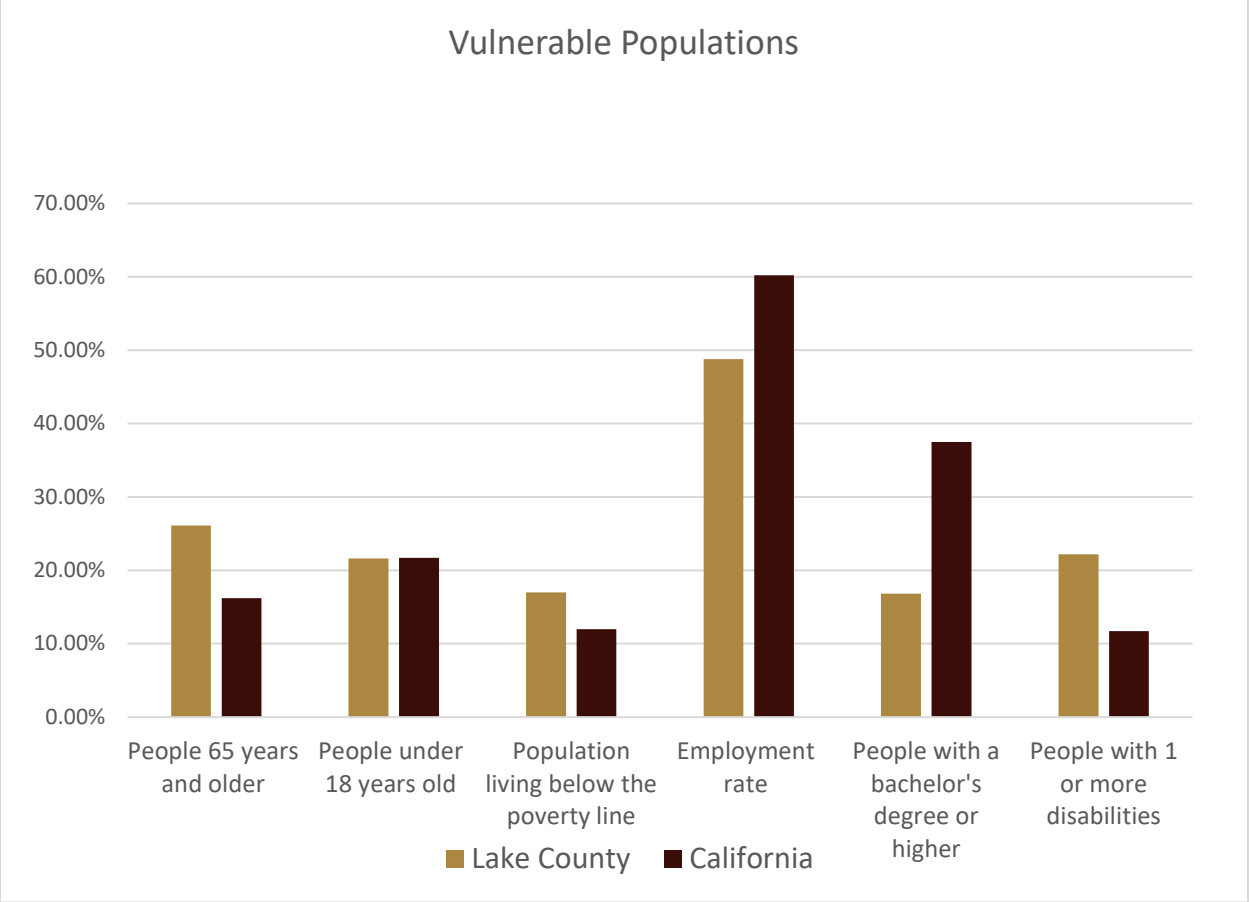
Figure 8: Lake County Demographics



Lake County, when compared to California in general, has:

- A higher median age
- A higher percentage of people who fall below the poverty line
- A lower employment rate
- A lower percentage of educational attainment
- A higher percentage of people with disabilities

Figure 9: Lake County Vulnerable Populations Compared to California

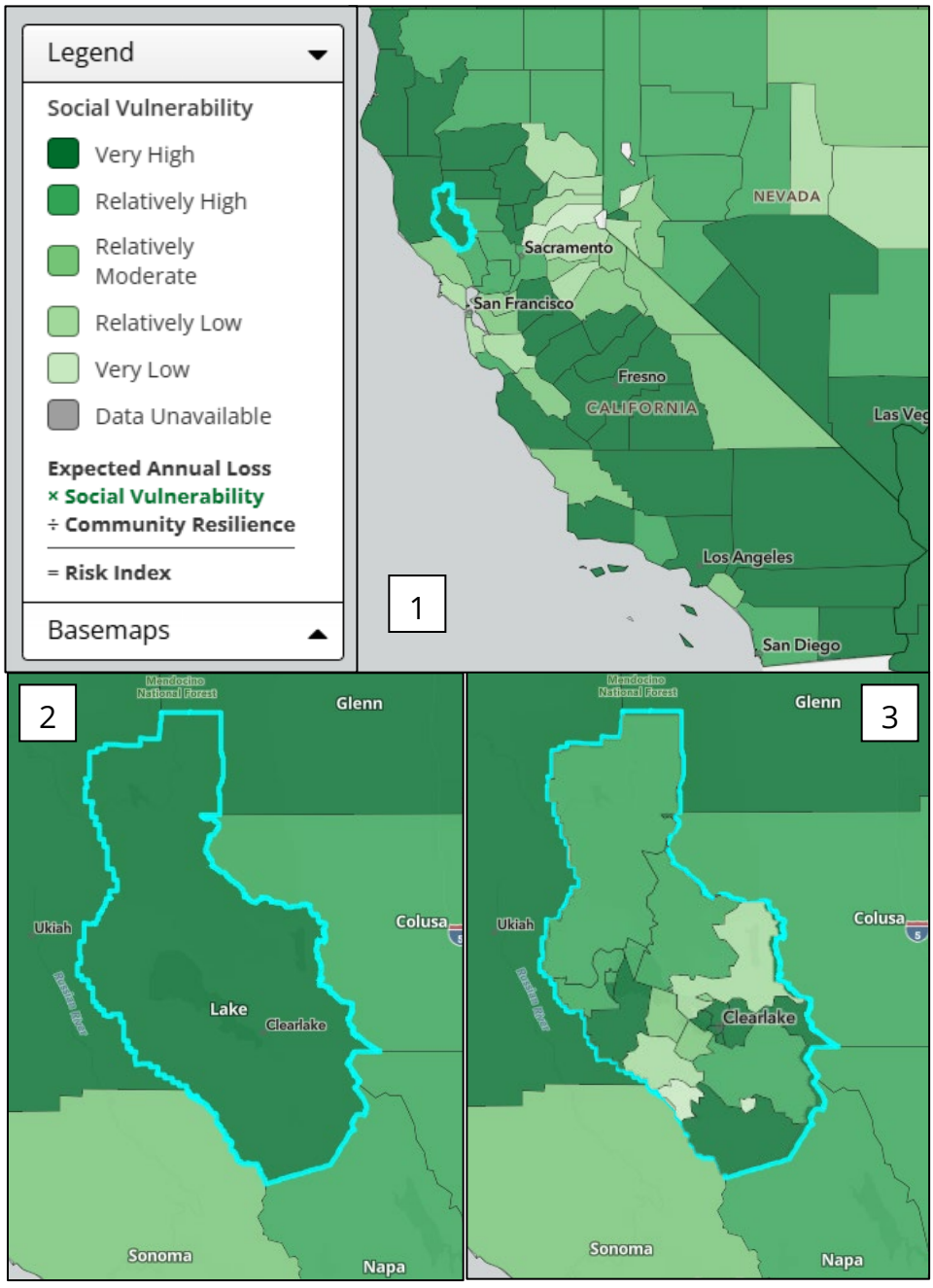


As part of FEMA's National Risk Index, a community's Social Vulnerability score indicates its relative social vulnerability compared to other communities. A higher Social Vulnerability score leads to a higher Risk Index score.

According to FEMA's National Risk Index, Lake County's social vulnerability is **Very High.**

Figure 10: FEMA's Social Vulnerability Maps.

Map 1: California's Ratings. Map 2: Lake County's Rating. Map 3: Lake County's Census Tract's Ratings



CHAPTER FOUR: Hazard Profiles and Risk Assessments

4.1 What's at Risk

4.1.1 Methodology

Prior to fixing a problem, it is necessary to define and quantify it. The risk assessment followed the four-step methodology described in the FEMA publication, "*Understanding Your Risks—Identifying Hazards and Estimating Losses*" (FEMA 386-2, 2002):

1. Identify hazards
2. Profile hazard events
3. Inventory assets
4. Estimate losses

The Planning Team and the HMPC, with public input, examined previous disaster declarations (*see 2.1 Disaster Declarations*), hazards included and excluded in the 2018 and 2023 Plans, and other possible hazards that may impact Lake County, and considered potential future effects to disaster intensity informed by climate change, ongoing drought and changes to the landscape due to previous wildfires (*see 2.2 Hazard Identification*).

The identified hazards of concern are profiled, and the following information is provided for each hazard:

- **General Background** as it pertains to the Planning Area.
    - Warning time estimated or known prior to hazard impact.
- **Hazard Profile**
    - Location – the geographic region within the Planning Area most affected.
    - Extent – how often and how severe the hazard occurs and impacts the Planning Area.
    - Previous occurrences
    - Probability of Future Events
    - Impacts of Climate Change
- **Secondary Hazards** – a summary of other hazards or impacts that result from the primary hazard event.
- **Exposure & Vulnerability** – assessed by overlaying hazard maps with an inventory of structures, facilities and systems followed by a descriptive summary.
    - Population
    - Property

- Critical Facilities & Infrastructure

Understanding what is at risk informs the mitigation strategy by identifying which hazards are of most concern and how they will impact the County (Planning Area). Knowing risks helps communicate and identify vulnerabilities, develop priorities and inform decision-making for hazard mitigation planning, emergency management in general and County Department efforts and planning.

4.1.2 Vulnerability

An estimate of the vulnerability of the Lake County Planning Area to each identified priority hazard, in addition to the estimate of risk of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

4.2 Underserved Populations/Communities

The National Disaster Recovery Framework defines underserved populations/communities as *groups that have limited or no access to resources or that are otherwise disenfranchised. These groups may include people who are socioeconomically disadvantaged; people with limited English proficiency; geographically isolated or educationally disenfranchised people; people of color as well as those of ethnic and national origin minorities; women and children; individuals with disabilities and others with access and functional needs; and seniors.*

General population statistics are included in *3.5 Population and Demographics*. Additional is provided in this chapter (and may be duplicated from Section 3.5).

4.2.1 Socioeconomically Disadvantaged

Social vulnerability is the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood.

The National Risk Index, a Social Vulnerability score and rating, represents the relative level of a community's social vulnerability compared to all other communities at the same level. A community's Social Vulnerability score measures its national rank or percentile. A higher Social Vulnerability score results in a higher Risk Index score. As evidenced in *Figure 10: FEMA's Social Vulnerability Maps.*, Lake County has a **VERY HIGH** rating.

Lake County's median household income of $59,444 is $36,077 less than the state average[6]. The County's 48.8% employment rate trails the state's 60% employment rate.

4.2.2 People with Limited English Proficiency

According to the latest Census data, 19.0% of Lake County residents speak a language other than English at home. Of those, 16.6% speak Spanish. Additionally, 5.9% of Lake County residents speak English "less than very well".

4.2.3 Geographically Isolated or Educationally Disenfranchised People

Geographic information is available to review in *CHAPTER THREE: Profiling Lake County*. Additionally, a map showing communities and the highway system is viewable in Figure 5. Lake County has no rail system, no interstate highways and no waters that provide thoroughfare across county boundaries. County borders, besides where the highways traverse, are very remote and terraneous. For more refer to *4.3.5 Outside County Access*.

There are two higher education campuses in Lake County, each offering educational attainment levels up to an Associate's degree. Access to obtaining a bachelor's degree requires remote institutions, traveling or moving out of the county.

4.2.4 Access and Functional Needs

Cal OES' Access and Functional Needs Viewer is an interactive, GIS-based tool that assists emergency managers in identifying, locating and deploying AFN-related assets and resources. The Viewer provides County-specific information. According to the Viewer, 19.77% of Lake County residents live with a disability.

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[6] 2020 Census Data

The Coordinated Public Transportation Plan: Lake County dated April 2021 and prepared for the Lake County Area Planning Council states:

> *According to the ACS, 20.1% of the non-institutionalized population of Lake County population has a disability. This proportion is much higher than both the state and national average … In Lake County, the top three disability issues for those disabled under 18 are cognitive, self-care, and vision difficulties. For those disabled between ages 18 and 64, the top three disability issues are cognitive, independent living, and ambulatory difficulties. For those 65 and older, the top three disability issues are ambulatory, self-care, and independent living difficulties. 42.7% of the non-institutionalized population in Lake County that is 65 and older has a disability These disability statistics, which cover six disability types, were produced based on questions introduced to the ACS in 2008.22. Because of changes in questions, one must be cautious when comparing previous Census/ACS disability data.*

The Coordinated Public Transportation Plan further states that 6.9% of residents, or over 1,700 households, do not have access to a vehicle. Transit origins and destinations include senior centers, casinos, Wal-Mart and social services/career/mental health services.

4.2.3 Tourists

The population of Lake County fluctuates daily due to travel and tourism. Tourists may be at higher risk from hazards due to a lack of knowledge about the area, transportation routes, alert and warning tools, and how to obtain important information.

4.3 Built Environment

4.3.1 County-Owned or Leased Facilities

These facilities are critical to the continuity of operations post-disaster. The list included herein is also managed by its location within the Planning Area and will be compared with potential exposure to each hazard in the profiles. The source for this information is Lake County Assessor.

Important to Note

- Most County-owned facilities are located in Lucerne with 145 locations.
- The highest total replacement cost value for a County owned/leased facility is the courthouse located at 255 N. Forbes St (estimated replacement $12-14mil)

4.3.2 Critical Facilities

A critical facility is classified by the following categories: (1) Essential Services Facilities: (2) At-risk Populations Facilities, (3) Hazardous Materials Facilities.

Essential Services Facilities include, without limitation, public safety, emergency response, emergency medical, communications, public utility plant facilities and equipment, and government operations. Sub-Categories for each category are:

- **Public Safety** - Police stations, fire and rescue stations, emergency operations centers
- **Emergency Response** - Emergency vehicle and equipment storage, essential governmental work centers for continuity of government operations.
- **Emergency Medical** - Hospitals, emergency care, urgent care, ambulance services.
- **Communications** - Main hubs for telephone, main broadcasting equipment for television systems, radio and other emergency warning systems.
- **Public Utility Plant Facilities** - including equipment for treatment, generation, storage, pumping and distribution (hubs for water, wastewater, power and gas).
- **Essential Government Operations** - Public records, courts, jails, building permitting and inspection services, government administration and management, maintenance and equipment centers, public health, vector control and air quality management.
- **Transportation Lifeline Systems** - Airports, helipads, and critical highways, roads, bridges and other transportation infrastructure (Note: Critical highways, roads, etc. will be determined during any hazard-specific evacuation planning and are not identified in this plan).

At-Risk Population Facilities include, without limitation, pre-schools, public and private primary and secondary schools, before- and after-school care centers with 12 or more students, daycare centers with 12 or more children, group homes, and assisted living residential or congregate care facilities with 12 or more residents.

Hazardous Materials Facilities include, without limitation, any facility that could, if adversely impacted, release hazardous material(s) in sufficient amounts during a hazard event that would create harm to people, the environment and property.

Hazard profiles discuss the potential impact and further describe critical facilities.

4.3.3 Other

According to the California State Hazard Mitigation Plan, Lake County has 82,544 acres of buildable lands (i.e. currently vacant lots that have land use or zoning designations permitting future development.)

Table 9: Values – 2025 Unincorporated Parcels, Land and Improved Structures

Communities	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Unincorporated Lake County					
CLEARLAKE CA	103	40	$23,928,751	$8,420,417	$32,349,168
CLEARLAKE OAKS CA	5,089	2,807	$250,923,154	$394,884,192	$645,807,346
CLEARLAKE PARK CA	1,197	494	$61,410,627	$69,592,222	$131,002,849
COBB CA	2,007	1,181	$118,426,293	$188,973,374	$307,399,667
FINLEY CA	197	174	$21,885,002	$36,548,263	$58,433,265
GLENHAVEN CA	211	148	$18,548,080	$25,349,356	$43,897,436
HIDDEN VALLEY LAKE CA	3,472	2,587	$144,770,063	$677,513,931	$822,283,994
KELSEYVILLE CA	8,227	5,623	$613,167,648	$1,250,315,275	$1,863,482,923
LAKE PILLSBURY CA	521	205	$24,490,899	$25,551,772	$50,042,671
LAKEPORT CA	3,449	2,736	$375,896,134	$682,482,848	$1,058,378,982
LOCH LOMOND CA	753	480	$39,080,506	$70,183,289	$109,263,795
LOWER LAKE CA	2,733	1,792	$314,817,895	$313,848,268	$628,666,163
LUCERNE CA	8,961	1,786	$155,500,850	$244,182,564	$399,683,414
MIDDLETOWN CA	2,183	1,350	$514,331,450	$573,680,717	$1,088,012,167
NICE CA	4,049	1,315	$100,509,115	$163,133,959	$263,643,074
UPPER LAKE CA	1,803	1,168	$151,761,033	$167,729,742	$319,490,775
WHISPERING PINES CA	359	157	$52,491,461	$81,833,602	$134,325,063
WITTER SPRINGS CA	173	114	$22,976,346	$22,231,673	$45,208,019
Unincorporated Lake County Total	45,487	24,158	$3,006,975,170	$5,001,109,304	$8,008,084,474

4.3.4 Future development

Lake County has lost housing stock every year since 2015 due to wildfires. This housing shortage affects the community at all income levels. The County supports additional growth and development and incorporates measures to address hazard mitigation (i.e. implementation and use of codes for decreasing fire threat, including PRC 4290 and 4291 regulations and home-hardening efforts based on the International Wildland Urban Interface Code.)

4.3.5 Outside County Access

There are three major ingress/egress routes for the County: State Roads 20, 29, and 175. These can be blocked by snow, slides, debris, wildfires, etc. In addition, the HMPC clearly pointed out the National Weather Service Radio coverage in Lake County is deficient according to the propagation maps. The NOAA/NWS radios given to residents in the burn scars of the Valley Fire, Clayton Fire and others might never hear an alert since they do not live in a coverage area. It is also known that NOAA/NWS would like to help increase coverage, but currently do not have any funds available now, nor are they expected in the future to improve the coverage for Lake County.

For detailed community information refer to *3.2 Planning Area Communities;* for a visual refer to *Figure 5: Map of Lake County Cities, Towns, Communities, and Highways*;

4.4 Natural Environment

4.4.1 Tribal Cultural and Natural Resources

Lake County lies within and near the ancestral lands of the various local Native American Tribes, including the Pomo, Wintun, Wappo, and Lake Miwok Indians, that have and continue to live within the Lake County Planning Areas. Lake County and its surrounding landscape have long been considered as having cultural, historical, and religious significance for these Tribes and consist of one of the largest conglomerations of cultural places, objects, heritage and traditions integral to the local Tribes and communities. There is a high sensitivity within the Planning Area based on the recordings in the area and tribal knowledge. All tribal cultural resources are at risk in an emergency, not only material objects and structures, but also landscapes, sacred sites, natural resources, traditions and customs. All these cultural resources, in addition to those identified above, should be considered in emergency and disaster planning.

To protect cultural resources from illegal removal or desecration, the locations of these resources are not public information. Emergency response actions that take place after a disaster can cause extensive damage and even destruction to Native American human remains, funerary objects, ceremonial items or artifacts, sites,

features, places, cultural landscapes, sacred features and places, and objects with cultural value to the local Tribes. The initial response may be to immediately restore and reconstruct property and infrastructure which may unknowingly result in impacts to cultural resources.

4.4.2 Natural Resources

Natural resources are important to include in cost/benefit analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetlands areas protects sensitive habitat as well as reducing the force of and storing floodwaters.

Lake County has over 10,000 acres of parks and public lands, and 500 square miles of waterways that are managed by various government entities, including the city, county, state and federal governments (i.e., Bureau of Land Management, U.S. Forest Service) and non-profit organizations (i.e., The Nature Conservancy).

4.5 Agricultural Resources

Agriculture is an integral part of Lake County and has continually adapted along with the County. The soils and climate of Lake County make it an ideal area to sustain many agricultural endeavors. Agriculture in Lake County is a mosaic of farmland intermingled with other uses (refer to Table 10 for detail).

Commodities grown in Lake County include vegetable crops; nursery and flower products; timber products; fruit and nut crops; livestock and poultry; egg production; apiary (beekeeping), pasture, rangeland; and field and seed crops. The top three commodities for the County are wine grapes, pears and cattle & calves.

A summation of crop production values, sourced from the Lake County Agricultural Commissioner's Annual Crop Reports, from 2017 - 2022 for Lake County is shown in

Table 11 Lake County Crop Production Values.

Table 10 Agricultural Land (California Department of Conservation's Farmland Mapping and Monitoring Program (FMPP))

Soil Category	2014 Acres	2018 Acres	2020 Acres
Prime Farmland	10,127	10,182	10,365
Farmland of Statewide Importance	827	902	901
Unique Farmland	11,207	12,506	12,933
Farmland of Local Importance	23,670	23,143	22,939
Grazing Land	239,724	239,851	239,681
Urban and Built-up Land	15,743	15,625	15,413
Water	46,811	501,766	501,743
Other Land	502,729	46,864	46,864
Total Area Inventoried	**850,838**	**850,839**	**850,839**

Figure 11: Top Three Commodities for the County

Ag Production Gross Value $107,098,745 a 28% increase from 2021

Wine Grape Gross Value $84,756,086 a 43% Increase from 2021.

Pear Gross Value $16,286,443, a decrease of 8% from 2021.

Livestock And Poultry Products (+41%), Livestock Production (+11%), Field And Seed Crops (+28%), Vegetables (+20%). Walnuts (-65%), Nursery Production (=45%) Timber Production (-91%).

Table 11 Lake County Crop Production Values

Crop	2019	2020	2021	2022
Fruit & Nut	$100,567,828	$70,308,792	$78,041,035	$101,389,921
Nursery	$767,500	$1,072,170	$1,135,927	$624,085
Vegetable Crops	$77,300	$170,500	$240,045	$287,078
Livestock Production	$1,538,800	$2,553,500	$2,045,612	$2,272,964
Livestock & Poultry Products	$149,800	$90,300	$161,555	$227,466
Field & Seed Crops	$1,720,120	$1,235,000	$1,798,522	$2,294,500
Timber	$1,606,805	$31,522	$29,670	$2,731
Total	**$106,428,153**	**$75,461,784**	**$83,452,366**	**$107,098,745**

CHAPTER FIVE: Wildfire

Figure 12 Photo courtesy of Lake County Sheriff's Office.

5.1 Wildfire Overview

Wildland fire is an ongoing concern in Lake County. The combination of complex terrain, Mediterranean climate and productive natural plant communities, along with ample natural and human-caused ignition sources create conditions for extensive wildfires. Generally, the fire season extends from early spring through late fall. However, in recent years, wildfire season is more of a year-round event. Fire conditions arise from a combination of high temperatures, low moisture content in the air and fuels, an accumulation of vegetation and high winds.

Wildland Urban Interface: The wildland urban interface (WUI) is a general term that applies to development adjacent to landscapes that support wildland fire. The WUI defines the community development into the foothills and mountainous areas and describes those communities that are mixed in with grass, brush and timbered covered lands (wildland).

There are two types of WUI environments. The first is the true urban interface where development abruptly meets wildland. The second is referred to as the *wildland urban intermix*. Wildland urban intermix communities are rural, low-density neighborhoods where homes are intermixed in wildland areas. This profile makes access, structure protection and fire control difficult as fire can freely run through the community.

Potential losses from wildfire include human life, structures and other improvements, natural and cultural resources, quality and quantity of water supplies, cropland, timber and recreational opportunities. Economic losses could also result. Smoke and air pollution from wildfires can be a severe health hazard. In

addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides and erosion during rain events.

Because wildfire is unpredictable and subject to changing fire conditions, warning time to provide for evacuation may range from hours to days. Several communities now have warning sirens in place and the Sheriff's Office provides alert and warning via LakeCoAlerts (Link) which can send voice calls, text messages and e-mail simultaneously.

5.2 Location and Extent

The entire Planning Area is at risk of wildfire. For detailed community information refer to *3.2 Planning Area Communities* and for a visual refer to *Figure 5: Map of Lake County Cities, Towns, Communities, and Highways*.

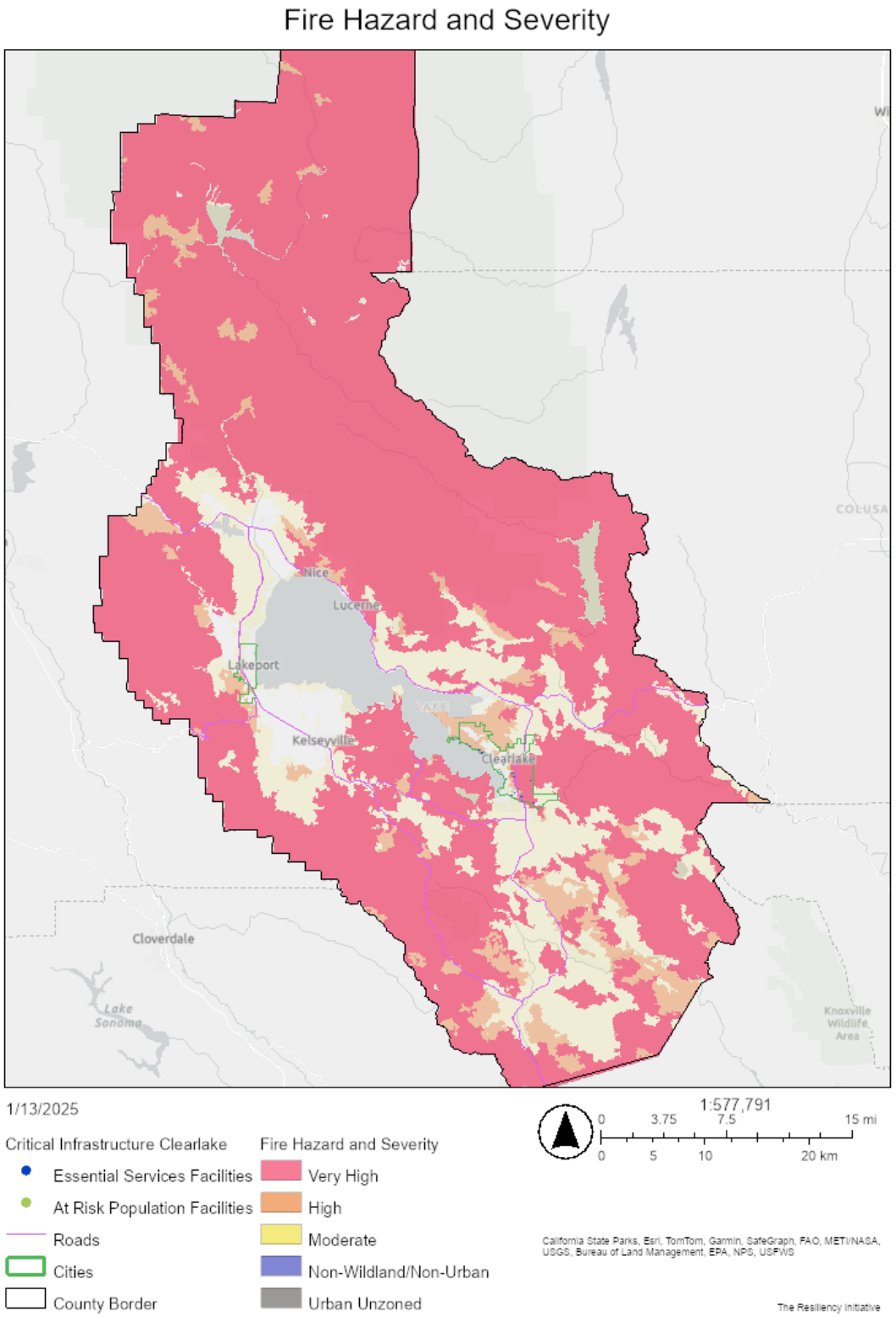
CAL FIRE's Fire Hazard Severity Zones (FHSZ) is a science-based and field-tested computer model that designates zones (Moderate, High, or Very High). Factors such as fuel, weather and terrain influence the zones. Most of Lake County's wildland areas and the communities of Nice, Lucerne, Glenhaven, Soda Bay, the Rivieras, Cobb and Lake Pillsbury are mapped within *Very High Fire Hazard Severity Zones*. Many County residents reside in *High* or *Moderate* zones.

Residents, or anyone interested, can enter an address to locate property on a map showing Fire Hazard Severity Zones via the Fire Hazard Severity Zones Viewer for a detailed view of the local community.

The potential location and extent of the hazard impacts to a wildfire within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: *Chapter Five: Wildfire*
  - 5.1.2 Differences between County and City assessments
  - 5.2 Location and Extent
- Lakeport Annex: *Chapter Five: Wildfire*
  - 5.1.2 Differences between County and City assessments
  - 5.2 Location and Extent

Figure 13: Fire Hazard Severity Zones



5.2.2 Konocti Wind

The local Lake County afternoon winds have been observed and discussed for generations as a predictable occurrence. With the support of the NOAA/NWS, CAL FIRE Lake County Leadership has developed the name “Konocti Wind” and tells the story of why this has and always will occur.

In the morning, Lake County sees a southern influence (see *Figure 14: Konocti Wind - Morning*). However, in the afternoon, the Konocti Wind travels over Cow Mountain between Ukiah and Lakeport from the coast (see *Figure 15: Konocti Wind - Afternoon*). It then dumps into Kelseyville's Big Valley and the north end of Clearlake's water surface area before picking up speed and creating white caps on the lake. Historically, CAL FIRE Clearlake Oaks Station personnel always watch to see if there are white caps on the lake in the morning. This indicates that greater winds will be present as the day goes on.

The wind stays low level, traveling South and East while splitting and going around each side of Mt. Konocti, creating eddies or erratic wind on the leeward side on Mt. Konocti. These winds speed up again as the geographical features of the terrain squeeze the pressure gradients. Fires may initially make a topographic run, but once gained, even a slight elevation will get influenced by this West/Northwest (WNW) wind. The effect is that a fire will shift from topographically-driven to wind-driven with the Southern/Eastern flank being the difficult flank to contain.

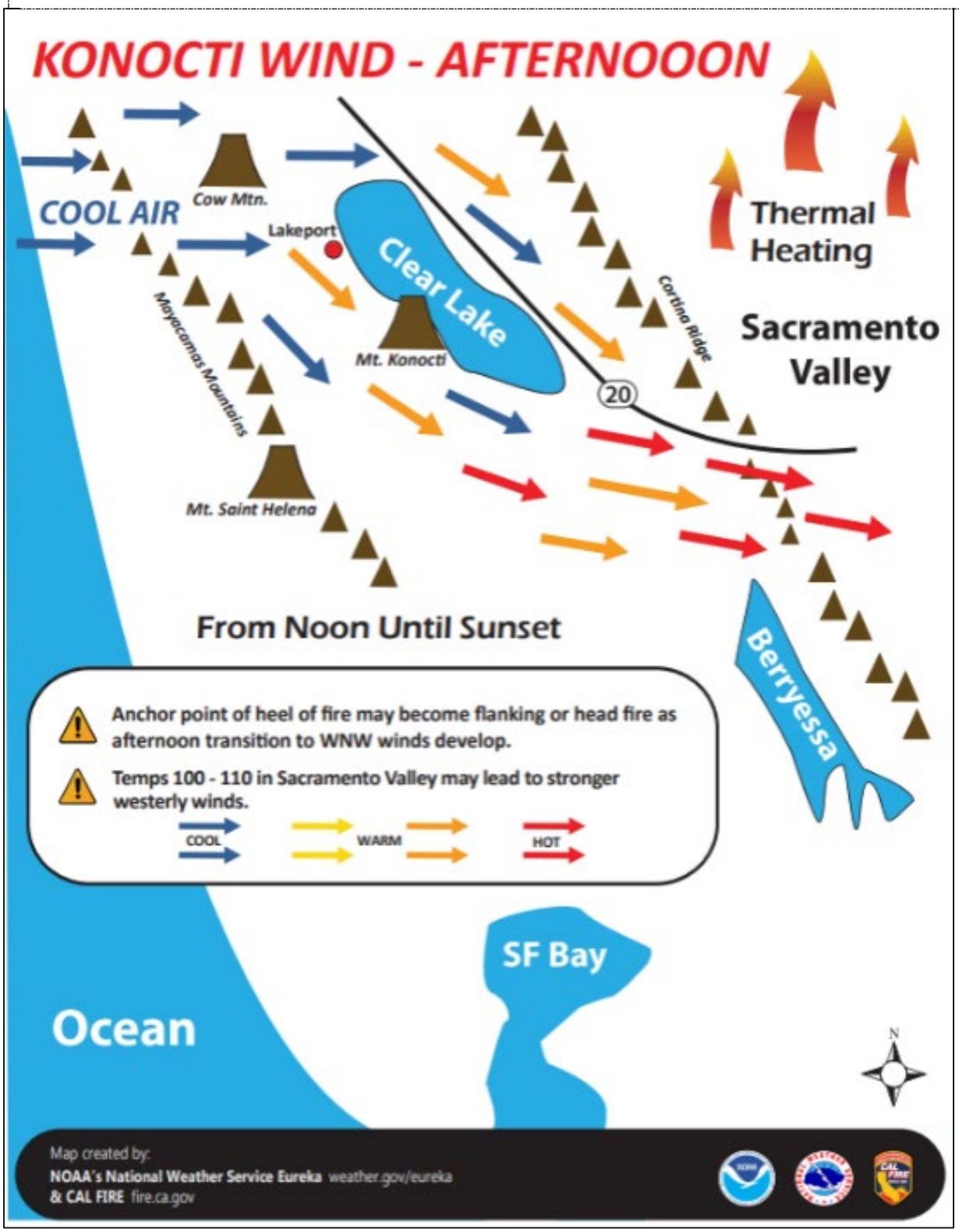
These winds continue out Hwy 20, Morgan Valley and Butts Canyon all traveling towards the Sacramento Valley going over the Cortina and Blue Ridges. The wind’s destination is the Sacramento Valley from the thermal heating and lift. The earlier and hotter the temperatures are in the Sacramento Valley, the greater this wind will be.

This phenomenon happens up and down the coastal range in California. Each year, the upcoming hot weather will bring the is as a normal daily event. It is not a prediction, but an observation that some days its influence could be stronger than others based on the heating in the Sacramento Valley. A "Red Flag" event is a predicted event, that does not occur daily. A Red Flag event typically will disrupt our normal foehn "Konocti Wind" influence[7].

[7] LAKE COUNTY WEATHER ADVISORY – KONOCTI WINDS

Figure 16: Konocti Wind - Morning

Figure 17: Konocti Wind - Afternoon



5.3 Previous Occurrences

5.3.1 Historical

Lake County fire history shows that there have been several major wildland-urban interface (WUI) fires. In the autumn of 1961, a 9,000+-acre fire burned through the Cobb Mountain area, destroying several structures. In the fall of 1964, the South County region again was subject to a 52,000-acre fire known as the Hanley Fire that started near the Lake/Napa County border northwest of Calistoga. This wildland fire ultimately burned all the way to the city limits of Santa Rosa, approximately forty miles southwest. That same year, a 15,000-acre wildland fire started at the Lake County dump (possibly the result of the past practice of burning garbage at the dump) and threatened the community of Middletown. In the fall of 1968, the Lower Lake area was subject to a 10,000-acre wildland fire. In 1981, the Lang Peak Fire consumed 11,000 acres. In 1981, the Cow Mountain Fire traveled eastward from the Bureau of Land Management (BLM) lands near Ukiah in Mendocino County and burned to the foothills near Lakeport. In 1985 an interface fire burned through the Hidden Valley residential community, leaving significant property damage. The Mendenhall Fire burned approximately 70,000 acres in Lake and Mendocino Counties in 1987, while the Fouts Fire burned 19,000 acres in Lake and Colusa Counties.

Until 2015, large fires in Lake County included the 1996 Fork Fire, the 2001 Trough Fire, and the 2008 Walker Fire. The Fork Fire started on the southern end of the Mendocino National Forest and burned 83,000 acres and eleven structures. The fire threatened the northern shore of Clear Lake, including the communities of Nice and Lucerne, and burned east almost to the Colusa County line. The Trough Fire started in eastern Colusa County at an intersection of U.S Forest Service roads in heavy brush and moved into Lake County. This fire burned through 24,970 acres, including portions of the Snow Mountain Wilderness.

The most recent large fire—the Walker Fire—started on June 22, 2008. The likely source of this fire was a vehicle being driven near Indian Valley Reservoir hitting a rock with its metal undercarriage. This fire burned 14,500 remote acres in the eastern portion of Lake County.

5.3.2 Since 2015

Since 2015, over 70% of Lake County's landmass has burned. Notably:

- July 2015, Rocky Fire: Caused by faulty gas-powered water heater inside an outbuilding and eventually merging with the Jerusalem Fire burning simultaneously, 43 homes and 69,438 acres burned.

- September 2015, Valley Fire: Faulty wiring of a hot tub ignited shortly after 1:00 pm near Cobb and by 6:30 PM had burned more than 10,000 acres. The fire ultimately spread to 76,067 acres, killed four people and destroyed nearly 2,000 buildings including 1,280 homes. High winds hastened the fire, spreading to Middletown, Hidden Valley and threatening northern Sonoma County and Napa County near the Geysers.
- August 2016, Clayton Fire: Caused by arson. 189 homes burned.
- October 2017, Sulphur Fire: 2,200 acres. 138 homes burned.
- Early Summer 2018, Pawnee Fire: 15,185 acres. 12 homes burned.
- July 2018, Mendocino Complex: Burning through September, 157 homes in Lake County and a total of 459,123 acres in four counties burned.
- August 2020, August Complex Fire: Starting in Mendocino County in August of 2020 and making its way into Lake County, is now the largest recorded wildfire in the history of California. (History of California Wildfires | WFCA)
- April 2021, Sky Fire: 65 Acres Morgan Valley Road and Sloan Ranch Road, Southeast of Clearlake
- June 2021, Pomo Fire: 42 Acres Pomo Road Cross and Hwy 20, Upper Lake
- August 2021, Cache Fire: 83 Acres Dam Rd and Wilkinson Ave, Clearlake
- August 2021, Coyote Fire: 127 Acres State Highway 29 and Spruce Grove Road, Hidden Valley Lake in Lake County
- September 2024, Boyles Fire: 30 structures and 40 vehicles and burned 81 acres.

5.4 Probability of Future Events

Highly Likely - 90-100% chance of occurrence in the next year or happens every year. (*For scale information refer to probability in Section 2.2.1 Priority*.) The overall outlook for wildfire in Lake County remains high.

Generally, four major factors sustain wildfires and allow for predictions of a given area's potential to burn. These factors are fuel, topography, weather and human actions.

- **Fuel** – Generally classified by type and volume, fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel sources are diverse and include everything from dead tree leaves, twigs and branches to standing dead trees, live trees, brush, chaparral and cured grasses. Fuels also include

manmade structures. Fuel is the only natural factor that is under human control.

  - Fuels in the wildland areas will continue to pose hazards to residents without active work to reduce them. Fuels reduction programs are key to improving the health of our forests and the communities that exist within and around them.

- **Topography** – An area's terrain and land slopes affect its susceptibility to wildfire spread. Both fire intensity and rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes. Elevation within Lake County ranges from 1,500 feet near lake level to peaks reach 5,000 – 7,000 feet on the Mendocino National Forest. The topography consists of broad rounded trending ridges running North/South, splitting around Clearlake. Slopes generally increase from ridgeline to drainage bottom. Steep slopes, drainages and timber fuels can significantly hinder firefighting efforts. Vineyards, roads and other manmade features provide a limited network of barriers that assist firefighting efforts.

- **Weather** – Components such as temperature, relative humidity, wind and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuel will ignite more readily and burn more intensely. Thus, during periods of drought, the threat of wildfire increases.

  Wind is the most treacherous weather factor. The greater a wind, the faster a fire will spread and the more intense it will be. In addition to wind speed, wind shifts can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides. Lightning also ignites wildfires, often in difficult to reach terrain.

  - The **Konocti Wind** travels from Cow Mountain between Lakeport and Ukiah, coming from the coast. It then dumps into Kelseyville's Big Valley and the north end of Clear Lake's water surface area before picking up speed creating white caps on the Lake. It stays low-level and splits going around each side of Mt. Konocti, speeding up again as the pressure gradients are squeezed by the geographical features of the terrain. It then heads South and Southeast out Hwy 20, Morgan Valley,

and Butts Canyon, traveling towards the Sacramento Valley going over the Cortina Ridge.

- **Human Actions** – Most wildfires are ignited as the direct result of arson, carelessness or accidents. Failure to maintain defensible space, use of spark-producing equipment during dry and hot conditions, and burn piles that escape control are examples of human actions that lead to wildfire. Further human actions that result in wildfire are improper use of outdoor cooking equipment, fires used within unhoused encampments, unattended control burns, tow chains dragging on roadways, cigarettes, and intentional non-arson fire ignitions.

5.5 Impacts of Climate Change

Warmer temperatures will exacerbate drought conditions. Drought often kills plants and trees, which serve as fuel for wildfires. Warmer temperatures could increase the number of wildfires and pest outbreaks, such as the western pine beetle. Cal-Adapts wildfire tool predicts the potential increase in the amount of burned areas for the year 2085, as compared to conditions pre-2015.

Wildfires, a longstanding and frequent threat to California, are expected to continue to increase in intensity, frequency, and size due to climate change and the lack of indigenous land stewardship over the previous 200 years. While California and much of the West is fire-dependent (most native plant communities depend on low-intensity fire to reproduce and maintain health), the increased intensity, frequency, and size of wildfires since 1950 in California has dramatically increased due to climate change.

If fires burn too hot or too frequently, they can prevent slow-growing native plants and trees from regrowing. More severe and intense fires also “scorch” the soil, causing it to behave like glass that doesn’t allow water to permeate the soils, and runs off instead. When this happens, the landscape can transform into a new type of ecosystem. For example, a forest will become a grassland, a grassland will become a desert, etc.

Additionally, as overnight low temperatures increase, relative humidity also decreases, slowing down the natural decomposition of forest litter (twigs, leaves, pine needles, branches, etc.) making the duff more primed to burn.

5.6 Secondary Hazards

5.6.1 Post-Wildfire Landslides and Debris Flows

Post-wildfire landslides and debris flows are of particular concern in Lake County. Fires that burn in hilly areas, which comprise much of Lake County, remove

vegetation that holds hillsides together during rainstorms. Once the vegetation is removed (burned out), the hillside may be compromised, resulting in landslides and debris flows.

2017 Post-Sulphur Fire Mapping

After the 2017 Sulphur Fire, a Watershed Emergency Response Team Evaluation report was completed by CAL FIRE, CGS, USGS, and other interested stakeholders. A Pre-Watershed Emergency Response Team (PRE-WERT) conducted a rapid assessment of the North Bay wildfires and concluded that a limited-scope report would be generated for the Sulphur Fire, identifying values at risk and proposing preliminary emergency protection measures. The following summarizes the findings for the Sulphur Fire:

- Most of the fire had a low-to-moderate soil burn severity, with the moderate burn severity mostly occurring on southwest slopes that had a pre-fire vegetative cover composed of mostly chaparral.
- USGS debris flow modeling shows that 3 out of 63 basins have a 60 to 80% likelihood of developing post-fire debris flows based on a 15-minute, 24 mm/hr rain event; 6 out of 63 basins have a 40 to 60% likelihood of post-fire debris flows under the same rain event. The basins with the highest probability of developing debris flows are in areas with no identified life-safety values at risk.
    - Batch ERMiT model results predict almost a 20-fold increase in post-fire surface erosion rates compared to the pre-fire conditions for the first year, assuming a 2-year recurrence interval storm.
    - A total of 9 Values At Risk (VARs) were identified, including:
        - Water quality within Clear Lake
        - Sulphur Bank Mercury Mine Superfund Site
        - City and County Roads and downslope infrastructure
        - Residential structures downslope of potentially unstable slopes
        - Residential structures near natural or man-made drainage ways

5.6.2 Agriculture Hazards (Smoke Taint, Wildlife Changes)

Wildfire burning through ag land or smoke inundation can cause consequences to agricultural resources including smoke taint, soil sterilization, reduced or eliminated production and extensive processes for restoration. Wildlife—especially endangered species—are impacted when the habitat is degraded.

5.6.3 Air Pollution (Wildfire Smoke, Out of Area)

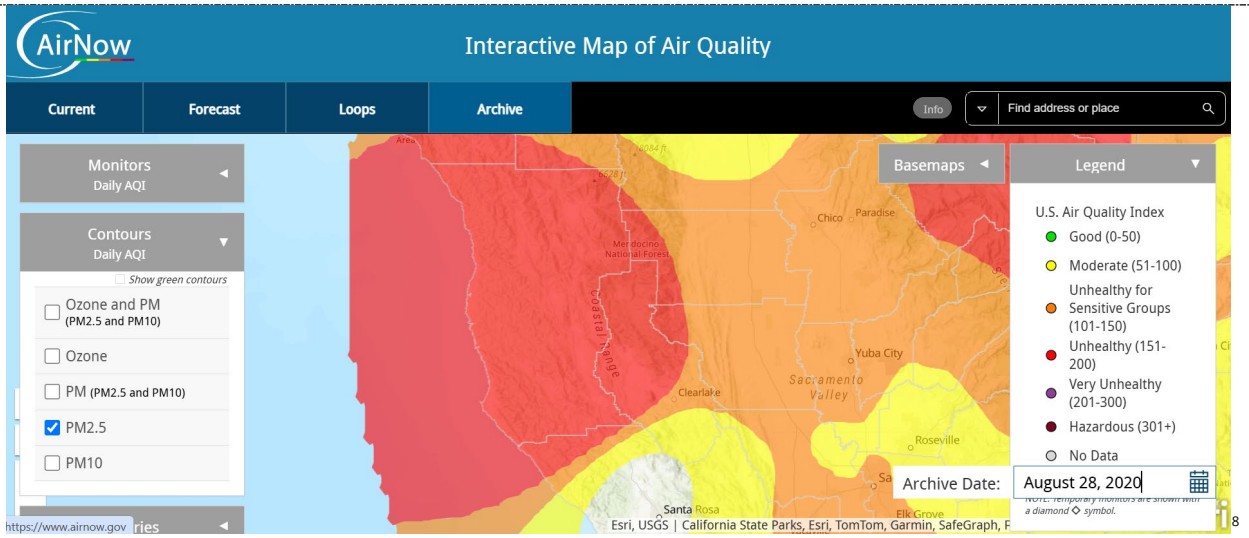
During many summer months in past years, Lake County residents have had to breathe wildfire smoke, from fires both within and outside of the County. Smoke from wildfires is made up of gas and particulate matter, which can be easily observed in the air. While the summer of 2015 brought terrible wildfires along with severe smoke impacts to numerous locations in California, impacts in Lake County were of a shorter duration than previous summers. During the summers of 2013 and 2014, several wildfire incidents occurred in Northern California and Lake County which significantly influenced the PM2.5 concentration measurements within Lake County.

Air quality standards have been established to protect human health from the pollutant referred to as PM2.5, which consists of particles 2.5 microns or less in diameter. These smaller particles are responsible for adverse health effects because of their ability to reach the lower regions of the respiratory tract. (Example: August 28, 2020.)

5.6.4 Insurance Coverage

The HMPC highlighted growing challenges related to home insurance in areas at risk of wildfire. Residents in these regions have experienced rising insurance costs, with some facing significant rate increases or even policy cancellations. This trend impacts not only those in high-risk zones but also residents in lower-risk areas. For instance, some homeowners in locations with minimal wildfire exposure have reported sharp premium increases, adding substantial financial burdens.

Figure 18: Air Quality for August 28, 2020



5.6.5 Public Safety Power Shut-Offs

To mitigate fire risk, PG&E, the main provider of electricity in Lake County, began Public Safety Power Shut-Offs (PSPS) in 2019, when the risk of fire ignition from their lines is perceived to be highest due to forecasted winds and other weather conditions. Through the first year, nearly all of the County was without power at somepoint for multiple days.

Since the 2019 implementation of PSPS the program has evolved significantly. Many electric distribution system hardening and undergrounding projects have been completed in Lake County within the High Fire Threat Districts as determined by the CPUC and even more have been underway for 2023 and beyond.

The result of these electric distribution system upgrades has been a significant reduction in the scope (size) of PSPS events and an increase in system reliability for day-to-day operations.

- 2022 - There were no PSPS de-energizations that affected Lake County.
- 2023 – Two PSPS events (8/30/2023 and 9/20/2023) affected Lake County with 50 customers each event.
- 2024 - Two PSPS events (10/17/2024 and 11/5/2024) affected Lake County with 1,088 customers and 1,168 customers respectively.

[8] https://gispub.epa.gov/airnow/index.html?contours=pm25&xmin=-14078843.958104957&xmax=-13296128.788464792&ymin=4629732.208871002&ymax=4884726.135230337&boundaries=nps%2Fcounty&showlegend=yes&tab=archive&archivedates=08/28/2020

Also notable are the distribution system “Microgrids” in Lucerne, Middletown and North Clearlake that provide back-up generation at Pre-Installed Hubs (PIH locations if Transmission Source Power is affected by PSPS. This capability allows critical infrastructure that have minimal fire risk in those locations to remain energized and available for customer needs. PSPS will continue to evolve. Since the inception of the program there has been an 80% reduction in wildfire ignitions caused by high wind impacts to PG&E facilities.

5.7 Exposure & Vulnerability

Vulnerability—Extremely High (Refer to *Section 4.1.2 Vulnerability* for scale detail.)

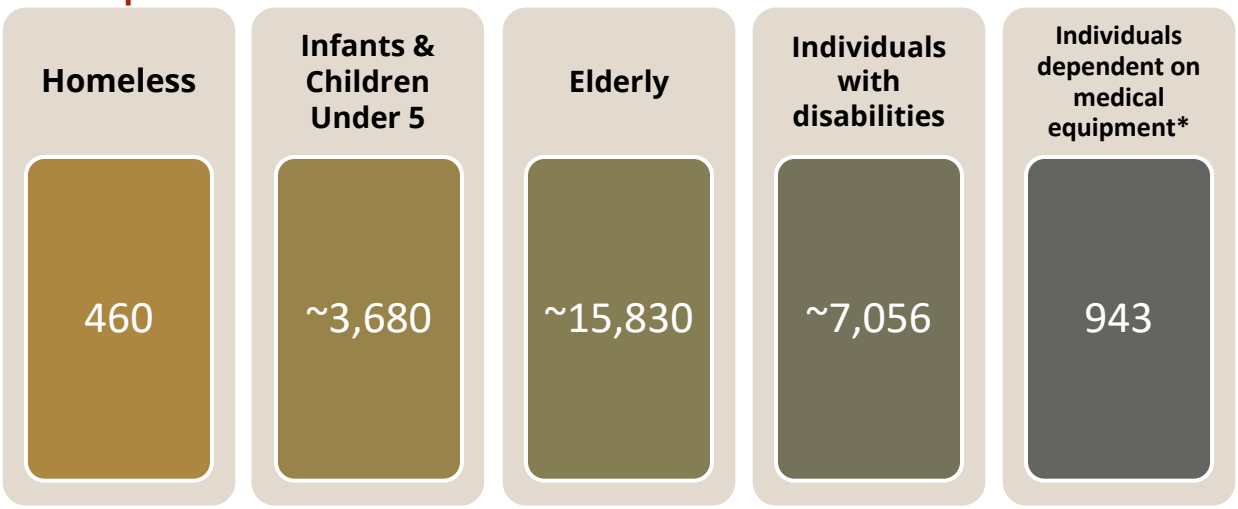
Risk and vulnerability to the Lake County Planning Area from wildfire is of significant concern. High fuel loads in the County, along with geographical and topographical features, create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, exacerbated by climate change, can result in frequent and sometimes catastrophic fires.

The wildfire hazard is the highest priority hazard in the County. Because of the fuels and weather patterns, vulnerability to this hazard has not changed since the 2018 Plan Update.

The National Fire Plan is a cooperative, long-term effort between various government agency partners with the intent of actively responding to severe wildland fires and their impacts to communities while ensuring sufficient firefighting capacity for the future. For purposes of the National Fire Plan, CAL FIRE generated a list of California communities at risk for wildfire. The preliminary criteria and methodology for evaluating wildfire risk to communities is published in the Federal Register, January 4, 2001. The National Fire Plan identifies 17 “Communities at Risk” in Lake County.

While not impossible, it is less likely that the entire County will be impacted by wildfire at once. The information below accounts for the entire County or worst-case scenario.

5.7.1 Population



***The US Department of Health and Human Services Empower Map (Link) provides information about Medicare beneficiaries by zip code, including those at risk of extreme heat due to dependence on electricity-dependent durable medical and assisted equipment and devices. Of those identified County wide, approximately 28% reside in the Clearlake zip code (95422), and no zip code in Lake County has none.

5.7.2 Property

Fire Responsibility Areas and Values at Risk - Fire Responsibility areas are generally categorized by Federal Responsibility Areas (FRA), State Responsibility Areas (SRA) and Local Responsibility Areas (LRA). The FRA and SRA in the County are relatively large in physical area.

Risk information is provided in Table 12 below, with information from County GIS and US Census.

Table 12 Fire Responsibility Area Population and Parcels at Risk

Area	Population	Parcels	Total Value
FRA	725	1,259	
SRA	30,800	37,469	$5.0 billion
LRA	36,700	8,478	$1.9 billion

It should be noted that fire does not just affect structural values; fire can also affect land values. As such the Assessor's land values and all parcels were accounted for in this analysis to represent total county assets at risk. However, it is highly unlikely the whole County will ever be on fire at once. The County parcel inventory and associated values by fire responsibility area are provided in Table 13.

Table 13 Lake County – Count and Values at Risk in Local, State, and Federal Responsibility Areas by Property Use with Contents Replacement Values

Fire Responsibility Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
FRA						
Agricultural	14	0	$0	$0	$0	$0
Commercial	2	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Open Space / Rural Lands	1,182	1	$839,757	$16,244	$16,244	$872,245
Residential	61	0	$0	$0	$0	$0
Unknown	0	0	$0	$0	$0	$0
FRA Total	**1,259**	**1**	**$839,757**	**$16,244**	**$16,244**	**$872,245**
LRA						
Agricultural	1,293	1,009	$132,386,356	$124,711,056	$124,711,056	$381,808,468
Commercial	862	692	$82,421,497	$129,039,625	$129,039,625	$340,500,747
Industrial	21	15	$3,043,287	$5,391,357	$8,087,036	$16,521,680
Open Space / Rural Lands	351	105	$12,077,424	$13,021,893	$13,021,893	$38,121,210
Residential	5,948	4,890	$344,355,926	$520,300,065	$260,150,033	$1,124,806,024
Unknown	3	0	$0	$0	$0	$0
LRA Total	**8,478**	**6,711**	**$574,284,490**	**$792,463,996**	**$535,009,642**	**$1,901,758,128**
SRA						
Agricultural	1,131	553	$117,902,499	$104,253,299	$104,253,299	$326,409,097
Commercial	834	394	$58,583,150	$138,643,525	$138,643,525	$335,870,200
Industrial	19	12	$3,629,723	$6,578,967	$9,868,451	$20,077,141
Open Space / Rural Lands	4,001	1,319	$395,217,582	$313,479,716	$313,479,716	$1,022,177,014
Residential	31,484	13,910	$893,712,038	$1,601,507,882	$800,753,941	$3,295,973,861
Unknown	0	0	$0	$0	$0	$0
SRA Total	**37,469**	**16,188**	**$1,469,044,992**	**$2,164,463,389**	**$1,366,998,932**	**$5,000,507,313**
Lake County Total	**47,206**	**22,900**	**$2,044,169,239**	**$2,956,943,629**	**$1,902,024,818**	**$6,903,137,686**

5.7.3 Critical Facilities & Infrastructure

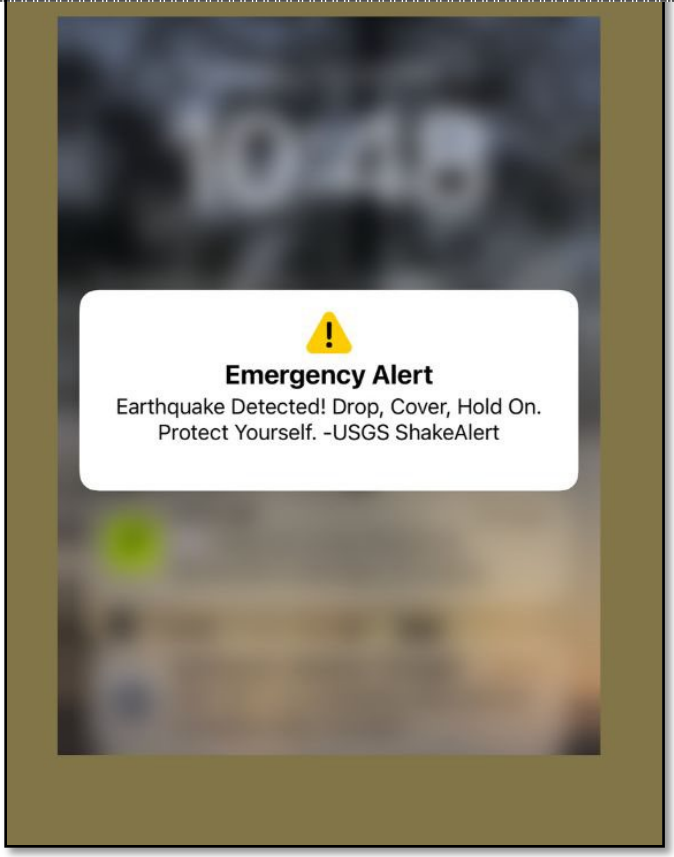
Wildfires can cause short-term and long-term disruption to the County operations, tourism and life. Fires may result in casualties and can destroy buildings and infrastructure.

Although the physical damages and casualties arising from wildland-urban interface fires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. In some cases, the economic impact of this loss of services may be comparable to the economic impact of physical damage or, in some cases, even greater. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Fires can also cause major damage to power plants and power lines needed to distribute electricity to operate facilities.

Past wildfires have caused major damage to the County. The County has suffered loss of recreation and tourism, loss of structures, loss of tax revenue, high costs of battling fires, and loss of lives.

CHAPTER SIX: Earthquake

Figure 19. A USGS Early Warning Alert notifies Lake County residents of an earthquake detection ahead of impact on December 5, 2024 at approximately 10:45 AM.



6.1 Earthquake Overview

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). This is discussed further in Section 6.2.

California is seismically active because it sits on the boundary between two of the earth's tectonic plates. Most of the state - everything east of the San Andreas Fault - is on the North American Plate.

For the purpose of planning there are two types of faults: active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Research is advancing warning time and systems. Cal OES's Earthquake Warning *MyShake App* is the first of its kind publicly available and provides users seconds or tens of seconds notice to take cover.

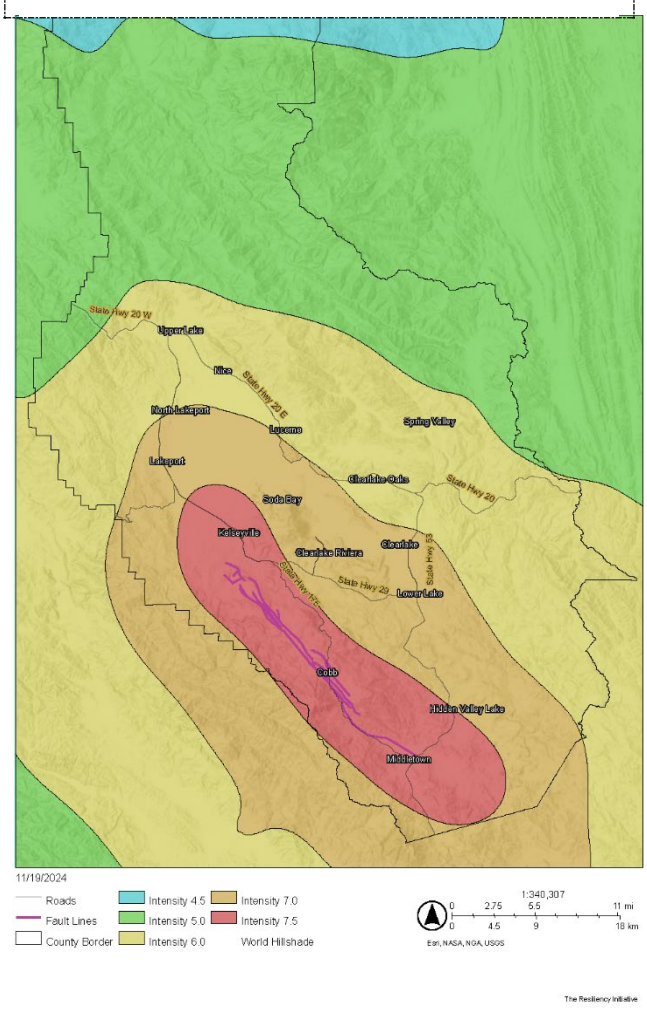
Additional information about population and land use, as well as the communities impacted are available in *Section 3.2 Planning Area Communities*.

6.2 Location and Extent

The Planning Area is in a seismically active region of California and is situated near several major fault systems, including the San Andreas Fault (within 30 miles to the west) and the Hayward Fault and Rogers fault extension into the Maacamas fault, which is within 10 miles to the west of Lake County.

- The **San Andreas Fault** traverses the entire length of the State of California. The fault zone is located approximately 30 miles west of the Lake County line traveling the coastline of Mendocino County.
    - The ground shaking of an 8.3 magnitude[9] earthquake on the northern section of the fault would result in serious damage and loss of life to Northern California including Lake County.
- The maximum credible earthquake (MCE) capable of being generated along this system, which was responsible for the October 17, 1989 Loma Prieta earthquake (magnitude 7.1), is 8.3 on the Richter scale.
- The **Collayomi Fault** is a dextral strike-slip fault that bounds the southwestern side of the Clear Lake basin in the northern Coast Ranges. This near-vertical dextral fault zone bounds the southwestern side of the

Figure 20: Collayomi Scenario

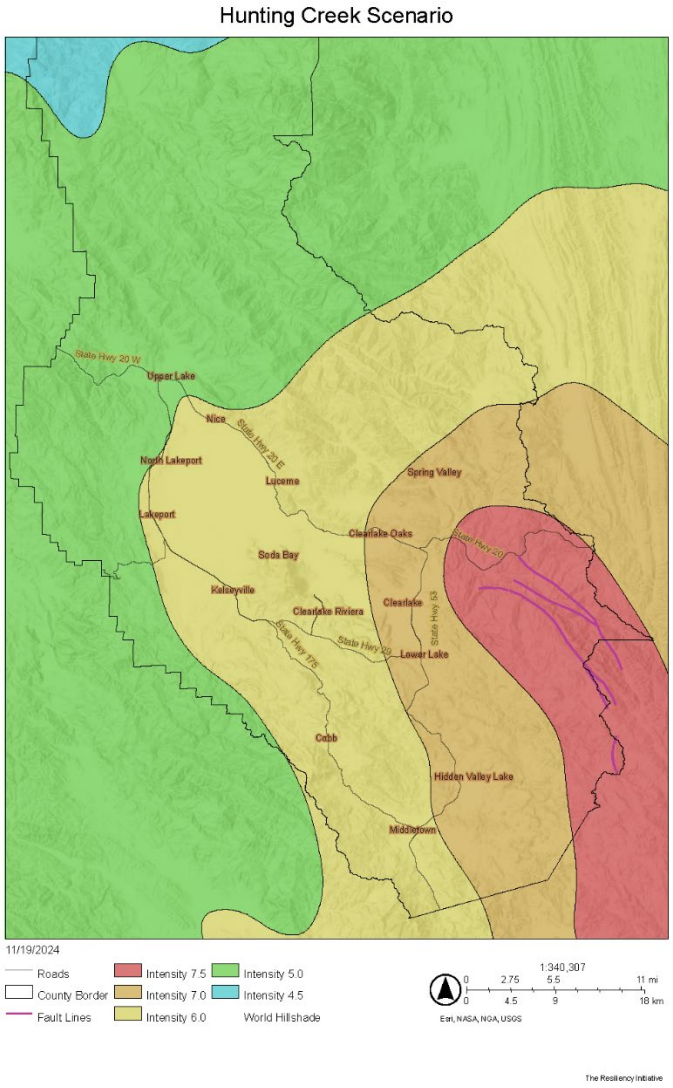


[9] The Richter Scale, developed in 1932 by the late Dr. Charles F. Richter of the California Institute of Technology, is used to quantify the magnitude or strength of the seismic energy released by an earthquake.

Clear Lake basin, an actively deforming basin formed primarily by shear and tensional stresses within the San Andreas fault system and modified by eruption of the Clear Lake Volcanics and subsequent subsidence. The Collayomi fault zone is as much as 0.9 km wide and extends from the Camelback Ridge area southeast to Middletown. Figure 20 shows the intensity simulation based on a 6.7-magnitude earthquake.

- The **Hunting Creek-Berryessa Fault** is an active dextral strike-slip fault system associated with the larger San Andreas fault system. The Hunting Creek-Berryessa fault system extends from the vicinity of Wilson Valley south-southeast to the Cedar Roughs area west of Lake Berryessa. In this compilation, the fault zone is divided from north to south into the Wilson, Hunting Creek, and Lake Berryessa sections. Figure 21 shows the intensity simulation based on a 7.1-magnitude earthquake.

Figure 21 Hunting Creek Scenario



- The **Maacama Fault** traverses the Lake and Mendocino County lines in the eastern mountains less than 20 miles from the Clear Lake basin.

- The **Mayacama Fault** is the northern segment of the Healdsburg/Rodgers Creek Fault Zone in Sonoma County. The **Healdsburg/Rodgers Creek Fault** line is the northern segment of the Hayward Fault Zone traversing the eastern portion of the San Francisco Bay Area.
    - Trenching studies across the fault by USGS have resulted in an estimated 250-year recurrence interval for magnitude 7.0 earthquakes.
    - The last major earthquake along the Healdsburg/Rogers Fault was in 1808, and the USGS considers this fault a prime potential for future large earthquakes.
    - The Hayward Fault Zone has a 25% chance of producing an earthquake of magnitude 7.0 or greater within the next 30 years, according to the California Division of Mines and Geology.

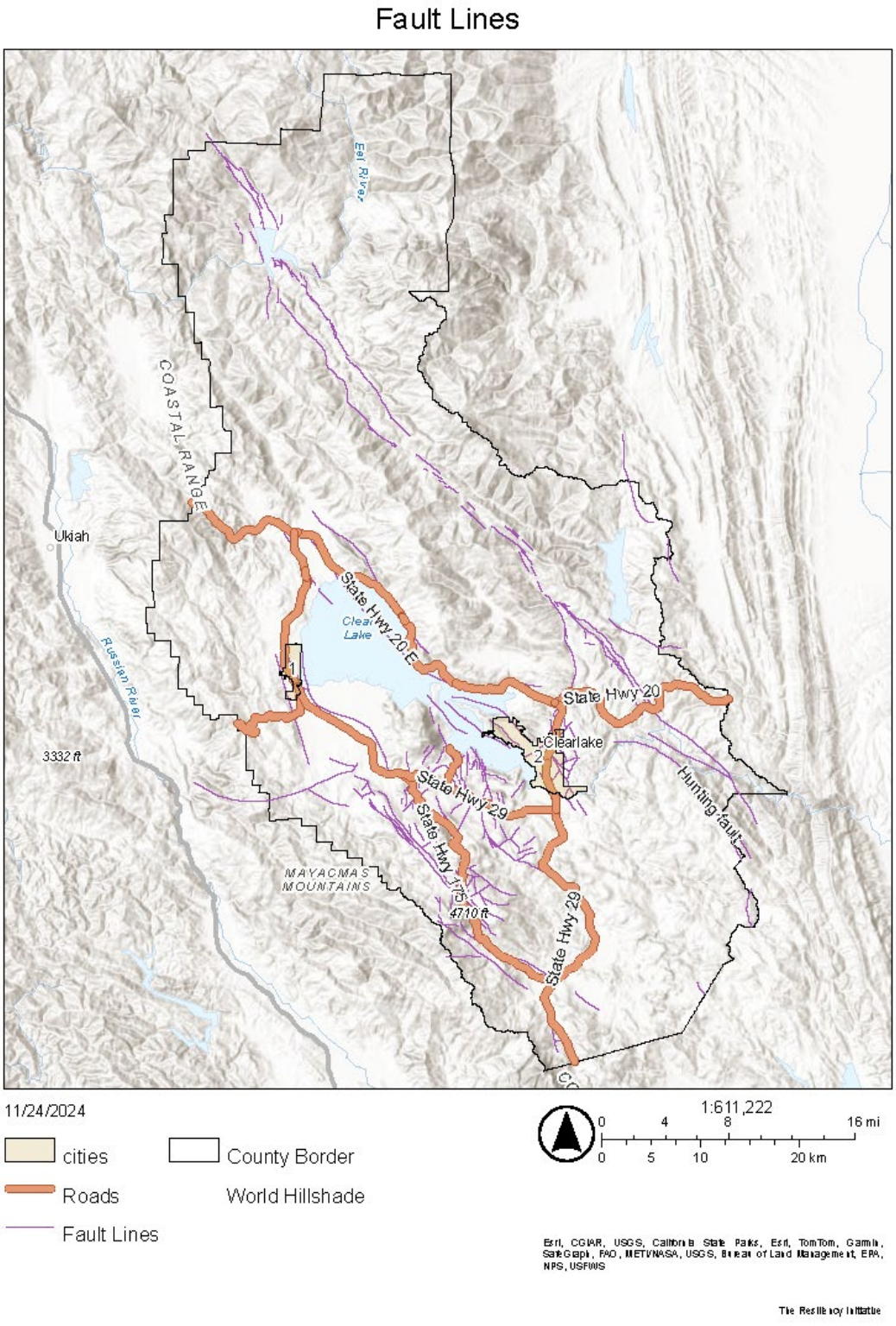
Additionally, several small active faults are located in Lake County. Most are centered in the Cobb Mountain area.

For detailed community information refer to 3.2 Planning Area Communities; for a visual, refer to Figure 5: Map of Lake County Cities, Towns, Communities, and Highways.

The potential location and extent of the hazard impacts of an earthquake within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: *Chapter Six: Earthquake*
    - 6.1.2 Differences between County and City assessments
    - 6.2 Location and Extent
- Lakeport Annex: *Chapter Six: Earthquake*
    - 6.1.2 Differences between County and City assessments
    - 6.2 Location and Extent

Figure 22 Active Faults in and near Lake County



6.2.1 Extent

Earthquakes can cause structural damage, injury and loss of life, as well as damage to infrastructure networks (i.e. water, power, gas, communication and transportation). Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires and landslides.

The extent of damage depends on many interrelated factors: magnitude, focal depth, distance from the causative faults, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography and the design, type and quality of building construction.

Seismologists have developed several scales to measure earthquake intensity. One of the first was the Richter Magnitude Scale, developed in 1932 by the late Dr. Charles F. Richter of the California Institute of Technology. The Richter Scale quantifies the magnitude or strength of the seismic energy released by an earthquake, and is expressed in whole numbers and decimals (e.g., 6.8).

Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface (see *Table 14 Modified Mercalli Intensity (MMI) Scale*). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 14 Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors; by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.

VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, and great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Much of Lake County would be susceptible to violent ground shaking in the event of an earthquake.

6.3 Previous occurrences

Minor earthquakes occur almost daily in the south County geothermal fields near the geysers-influenced region. The Geysers Geothermal Field is located west of the Middletown area in both Lake and Sonoma Counties. Since the early 1980's, geothermal power development has been a major industry in this area.

According to the 2018 California State Hazard Mitigation Plan, magnitude 5.5 to 5.9 earthquakes occur three to four times per year in California and are large enough to cause moderate damage to structures. Earthquakes between magnitudes 6 to 6.9 occur in California once every two to three years and can cause major damage. Major earthquakes of magnitude 7 to 7.9 occur in California once every 10 years[10]. A magnitude 8.0 or greater has never been recorded in California. In January 1700 a magnitude 9.0 occurred on the Cascadia Subjection Zone which extends from Cape Mendocino in Northern California to British Columbia. Earthquakes of this size are capable of extensive damage over a very broad region.

The USGS National Earthquake Information Center database contains data on earthquakes in the Lake County area. According to USGS, a magnitude 5.0 earthquake could be felt up to 90 miles away. Three earthquakes greater than 5.0

[10] The strongest earthquakes in the state's recorded history were the 1857 Fort Tejon and 1906 San Francisco quakes, estimated at 7.9.

magnitude have been centered within 100 miles of Clear Lake in the previous 40 years:

- 2016-12-14 5.0 10 km W of Cobb, Ca
- 2016-08-10 5.1 20 km NNE of Upper Lake, Ca
- 2014-08-24 6.0 South Napa

6.4 Probability of Future Events

Occasional (major earthquake); Likely (minor earthquake)— (For scale information refer to Probability in *Section 2.2.1 Priority*.)

California is known for its high seismic activity, with earthquakes being a common occurrence in the state. Northern California, where Lake County is located, is particularly seismically active due to the presence of several major fault systems, including the San Andreas Fault and the Hayward Fault. The San Andreas Fault, in particular, is a major concern for the region as it runs through much of California and is capable of producing large earthquakes.

Lake County seismic activity within the past two hundred years has shown absence of any major or damaging earthquake occurring on identified fault lines within Lake County. However, the possibility of an earthquake is ever-present in Lake County. The combination of plate tectonics and associated California coastal mountain range building geology essentially guarantees earthquake because of the periodic release of tectonic stresses. Lake County's mountainous terrain lies in the center of the North American and Pacific tectonic plate activity. There have been earthquakes because of this activity in the historic past, and there will continue to be earthquakes in the future of the California north coastal mountain region.

Seismic studies of the Geysers Geothermal Fields indicate a potential increase in micro seismic events of 4.0 or less on the Richter scale with a relationship between micro seismic activity and geothermal production in the Geysers. A 4.0 or less earthquake does not result in dangerous ground shaking.

According to the 2018 California Hazard Mitigation Plan, the USGS and other scientists estimate a 72% probability that at least one earthquake of magnitude 6.7 or greater will occur in the San Francisco Bay Area before 2044. This could impact Lake County, at least minimally, depending on the epicenter. Should the epicenter occur on a fault near or in Lake County, consequences would be more drastic.

6.5 Impacts of Climate Change

While scientists know earthquakes can be triggered or inhibited by changes in the amount of stress on a fault, the largest climate variable that could change fault

stress loads is surface water in the form of rain and snow, which climate change will increase amounts of, and several studies have supported such correlations according to NASA. However to date, the correlations are only for naturally-occurring micro-earthquakes too small for humans to detect.

According to the U.S. Geological Survey, the only correlation that's been noted between earthquakes and weather is that large changes in atmospheric pressure caused by major storms like hurricanes have been shown to occasionally trigger what are known as "slow earthquakes," which release energy over comparatively long periods of time and don't result in ground shaking like traditional earthquakes do. They note that while such large low-pressure changes could potentially be a contributor to triggering a damaging earthquake, "the numbers are small and are not statistically significant."

Additionally, periods of extended drought — which causes soils, vegetation, and even rocks to lose weight due to lack of water — then followed by extreme amounts of rain, could stress fault lines/zones, but more study needs to be done.

6.6 Secondary Hazards

6.6.1 Post-Earthquake Landslides and Debris Flows

Earthquakes may cause landslides and debris flows particularly during the wet season, in areas of high water or saturated soils.

6.6.2 Post-Earthquake Dam Failure

Earthquakes can cause dams to fail. For more information, refer to *Chapter 11 Dam Failure*.

6.6.3 Post-Earthquake Hazmat Incidents

Earthquakes can cause disastrous landslides. River valleys are vulnerable to slope failure, often due to loss of cohesion in clay-rich soils. Additionally, fires can result from gas lines or power lines that are broken or downed during the earthquake. It may be difficult to control a fire, particularly if the water lines feeding fire hydrants are also broken.

6.6.4 Post-Earthquake Levee Failure

Ground shaking in and around levees resulting from earthquakes *over 60 miles away* can affect levee performance. Additional levee failure information is profiled in *CHAPTER TEN: Levee Failure*.

6.6.5 Post-Earthquake Seiche

An earthquake has the potential to trigger a *seiche* in Clear Lake. A seiche—often described as a tsunami within an enclosed or partially enclosed body of water—occurs when seismic activity generates standing waves that oscillate within the affected water body.

While seiches can cause significant localized flooding and damage to lakeshore areas, they remain a relatively under-researched phenomenon in California. The 2018 *California Hazard Mitigation Plan* notes that limited studies have been conducted on seiches within the state, underscoring the need for further investigation to better understand their risks and impacts.

6.7 Earthquake: Exposure & Vulnerability

Vulnerability—Medium (Refer to *Section 4.1.2 Vulnerability* for scale detail.) Unchanged since the 2018 Plan Update.

Earthquake losses will vary across the Planning Area depending on the source and magnitude of the event. Lake County faces several specific vulnerabilities to earthquakes, including[11]:

- **Ground Failure:** Ground shaking and soil liquefaction in low-lying areas can lead to foundation damage and disruptions to underground utilities.
- **Utility Disruption:** Electricity, water and gas lines may be severed by earthquakes, leading to prolonged outages and increased risks to public health and safety.
- **Fire Hazards:** Damaged electrical and gas lines may ignite.
- **Landslides**: The county's hilly terrain increases the likelihood of landslides, which could block roads, damage property and disrupt transportation and communication routes.
- **Ground rupture:** Surface faulting may directly damage infrastructure.
- **Dam Damage:** Damage to area dams may result in downstream flooding, posing risk to people and property.

*Population details are included in Section 3.5 Population and Demographics***.** An in-depth look at what's at risk in Lake County (including the built environment, natural environment and agricultural resources) is included in *CHAPTER FOUR: Hazard Profiles and Risk Assessments*.

[11] Adapted from the 2023 California Hazard Mitigation Plan Volume 1, Part 2 with an analysis of Lake County specific characteristics and vulnerabilities.

To further evaluate potential losses associated with earthquake activity in the Planning Area, HAZUS-MH probabilistic earthquake scenarios were run by a team of researchers from Mississippi State University including:

- a 7.0 magnitude earthquake along the Macaama Fault
- an 8.3 magnitude earthquake on the San Andreas Fault in Mendocino County, and
- a 9.0 magnitude earthquake at the Mendocino Triple Junction in Humboldt County.

The report and findings follow:

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Hazus Report April 18, 2023

The Hazus software will be used to assess the potential impact of the three earthquake scenarios on the infrastructure, buildings, and human populations in Lake County. Hazus is a tool developed by the Federal Emergency Management Agency (FEMA) that provides a standardized methodology for estimating the potential losses and damages caused by natural disasters, such as earthquakes and floods.

The software uses various inputs, including the location and magnitude of the earthquake, the characteristics of the buildings in the affected area, and the population and infrastructure data, to estimate potential losses and damages.

For this report, the Hazus software will be used to estimate the direct physical losses and damages to buildings, critical facilities, and infrastructure, as well as the indirect losses such as economic impacts, displacement of populations, and social disruption. The results of the Hazus analysis will be used to identify the most vulnerable areas and populations in the county and to inform recommendations for mitigation strategies that can reduce the potential losses and damages caused by earthquakes and floods in the future.

The Hazus software models building characteristics based on a range of parameters, including building type, occupancy class, construction material, and age. These parameters are used to estimate the building's response to earthquake shaking, including its likelihood of damage and the extent of that damage. Building types in Hazus include wood frame, reinforced masonry, unreinforced masonry, steel frame, concrete frame, and tilt-up concrete. Occupancy classes range from residential to commercial to critical facilities, such as hospitals and emergency response centers.

The occupancy classes in Hazus are also diverse and include both residential and commercial uses. The software models different occupancy classes based on their different structural characteristics and the potential for human occupancy during and after an earthquake. The occupancy classes are further divided into subcategories based on specific uses, such as hospitals, schools, or government buildings.

The software also considers the level of seismic retrofitting, if any, that has been performed on the building. Retrofitting measures can include the installation of seismic bracing or shear walls, the addition of reinforced concrete or steel elements, or the strengthening of the foundation. These retrofitting measures can greatly improve the building's resilience to earthquakes and reduce the likelihood and severity of the damage. However, many buildings in Lake County may not have undergone any seismic retrofitting, particularly older buildings that predate modern building codes and standards. The Hazus analysis will provide insights into the vulnerability of different building types and occupancy classes in the county and will identify areas where seismic retrofitting could be a cost-effective mitigation strategy.

The transportation infrastructure in Lake County includes a mix of major highways, local roads, and bridges. The major highways in the county include California State Route 20, which runs east-west across the northern part of the county, and California State Route 29, which runs north-south through the center of the county. These highways are critical for the movement of people and goods throughout the county and beyond.

In addition to the major highways, there are numerous local roads that provide access to residential and commercial areas throughout the county. Many of these local roads are located in areas that are susceptible to natural hazards, such as flooding or landslides, which can impact the ability of people and goods to move throughout the county. Overall, the transportation infrastructure in Lake County plays a critical role in the county's economy and social well-being.

Hazus Model

The input data used in the Hazus model for the Lake County study included building inventory data, population data, geospatial data, and other relevant data such as road and bridge inventory data. The building inventory data

included information on building type, occupancy class, construction material, and age, which was used to estimate the vulnerability of the building stock to earthquake damage. The population data used to estimate the number of people who could be impacted by the earthquake scenarios.

The geospatial data used in the Hazus model included digital elevation data, which was used to model the potential impacts of flooding in the study area. Other geospatial data included information on the location and characteristics of critical infrastructure, such as roads, bridges, and hospitals, which was used to estimate the potential impacts of an earthquake.

Overall, the Hazus model and the input data used in the Lake County study provided a comprehensive approach to estimating potential damage and losses from natural hazards. The results of the study can be used to inform mitigation strategies and improve the overall resilience of the study area. The Hazus model was used to simulate three earthquake scenarios in Lake County, each with varying magnitudes and locations, to estimate potential damage and losses." The three scenarios are as below:

1. The first fault is located on the Macaama fault, a significant geological feature that runs through the northern part of California, including Lake County. The fault is part of the larger San Andreas Fault system and is capable of producing earthquakes with magnitudes up to 7.0. The fault has a long history of seismic activity, including several notable earthquakes in the past century. The fault is particularly concerning for Lake County because it runs directly through the county, potentially putting a large number of people and structures at risk.

   Since the first scenario's magnitude was available in shakemap scenarios. We used a 7.5 magnitude earthquake with a geographic location of N39.18; W123.14. The impact shape is shown in Figure 1.

2. For the second scenario since there was no available earthquake on a scale above 7.8 to 8, the deterministic hazard (Source event) has been used. This earthquake has an 8.3 magnitude and is located on geographic coordination of N38.97: W123.66.

3. For the third, the deterministic hazard earthquake with a magnitude of 9.0 and location of N40.24; W124.39 has been used.

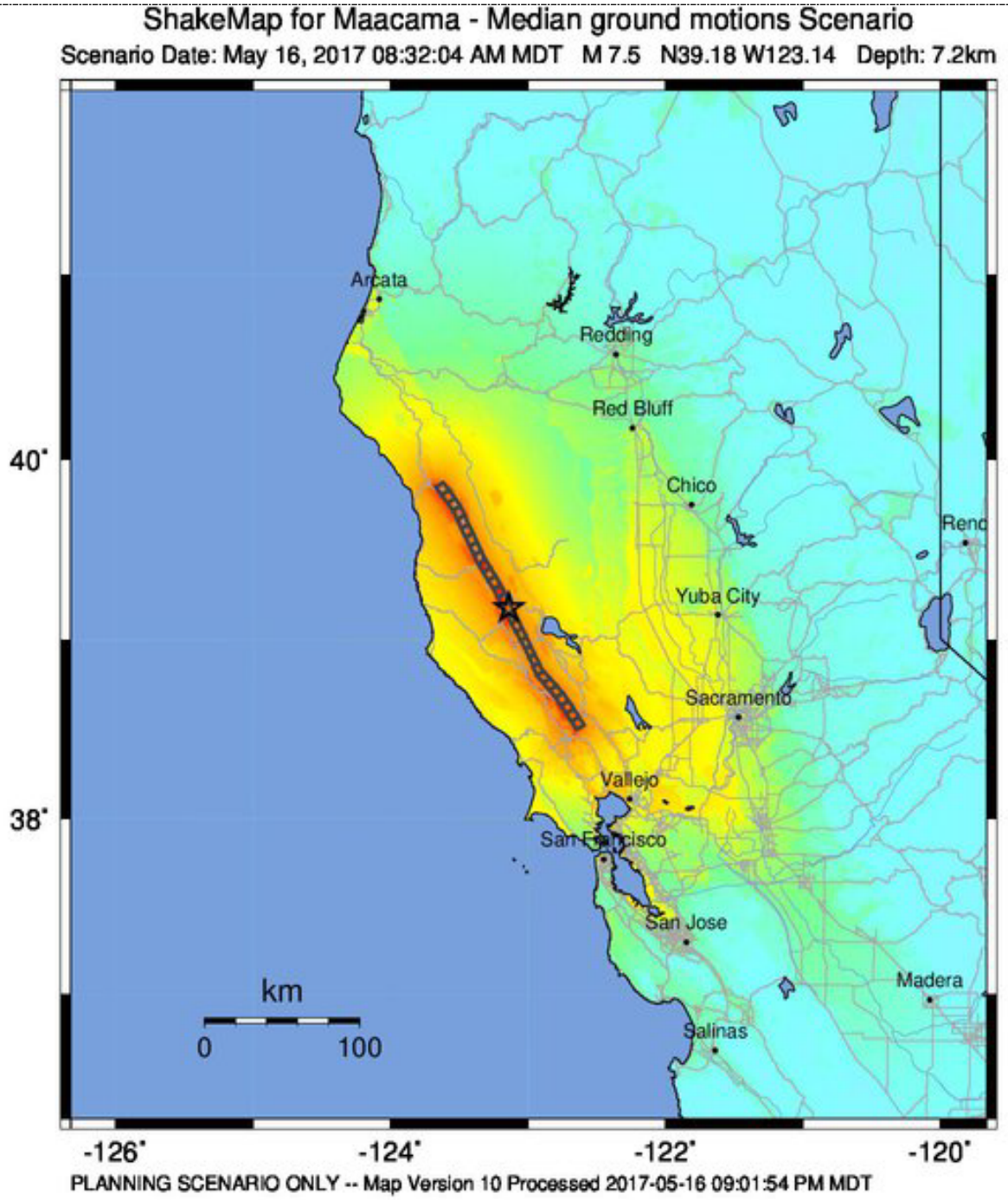
HAZUS Earthquake Results

For the scenarios, the results are automatically produced by Hazus software. Table 15 Summary of social impact and economic loss shows the social impact and economic loss in each specific scenario for the first three scenarios.

Table 15 Summary of social impact and economic loss

Scenario	Social Impact			Economic loss			
	Shelter Requirement		Casualties	Transportation system	Utility System	Building-Related Economic Loss Estimates	
	Displaced households as a result of the earthquake	Person seeking temporary public shelter	Victims	Economic loss	Economic loss	Income losses	Capital stock losses
No.	Person	Person	Person	M$	M$	M$	M$
1	115	63	4	2.08	77.34	74.42	329.89
2	79	44	4	2.15	174.11	63.93	317.91
3	128	72	5	2.96	201.40	87.71	423.77

Figure 23 Shakemap 7.5 Earthquake scenario



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	*<0.02*	*0.1*	*1.4*	*4.7*	*9.6*	*20*	*41*	*86*	*>178*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2012)

Figure 24 A cyanobacteria bloom near the shore of Clear Lake.

Clear Lake is California's largest freshwater lake entirely within the state[12], covering 43,000 acres (68 square miles) of surface area with 110 miles of shoreline. The lake's vast size gives it the ability to support large populations of waterfowl such as ducks, pelicans, grebes, blue herons, egrets, and osprey year-round and winter populations of bald eagles and white pelicans.

Clear Lake is the source of drinking water for more than 45,000 community residents. The lake is also home to many bass tournaments because of its prize fishing, and residents and tourists alike enjoy various forms of boating and recreation on the lake.

The average depth of the lake is about 25 feet. Prevailing winds and the lake's modest depth facilitate vertical mixing. Submerged thermal springs and gas vents in the floor of the lake further promote mixing. These geologic features are not considered to impact the Clear Lake water utilities negatively. The lake stratifies during warm summer days but generally recirculates during the cooler nights unless surface conditions are unusually calm.

Clear Lake has three distinct arms with distinct drainage basins: Upper Arm, Oaks Arm, and Lower Arm. Westerly winds push surface water from the Upper Arm into the Oaks Arm and Lower Arm, setting up a return flow of bottom water. "The Narrows" limits those exchanges. It takes about 100 days for water in the Lower

[12] Lake Tahoe, which is partially in Nevada, is larger.

Arm and Oaks Arm to be completely exchanged with the Upper Arm due to wind driven currents.

7.1 Hazard Profile

Aquatic hazard concerns include toxins and invasive species.

Cyanobacteria Bloom

Blue-green algae, also called cyanobacteria, occur naturally in freshwater ecosystems and are not harmful to humans or animals when their levels are low. When cyanobacteria "blooms" and the concentrations are high, typically exacerbated by high nutrients and stagnant, warm waters, the resulting production of cyanotoxins can be harmful when touched or consumed at high levels.

The major manifestation of water pollution is the algae in Clear Lake. Although the problem appears to be largely a result of natural conditions conducive to algae growth, man's activities including land disturbance and fertilizing the soil no doubt contribute to the problem. Other pollutants, organic pesticides and mercury, found in the lake are hazardous to the fish and, in significant enough concentration, result in fish kills.

Invasive Species

Clear Lake supports considerable growth of vascular native and exotic invasive aquatic plants. Hydrilla forms mats so dense in places as to be unsuitable even for fish habitat. The lake is heavily used for recreational boating and supports sport fishing year around. Native fish have been largely replaced by introduced warm-water species, notably black bass, catfish, carp, and largemouth bass.

While invasive species such as the quagga mussel (*Dreissena rostriformis bugensis*) are not present in Clear Lake, nor other major waterways in Lake County, the threat exists and would cause devastating impacts.

A new invasive species, the Golden Mussel, was detected in the Sacramento-San Joaquin Delta (CA) on October 17, 2024. This is the first known occurrence of this high-risk-species in North America. Golden mussels, *Limnoperna fortune,* are considered one of the highest-risk invasive mollusks worldwide. They can rapidly colonize hard surfaces and cause major biofouling damage to built infrastructure such as hydroelectric and water delivery systems. Golden mussels are more effective filter feeders than zebra mussels, substantially reducing the abundance of both zooplankton and phytoplankton and leading to widespread food web impacts. Golden mussel invasions are also associated with an increased frequency of potentially toxic blooms of cyanobacteria like *Microcystis*. Golden mussels can clog

pipes, filters, and intakes in water treatment facilities, power stations, irrigation systems, and industrial plants

First discovered in 1988 in the Great Lakes, the quagga mussels have spread at an alarming rate through much of the United States by moving with the flow of water and on water vessels. Per the *2019 Quagga and Zebra Mussel Prevention Plan* written by the County of Lake, "aquatic nuisance species, such as Q/Z mussels, present a growing worldwide problem. Impacts from aquatic nuisance species can be extreme and affect ecosystems, recreation, and economics. Aquatic nuisance species infestations are generally permanent; prevention is the best strategy to combat them. Education is a critical piece to prevention as aquatic nuisance species generally need humans to move anywhere but downstream."

7.2 Location and Extent

7.2.1 Cyanobacteria Bloom

Cyanobacteria blooms are typically most serious at the eastern end of the lake where prevailing winds can push floating cyanobacteria colonies into huge mats that can rot in the sun, producing strong, noxious odors. Erosion of sediments from the upper watershed carries nutrients that contribute to cyanobacterial growth, particularly phosphorus. Recent research indicates that phosphorus in the water column of Clear Lake has been increasing over time since 1968, when water monitoring began. Combined with increases in water column temperature, cyanobacteria blooms are probably going to continue with some certainty.

Cyanobacterial blooms can cause significant reductions in safe recreation for people and animals, and decaying blooms consume oxygen which can cause fish kills and harm other wildlife. Blooms are most common in summertime and fall, when the air temperatures are hottest and people want to recreate in the lake or on the shore. The United States Environmental Protection Agency published guidelines to ensure that human safety is preserved.

Blooms occur naturally, and cyanobacteria genera are found in every freshwater and marina water body in the world; however due to increased nutrients and temperatures, global occurrences of blooms are increasing (and more frequently identified thanks to enhanced monitoring and tracking.) Specifically, blooms are promoted by anthropogenic nutrient loading from runoff of sediments, storm and agricultural waters containing nutrients such as phosphorates and nitrogen, with phosphorus being the main driver. Sewage overflows and leaking septic systems also contribute to the nutrient problem in Clear Lake.

Recent cyanobacteria monitoring data, along with historical data and sign recommendations, can be found at the Big Valley Rancheria Cyanotoxin webpage (https://www.bvrancheria.com/clearlakecyanotoxins). The most common genera of cyanobacteria that can be found in Clear Lake include the microcystin-producing *Microcystis sp*., *Gloetrichia sp*., the cylindrospermopsin- and Saxitoxin-producing *Microseria sp.* and *wollei sp.* (prev. Lyngbya), and the Anatoxin-a producing *Planktothrix sp*., *Aphanizomenon sp*. and *Phormidium sp.*

7.2.2 Invasive Species

If invasive species are allowed to infiltrate Lake County's waterways, the entire County will be at risk. Species such as the quagga or zebra mussel spread quickly and can invade water supply facilities, tributaries and more.

Invasive mussels can survive for several days on land by their ability to retain moisture. As a result, there is concern that these mussels can spread into Clear Lake by transportation on recreational boats, other boating and fishing gear. The mussels reproduce quickly, disrupting the ecosystem, and can clog drinking water intakes and motorboat engines, and litter beaches with jagged, foul-smelling shells.

An introduction of invasive mussels would devastate the economy and ecology of Clear Lake. Recreational tourism, such as fishing and boating, will be most impacted through access restrictions and implementation of mandatory and expensive decontamination, whose costs will be borne by the individual boat or business owners. Degradation of fisheries could occur as invasive mussels outcompete the existing habitat for food.

Drinking water systems will also be most impacted.

The potential location and extent of the hazard impacts to aquatic hazards within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: Chapter Seven: *Aquatic Hazards*
  - 7.1.2 Differences between County and City assessments
  - 7.2 Location and Extent
- Lakeport Annex: Chapter Seven: *Aquatic Hazards*
  - 7.1.2 Differences between County and City assessments
  - 7.2 Location and Extent

7.3 Previous occurrences

Lake County has no disaster declarations related to aquatic hazards.

Comprehensive cyanobacteria monitoring in Clear Lake has only been occurring since 2014, but in any given year, a majority of the 20 sample sites result in low trigger levels of cyanotoxins, with few locations resulting in higher, elevated concentrations of health hazard concern.

Cyanotoxin trigger levels, and recommended corresponding signage language for public access locations, is provided by the Office of Health Hazard Assessment (OEHHA) of the California EPA. OEHHA has established trigger levels as reference in *Figure 25 Trigger Levels for Human and Animal Health (Cyanotoxin).*

Figure 25 Trigger Levels for Human and Animal Health (Cyanotoxin)

Trigger Levels For Human and Animal Health				
Criteria*	No Advisory [a]	Caution (TIER 1)	Warning (TIER 2)	Danger (TIER 3)
Total Microcystins [b]	**< 0.8** µg/L	**0.8** µg/L	**6** µg/L	**20** µg/L
Anatoxin-a	**Non-detect** [c]	**Detected** [c]	**20** µg/L	**90** µg/L
Cylindrospermopsin	**< 1** µg/L	**1** µg/L	**4** µg/L	**17** µg/L
Cell Density of potential toxin producers	**< 4,000** cells/mL	**4,000** cells/mL	_____	_____
Site-specific indicator(s)	No site-specific indicators present	Discoloration, scum, algal mats, soupy or paint-like appearance. Suspected illness	_____	_____

Clear Lake is identified as an impaired water body for nutrients and mercury on the State Water Resources Control Board CWA 303d list; and on its southeastern shoreline is Sulphur Bank Mercury Mine, Superfund Site EPA #: CAD980893275, established in 1990. The Clear Lake Nutrient TMDL was adopted in 2006 and the Clear Lake Mercury TMDL was adopted in 2003. California OEHHA issued a fish consumption advisory, most recently updated in 2014, for Clear Lake due to mercury levels in fish tissues.

Swimming, boating, wading, water skiing / surfing, and other water-based recreational activities are all safe in Clear Lake with respect to mercury exposure. Mercury is found in the sediments and can pose a hazard only if someone is chronically exposed to sediments containing mercury or by overconsumption of specific species of fish from the lake.

Current efforts by the US EPA are addressing the Superfund Site Cleanup and a majority of the Phase I construction is expected to occur by 2025. More information on the Superfund Site, the Cleanup plan, and outreach and education efforts and findings, can be found here: https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0902228

7.3.1 Cyanobacteria Bloom

In 2014, the Big Valley Band of Pomo Indians Environmental Protection Department initiated a water monitoring program to evaluate cyanotoxins in Clear Lake.

In 2016, the California State Water Resources Control Board (SWRCB) began tracking blooms on public water bodies (see Table 16).

Table 16 SWRCB Harmful Algal Bloom and Illness Reports in California

Year	Bloom Reports	Illness Reports
2016	91	n/a
2017	181	n/a
2018	190	19
2019	241	22
2020	370	
2021	603	
2022	684	
2023	468	
(Tracking California, n.d.)		

7.3.2 Invasive Species

None to date.

7.4 Probability of Future Events

Table 17 Probability of Future Aquatic Hazard Events

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Biological Hazards: **Aquatic Invasive Species**	Extensive	Likely	Limited	High	High
Aquatic Biological Hazards: **Quagga/ Zebra Mussels**	Extensive	Highly Likely	Critical	High	High
Aquatic Biological Hazards: **Nutria**	Limited	Unlikely	Limited	Medium	High
Aquatic Biological Hazards: **Invasive Aquatic Plants**	Extensive	Likely	Negligible	High	High
Aquatic Biological Hazards: **Invasive Aquatic Plants (Primrose)**	Extensive	Likely	Negligible	High	High
Aquatic Biological Hazards: **Invasive Aquatic Plants (Hydrilla)**	Significant	Occasional	Critical	High	High
Aquatic Biological Hazards: **Invasive Aquatic Plants (Water Hyacinth)**	Limited	Occasional	Negligible	Minimal	High
Aquatic Biological Hazards: **Invasive Aquatic Plants (South American Sponge Plant)**	Limited	Occasional	Negligible	Minimal	High

7.4.1 Cyanobacteria Bloom

Highly Likely – (For scale detail refer to probability in *Section 2.2.1 Priority*.)

Cyanobacterial bloom is an annual event in Clear Lake. The severity of blooms varies by year, but are most likely associated with rain and temperatures the previous winter, with less precipitation and warmer winters associated with more bloom events of higher severity. Biologists predict that this phenomenon is likely to recur for an unknown length of time.

Comprehensive cyanobacteria monitoring in Clear Lake has been occurring only since 2014, but in any given year, most of the 20 sample sites result in low trigger levels of cyanotoxins, with few locations resulting in higher, elevated concentrations of health hazard concern.

7.4.2 Invasive Species

Likely – (For scale detail refer to probability in *Section 2.2.1 Priority*.) Quagga and/or zebra mussels can enter Clear Lake through transport on visiting or local watercraft. Should these mussels become established in Clear Lake, they would represent a potentially significant cost to water utilities as they have to similar water districts across the nation. If these mussels infect Clear Lake, there will be an increased risk of contaminated waterbodies downstream, and throughout the Sacramento River Systems and the Delta, similar to how the Colorado River served as a carrier to Southern California.

According to the 100th Meridian Initiative no practical technologies or biocides are available to remove these mussels once entered a water body. As a result, preventing infected boats from entering Clear Lake appears to be the only countermeasure.

7.5 Impacts of Climate Change

Climate change and a warming world also includes warming waters. As daytime and nighttime temperatures increase raising temperatures of Clear Lake, the warmer waters allow cyanobacterial blooms to continue through fall. In 2021, cyanotoxins were at concerning levels into December, which impacts public and private water systems. Over 60% of Lake County residents receive their drinking water from Clear Lake; for those not using public water systems for household waters, testing for contaminants such as cyanotoxins is not regularly completed, endangering public health.

Climate change can also allow non-native and invasive species to flourish, and also impacts native fisheries and habitats by decreasing water flows or disconnecting streams from larger water bodies during spawning season. Warming waters also

increase episodes of dissolved oxygen events, killing native and recreational fish as water oxygen levels plummet.

7.6 Secondary Hazards

Contaminated Drinking Water – Clear Lake is a source of water for public water systems and individual homeowners.

> ***Cyanobacteria Bloom****:* While current public water treatment processes have been successful filtering out toxins to safe levels, future toxin levels may break through the treatment process and be detected in the finished water. The risk to individual water systems remains high as smaller self-supplied systems are unable to effectively remove cyanotoxins.
>
> When higher concentrations of harmful algal blooms (HABs)are detected in areas where self-supplies systems draw water, the Public Health Officer issues a "Do Not Drink" Notice for tap water. Most recently this occurred in 2021, and alternate sources of tap water were set up for impacted homes.
>
> ***Invasive Species****:* The presence of quagga mussels or other invasive species can impact functionality and operability of public and private water systems. Mussels can clog pipelines and water intakes. The cost to provide maintenance and cleaning for drinking water intakes is significant and will probably bankrupt several of the smaller systems around the lake and impact individual self-supply systems. Research indicates range costs between $11.36 - $24.36 per Mgal for Public /Commercial Water Treatment Facilities and $1,345 - $7,348 per Mgal treated for self-supplied systems.

Degraded Recreational Lake Use – Lake County relies on tourism dollars, heavily centered on use of Clear Lake for recreational fishing and boating. Aquatic hazards impact fish populations.

> ***Cyanobacteria Bloom****:* Regardless of the presence of harmful toxins, the odor produced by decaying blooms deters visitors and impact the aesthetics around the shoreline. At its worst, the toxicity to pets, wildlife and potential for harm to humans (generally by way of rashes and flu-like symptoms), further deters visitors. Areas that have an active bloom are generally unusable.
>
> ***Invasive Species****:* The presence of quagga mussels or other invasive species impacts boaters and causes increased costs from mussels growing on hulls,

engines and steering components. Beaches/shoreline can become unusable due to sharp shells and the odor of dead mussels.

7.7 Exposure & Vulnerability

Vulnerability—High (Refer to *Section 4.1.2 Vulnerability* for scale detail.) Increased since the 2018 Plan Update due to drought conditions.

7.7.1 Population

Clear Lake is the source of drinking water for more than 45,000 community residents (up to 60% of the County). The lake is also home to many bass tournaments because of its prize fishing, and residents and tourists alike enjoy various forms of boating and recreation on the lake.

Cyanobacteria can produce toxins that can be harmful for animals and people when consumed at high levels. Residents along the impacted shoreline report severe odors as well as nonspecific ocular irritation and hay-fever-like symptoms, although cyanobacteria can impact different individuals in different ways, and much like allergies, can vary from mild to severe depending on the individual and level of exposure.

7.7.2 Property

Continued widespread and persistent cyanobacterial blooms may adversely affect lakeside property values and the desirability to visit and recreate at Clear Lake. Non-native aquatic vegetation has been demonstrated to adversely affect real estate values of shoreline property in the County. Future developments could be impacted by the noxious presence of cyanobacteria in Clear Lake, affecting tax bases and economic development improvements.

7.7.3 Critical Facilities & Infrastructure

Public and private water systems rely on Clear Lake. Cyanobacterial toxins and invasive species threaten drinking water for more than 45,000 residents. Once established, invasive mussels can clog water intake and delivery pipes; dam intake gates and pipes; adhere to boats, pilings, and most hard and some soft substrates, and litter beaches and shores with jagged, foul-smelling shells. Should quagga mussels reach Lake County and Clear Lake the economic impacts would be substantial and potentially unaffordable for most of the treatment providers around the lake.

CHAPTER EIGHT: Drought

Figure 26 Photo of drought impacts on Clear Lake from Lakeport, facing Mt. Konocti late 2022. Photo Courtesy of City of Lakeport.

Drought is a gradual phenomenon of a prolonged period of abnormally low rainfall, leading to a shortage of water. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends, nor is it easy to predict or prepare for how a drought can impact different watersheds and aquifers.

8.1 Drought: Hazard Profile

Water service districts normally require at least a 10-year planning horizon to implement a multiagency improvement project to mitigate the effects of a drought and water supply shortage.

Drought is a complex issue involving many factors, occurring when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects:

- *Meteorological drought* is usually defined by a period of below-average water supply.

- *Agricultural drought* occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock.
- *Hydrological drought* is defined as deficiencies in surface and subsurface water supplies. It is generally measured as streamflow, snowpack, and as lake, reservoir, and groundwater levels.
- *Socioeconomic drought* occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.
- *Ecological drought* is when natural ecosystems are impacted by drought.

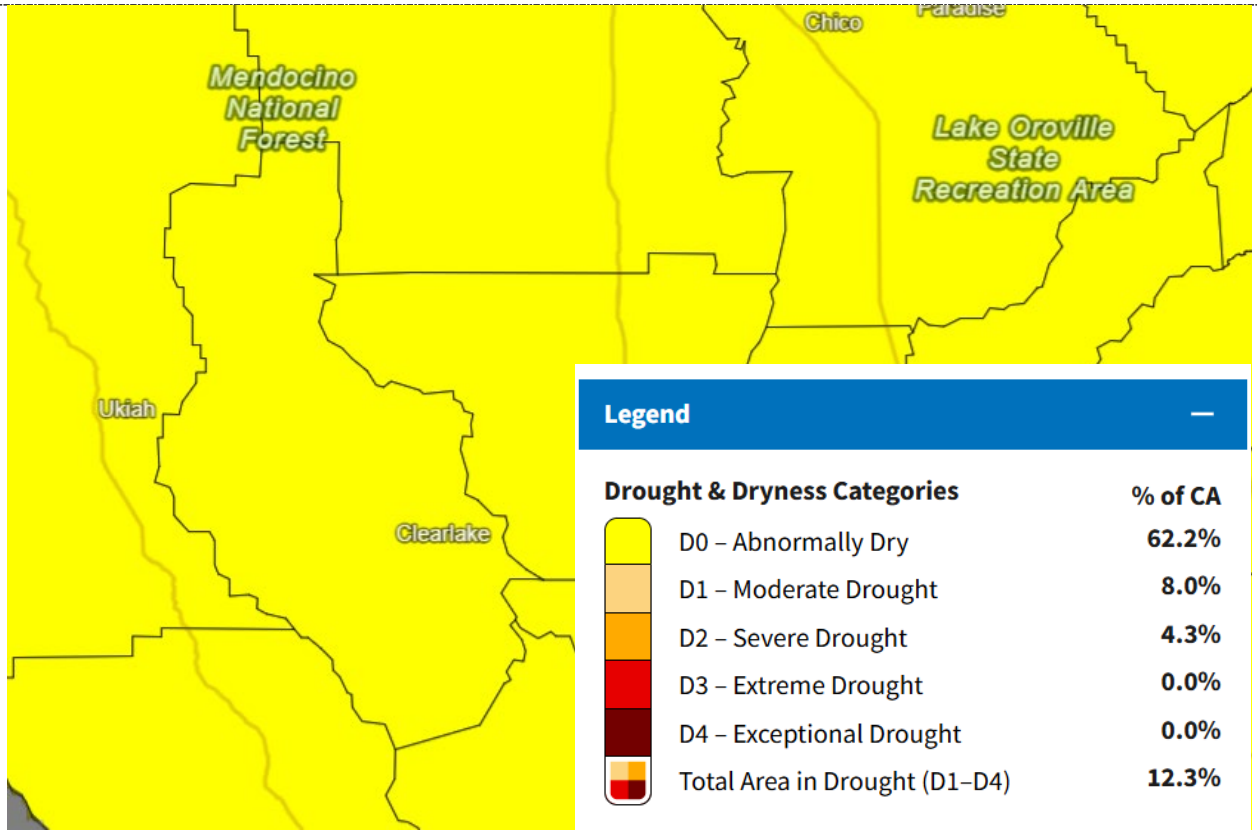
The drought issue in California is further compounded by water rights, the legal permission to use a reasonable amount of water for a beneficial use. Water in California is protected for the use and benefit of all Californians. Waters within the borders of California cannot be owned by an individual, governmental agencies, business or group. The California State Water Resources Control Board issues permits, licenses, and registrations, allowing individuals and others the right to use our water resources for beneficial reasons. The prioritization of water rights between farming and federally protected fish habitats in California contributes to this issue.

8.2 Location and Extent

Drought has and will continue to potentially affect the entire Lake County Planning Area. Historical droughts including the droughts of 1976 and 2014 have resulted in different and widespread impacts throughout the entire community. *For detailed community information refer to 3.2 Planning Area Communities; for a visual refer to Figure 5: Map of Lake County Cities, Towns, Communities, and Highways*.

The National Drought Mitigation Center produces drought monitor maps for the United States. It classifies droughts into five categories: D0 is the least severe, with abnormally dry conditions; and D4 is the most severe, with exceptional drought conditions. An example of drought extent in Lake County during the peak of the most recent drought is shown in Figure 27.

Figure 27 Lake County Drought Classification During the Last Drought



Drought impacts are wide-reaching and may be economic, environmental, and/or societal. The most significant impacts associated with drought in the Planning Area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. In addition, allocations during a drought are reduced and water costs increase, which results in reduced water availability.

Voluntary conservation measures are a normal and ongoing part of system operations and are actively implemented during extended droughts. A reduction of electric power generation and water quality deterioration are also potential problems.

Approximately 60% of Lake County residents depend on Clear Lake as their source of drinking water. Not only does drought impact the already shallow lake, but prolonged drought conditions also increase harmful algal blooms (HABs).The drinking water infrastructure cannot keep up with the heightened risk and spread of HABs we have been seeing during this drought.

Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding and erosion.

Another impact drought has throughout the Lake County Planning Area is the impact to aquifers, the water below the surface of earth. Drought can impact groundwater by lowering groundwater levels, resulting in dry wells and potential impacts to surface water.

The potential location and extent of the hazard impacts to drought within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: Chapter Eight: *Drought*
  - 8.1.2 Differences between County and City assessments
  - 8.2 Location and Extent
- Lakeport Annex: Chapter Eight: *Drought*
  - 8.1.2 Differences between County and City assessments
  - 8.2 Location and Extent

8.3 Previous occurrences

Three state drought disaster declarations have included Lake County:

- 1976-1977: While storage reservoirs had been built in previous years, this drought resulted in major reduction of available water supplies. Clear Lake hit record low lake levels during this drought.
- 2014: Statewide impact to all counties.
- 2020: Initially, precipitation was below average while temperatures were above average.
- 2021 through spring 2023. 2021 was the second driest on record statewide.

8.4 Probability of Future Events

8.4.1 Drought

Likely— (For scale detail refer to probability in *Section 2.2.1 Priority*.) Historical drought data for the Lake County Planning Area and region indicate 5 significant droughts in the last 84 years. This equates to a drought every 16.8 years on average or a 6.0% chance of a drought in any given year. However, based on this data and given the multi-year length of droughts, the HMPC determined that future drought occurrences in the Planning Area are likely.

8.4.2 Water Shortage

Occasional — (For scale detail refer to probability in *Section 2.2.1 Priority*.) Recent historical data for water shortage indicates that Lake County may at some time be at risk of both short and prolonged periods of water shortage. Based on this it is

possible that water shortages will affect the County in the future during extreme drought conditions. However, to date, Lake County has continued to have relatively consistent water supply.

Based on historical information, the occurrence of drought in California, including Lake County, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users including surface water and groundwater.

8.5 Impacts of Climate Change

Climate scientists studying California find that drought conditions are likely to become more frequent and persistent over the 21st century due to climate change. The experiences of California during recent years underscore the need to examine more closely the state's water storage, distribution, management, conservation, and use policies. In 2021, 30 household drinking water wells in Lake County were reported to the CA Dept of Water Resources as having gone dry. As most people do not make a report to the State database, we can assume the number of household wells that went dry last year was at least twice that number, if not more.

Climate change can also cause water conveyance infrastructure to collapse, shift, and/or rupture due to expansive soils (clay) that are prevalent in Lake County, costing public and private water systems high repair bills. Additionally, water intake systems that draw from Clear Lake have incurred high costs to extend further out into Clear Lake due to drought conditions.

8.6 Drought: Secondary Hazards

Drought is a major determinant of wildfire hazard because it increases the burn season and fuels, and reduces water availability. Additional secondary hazards include an increased risk to trees from beetle kills and other drought-related issues. Water quality deterioration and increased cyanobacterial bloom are also potential problems. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding.

According to the *2018 California Hazard Mitigation Plan*, drought amplifies the risk of loss of biodiversity, impacting animal and plant species who struggle to endure drought.

8.7 Drought: Exposure & Vulnerability

Vulnerability—High (Refer to *Section 4.1.2 Vulnerability* for scale detail.) Unchanged since 2018 Plan Update.

8.7.1 Population

The vulnerability of Lake County to drought is countywide, but impacts may vary and include reduction in water supply, agricultural losses, and an increase in dry fuels.

Adequate water is the most critical issue for ecological, agricultural, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

8.7.2 Property

The drawdown of the groundwater table is one factor that has been recognized to occur during repeated dry years. Lowering of groundwater levels results in the need to deepen wells, which subsequently lead to increased pumping costs. These costs are a major consideration for residents relying on domestic wells and agricultural producers that irrigate with groundwater and/or use it for frost protection.

8.7.3 Critical Facilities & Infrastructure

The most significant qualitative impacts associated with drought in the Planning Area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Mandatory conservation measures are typically implemented during extended droughts.

Small water systems are vulnerable to complications from drought, especially when lacking a reliable water source. As Clear Lake levels decline, water systems that rely on the lake are impacted. Increased nutrient enrichment, resulting in more frequent and severe cyanobacteria blooms, otherwise known as harmful algal blooms (HABs), are more likely to occur in drought periods. In general, Clear Lake water column temperatures have increased since 1968, along with the main driving nutrient of phosphorus.

CHAPTER NINE: Flood

Figure 28 Historical photo of the Keys flooding in 1983.

Flooding is the rising and overflowing of a body of water onto normally dry land. History clearly highlights floods as one of the natural hazards impacting Lake County. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide.

Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. Three floods are referenced:

- **1% (or 100-year) Flood**: In its common usage, the floodplain most often refers to that area that is inundated by the 1% annual chance (or 100-year) flood, the flood that has a 1% chance in any given year of being equaled or exceeded. The 1% annual chance flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program.
- **500-year Flood:** The flood that has a 0.2% chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain.
- **Localized:** A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

9.1 Flood: Hazard Profile

Flood hazard zones in Lake County are defined by FEMA and can be analyzed using data from the National Flood Hazard Layer (NFHL), available to download from %FEMA's website. The 100-year flood zone, also referred to as the base flood or the 1% annual chance flood, is identified by combining Zone A, Zone AE, and Zone AO, and includes the zones considered high-risk for flooding. These zones are depicted on Flood Insurance Rate Maps (FIRM) or Flood Hazard Boundary Maps, which provide a detailed visualization of flood risk levels within a community.

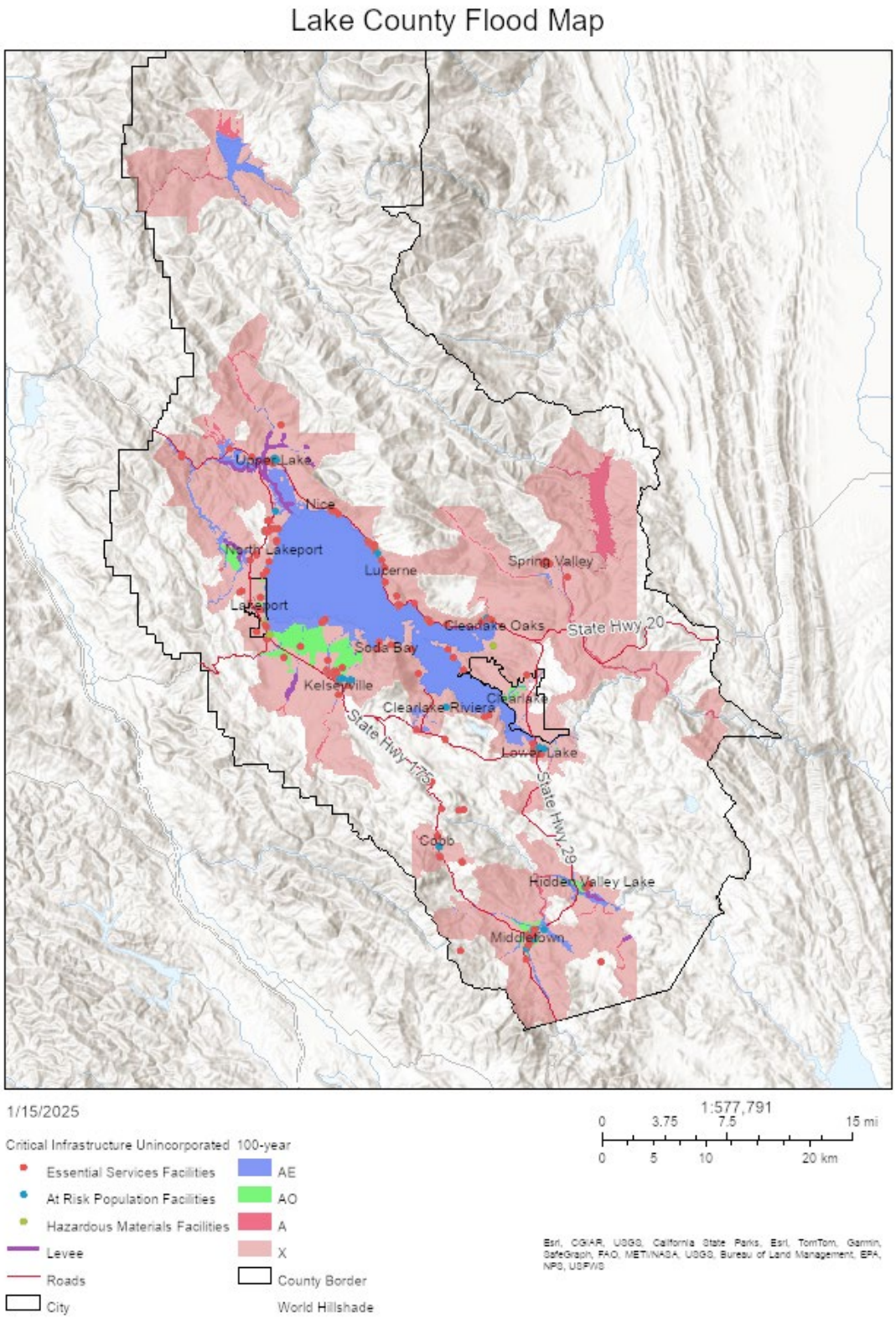
Flood zones reflect varying degrees of flood risk:

- *Zone A:* Areas with a 1% annual chance of flooding, where base flood elevations have not been determined.
- *Zone AO*: Areas with shallow flooding (typically 1-3 feet) caused by sheet flow, where average flood depths are specified.
- *Zone AE*: Areas with a 1-perent annual chance of flooding where base flood elevations have been established.
- *Zone X (Shaded)*: Areas of moderate flood hazard, typically between the 100-year and 500-year flood limits.
- *Zone X (Unshaded):* Areas with minimal flood hazard beyond the 500-year floodplain, where the risk of flooding is very low but not entirely absent.

Flood hazard areas are regions expected to be inundated during the 1% annual chance flood event. This event is commonly referred to as a "100-year flood," but it is important to note that the probability of such an event occurring does not diminish year to year—it remains a 1% chance annually.

The FEMA Flood Hazard and Risk Data Viewer provides the ability to view flood information at a community level. Figure 29 below shows Lake County's 100 Year Flood Map and Figure 30 show the NFIP Zones.

Figure 29: Lake County Flood Map



9.2 Location and Extent

Drainage from the northern part of Lake County is westward, directly to the ocean, and drainage in the central and southern sectors is eastward to Clear Lake, which eventually ends up in the Sacramento River. Lake County encompasses multiple rivers, streams, creeks, and associated watersheds. Lake County crosses six watersheds:

- Upper Eel Watershed
- Middle Fork Eel Watershed
- Russian Watershed
- Upper Stony Watershed
- Upper Cache Watershed
- Upper Putah Watershed

Lake County contains an abundance of streams and lakes. Cole Creek, Adobe Creek, Anderson Creek, Copsey Creek, Coyote Creek, Dry Creek, Herndon Creek, Kelsey Creek, North Fork Cache Creek, Puta Creek, Schindler Creek, Scotts Creek, and St. Helena Creek all run through areas of the County. Clear Lake, Pillsbury, and Indian Valley Reservoir are the principal bodies of water in Lake County.

- **Clear Lake**, the largest freshwater lake entirely in California, covers an area of 64 square miles at a normal lake level of 1,320 feet. Its principal tributaries are Scotts, Middle, Clover, Kelsey, and Adobe Creeks. The creeks enter the north end of the lake by way of Rodman Slough, Kelsey Creek, and Adobe Creek. Outflow from the lake is controlled by a small dam on Cache Creek. Active storage capacity is defined by a court decree that sets upper and lower stages.

    - The **Rumsey Gauge** is a measurement system used to track the water levels of Clear Lake by establishing a scale relative to a designated zero point.

      The Rumsey Gauge was introduced in the 19th century by Captain DeWitt Clinton Rumsey, a local surveyor, as a standardized method for measuring Clear Lake's water levels. The scale is based on the elevation of the lake's natural outlet at Cache Creek. This point corresponds to the lowest water level at which water can flow naturally out of Clear Lake into Cache Creek. When the gauge reads "0.00' (feet) Rumsey," it indicates the lake's natural outlet is just at capacity for water outflow. Positive readings indicate that the water levels are above the outlet threshold and the lake is spilling into Cache

Creek. A negative reading indicates that no outflow is occurring. A reading of 7.56 Rumsey is considered a "full" lake. When the lake is "full" the outlet capacity of Cache Creek is limited to 2,540 cubic feet per second.

Per the Lake County Water Resource Historic Water Levels memo dated June 2022, statistically[13], the following peak flood levels can be expected on Clear Lake:

- 10% chance year 10.04 feet
- 2% chance year 11.74 feet
- 1% chance year 12.34 feet
- 0.2% chance year 13.84 feet

Levels above 8.0' Rumsey are considered flood stage, and trigger flood control measures.

- **Lake Pillsbury**, a power and irrigation project in the Eel River drainage, is situated in the northwest corner of the county. The reservoir has a surface area of approximately 3 square miles, a lake level of approximately 1,800 feet, and a storage capacity of 87,000 acre-feet.

- **Indian Valley Reservoir** is a multiple purpose project located 11 miles upstream from the mouth of North Fork Cache Creek. It has a surface area of approximately 6 square miles, a storage capacity of 300,000 acre-feet, and a gross pool elevation of 1,485 feet.

Other smaller bodies of water in Lake County are Upper and Lower Blue Lakes, Thurston Lake, Borax Lake, Little Borax Lake, and Highland Lake. Some of the lakes at higher elevations are intermittent.

Localized flooding may occur anywhere rainfall exceeds the capacity of drainage systems. Across Lake County, areas known to be subject to this most often include the following:

[13] Actual flood levels depend on a variety of characteristics including the level of the lake and ground saturation prior to the event onset.

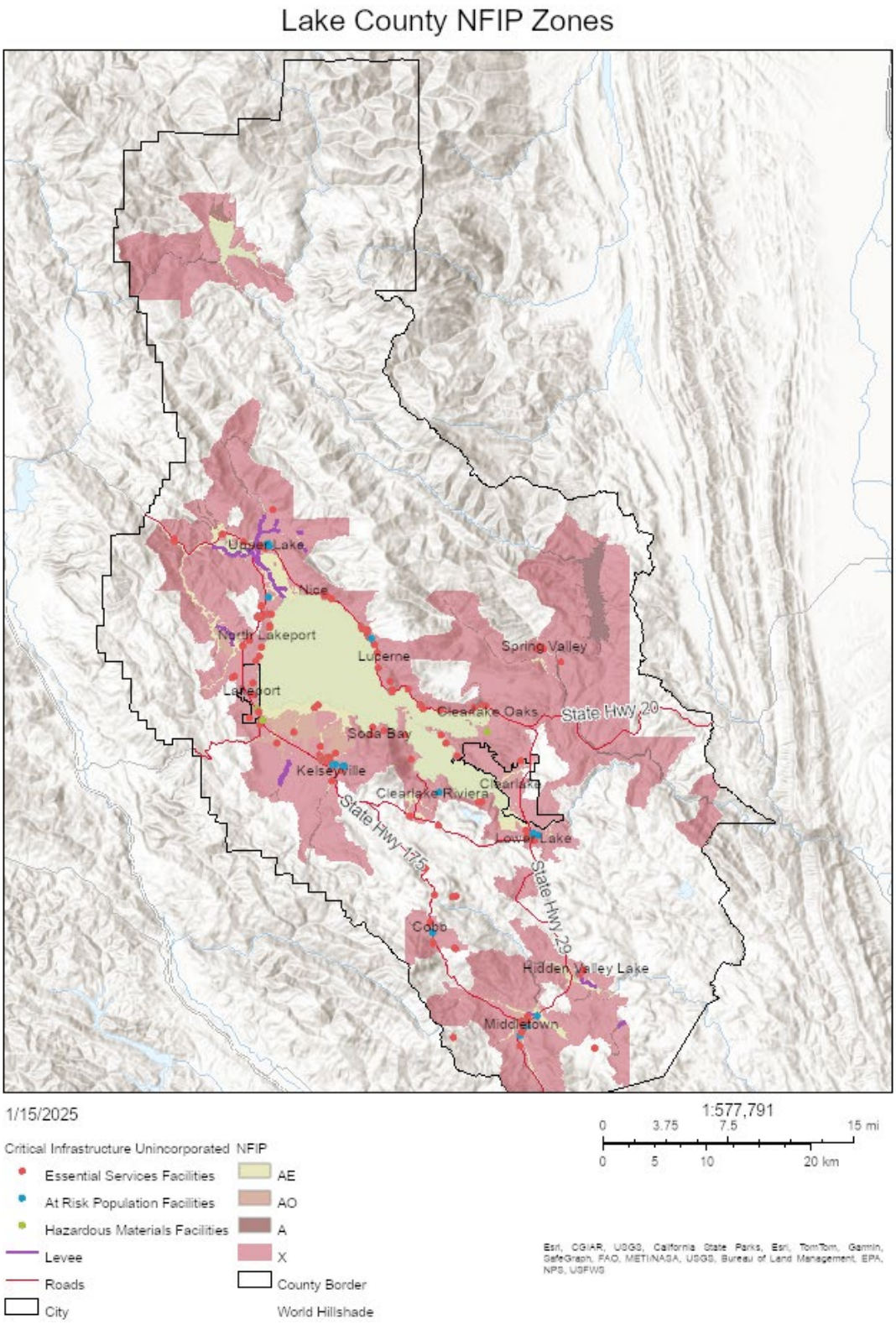
- Nice / Lucerne Cutoff
- Scotts Valley Road
- Hill Road
- New Long Valley Road
- Island Drive
- Keys Blvd.
- Lake Street
- St. Francis
- Soda Bay Road
- Lands End Drive
- Clearlake Keys Community
- Lands End Community
- Corinthian Bay Community

For detailed community information refer to Section 3.2 Planning Area Communities; for a visual refer Figure 28 which shows the NFIP flood zones in Lake County.

The potential location and extent of the hazard impacts to flood within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: Chapter Nine: *Flood*
  - 9.1.2 Differences between County and City assessments
  - 9.2 Location and Extent
- Lakeport Annex: Chapter Nine: *Flood*
  - 9.1.2 Differences between County and City assessments
  - 9.2 Location and Extent

Figure 30 NFIP Flood Zones in Lake County



9.2.1 Extent

Flooding in Lake County results from prolonged heavy rainfall over tributary areas typically during the period from November through March. Flooding is more severe either when antecedent rainfall has caused saturated ground conditions or when the ground is frozen in the higher elevations and infiltration is minimal. On rare occasions, melting snow could augment runoff from general rain.

Rain flooding on streams is characterized by high peak flows with durations of 2 to 3 days. On Clear Lake, lake stage could continue above flood level for many days. In the northern sector of the County, floods in the Eel River drainage would be extremely rare events and, due to the lack of development, damage potential is minimal. The outlets of Lake Pillsbury are normally open during the winter and closed during spring to store for power and irrigation. The channel downstream can contain all high flows that could reasonably be expected.

Of the streams, tributaries to Clear Lake, Scotts, Cole, Kelsey, and Adobe Creeks have the most serious flooding problems. These streams also contribute significantly to high lake stages and lakeshore flooding. Wind sets may increase the depth and extent of shoreline flooding, but the most important factor is inadequate outlet capacity, which increases and prolongs high lake stages.

Clear Lake Dam is capable of impounding water in the lake to an elevation of 10.3 feet on the Rumsey gauge (located on the city wharf in Lakeport) or approximately 1,329 feet above the National Geodetic Vertical Datum 1929 (NGVD). The gauge datum is 1318.26, and lake stages are converted to elevations above NGVD by adding this figure.

Orders of the Superior Court of the State of California in and for the County of Mendocino set limits to raising the level of Clear Lake (noted in the FIS as M.M Gopcevic et. al. versus Yolo Water and Power Company, a corporation et. al., October 7, 1920). These orders prohibit raising Clear Lake above 7.56 feet above zero on the Rumsey Gauge; the level may be raised above 7.56 feet but not above 9.00 feet for a period not exceeding ten successive days during storms.

It is not physically possible to operate within these limits because outflow is restricted by the Grigsby Riffle, a natural restriction on the outlet channel upstream of the dam. To reduce flooding, efforts were made in 1938 to reduce the restriction at the Grigsby Riffle. However, the courts stopped these actions. The Superior Court of the State of California in and for the County of Yolo prohibited changing the outlet of Clear Lake to increase the flow of waters from Clear Lake into Cache Creek (noted in the FIS as Mary E. Bemmerly and Agnes H. Bemmerly versus the County of Lake et. al., December 18, 1940).

In essence, the effect of the court orders is to prolong flood stages and prevent their rapid reduction. Flood conditions along the lakeshore may continue for as long as 90 days.

Flood problems along Cache Creek downstream from Clear Lake are largely confined to the main stem reach in the vicinity of Lower Lake and along the lower reaches of North Fork Cache Creek. In the Putah Creek basin, the principal flood problems are in Coyote and Collayami Valleys and in Middletown.

Localized, stormwater flooding occurs throughout the County during the rainy season from November through April. In addition to flooding, damage to these areas during heavy storms can include pavement deterioration, washouts, landslides/mudslides, debris areas, and downed trees. The amount and type of damage or flooding that occurs varies from year to year, depending on the quantity of runoff.

9.3 Previous Occurrences

- **Clear Lake** Since 1873, levels above 8.0 Rumsey were recorded in 22 months (the most recent: February 2024), and at 9.0 or more on the following dates:

Year	Month	Level
1876	March	12.37
1878	March	12.39
1880	April	10.08
1881	February	10.25
1890	January	13.66
1893	March	9.70
1895	January	12.25
1902	March	9.98
1904	April	11.91
1906	April	9.66
1907	March	11.64
1909	February	13.38
1911	March	9.09
1914	January	11.12
1915	February	10.68
1927	February	9.00
1938	February	10.25
1942	February	9.6
1956	February	9.53
1958	February	10.86

Year	Month	Level
1965	January	9.03
1970	January	10.37
1974	April	9.10
1980	February	9.61
1982	April	9.17
1983	March	11.32
1986	February	11.34
1995	March	10.72
1998	February	11.44
2011	March	9.37
2017	February	10.58
2019	March	9.91

- **February 2nd to 28th, 1998** –Flooding around Clear Lake caused over $5 million in damages, over 60 flooded homes, and the evacuation of some residents for weeks. Rainfall rates of 4 inches in 6 hours were observed at the onset of the flooding, and at the peak, Clear Lake reached 2.5 feet above flood stage. The flooding continued into March and April. State Route 20 was closed for weeks. No deaths or injuries were reported.
- **January 1st to 3rd, 2006** – A series of warm winter storms brought heavy rain, mudslides, flooding, and high winds to Northern California. Three deaths occurred due to these storms. Counties declared in need of federal disaster assistance were Alpine, Amador, Butte, Colusa, El Dorado, Lake, Nevada, Placer, Plumas, Sacramento, San Joaquin, Shasta, Solano, Sutter, Yolo, and Yuba.
- **December 11, 2014** – An atmospheric river event beginning early December 11th brought periods of heavy rainfall, flooding from overly saturated grounds and high river/stream water levels. On December 22, Governor Brown declared a state of emergency for heavy rain, flooding and wind damage in counties including Tehama, Lake, Shasta, and Yolo. Flooding was reported in Clearlake, bringing significant and widespread damage. Neighborhoods were evacuated. Roads were damaged. Extensive road repair and debris removal was required. No deaths or injuries were reported.
- **February 2, 2017** – Flooding of Clear Lake brought the closure of multiple roads: Lakeshore Boulevard at several locations in north Lakeport, Nice-

Lucerne Cutoff, Keys Boulevard, St. Francis Drive, and Lands End Drive. There were several additional roads throughout the county that were closed due to slides, slip-outs and debris, however those were temporary until the road was repaired or material was removed. Clear Lake's level stayed in flood stage for a month and led to mandatory evacuations in parts of the city of Lakeport. Lake County Public Works Director said early assessments suggested damage to county-maintained roads ranged between $5 million and $7 million. No deaths or injuries were reported in Lake County.

- **2018 – Current** – No significant flooding events.

9.4 Probability of Future Events

1% Annual Chance Flood

Occasional—The 1% annual chance flood (100-year) is the flood that has a 1% chance of being equaled or exceeded in any given year. This, by definition, makes the likelihood of future occurrence occasional. However, the 100-year flood could occur more than once in a relatively short period of time.

0.2% Annual Chance Flood

Unlikely—The 0.2% annual chance flood (500-year) is the flood that has a 0.2% chance of being equaled or exceeded in any given year. This, by definition, makes the likelihood of future occurrence unlikely.

Localized (Storm Water) Flood

Highly Likely—With respect to the localized, storm water flood issues, the potential for flooding may increase as storm water is channelized due to land development. Such changes can create localized flooding problems in and outside of natural floodplains by altering or confining natural drainage channels.

Urban storm drainage systems have a finite capacity. When rainfall exceeds this capacity or systems clog, water accumulates in the street until it reaches a level of overland release. With older infrastructure, this type of flooding will continue to occur on an annual basis during heavy rains.

For additional detail refer to probability in Section 2.2.1 Priority.

9.5 Impacts of Climate Change

Flooding has always been a concern in Lake County, particularly in shoreline communities and communities that rely on levees to protect homes and lives. In 2011, the US Geological Survey released the "ARkStorm" (Atmospheric River + k = 1,000 year Storm event) scenario based on the devasting floods after the 1861-1862 winter that saw back-to-back atmospheric river storms for a 43-day period, causing a 300-mile-long inland lake destroying Sacramento and many towns in the Central Valley. As the climate continues to warm, the ability of the atmosphere to hold and transport more moisture increases, raising the chances of another, or more frequent and intense, ARkStorm.

Additionally, climate change is causing weather events to be more complex. The American Meteorological Society (AMS) reports on "compound events" – where climate change causes two extreme things to happen at the same time or consecutively. For instance, in the winter of 2015 (December 2014 through February 2015), after years of severe drought in Lake County, a large atmospheric river storm dropped excessive amounts of rain over a 36-hour period. Because soils were parched, most rain water ran off, causing localized flooding and rapid vegetation growth. Later that year, Lake County was devastated by several massive wildfires, ushering in the new age of "mega fires" in California.

If an ARkStorm were to occur in Lake County, the impacts could be catastrophic. Clear Lake and its tributaries may flood, inundating drinking water and sanitary sewer systems, contaminating home wells, destroying homes and roads, and communications infrastructure.

9.6 Flood: Secondary Hazards

9.6.1 Public Health

Flood events, post-flood complications, and other public health concerns related to flooding can pose significant health hazards to individuals and communities.

- **Flood Water** – Flood waters often contain various contaminants, including pathogens, toxic chemicals, and debris, which can cause a range of health problems.
    - One of the primary health hazards associated with flood water is exposure to **pathogens**, such as bacteria, viruses, and parasites. Flood water can be contaminated with sewage and other human waste,

leading to the spread of diseases like cholera, typhoid fever, and hepatitis A.
    - Floods can increase the population of disease-carrying mosquitoes, leading to the spread of diseases like malaria and dengue fever. Traditionally, this takes place in more humid and hot climates where zoonotic vectors are more prevalent, but with the extreme weather conditions, it is possible in Lake County.
    - Flood water can also contain **toxic chemicals**, such as pesticides, herbicides, and industrial waste, which can cause serious health problems, including respiratory issues, skin irritation, and cancer. Exposure to these chemicals can occur through skin contact, ingestion, or inhalation, making it critical to avoid contact with flood waters and properly dispose of any contaminated materials.
    - Floodwaters carry anything that was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Floodwaters saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as *e. coli* and other disease-causing agents.
- **Post-Flood Complications**: Post-flood complications can also pose health risks.
    - **Mold growth** is a common problem in flooded buildings, and exposure to mold can cause respiratory issues and other health problems. Flood water can saturate building materials such as drywall, insulation, and carpeting, providing an ideal environment for mold spores to grow and thrive. Mold spores can begin to grow within 24 to 48 hours of exposure to moisture, so it is critical to begin drying out flooded buildings as soon as possible to prevent mold growth.
    - Individuals participating in **post-flood cleanup** efforts may be at risk of injury, including cuts, burns, and infections. Proper cleanup and remediation are critical to addressing mold growth in flooded buildings. This may include removing contaminated materials, drying out the affected area, and using specialized cleaning techniques to remove

mold and prevent its growth. It is important to consult with a professional mold remediation specialist to ensure that the cleanup is done safely and effectively.
    - **Stagnant Water** – Stagnant pools can become breeding grounds for mosquitoes.
    - **Forced Air System Ducts** – When heating ducts in a forced air system are not properly cleaned after inundation and the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants.
    - **Public Water System** – a boil order may be issued to protect people and animals from contaminated water.
- **Potential Interruption of Medical Services**: Floods can disrupt hospitals and other healthcare facilities, making it challenging to access medical care. Additionally, floods can cause power outages, leading to the loss of refrigerated medications and other critical medical supplies.
- Floods can interrupt the delivery of **medical supplies and medications**, making it difficult for people with chronic illnesses and medical conditions to access the care they need.

9.7 Flood: Exposure & Vulnerability

Vulnerability—Extremely High (Refer to *Section 4.1.2 Vulnerability* for scale detail.) Remains unchanged since the 2018 Plan Update, however progress has been made with the Middle Creek Project. Once complete, this project will significantly alleviate flood concerns on the north shore of Clear Lake.

Flooding has occurred both within the 1% and 0.2% annual chance floodplains and in other localized areas. The vulnerability of the County to severe flooding is **extremely high** as it can result in significant economic impacts to the County. Past flooding and high lake levels have shut down Clear Lake for six months at a time.

Historically, much of the growth in the County has occurred adjacent to Clear Lake, rivers, or streams, resulting in significant damages to property, and losses from disruption of community activities during periods of flooding. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in storm water runoff. Other problems connected with flooding and storm water runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

9.7.1 Population, Property, Critical Facilities & Infrastructure

Lake flooding poses the greatest threat to the lakeshore communities adjacent to Clear Lake, Lake Pillsbury, Blue Lakes, and the area near Indian Valley Reservoir. The greatest concentration of these communities is located adjacent to Clear Lake, where more than half of the 71-mile rim has been developed. The primary danger is property damage rather than loss of life due to the ample warning time generally available.

Community detention and diversion structures are vulnerable when the Clear Lake level rises above 7.56 feet at the Rumsey Gage. These structures include sanitation district ponds, levees and other critical structures.

An analysis of flooding included in the 2000 Lake County Flood Management Plan[14] and reviewed for current validity by the HMPC is shown in Table 18.

City specific flood analysis is in Clearlake Annex: *Chapter Nine – Flood* and Lakeport Annex: *Chapter Nine – Flood*. Section 9.7.1 outlines the impact to city level critical infrastructure and Section 9.7.2 discusses the repetitive loss areas.

Table 18 Water Body Flood Analysis

Water Body	**Flood Hazard**	**Impact**
Clear Lake Limited flow causes Clear Lake to rise rapidly and lower more slowley after rains stop.	Frequent flooding, usually of long duration. High winds can cause large waves.	Many homes (>3,500) subject to flooding and/or loss of access for extended periods. Wave damage. Large inflows to sanitary sewer systems cause overflows and contamination. Repetitive Loss area.
Cole Creek Because of the limited channel capacity, overflows occur nearly every year, with extensive	Overflows frequently north of Konocti Road Bridge.	Numerous structures along Sylar Lane and Blue Court are subject to shallow flooding for short periods. Green Acres area (Clark Drive) is subject to

[14] The 2000 Lake County Flood Management Plan is the current plan. Due to its age, information was carefully reviewed and updated within the HMP for relevancy and currency.

Water Body	**Flood Hazard**	**Impact**
sheet flow occurring during major flood events.		up to several feet of sheet flow flooding, with some areas subject to flooding of several days to weeks. Flows increase significantly near Soda Bay Road when Kelsey Creek overflow joins Kelsey Creek (35-year +/- event). Repetitive Loss area.
Adobe Creek Soda Bay Road has shoulder damage due to flooding in 1995 and 1997.	High flows leave channel north of HWY 29 and south of Bell Hill Road. Approximate flood zone south of Bell Hill Road.	Flooded areas include the community of Finley (residential and commercial development with 30 to 40 mostly pre-FIRM structures), several hundred acres of developed agricultural land (vineyards, pear and walnut orchards) and pasture. Several public roads are also flooded, including Thomas Drive, Finley East Road and Soda Bay Road. Soda Bay Road has shoulder damage due to flooding in 1995 and 1997. Flooding is shallow (generally less than one foot depth) with low velocities and short duration, therefore damage is limited. Flooded septic tanks or agricultural wastes may contaminate floodwaters.

Water Body	**Flood Hazard**	**Impact**
Anderson Creek Much of the watershed is heavily forested mountain slopes and receives some of the highest rainfall amounts in Lake County. As a result, flows rise and fall quickly and contain significant quantities of natural debris.	Infrequent flooding. Blockages of bridges by logs and debris cause flooding.	Many of the structures are pre-FIRM and constructed close to the creek. Because of the steep valley sides, many of the structure's livable areas are located above the base flood elevation. There are several bridges across Anderson Creek that are susceptible to blockage by debris. This has resulted in damage to the bridges, block access and collateral damage to structures.
Copsey Creek Flood flows are contained within the creek channel until it passes under Morgan Valley Road.	Overflows during infrequent events (>10-year). Have experienced two floods with elevations greater than the mapped 100-year elevation.	Numerous structures built when approximately mapped (until 3/2/98) are subject to sheet flows and damage. Approximately ten homes along the creek are subject to flooding during high flows. Some of the homes are impacted by floodwaters from both Copsey and Herndon Creek, increasing their risk. Repetitive Loss area.
Coyote Creek Shallow flooding through the Hidden Valley Lake Subdivision below Hidden Valley Lake until it joins Gallagher Creek, where it	Frequent shallow flooding.	Floods golf course, several homes on Fishhook Court and Clubhouse at Hartmann Road.

Water Body	Flood Hazard	Impact
is contained by its channel and levees until it joins Putah Creek.		
Dry Creek The watershed is very steep, with the highest recorded rainfall amounts for Lake County in the upper watershed. Flows rise and fall quickly and cause considerable flooding in the Middletown area.	Frequent flooding. Large areas of sheet flow near HWY 175 due to inadequate channel and bridge capacities.	Flooded areas are agricultural and low density rural residential. High flows also flow across Highway 175 and through the Callayomi Park Subdivision. Approximately 10 to 15 homes are subject to shallow flooding during these events. Flow depths are generally less than one foot and velocities are low, therefore damage is limited. Flooded septic tanks or agricultural wastes may contaminate floodwaters.
Herndon Creek A major overflow occurs approximately one-quarter mile upstream of the culvert, which causes sheet flow across Bonham Road into the Copsey Creek Ranch subdivision.	Overflows during infrequent events (>10-year) with large areas of shallow sheet flow. Has caused repetitive losses.	Numerous structures built when approximately mapped (until 3/2/98) are subject to sheet flows and damage. Repetitive Loss area.
Kelsey Creek (Kelseyville) Generally contained within its banks between the Sweetwater Ranch area to approximately one mile	High flows contained within channel from Gross Crossing to corner on Finley East Road. Channel overflows both east and west banks	Overflows cause sheet flow, flooding 10-20 structures and adding to Cole Creek flows at Soda Bay Road (contributes to Repetitive Loss). Channel aggradation could

Water Body	**Flood Hazard**	**Impact**
north of Kelseyville, where it overflows both the east and west banks generating sheet flo**w** into adjacent drainages.	below this point in major flows (>35-yr event).	increase chances of upstream flooding in 20+/- years. Several significant archeological sites along the creek are subject to erosion at high flows. Several hundred acres of vineyards and pears are subject to the periodic flooding, however, since the depths are shallow, velocities low and the period short, damage is limited. Flooded septic tanks or agricultural wastes may contaminate floodwaters.
Kelsey Creek (Sweetwater Ranch) Kelsey Creek is near its "natural" geomorphic configuration, and frequently floods outside its normal flow channel. The area was subject to intensive gravel mining until 1987 and is readjusting to a natural condition.	Overflows frequently, with significant flooding during major flows (30+ year events. Approximate flood zone.	Flooding of over 3 feet has been reported at some homesites. Erosion threatens Kelsey Creek Drive. Ten to fifteen homes are subject to flooding. Several properties on the east side of the creek have vehicular access cutoff during high flows. Repetitive Loss area.
Laurel Dell Lake (Lower Blue Lake) Inflows to the lake cause rises in water level.	Frequent flooding caused by Scotts Creek backup.	Four to five homes have suffered repetitive losses. Flooding can last for several days to weeks. In addition to the 30 to 40 at-risk structures around Laurel Dell Lake, flooding limits access to Scotts

Water Body	Flood Hazard	Impact
		Valley Road and to properties across the creek. Floodwaters may become contaminated by flooded septic tanks.
North Fork Cache Creek	Some shallow flooding and erosion. Partially regulated by Indian Valley Reservoir. Approximate flood zone.	Most of flooded area is undeveloped. Water Treatment Plant at Spring Valley Lake is vulnerable, especially to erosion. Several lots on Pomo Trail may be at risk. The areas geology is prone to landslides. A large landslide into the creek could block water flow causing flooding.
Putah Creek Much of the upper watershed is heavily forested mountain slopes and receives some of the highest rainfall amounts in Lake County. Despite the size of the drainage, flows rise and fall quickly; however, extended periods of heavy rain can keep the creek above flood stage for several days.	Infrequent flooding. Most flows contained within channel. Approximate flood zone near Anderson Springs.	Most flooded land is agricultural or undeveloped. Overflows at HWY 175 threaten roadway. High creek levels at Hidden Valley Lake Subdivision limit outflow through levee, causing interior flooding. The cause of the flooding is inadequate channel and bridge capacities. Repetitive Loss area.
Schindler Creek Schindler Creek drains the High Valley area through the community of Clearlake Oaks.	Potential flooding along creek south of HWY 20. Also subject to severe bank erosion.	Erosion is endangering several structures. Deposition at mouth is reducing channel/bridge capacity and creating navigation problem.

Water Body	**Flood Hazard**	**Impact**
Scott's Creek Scotts Creek's flood flows exceed its channel capacity for nearly the entire stream below the Scotts Valley Road Bridge. Some areas flood frequently, while others receive partial protection behind levees.	Extensive flooding occurs from the confluence with Middle Creek to the Scotts Valley Road Bridge (20 mi. +/-). Land is primarily agricultural. Levees in Scotts Valley are not adequate and are prone to failure. Flooding can extend for periods of several days.	Levee at HWY 29 is of insufficient height to provide 100-year flood protection. Overtopping in 1995 resulted in flood depths of up to 8 feet. Interior drainage is unable to flow into Scotts Creek during severe events, also causing flooding of up to 5 feet. Severe flooding of several homes in the Blue Lakes area (a Repetitive Loss area). Reduction of productivity of some agricultural land, severely restricted access to property across creek, and frequent flooding of public roads (Scotts Valley and Eickhoff Roads).
St. Helena Creek The watershed is steep, much of which is forested. Flows rise and fall quickly, with shallow flooding from Bradford Road through Middletown to Putah Creek. The cause of the flooding is inadequate channel and bridge capacities	Frequent flooding. Bank erosion problems in Middletown.	Shallow flooding of residential development south of Middletown. Approximately 60 lots are subject to shallow flooding. Structures west of the creek are generally in the floodplain and subject to frequent flooding (10-year event), with most of the structures on the east side of the creek on high terrace and not subject to flooding. Flooded septic tanks or agricultural

Water Body	Flood Hazard	Impact
		wastes may contaminate floodwaters.

Source: 2000 Lake County Flood Management Plan and 2024 staff verification of current relevance.

Flooding in Lake County can create challenges, particularly for transportation infrastructure. Roads and highways can experience temporary closures due to standing water, minor washouts, or debris, which may inconvenience travelers and delay services. While localized flooding is common during heavy rains, it typically does not result in widespread damage but can still affect low-lying areas and overwhelm drainage systems. In some cases, saturated soils can lead to tree falls, which may damage structures or utility lines.

Localized flooding can also disrupt utilities and cause short-term electrical outages. These outages, while generally limited in scope, may temporarily impact governmental operations, businesses, and public schools, occasionally requiring delayed starts or closures. However, such disruptions are typically resolved quickly, minimizing broader community impacts.

Overall, while severe flooding remains a concern in specific scenarios, most localized flooding in Lake County is manageable with proper drainage maintenance and infrastructure improvements to reduce minor inconveniences and prevent more significant damage.

Erosion from floodwaters can potentially damage homes, businesses, and government structures, particularly ancillary structures and utilities. Structural foundation undercutting, though less frequent, is a primary concern for buildings located near creeks or in flood-prone areas.

CHAPTER TEN: Levee Failure

Figure 31 Middle Creek Flood Control project levee in early spring, unknown date. Photo courtesy of Lake County Water Resources.

A levee is a man-made structure designed to control, contain or divert water to reduce the risk of flooding. Typically made from compacted earth, other construction materials may be used.

Levees are not infallible. Designed to protect against specific flood levels, levees reduce, *but do not eliminate*, the risk to people and structures in areas they protect. During severe weather events or dam failures, levees may be overtopped or fail, leading to potentially severe flooding and high-water velocities. Regular maintenance and proper operation are essential to minimize the risk of failure and maintain their effectiveness.

10.1 Hazard Profile

Lake County features agricultural levees, many of which were originally built to protect farmland from frequent flooding. These levees typically offer protection against flood events with a 5% to 20% annual chance of occurrence. While these levees provide some defense for agricultural ground, development in levee protected areas has introduced additional vulnerabilities.

In most cases, the areas behind these levees are mapped as FEMA-designated floodplains. Newer homes may be elevated or constructed with flood resistant materials or design, but the presence of levees can create a false sense of security. When levees fail, the flooding is rapid and deep, as evidenced by the levee failures along Scotts Creek in 1995 and 2005 and Alley Creek in 2005.

A significant challenge lies in the maintenance and repair of these levees. Unlike publicly-maintained flood control infrastructure, most agricultural levees in Lake County are privately owned and lack consistent upkeep. Consequently, they are often ineligible for public disaster funding from FEMA, leaving repair responsibilities to individual property owners where the levee failure occurred.

Middle Creek Flood Control Project

The Project, operated and maintained by the Lake County Watershed Protection District, serves to mitigate flood risks in the Upper Lake area. This system includes approximately **14.4 miles of levees**, a **pump station**, and a **diversion channel** to divert overflow from Clover Creek around the town of Upper Lake. The upper portion of the project protects Upper Lake from flooding caused by Middle and Clover Creeks, while the lower portion safeguards farmland and some residential areas from inundation by Clear Lake.

The potential location and extent of the hazard impacts of levee failure within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: Chapter Ten: *Levee Failure*
  - 10.1.2 Differences between County and City assessments
  - 10.2 Location and Extent
- Lakeport Annex: Chapter Ten: *Levee Failure*
  - 10.1.2 Differences between County and City assessments
  - 10.2 Location and Extent

10.2 Location and Extent

For detailed community information refer to 3.2 Planning Area Communities; for a visual refer to Figure 5: Map of Lake County Cities, Towns, Communities, and Highways.

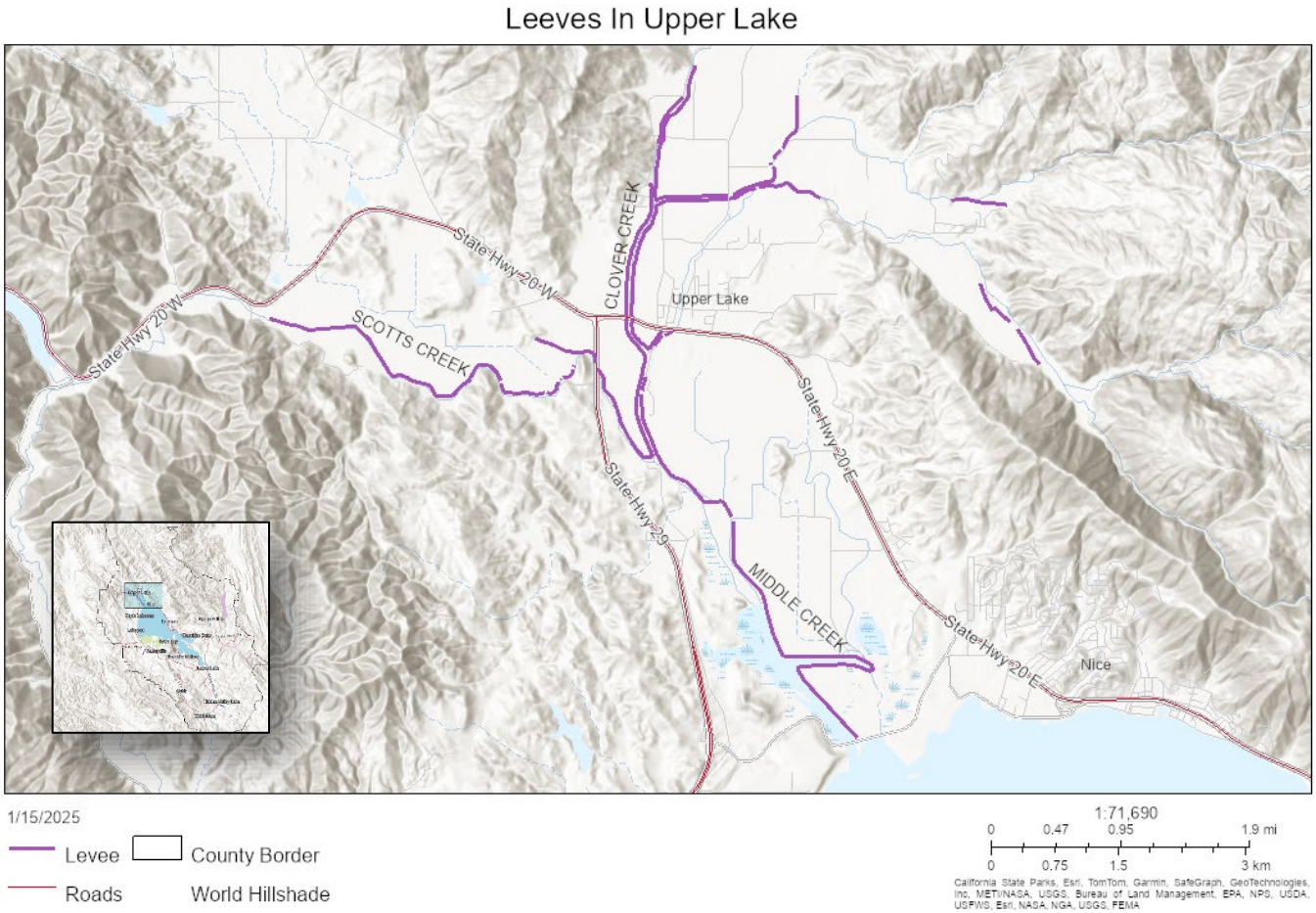
Middle Creek Levee System

A map of Lake County levees within the Middle Creek Levee System and within partial control of the County of Lake or the Lake County Watershed Protection District is shown on Figure 30 and includes the:

- **Middle Creek left bank** (3.35 miles): Middle Creek runs north to south through the community of Upper Lake before feeding into the north end of Clear Lake. Clover Creek runs through Upper Lake and joins Middle Creek about one thousand feet south of Highway 20.
- **Middle Creek right bank** (2.66 miles): Unit 2 levee system is a portion of the Middle Creek Flood Control Project. The levee system reduces the risk of flooding for Lake County and adjacent rural and agricultural lands from flood waters in Middle Creek and Scott Creek.

- Other levees within this system include the **Page, Alley**, and **Clover Creek Diversion** right bank (1.49 miles) and left bank (1.03 miles). The U.S> Army Corps of Engineers (USACE) maintains another levee (Maintenance Area 17) along Middle Creek, accounting for 3.9 miles of additional levee.

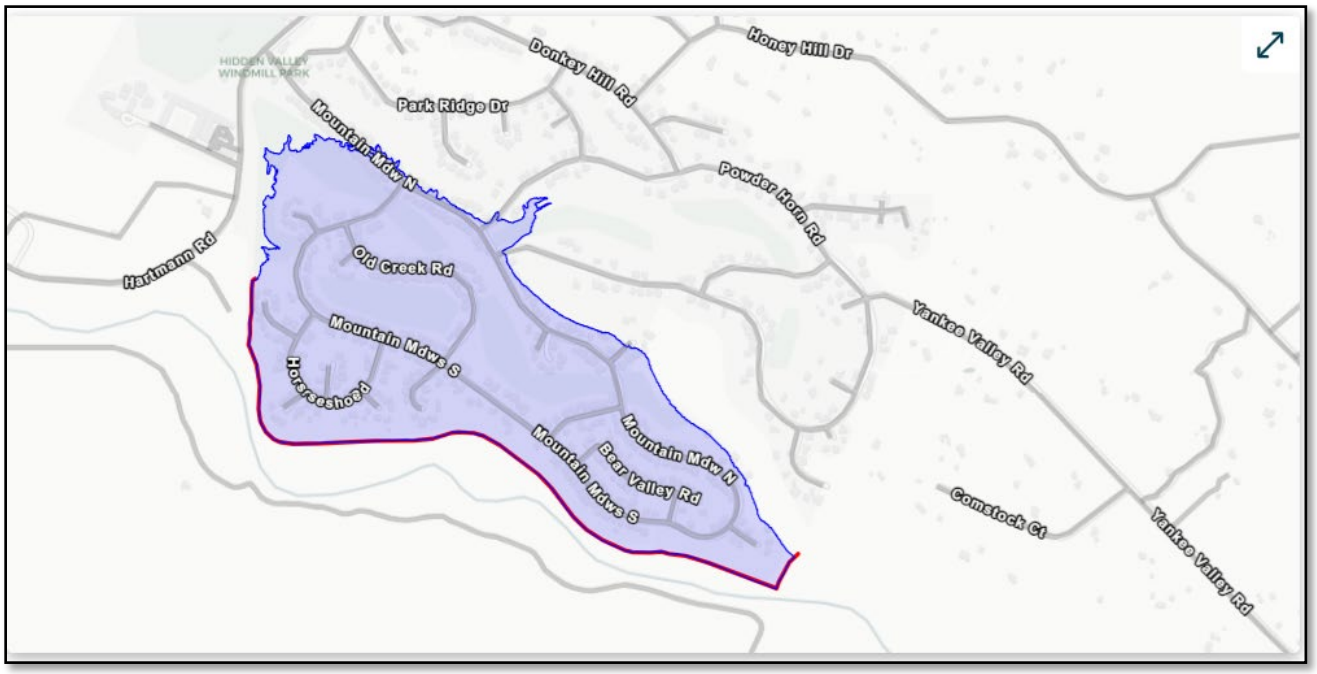
Figure 32 Lake County – Local Levees Map



Putah Creek Levee System

Lake County Levee System 7, located in Hidden Valley Lake along Putah Creek, is 1.291 miles and maintained jointly by the Hidden Valley Lake Community Services District[15] and the Hidden Valley Lake Homeowners Association.

Figure 33 Lake County Levee System 7 at Hidden Valley Lake as shown in the National Levee Database including the levee (purple line) and levee protected area (purple shading).

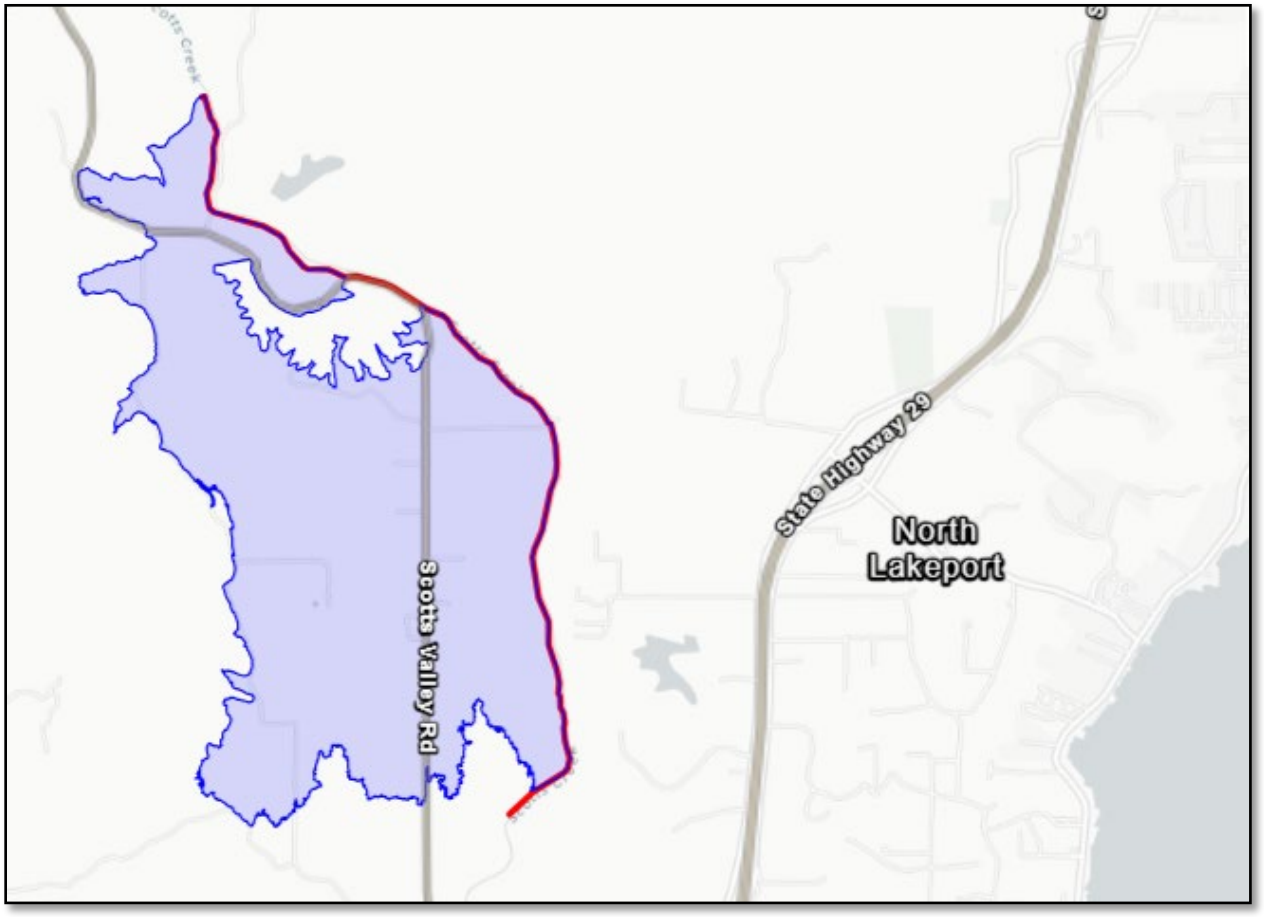


[15] The Hidden Valley Lake levee system is profiled in the Hidden Valley Community Services District's Hazard Mitigation Plan. Additional details here (link).

Scotts Creek Levee System

Levees maintained privately include the **Scotts Creek left bank** (1.36 miles).

Figure 34 Scotts Creek Levee as show in the National Levee Database including the levee (purple line) and levee protected area (purple shading).



10.2.1 Extent

Middle Creek Levee System

The Middle Creek Flood Control Project levees, constructed by the US Army Corps of Engineers (USACE) in 1959 to protect Upper Lake from a 200-year flood (0.5% annual chance), were later accredited by FEMA in the 1970s for 100-year flood (1% annual chance) protection. However, since 2005, updated FEMA certification criteria have deemed these levees non-compliant due to concerns about failure and catastrophic flooding. The levees have not been upgraded to meet current standards.

A levee failure could lead to significant flooding, with inundation depths reaching up to 10 feet in areas such as the Upper Lake General Plan Boundary. Vulnerable sections, particularly near Highway 20, are at risk of overtopping or breaching

during a 100-year flood due to inadequate freeboard and sedimentation. Flooding would impact approximately 1,700 acres, including agricultural lands, residential areas, and critical infrastructure.

Floodwaters could reach nearby areas within 2 hours and persist for several days to weeks, depending on the breach scale and drainage capacity. Hydraulic analysis estimates a 28% annual chance of levee failure, exacerbated by aging infrastructure and sedimentation, particularly during high-flow events.

Putah Creek Levee System

The Putah Creek Levee System is not FEMA-certified to provide protection from a 1% annual chance flood. Failure would occur rapidly, with the duration of flooding influenced by conditions such as the presence of an atmospheric river.

According to the Flood Insurance Study (FIS), portions of the levee system were reanalyzed to align with FEMA policy. The levees, approximately 8 feet high, were built to protect a subdivision and golf course in the historic Coyote Creek floodplain. However, these levees lack government certification, adequate maintenance, and sufficient freeboard in certain areas, including between River Miles (RM) 10.28 and 10.46 and near RM 11.07.

Scotts Creek Levee System

Levees in the Scotts Creek area are not FEMA certified as providing protection from the 1% chance of flood. Much of the leveed area is agricultural land and floodwaters could reach several feet in depth, depending on the location and volume of water. Low-lying areas near Scotts Creek would experience the most significant impacts.

10.3 Previous occurrences

There have been no disasters declarations related to levee failure in Lake County.

Middle Creek had an event in 2011. Scotts Creek in 1995 and 2005 and Alley Creek in 2005 had levee failure events, but limited data is available. There was a near failure of a portion of the levee along Putah Creek in Hidden Valley in 2017 due to high creek flows. The levee was repaired prior to failure. The HMPC received information that a private levee failed in 2019.

10.4 Probability of Future Events

Likely – (For scale detail refer to probability in *Section 2.2.1 Priority*.) Due to the number and age of levees in Lake County, future levee failures are currently considered likely.

10.4.4 Future Development

Future development built in the levee zones is subject to the standards in the Lake County Floodplain Ordinance. Lake County is also evaluating the feasibility of projects to bring some area levees up to a 0.1% annual chance or greater level of protection which will also change future development standards in levee protected areas.

10.5 Impacts of Climate Change

In general, increased flood frequency in California is a predicted consequence of climate change. Mechanisms whereby climate change leads to an elevated flood risk include more extreme precipitation events and shifts in the seasonal timing of river flows. This threat may be particularly significant because recent estimates indicate the additional force exerted upon the levees is equivalent to the square of the water level rise. These extremes are most likely to occur during storm events, leading to more severe damage from waves and floods.

10.6 Levee Failure: Secondary Hazards

Flooding, bank erosion and critical infrastructure failure are potential secondary hazards. Additionally, a levee failure could destroy habitat for plants, fish and related ecosystems.

10.7 Levee Failure: Exposure & Vulnerability

Vulnerability—Medium (Refer to *Section 4.1.2 Vulnerability* for scale detail.)

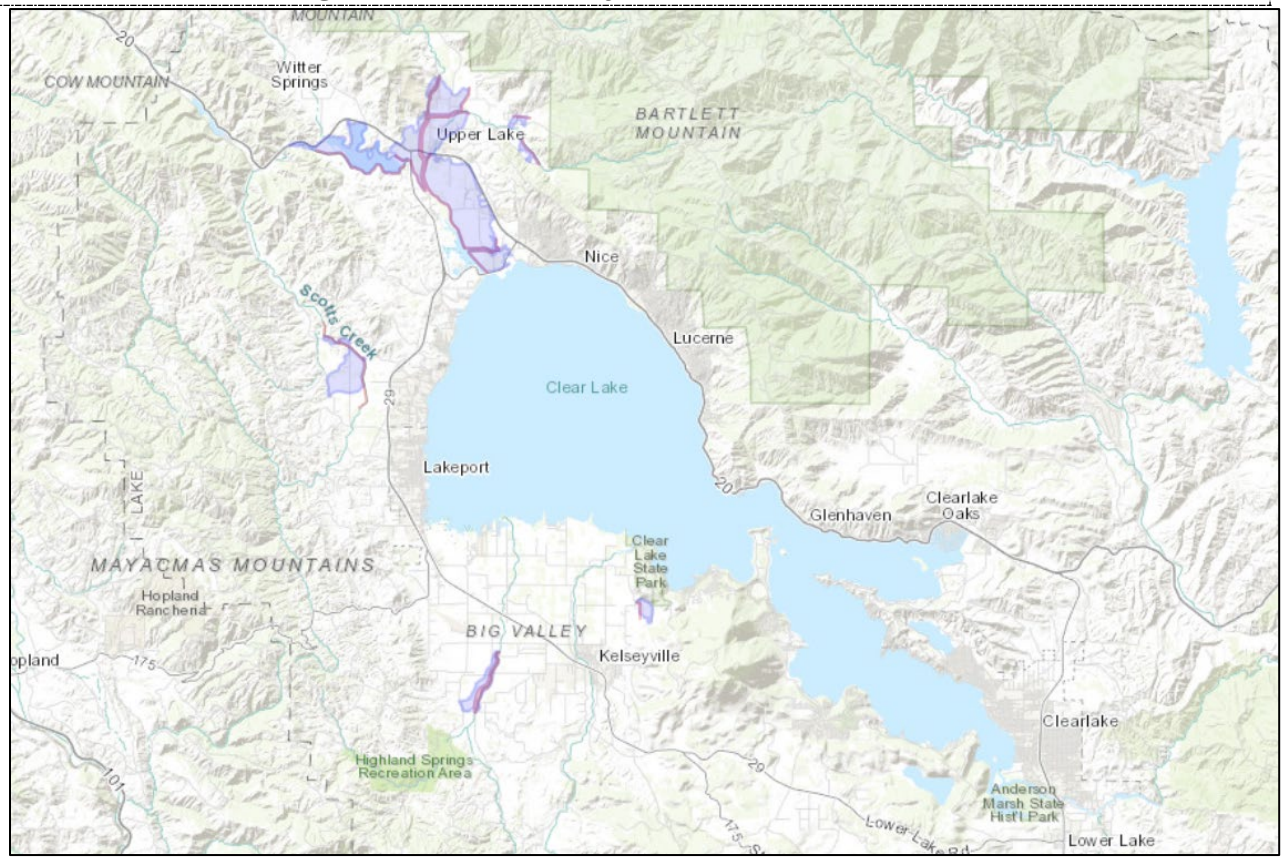
Levee failure flooding would vary in the Planning Area depending on which structure fails and the nature and extent of the failure and associated flooding. This flooding presents a threat to life and property, including buildings, their contents, and their use. Large flood events can affect lifeline utilities (e.g., water, sewage, and power), transportation, jobs, tourism, the environment, agricultural industry, and the local and regional economies.

The National Levee Database (NLD), developed by the USACE, contains some information about the project levees in the County. Authorized by Congress in 2007, the database contains information to facilitate and link activities, such as flood risk communication, levee system evaluation for the NFIP, levee system inspections, flood plain management, and risk assessments. The NLD continues to be a dynamic database with ongoing efforts to add levee data from federal agencies, states, and tribes.

The NLD currently contains most levees within the USACE program. The NLD contains the levee protected areas shown on Figure 35. It should be noted that this levee protected areas do not provide protection for a 1% annual chance flood.

FEMA guidelines assume uncertified levees without adequate freeboard do not exist when mapping flood elevations.

Figure 35 Lake County Levee Protected Areas

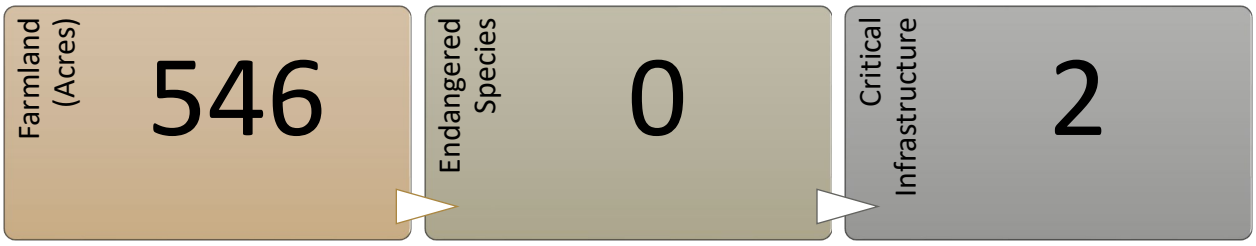


Source: National Levee Database 2024

Middle Creek Levee System

At Risk Behind the Levee System (Per *combined* data available in the National Levee Database):

Buildings	Populations	Property Value
349	814	$55.6m



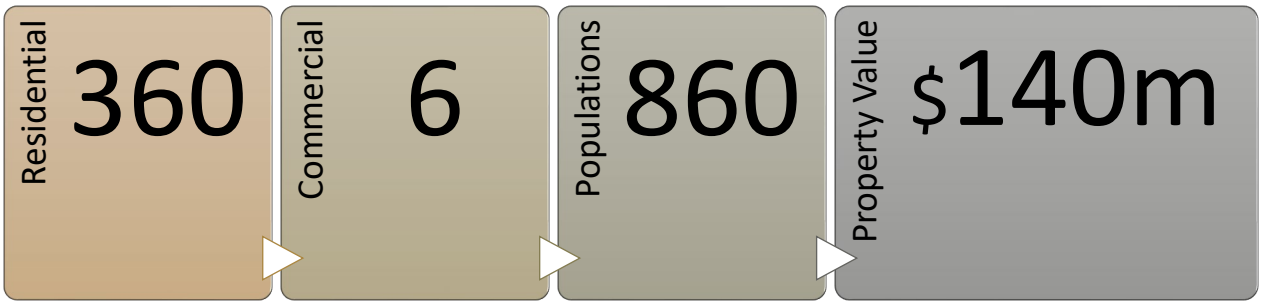
Middle Creek left bank – Unit 5 and part of 1: Per the NLD, the leveed area of this system is considered low risk. If this levee breached (broke open) during a flood, it is estimated that 2 feet of water would flow overland, and water could pond at the southern end of the levee system at depths up to 5 feet.

Middle Creek left bank – Unit 1 south: Per the NLD, while the levee is not expected to perform well during a flood, the consequences of a levee failure are relatively low and this system is considered low risk. About 170 people live or work inside the leveed area and they are, in general, moderately aware of the levee system and the role it plays in lowering flood risk. In the event of a breach, the population at risk would see flood water depths up to 6 feet; however, most of the population lives in areas where flood water depths would be less than 2 feet.

Putah Creek Levee System – Lake County Levee 7

In the worst-case scenario, a levee breach upstream of RM 11.07 would allow water to flow into the subdivision, which lies lower than the creek. Excess water from Coyote Creek, perched above the subdivision, would flow into the area, where it could become trapped behind downstream levees. While peak overflow rates would remain under 1,000 cfs, resulting inundation would be shallow—less than one foot deep—and mapped as Zone X.

At Risk Behind the Levee (Per data available in the National Levee Database for Lake County Levee 7):



Critical infrastructure includes roads and utilities. No agricultural land, natural and cultural resources, or tribal communities are identified as at risk. These levees are of high concern to the HMPC due to their poor (lacking) maintenance program and the number of homes currently "protected".

Scotts Creek Levee System

Scotts Creek Levee System is comprised of Lake County Levees 5, 9 and 14.

At Risk Behind the Levee System (Per *combined* data available in the National Levee Database):

CHAPTER ELEVEN: Dam Failure

Figure 36 An aerial view at an unknown date of the Indian Valley Dam, courtesy of Yolo County Flood Control District.

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failures can also result from other natural or manmade disasters. For the purposes of this HMP, dam failure is profiled in relation to natural hazards only.

11.1 Hazard Profile

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify

and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously; the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach; a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The California Department of Water Resources (Cal DWR) Division of Safety of Dams has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional.

The Division of Safety of Dams assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property:

- *Extremely High Hazard* indicates that a dam failure would cause considerable loss of human life or inundate an area with a population of 1,000 people or more.
- *High Hazard* indicates that a failure would most probably result in the loss of life.
- *Significant Hazard* indicates that a failure could result in appreciable property damage.
- *Low Hazard* indicates that failure would result in only minimal property damage and loss of life is unlikely.

Additional information about population and land use, as well as the communities impacted are available in Section 3.2 Planning Area Communities.

11.2 Location and Extent

According to data provided by Lake County, Cal DWR, and Cal OES, there are 21 dams in Lake County that were constructed for flood control, storage, treatment impoundments, electrical generation, and recreational purposes. Of the 21 dams, 14 are rated as High Hazard and 7 as Low Hazard.

At this time of this plan update, there are no dams withing Lake County that meet the qualifications of being eligible for the High Hazard Potential Dams Grant Program. The dams in Lake County that are High Hazard are all rated in their conditions assessment as satisfactory or fair. The two dams that are rated fair are both Federal Energy Regulatory Commission dams. Table 19 identifies the 21 dams located in the Lake County Planning Area.

Table 19 Lake County Dam Inventory

Name	Owner	Hazard Classification	Dam Type	River/Stream	Structural Height (ft)	Maximum Storage (acre-ft)	EAP
Adobe Creek	Lake County Watershed Protection District	High	Rockfill	Adobe Creek	36	695	Yes
Allen	Richard and Wendy Reynolds	High	Rockfill	Tr Kelsey Cr	33	85	Yes
Bar X Ranch Reservoir # 2	Kiran Sidhu	High	Rockfill	Crazy Creek	30	147	No
Bordeaux, Lake	Langtry Farms, LLC	Low	Rockfill	Tr Bucksnort Creek	42	538	N/A
Bottoms	Middletown Enterprises	High	Rockfill	Tr Helena Creek	47	315	Yes
Burgundy, Lake	Langtry Farms, LLC	Low	Rockfill	Tr Bucksnort Creek	27	200	N/A

Name	Owner	Hazard Classification	Dam Type	River/Stream	Structural Height (ft)	Maximum Storage (acre-ft)	EAP
Cache Creek	Yolo County Flood Control and Water Conservation District	Low	Gravity	Cache Creek	35	378,000	Yes
Coyote Creek	Hidden Valley Lake Association	High	Rockfill	Coyote Creek	92	3,375	Yes
Graham	Matthew G. Boyer	Low	Rockfill	Tr Highland Cr	39	62	N/A
Guenoc Lake	Langtry Farms, LLC	High	Rockfill	Bucksnort Creek	50	3,237	No
Highland Creek	Lake County Watershed Protection District	High	Rockfill	Highland Creek	75	3,500	Yes
Homestake Tailings	Homestake Mining Company	High	Rockfill	Tr Hunting Cr	169	32,370	Yes
Indian Valley	Yolo County Flood Control and Water Conservation District	High	Earth	North Fork Cache Creek	207	359,000	Yes
Lake Co San Dist	Lake County Sanitation District	High	Rockfill	Tr Burns Val Creek	40	530	Yes
Lake Co San Dist 2	Lake County Sanitation District	High	Rockfill	Tr Lyons Creek	77	870	Yes

Name	Owner	Hazard Classification	Dam Type	River/Stream	Structural Height (ft)	Maximum Storage (acre-ft)	EAP
Lakeport	City of Lakeport Municipal Sewer District Number 1	High	Rockfill	Tr Manning Cr	51	650	Yes Link to EAP
Langtry	Langtry Farms, LLC	Low	Rockfill	Tr Cassidy Creek	50	525	N/A
McCreary	Langtry Farms, LLC	Low	Rockfill	Bucksnort Creek	20	2,100	N/A
Peters	Stephen Cowan	Low	Rockfill	Benmore Creek	33	112	N/A
Scott	Pacific Gas and Electric Company	High	Gravity	Eel River	134	80,463	Yes
Spring Valley	County of Lake	Significant	Rockfill	Wolf Creek	37	325	Yes

Source: Cal OES and the National Performance of Dams Program

*One Acre Foot=326,000 gallons

Most dams in Lake County are removed from the population clusters. The remote locations of the dam's shields residences from the potential hazards associated with dam failure and resulting inundation. There are three exceptions to this: Indian Valley Reservoir, Coyote Creek Dam and the effluent storage reservoir at the Southeast Wastewater Treatment Plant.

According to the HMPC, of the 21 total dams in the County, 9 dams are of greatest concern:

- Cache Creek
- Scott Dam
- Indian Valley
- Coyote Creek
- Highland Creek

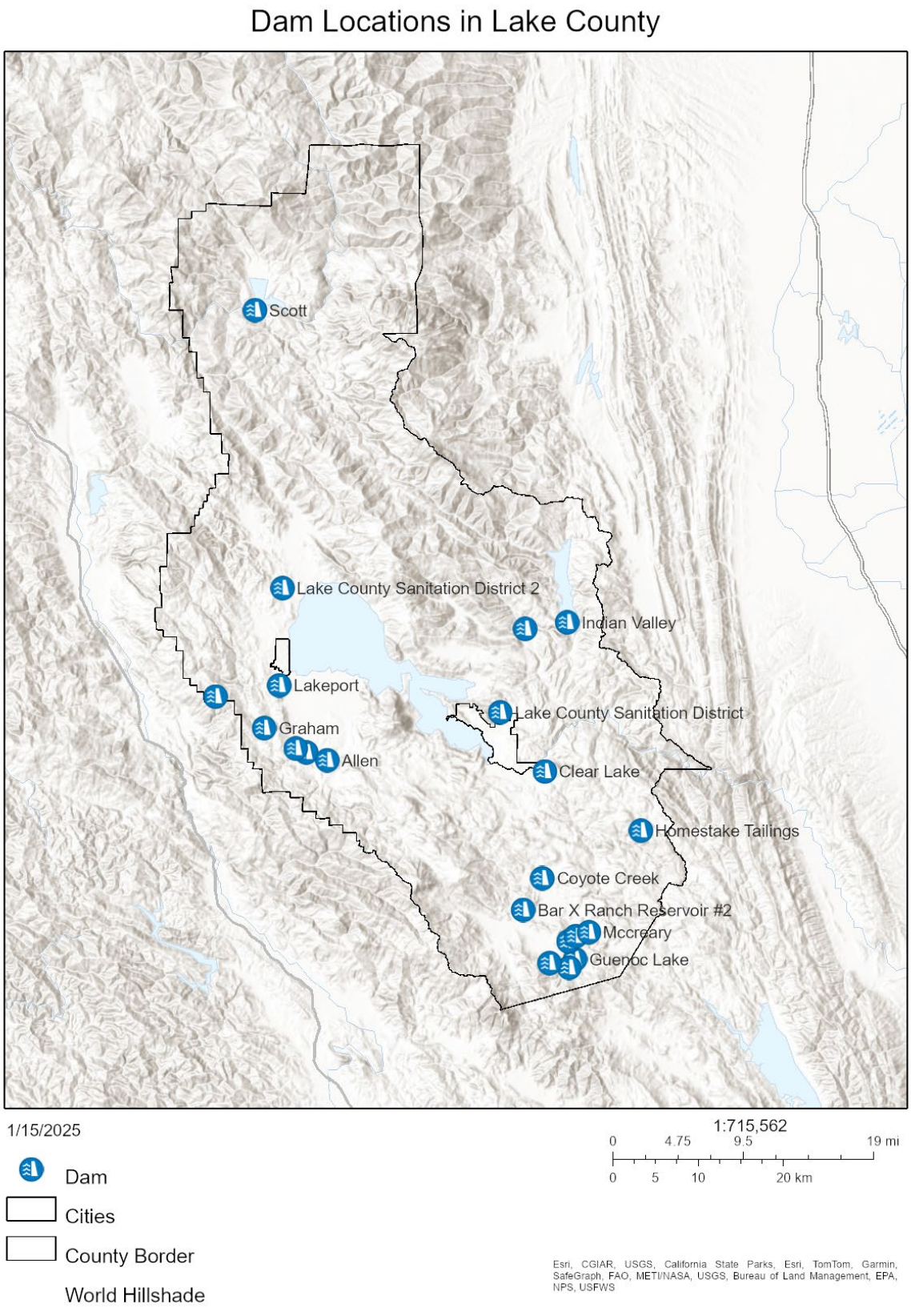
- Adobe Creek
- Northwest Wastewater Treatment Plant
- Southeast Wastewater Treatment Plant
- Lakeport Wastewater Treatment Plant

Refer to *Figure 37 Lake County Dams* for locations. For detailed community information refer to *3.2 Planning Area Communities*.

The potential location and extent of the hazard impacts of dam failure within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: Chapter Eleven: *Dam Failure*
  - 11.1.2 Differences between County and City assessments
  - 11.2 Location and Extent
- Lakeport Annex: Chapter Eleven: *Dam Failure*
  - 11.1.2 Differences between County and City assessments
  - 11.2 Location and Extent

Figure 37 Lake County Dams



11.2.1 Cache Creek

The Cache Creek Dam is located 3.5 miles downstream of the outlet from Clear Lake. The dam is a concrete, gravity-type structure. This dam is owned and operated by Yolo County Flood Control and Water Conservation District (YCFCWCD). The relationship between Clear Lake and the dam is unique in that the dam does not control maximum overflows from Clear Lake. The Grigsby Riffle located near Lake Street between Clear Lake and the dam controls maximum outflows. The maximum flows past the Grigsby Riffle when the lake is 7.56 ft. Rumsey is approximately 2,550 cfs. At this flow, Clear Lake would be lowered by approximately 1.5 inches per day, with the maximum flows being reduced as the lake loses elevation. Because of this unique relationship, there are two separate failure scenarios:

- **Winter Failure**: When the lake is above 7.56 feet Rumsey (full), the dam releases flows at the channel capacity and there is little water stored behind the dam. Catastrophic dam failure under these conditions would result in a minimal flood wave downstream.
- **Sunny Day Failure**: A sunny day failure would be the most severe if Clear Lake is full and there are minimal releases from the dam. Catastrophic failure of the dam would release all the water stored between the dam and the Grigsby Riffle, causing a significant flood wave (8 to 18 feet high) through the Cache Creek Canyon. At this elevation, flows from Clear Lake would be limited to approximately 2,500 cfs by the Grigsby Riffle. The flood wave would be mitigated to insignificant levels by the storage pool at the Capay Diversion Dam.

No communities below the Cache Creek Dam would be flooded by a dam failure. The primary concern would be people using the creek area for recreational purposes, which could include rafting, kayaking, fishing or using low-lying areas adjacent to the creek. If the lake level is still high, failure of the dam could cause significant property damage along Cache Creek above the dam, as water levels would drop rapidly between the Dam and the Grigsby Riffle causing bank and retaining wall failures, and destruction of many of the docks within Cache Creek.

11.2.2 Scott Dam

Scott Dam is located on the upper Eel River in the Mendocino National Forest. It can be reached through Potter Valley, Mendocino County or Elk Mountain Road from Upper Lake. Dam failure inundation zones include Mendocino County communities, and the Cities of Rio Dell, Fortuna and Ferndale in Humboldt County to the Pacific Ocean. The dam is owned and operated by Pacific Gas & Electric (PG&E).

Scott Dam is the second largest dam in Lake County, located at the western edge of Lake Pillsbury.

Failure of this dam would result in potential damage to life and property at Soda Creek Station and PG&E campsites along the Eel River, and catastrophic damage to life and property in neighboring Mendocino County and further north into Humboldt County. Residents of Lake Pillsbury area would be isolated due to damaged roads. Emergency planning considerations would be to conduct air evacuation from rural Gravelly Airport. Emergency management considerations would be to assist other counties.

11.2.3 Indian Valley

Indian Valley Dam is located approximately 5 miles north of State Highway 20 between Clear Lake and Williams. It can be reached by Walker Ridge Road. The dam is an earthen structure and the largest dam in Lake County. The dam is owned and operated by the Yolo County Flood Control and Water Conservation District.

Failure of this dam would result in flooding. The primary area of concern is the Spring Valley development where residents are in the inundation zone. There are 210 residential structures subject to flooding in Lake County due to dam failure.

New Long Valley Road and State Highway 20 could be washed out, isolating and trapping numerous residences. Other evacuation concerns are for seasonal population along Cache Creek and vehicular traffic on State Highway 20. Catastrophic damage would be experienced downstream to Yolo County communities.

11.2.4 Coyote Creek

Coyote Creek Dam is located east of Highway 29, between the communities of Lower Lake and Middletown at the Hidden Valley Lake residential area. Coyote Creek Dam is owned and operated by the Hidden Valley Lake Association. The dam is an earthen structure.

Failure of the dam would cause extensive property damage to residential structures, an elementary school, commercial buildings, a golf course and State Highway 29.

11.2.5 Highland Creek

Highland Creek Dam is located approximately 0.5 miles west of Adobe Creek Dam. The dam can be reached on Highland Springs Road, Bell Hill Road or the Old Toll Road. The dam is an earthen structure. The dam is owned and operated by the Lake County Watershed Protection District.

Dam failure inundation zones include Adobe Creek areas south of State Highway 29. Failure of the dam would result in extensive property damage to residential structures and agricultural properties along Adobe Creek.

11.2.6 Adobe Creek

Adobe Creek Dam is located approximately 5 miles south of Finley. It can be reached from State Highway 29 by the Highlands Springs turn-off on Bell Hill Road near Kelseyville or from Hopland in Mendocino County via Old Toll Road. Adobe Dam is an earthen structure. Lake County Watershed Protection District is the Owner and Operator of the dam.

Dam failure inundation zones include Adobe Creek areas south of State Highway 29. Failure of the dam would result in extensive property damage to residential structures and agricultural properties along Adobe Creek.

11.2.7 Northwest Wastewater Treatment Plant

The Northwest Wastewater Treatment Plant is located approximately 5 miles north northwest of the City of Lakeport. It can be reached from Highway 29 at the Nice/Lucerne cutoff. The Northwest Wastewater Treatment Plant Reservoir is created by an earthen dam. Lake County Special District is the Owner and Operator of the reservoir.

Failure of the dam would result in extensive property damage to residential structures, the juvenile hall facility and agricultural properties along Waylan Way and Hill Road.

11.2.8 Southeast Wastewater Treatment Plant

The Southeast Wastewater Treatment Plant is located approximately 1.5 miles north of the City of Clearlake. It can be reached from State Highway 53 by the north Old Highway 53 turn-off and then on to Pond Road. The Southeast Wastewater Treatment Plant Reservoir is created by an earthen dam. Lake County Special District is the Owner and Operator of the reservoir.

Failure of the dam would result in extensive property damage to residential structures along Pond Road, areas of Old Hwy 53 and Rumsey Road.

11.2.9 Lakeport Wastewater Treatment Plant (Lakeport Dam)

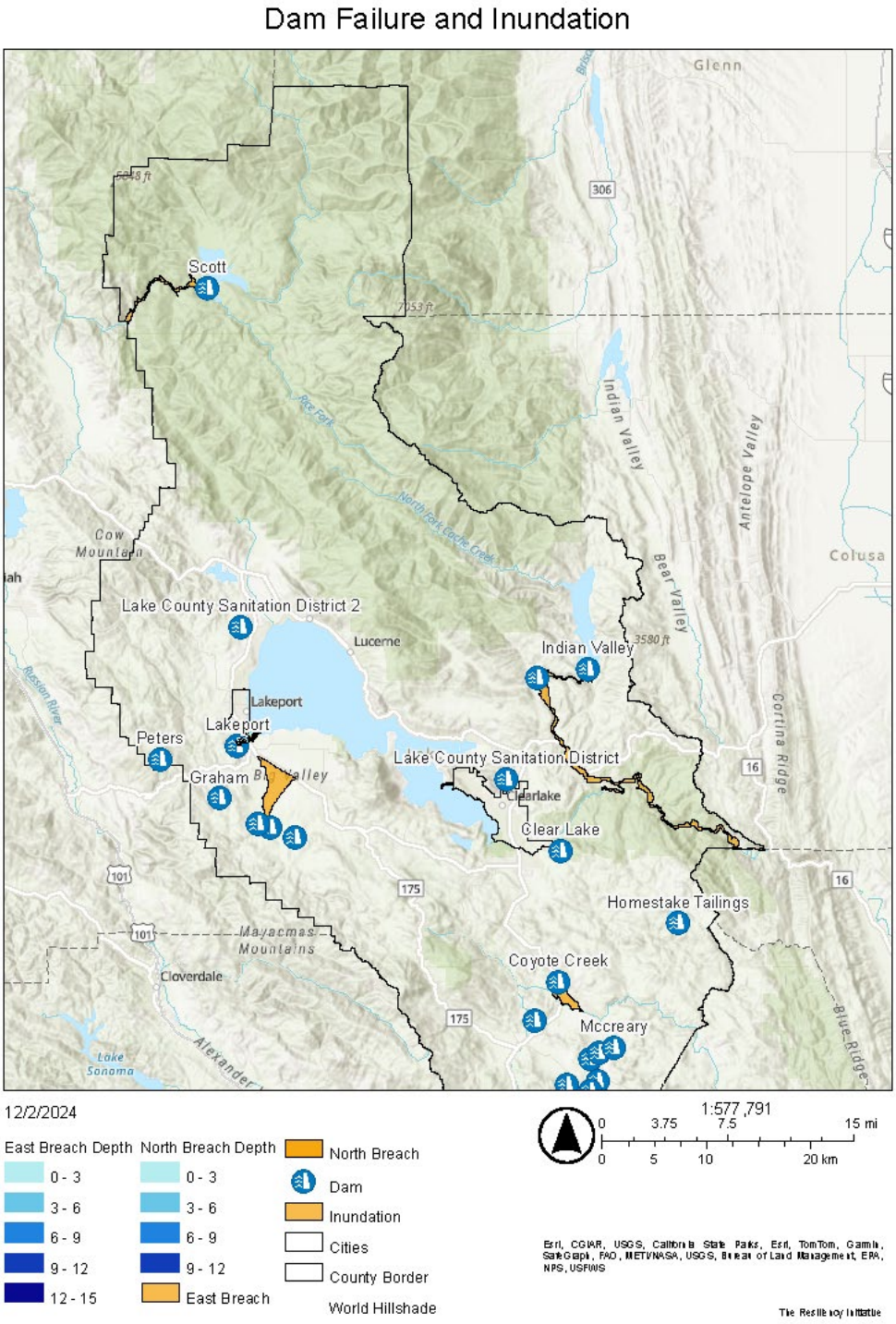
This dam is not located within the unincorporated area. It is included because its failure could impact County area parcels within the Planning Area. Read the City of Lakeport Annex *for greater detail.*

The Lakeport Wastewater Treatment Plant is located approximately 2 miles from central Lakeport, within city limits. It can be reached from Highway 29/175 intersection. The Lakeport Wastewater Treatment Plant Reservoir is created by

Lakeport Dam, an earthen structure. City of Lakeport is the Owner and Operator of the reservoir.

Lakeport Dam has a High Hazard classification, and its failure would result in extensive property damage to residential structures and agricultural properties along Linda Lane in Lakeport and other nearby residential and commercial areas as shown on the Lakeport Dam Failure Inundation Maps. The Lakeport Dam Emergency Action Plan was adopted and approved in 2021.

Figure 38: Lake County Dam Failure and Inundation Maps



11.3 Previous occurrences

11.3.1 Disaster Declaration History

There have been no disaster declarations related to dam failure in Lake County.

11.3.2 NPDP Events

The National Performance of Dams Program at Stanford University tracks dam failures. A search of the National Performance of Dams Program database showed no past dam failure events in Lake County.

11.3.3 Hazard Mitigation Planning Committee Events

According to the HMPC, there have been no known major dam failures in Lake County.

11.4 Probability of Future Events

Occasional — (For scale detail refer to probability in *Chapter 2.2.1 Priority*.) The County remains at risk of dam breaches/failures from numerous dams under a variety of ownership and control and of varying ages and conditions. Although there is no history of past dam failures, given the number and types of dams in the County and their ages, a potential exists for future dam issues, including failures, in the Lake County Planning Area. Thus, the HMPC determined the likelihood of future occurrence to be occasional.

In addition to the aging dam infrastructure, this ranking was based on the recent issues with the nearby Oroville dam that was at risk of overtopping and failure during the Winter 2017 storms. There is concern that many of the State's older dams, including those in Lake County, could start experiencing similar problems.

11.5 Impacts of Climate Change

Increases in both precipitation and heat causing snow melt could increase the potential for dam failure and uncontrolled releases in Lake County.

11.6 Dam Failure: Secondary Hazards

Economic and environmental impacts – these vary for each dam. Generally, when a dam can no longer impound water for beneficial uses, then there would be negative economic and environmental impacts.

For example, if Indian Valley Dam failed, then irrigation water from that source could not be provided to farmers. Farmers would have to rely more on groundwater which would negatively impact groundwater supplies, which could impact systems that rely on groundwater. In addition, the lack of surface water would greatly and catastrophically impact farmers who rely solely on surface water. All of this would affect the people in businesses who rely on their agricultural customers (farm workers, equipment sales and servicing, food processors, agricultural chemical purveyors, etc.).

The lack of water released from not having a dam would mean that flows that keep the riparian ecosystem healthy would be negatively impacted. It is important to

note that riparian ecosystems have the highest diversity of both flora and fauna species.

Another example: A Cache Creek Dam failure could result in negative impacts to recreation on Clear Lake, and thus the businesses that rely on that would be impacted as well.

11.7 Dam Failure: Exposure & Vulnerability

Vulnerability—Medium (Refer to *Section 4.1.2 Vulnerability* for scale detail.) No change from the 2023 Plan Update.

11.7.1 Lakeport Wastewater Treatment Plant

Information is available in the Lakeport Annex.

11.7.2 Population

An analysis was performed for the 2018 HMP to determine population in dam inundation areas. Using GIS, the dam inundation area dataset was overlayed on the improved residential parcel data. Those parcel centroids that intersect an inundation area were counted and multiplied by the Census Bureau average household size for Lake County (2.39). Results were tabulated and are shown in Table 20. According to this analysis, for the entire Planning Area, there is a population of 1,742 in dam inundation areas.

Table 20 Total Population at Risk of Dam Inundation Flooding

Jurisdiction	Improved Residential Parcels	Population*
Unincorporated County	729	1,742

Source: Cal OES; US Census Bureau 2010 Estimates, Lake County 1/3/2017 Parcel/Assessor's Data

It is unlikely that all dams that could affect Lake County would fail at the same time. Table 21 shows the populations at risk of dam failure flooding for each dam.

Table 21 Population at Risk of Each Dam Inundation Flooding

Jurisdiction	Improved Residential Parcels	Population*
Adobe Creek	0	0
Adobe Creek and Highland Creek	5	12
Coyote Creek	506	1,209
Indian Valley	218	521
Scott	0	0
Lake County Total	**729**	**1,742**

Source: Cal OES; US Census Bureau 2010 Estimates, Lake County 1/3/2017 Parcel/Assessor's Data

11.7.3 Property

Table 23 contains the dam inundation analysis results for the Lake County Planning Area broken out by dam inundation area. This table shows the total and improved number of parcels, and values at risk of dam failure by each individual dam for the Lake County Planning Area. ***Note***: due to overlap in dam inundation areas, there are properties that may be counted more than once.

Table 22 Lake County – Values and Parcels by Dam Inundation Area*

Planning Area / Dam Inundation Source	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value*
Adobe Creek	126	107	$16,507,687	$11,583,052	$19,274,341	$65,535,965
Coyote Creek	633	540	$18,923,832	$84,154,008	$8,583,186	$22,890,180
Highland Creek	124	107	$15,942,687	$11,583,052	$19,274,341	$64,970,965
Indian Valley	633	227	$10,466,227	$24,405,049	$12,666,618	$47,664,208
Scott	4	0	$64,758	$0	$0	$64,758
Lake County Total	**1,520**	**981**	**$61,905,191**	**$131,725,161**	**$59,798,486**	**$201,126,076**

Source: Cal OES, Lake County 1/3/2017 Parcel/Assessor's Data

*Note: The Southeast Wastewater Treatment Plan does have an inundation area in the City of Clearlake, but not in the Lake County Planning Area; therefore, it is not included in this analysis.

11.7.4 Critical Facilities & Infrastructure

An analysis was performed for the 2018 HMP on the critical facility inventory in Lake County to determine critical facilities in the dam inundation zones. Using GIS, the dam inundation zones were overlayed on the critical facility GIS layer. Table 23 details critical facilities by facility type and count.

Table 23 Lake County – Critical Facilities in Dam Inundation Areas

Dam Inundation Area	Critical Facility Category	Facility Count
Unincorporated Lake County		
Coyote Creek Dam Inundation Area	Essential Services Facilities	1
	At Risk Population Facilities	1
	Total	2
Highland Creek Dam Inundation Area	Essential Services Facilities	1
	Total	1
Indian Valley Dam Inundation Area	Essential Services Facilities	3
	Total	3
Unincorporated Lake County Total		**6**
City of Clearlake		
Southeast Wastewater Treatment Dam Inundation Area	Essential Services Facilities	2
	At Risk Population Facilities	4
	Total	6
City of Clearlake Total		**6**
City of Lakeport		
Lakeport Wastewater Treatment Plant	Essential Services Facilities	3
	Total	3
City of Lakeport Total		**3**
Grand Total		**15**

Source: Cal OES, Lake County GIS

CHAPTER TWELVE: Severe Weather | Extreme Heat

Figure 39 A hot summer day in Northern Lakeport, August 2024.

Severe weather is generally any destructive weather event, but usually occurs throughout the Lake County Planning Area as localized storms that bring heavy rains, snow and storms; wind; and extreme heat. (Also see *CHAPTER THIRTEEN: Severe Weather | Heavy Rains, Snow & Storms).* This profile is focused on extreme heat.

To align with the *2023 California Hazard Mitigation Plan*, extreme heat for purposes of this plan is defined as temperatures that are 10° F or higher than the average high temperatures for a region for several days or more.

12.1 Hazard Profile

The National Weather Service (NWS) issues heat advisories and extreme heat warnings based on Heat Risk values. The Heat Risk changes through the year based on climatology. For instance, the temperature triggering advisories/warnings is lower in the spring than during the summer when temperatures are typically hotter. This is because people acclimate through the year. A lower temperature causes more impacts in the spring than in the summer.

These events can impact the healthcare system with increased heat-related illness or death, worsen drought, strain the electric grid and negatively impact water supply and other infrastructure.

The expected severity of the heat determines whether advisories or warnings are issued. The NWS Heat Risk forecast provides a quick view of heat risk potential over the upcoming seven days. The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. This can be seen in Table 24.

Table 24 National Weather Service Heat Risk Categories

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

Source: National Weather Service

The NWS office in Eureka monitors and forecasts for Lake County and issues the following heat-related advisory as conditions warrant:

- **Heat Advisories** are issued during events where the Heat Risk is on the Orange/Red threshold (Orange will not always trigger an advisory).
- **Excessive Heat Watches/Warnings** are issued during events where the Heat Risk is in the Red/Magenta output.

12.2 Location and Extent

Extreme heat can impact the entire Planning Area at once. For detailed community information refer to *Section 3.2 Planning Area Communities;* for a visual, refer to *Figure 5: Map of Lake County Cities, Towns, Communities, and Highways*.

The potential location and extent of the hazard impacts of extreme heat within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: Chapter Twelve: *Severe Weather: Extreme Heat*
    - 12.1.2 Differences between County and City assessments
    - 12.2 Location and Extent
- Lakeport Annex: Chapter Twelve: *Severe Weather: Extreme Heat*
    - 12.1.2 Differences between County and City assessments
    - 12.2 Location and Extent

12.3 Previous occurrences

There have been no FEMA or Cal OES disasters related to extreme heat. NWS Eureka issued 37 advisories and warnings since 2020 as seen in Table 25. (Note: This is not an indication of *number of days* of excessive heat.)

Table 25 NWS: Eureka Advisory & Warnings History

Year	Heat Advisory	Excessive Heat Warning
2024	6	2
2023	1	2
2022	5	2
2021	7	3
2020	6	3

Table 26 National Weather Services: Eureka Office Record High Temperatures in Lake County

Date	Record Temperature (Highs)	Location*
June 30, 1977	114	Clearlake 4 SE
July 16, 1972 & tied July 5, 1984	113	Clear Lake 4 SE & Lakeport
September 7, 2022	113	Clear Lake 4 SE
July 6, 2024	112	Mt. Konocti
August 9, 1981 & tied in 1981 and 1971 (7, 8, 10, 11)	112	Clear Lake 4 SE & Lakeport
July 7, 2024	110	Mt. Konocti
July 5, 2024	109	Mt. Konocti
July 13, 2024	108	Mt. Konocti
October 16, 1914	104	Upper Lake
May 30, 1910	102	Upper Lake
February 14, 1917	97	Upper Lake
April 30, 1994	94	Clear Lake 4 SE
November 16, 1895	94	Upper Lake

Date	Record Temperature (Highs)	Location*
March 18, 1914	90	Upper Lake
January 17, 2003	85	Upper Lake
December 26, 1967	80	Upper Lake
***Clear Lake 4SE Coop, 1950 – 2022; Upper Lake 2 N Coop, 1896 - 2006 with large gaps in the data; Lakeport Coop, 1920-2001**		

12.4 Probability of Future Events

Highly Likely - (For scale detail refer to probability in *Section 2.2.1 Priority*.)

12.4.1 Extreme Heat: Future Development

As the County shifts in demographics, more residents will become senior citizens. The residents of nursing homes and elder care facilities are especially vulnerable to extreme temperature events. Low-income residents and homeless populations are also vulnerable.

12.5 Impacts of Climate Change

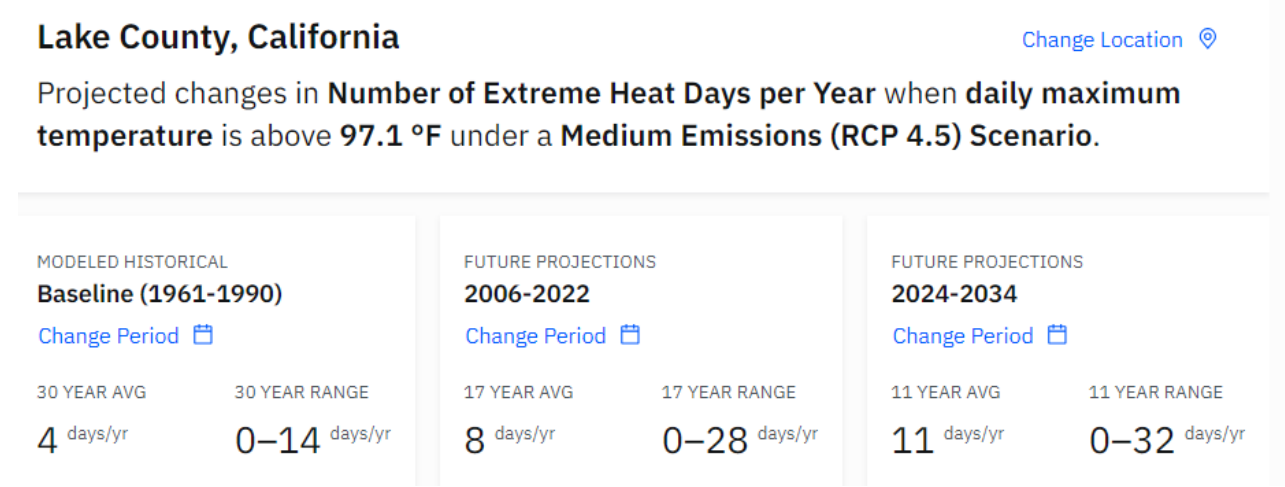
Climate change is projected to increase the frequency, intensity, and duration of extreme heat events across the state, particularly with the increasing warming of overnight low temperatures, making recovery from extreme heat during the daytime hours more challenging.

Cal-Adapt provides an extreme heat tool to assist with climate modeling. Figure 40 shows baseline data, future projections as demonstrated by current years, and future projects for ten years ahead.

12.6 Severe Weather | Extreme Heat: Secondary Hazards

- Increased risk of energy shortages due to increased air conditioning use – most impactful while other areas of the State are experiencing extreme heat.
- PG&E's Public Safety Power Shutoff (PSPS) events due to heightened fire danger due to specific weather conditions.
- Increased fire danger.
- Heightened drought conditions.

Figure 40 Cal Adapt's Extreme Heat Tool



12.7 Severe Weather | Extreme Heat: Exposure & Vulnerability

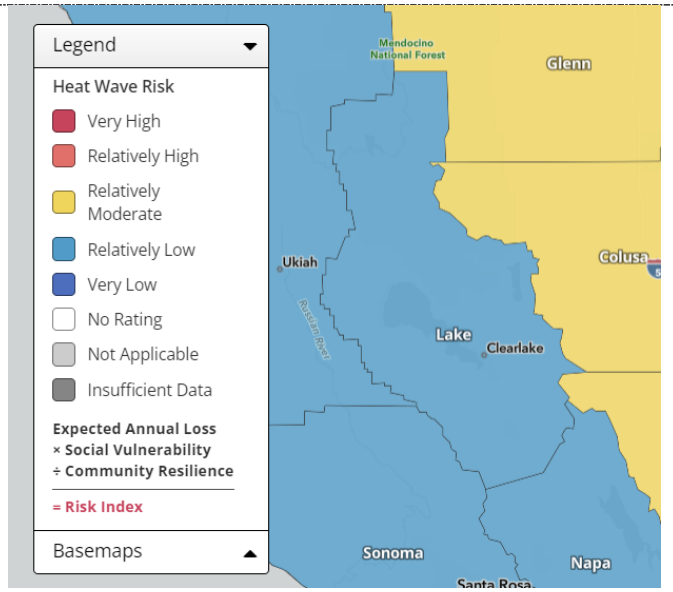
Vulnerability—High (Refer to *Section 4.1.2 Vulnerability* for scale detail.) Since the 2018 Plan Update, our understanding of extreme heat vulnerability has improved through better research, while the actual risks have increased due to climate change.

FEMA's National Risk Index developed a Heat Wave Risk Index score and rating to represent a community's relative risk for heat waves when compared to the rest of the United States. As evidenced in Figure 41, Lake County's rating is *relatively low*.

Extreme heat events are a recurring hazard in Lake County, particularly during summer months, though their intensity and frequency may vary from year to year. However, only limited county-specific data on the impacts of temperature extremes was available during the development of this profile.

Extreme heat typically does not significantly affect structures, as periodic relief from cooler temperatures reduces prolonged stress on buildings. Nationwide assessments generally identify areas prone to high temperatures but lack detailed, localized data on specific structures.

Figure 41 FEMA's National Risk Index rating for Lake County.



Prolonged periods of extreme heat can strain electricity demands, locally and state-wide or beyond, particularly for air conditioning in homes and businesses, and pose health risks for individuals exposed to high temperatures. Additionally, extreme heat can exacerbate or mimic drought conditions by increasing evapotranspiration and reducing vegetation moisture, thereby heightening wildfire vulnerability.

12.7.1 Population

The Public Health Alliance's Health Disadvantage Index identifies areas in California at greater risk of hazards like extreme heat by combining multiple health and socioeconomic factors. Vulnerable populations[16] in Lake County include:

Homeless	Infants & Children Under 5	Elderly	Individuals with disabilities	Individuals dependent on medical equipment*
460	~3,680	~15,830	~7,056	943

[16] Homeless data is derived from the Point in Time Count, available here (link). Population data is derived from the 2020 Census data.

*****The US Department of Health and Human Services Empower Map (Link) provides information about Medicare beneficiaries by zip code, including those at risk of extreme heat due to dependence on electricity-dependent durable medical and assisted equipment and devices. Of those identified Countywide, approximately 28% reside in the Clearlake zip code (95422); no zip code in Lake County has none.

In addition to vulnerable populations, pets, livestock and wildlife are at risk of extreme heat.

12.7.2 Property & Critical Infrastructure

All property, critical infrastructure and other County owned/leased properties are at risk. For details refer to *4.3.2 Critical Facilities*. Older construction and mobile homes may lake sufficient cooling equipment.

Figure 42 An unexpected snow day:

February 24, 2023 in Nice, Ca, with Clear Lake in the distant background.

Severe weather is generally any destructive weather event, but usually occurs throughout the Lake County Planning Area as localized storms that bring heavy rains, snow and storms; wind; and extreme heat. See *CHAPTER TWELVE: Severe Weather | Extreme Heat*.

The National Weather Service (NWS) reports that storms and thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of greater than 35,000 ft. As the rising air reaches its dew point, water droplets and ice form and begin falling long distances through the clouds towards earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at Earth's surface and causes strong winds associated with thunderstorms.

13.1 Hazard Profile

Storms in Lake County occur regularly and are characterized by heavy rain, strong winds, and sometimes lightning, hail, or snowfall. These storms are influenced by four primary climatic factors: geographical altitude, the Pacific Coastal Mountain range, prevailing storm tracks, and air masses.

1. **Geographical Altitude**
   Lake County's elevation varies significantly, ranging from 1,200 feet to over 7,000 feet, which contributes to localized weather variations.
2. **Mountain Range as a Barrier**
   Situated in the Pacific Coastal Mountain range, Lake County lies about 30 miles inland from the Pacific Ocean. The mountains act as a barrier, forcing westward-moving air masses to rise, which increases the likelihood of precipitation.
3. **Storm Track Influence**
   Winter storms are guided by the Westerlies, a global atmospheric wind pattern. Storm systems often originate from a low-pressure system in the Gulf of Alaska and are funneled southward along the California coast, bringing significant precipitation to the region.
4. **Air Mass Characteristics**
   Marine polar air masses dominate the region, bringing cold, moist air from the Pacific Ocean, particularly during the winter months.

Short-term heavy storms can cause widespread flooding and localized drainage issues, exacerbated by insufficient drainage infrastructure due to population growth. Additionally, strong winds during storms, combined with saturated soil, can uproot mature trees, causing potential damage to property and infrastructure.

13.2 Location and Extent

For detailed community information refer to 3.2 Planning Area Communities; for a visual refer to Figure 5.

Severe weather, including **heavy rain**, **snow**, and **wind**, can impact the entire Planning Area simultaneously. **Heavy rain** can cause a range of issues, from saturated ground and localized flooding to lake-level floods. Other storm impacts may include power outages (often caused by trees hitting power lines), downed trees, road closures, washouts, and property damage, ranging from minor issues like damaged fencing to the complete destruction of homes. Rainfall is usually manageable; however, severe storms delivering heavy rain in short periods can cause localized flooding that affects road conditions.

Snowfall can occur throughout the Planning Area but is typically concentrated in higher elevations. When snow accumulates at lower elevations, road conditions may be affected. Larger snowstorms, with several inches or more, can lead to secondary impacts such as power outages from falling trees or closed roads, disrupting residents' daily lives.

When combined with **strong winds**, these storms can uproot trees and cause additional power outages. The County relies on the National Weather Service to monitor weather conditions and issue severity alerts, watches, and warnings to help mitigate storm impacts.

- For a **Wind Advisory**, the thresholds are the same regardless of elevation:
    - Frequent gusts of 45 mph or sustained winds of 35 mph.

- For a **High Wind Warning**, the thresholds vary by elevation:
    - For **lower elevations** (for Lake County this is below around 1800 feet or around the Lake) the threshold is frequent gusts of 58 mph or sustained wind of 40 mph.
    - For **higher elevations** (generally above 1800 feet) the threshold is frequent gusts of 70 mph or sustained wind of 45 mph.

The potential location and extent of the hazard impacts to heavy rain, snow and winds within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: Chapter Thirteen: *Severe Weather: Heavy Rains, Snow, & Storms*
    - 13.1.2 Differences between County and City assessments
    - 13.2 Location and Extent

- Lakeport Annex: Chapter Thirteen: *Severe Weather: Heavy Rains, Snow, & Storms*
    - 13.1.2 Differences between County and City assessments
      13.2 Location and Extent

24

Severe Storm Related Disaster Declarations in Lake County since 1950

13.3 Previous occurrences

For a complete list of previous disaster declarations refer to Section 2.1 Disaster Declarations.

The most recent disaster declarations include:

- **2024 Late January, Early February Winter Storms**
  Heavy rain and strong winds in a short duration led to downed trees and power lines, disrupting transportation routes, first responder access, and residential areas, with the most significant impacts reported in Cobb, Kelseyville, and Lucerne. Clear Lake exceeded 8' Rumsey. Over 70 damage reports were submitted by residents, detailing issues ranging from missing roof shingles on sheds and damaged fences to the complete destruction of homes.
- **2023 – Late February Snow and Extreme Cold**
  Snowpack built up, causing damage to infrastructure and impacts to transportation combined with extreme cold. Many residents were stranded at home without power. A warming center operated through the coldest hours, and Search and Rescue Volunteers were activated to provide transportation to those stranded at home and in need of help. Over 40 residents and business owners reported a range of impacts including collapsed roofs on sheds, arenas and homes.

13.3.1 Rain

Data from NWS show average annual precipitation in Lake County at various locations:

- Middletown 42.6"
- Clearlake SE4 29.86"
- Upper Lake 39.59"
- Lakeport 34.5"

The highest recorded annual precipitation is:

- Middletown 2016-2017 84.53"
- Clearlake SE4 1997-1998 58.32"

- Upper Lake 1914-1915 63.16”
- Lakeport 1997-1998 57.78”

13.3.2 Snow

Data from NOAA shows Lake County snow records:

- One-day Snowfall recorded 28” of snowfall on March 15, 1942 on Cobb Mountain.
- Three-day Snowfall recorded 38” on March 1, 2023 near Lake Pillsbury.
- Average snowfall county wide is approximately 1.0 inches.

13.3.3 Wind

NWS Eureka issued 40 advisories and warnings since 2020 as seen in Table 25.

Figure 43 NWS: Eureka Advisory & Warnings History (Wind)

Year	Wind Advisory	High Wind Warning
2024	10	2
2023	13	0
2022	7	0
2021	7	0
2020	1	0

13.4 Probability of Future Events

Highly Likely - (For scale detail refer to probability in *Section 2.2.1 Priority*.)

According to historical hazard data, severe weather is an annual occurrence in Lake County. Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future.

Heavy rain and thunderstorms are the most frequent type of severe weather occurrences in the County. Wind and lightning often accompany these storms and have caused damage in the past. Hail is rare in the County.

Despite these facts, actual damage associated with the primary effects of severe weather have been limited. It is the secondary hazards caused by weather, such as floods, fire, and agricultural losses that have had the greatest impact on the County.

13.4.1 Future Development

Future development must prioritize resilience to severe weather, including heavy winds, rain, and snow. Key considerations include avoiding building in high-risk

areas such as floodplains and regions with poor drainage. Building designs should adhere to updated codes for wind resistance, snow load capacity, and elevated structures in flood-prone areas. Robust stormwater management systems, including permeable pavement, upgraded culverts, and retention basins, are essential to mitigate flooding. Transportation networks must be designed or updated for year-round access, with roads, bridges, and evacuation routes engineered to withstand severe weather impacts.

Additionally, preserving natural floodplains, stabilizing slopes, and implementing fire-resistant landscaping can reduce environmental risks. Long-term adaptation strategies, including the integration of climate projections into planning, are critical to ensure sustainable and safe development in the face of changing weather patterns.

13.5 Impacts of Climate Change

MIT scientists found that extreme precipitation events in California should become more frequent as the Earth's climate warms over this century[17]. In California, they calculated that, if the world's average temperatures rise by 4 degrees Celsius by the year 2100, the state will experience three more extreme precipitation events than the current average, per year.

13.6 Next Hazard: Secondary Hazards

13.6.1 Agricultural Impacts:

According to the US Department of Agriculture (USDA), every year natural disasters, such as droughts, earthquakes, extreme heat and cold, floods, fires, earthquakes, hail, landslides, and tornadoes, challenge agricultural production. Because agriculture relies on the weather, climate, and water availability to thrive, it is easily impacted by natural events and disasters. Agricultural impacts from natural events and disasters most commonly include:

- contamination of water bodies
- loss of harvest or livestock
- increased susceptibility to disease
- destruction of irrigation systems and other agricultural infrastructure.

These impacts can have long lasting effects on agricultural production including crops, forest growth, and arable lands, which require time to mature.

[17] Study finds more extreme storms ahead for California – Climate Change: Vital Signs of the Planet (nasa.gov)

13.6.2 Landslide & Debris Flow

Landslides within the Planning Area tend to occur during periods of excessive rainfall. Since Lake County's mountainous terrain defies gravity as it rapidly rises to upper elevations, much of the remote high-relief topography in the county can be identified as having the potential for landslides. Landslide and debris flows threaten roads, including the primary transportation routes and in the remote mountain areas maintained by County Roads Department.

Areas throughout the Planning Area that experienced landslides historically include Clearlake Oaks, Lucerne, Clearlake Riviera, Cobb Mountain, and Bartlett Springs.

Notable slides include:

- **Spring Valley Landslide (also referred to as the Cache Creek Slide**)- The Slide is located approximately 1.5 miles downstream of the Indian Valley Dam and approximately 2.5 miles upstream of the residential community of Spring Valley in northeast Lake County, California.

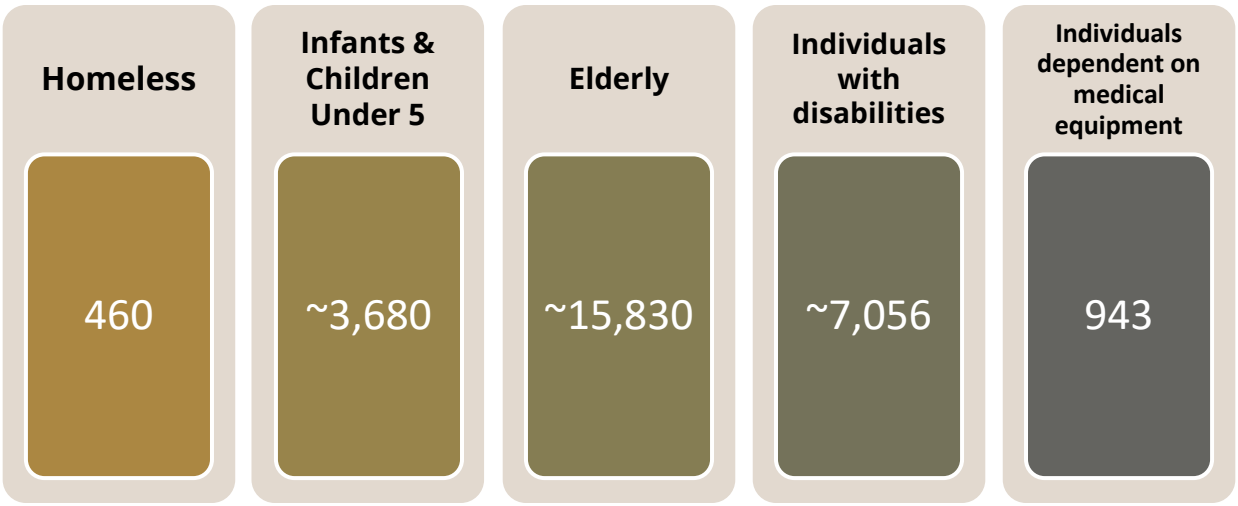
  Significant movement of the slide is noted between 1993 and 1999. A 2002 geotechnical analysis of the landslide slope stability indicates a very high risk of failure associated with a 100-year, 10-day storm. The analysis examined two potential landslide scenarios:

  - Mid-Level: Only the upper portion of the landslide would fail into the creek resulting in a dam approximately 105 feet high. [Most probable.]
  - Complete: The entire landslide would fail to the toe of slope resulting in a landslide dam 191 feet high.

- **Anderson Springs** where an approximately 4-acre landslide developed on private property leased by Calpine. The slide is at the westerly end of the community of Anderson Springs, and slide debris closed Anderson Springs Road during the winter storms of 2017.
- **The community of Ettawa Springs**. This approximately 2-acre slide was also discovered during the winter storms of 2017.

13.7 Severe Weather | Heavy Rains, Snow & Storms: Exposure & Vulnerability

Vulnerability—High (Refer to *Section 4.1.2 Vulnerability* for scale detail.) No change since 2023 Plan Update.



13.7.1 Population

The entire population of Lake County, including residents, employees, and visitors, are at risk from the impacts of severe weather including disruption of daily life, with impacts on transportation, utilities and access to essential services and employment. Extreme weather events hinder emergency response efforts due to impassable roads, fallen trees and downed power lines.

Residents with access and functional needs, especially those dependent on medical equipment, are at heightened risk due to mobility challenges especially when power outages occur. Homeless populations face direct exposure to severe weather conditions.

13.7.2 Property and Critical Facilities & Infrastructure

All property, critical infrastructure and other County owned/leased properties are at risk. Risk to **residential and commercial properties** include localized flooding, damaging building foundations and low-lying homes. Strong winds can cause roof damage, broken windows and uprooting of trees that could fall on structures.

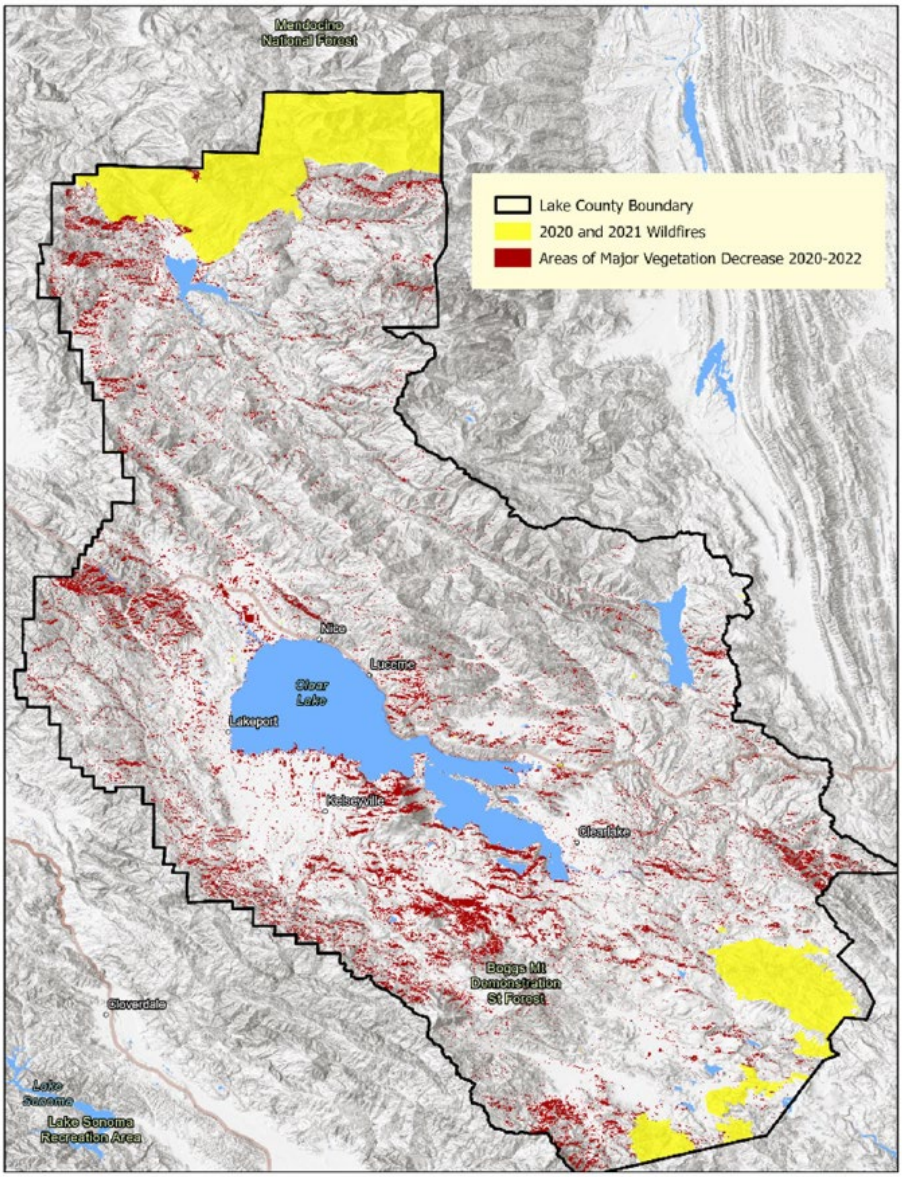
Agricultural lands may experience soil erosion, crop flooding and damage to irrigation; high winds damage fences, barns and other structures and while rare, snowfall can damage crops and impact livestock.

Transportation systems and utilities can be impacted by these events. Communication infrastructure is susceptible to damage from high winds and falling debris.

CHAPTER FOURTEEN: Tree Mortality

Repeated wildfire events, drought and persistent historically high temperatures have had compounding effects in Lake County. One profound consequence has been dramatic growth in conifer tree death, categorically known as "Tree Mortality." With two-thirds of our landmass having burned since 2015, bark beetles have found an ideal environment to flourish in Lake County, and resulting conifer infestation has been devastating. On May 3, 2022, the Lake County Board of Supervisors declared a Local Emergency due to "Pervasive Tree Mortality." Vegetation loss over the period of 2020-2022 was truly startling, as reflected in Figure 44 .

Figure 44 Vegetation Loss due to Tree Mortality



14.1 Hazard Profile

Tree Mortality is currently widespread and worsening in many parts of California, as demonstrated by the United States Forest Service's (USFS') Annual Aerial Surveys.

https://www.fs.usda.gov/detail/r5/forest-grasslandhealth/?cid=fsbdev3_046696

In 2019, USFS estimated 1,000 Lake County acres were afflicted by Tree Mortality. The estimated number of dead trees was 3,000.

Those estimates have exponentially grown in the time since:

- 2019 – 1,000 Acres, 3,000 dead trees
- 2021 - 21,000 Acres, 331,000 dead trees
- 2022 - 31,000 Acres, 590,000 dead trees
- 2023 - 13,000 Acres, 790,000 dead trees
- 2024 - The Northern California area had many large fires 3 years ago which were resurveyed for the first time in 2024. Approximately 8.8 million acres were surveyed in 2024 compared to ~7.1 million acres surveyed in 2023. 2024 Data has not been release at the time of this update.

Note: no directly analogous survey was conducted in 2020.

Dead and dying trees located near County roadways and evacuation routes pose the most immediate concern, and 22,000 such trees had been documented as of early April 2023. The magnitude of this issue means remediation carries a highly significant level of cost, with some estimates to address roadside trees, ranging into the tens of millions of dollars. Project planning is underway to perform mitigation activities in areas of high priority, but this is expected to be a long-term concern, with work continuing for perhaps a decade or more.

14.2 Location and Extent

A map demonstrating geographic locations of Tree Mortality as of 2022 and nearby populations is included as Figure 44. Dr. Michael Jones, the University of California Cooperative Extension's Forest Advisor for Lake County and a trained entomologist, indicates that removal of dead and dying trees is critical to mitigating multi-species bark beetle infestation; in the absence of such remedies, conditions will continue to worsen.

The potential location and extent of the hazard impacts to tree mortality within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: Chapter Fourteen: *Tree Mortality*
    - 14.1.2 Differences between County and City assessments

    - 14.2 Location and Extent
- Lakeport Annex: Chapter Fourteen: *Tree Mortality*
    - 14.1.2 Differences between County and City assessments
      14.2 Location and Extent

14.3 Previous occurrences

Prior to 2022, there had been no disaster declarations related to Tree Mortality in Lake County. Previous waves of tree mortality have occurred in the State of California, and then-Governor Edmund G. Brown, Jr., declared a State of Emergency in October of 2015.

14.4 Probability of Future Events

Highly Likely - (For scale detail refer to probability in *Section 2.2.1 Priority*.)

Tree Mortality is pervasive and worsening at this time, and efforts to respond are likely to persist through the full period encompassed by the *2023 Hazard Mitigation Plan*.

14.5 Impacts of Climate Change

Drought and wildfire have been significant instigators of this recent and devastating wave of Tree Mortality. In general, the frequency of such events in California is expected to increase due to climate change. Winter storms of 2023 demonstrated significant windstorms, rain and low elevation snowfall that can cause vulnerable trees to fall in roadways and on structures; these concerns may grow with greater stochasticity (randomness) and severity in weather patterns.

14.6 Secondary Hazards

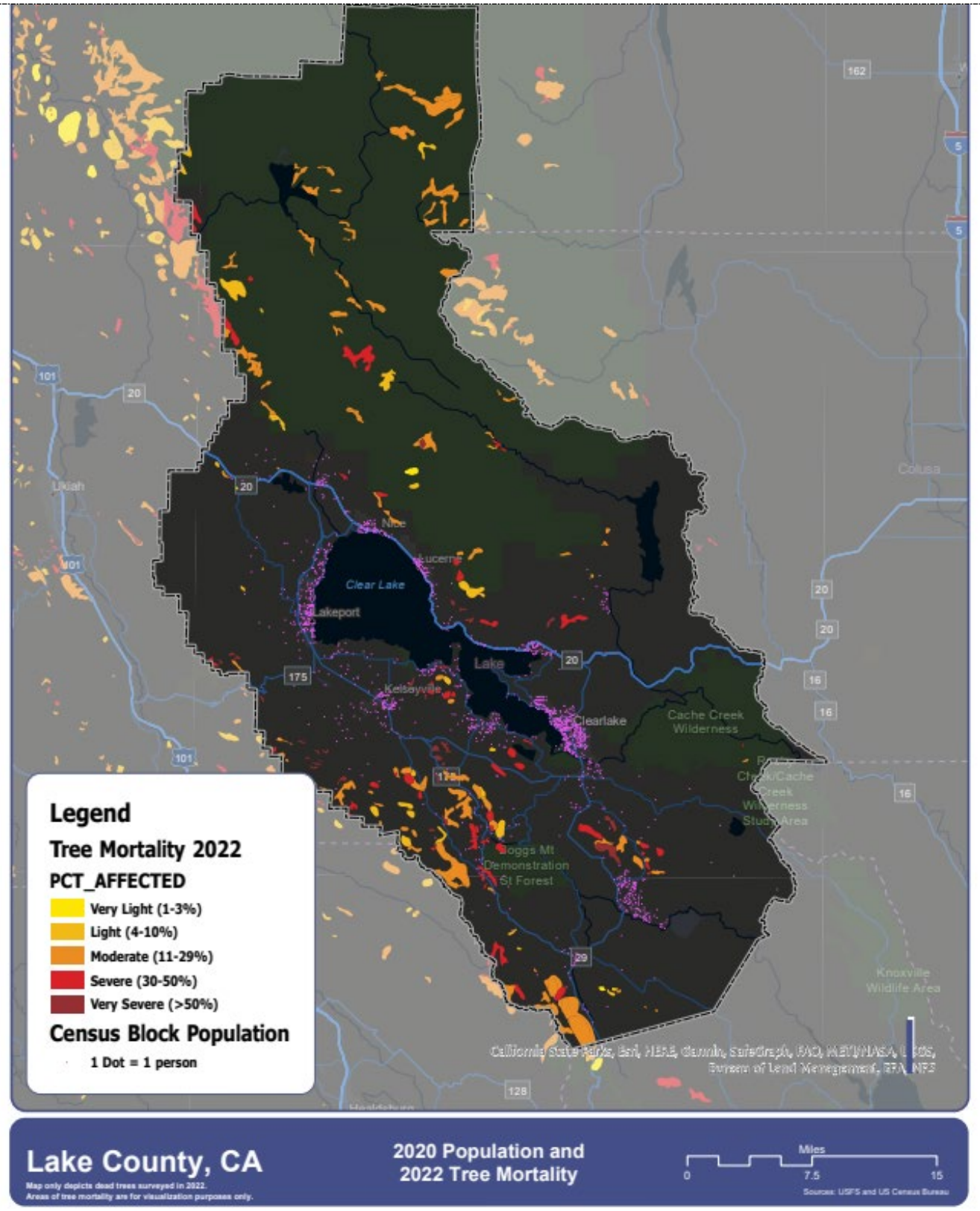
Dead and dying trees increase the availability of fuels, and carry the potential to promote the spread of wildfire. Vegetation losses from 2020-2022 have occurred in areas outside of the footprints of recent wildfire events.

14.7 Exposure & Vulnerability

Vulnerability—Extremely High (Refer to *Section 4.1.2 Vulnerability* for scale detail.)

Severe Tree Mortality in population-dense areas can cause significant loss of life and property, if trees were to fall along roadways during a wildfire event, for example. Please see Figure 45 for a visualization of Tree Mortality severity, as compared to population density, in the geographic boundaries of Lake County.

Figure 45 Tree Mortality and Population



CHAPTER FIFTEEN: Volcano and Geothermal Gas Release

Figure 46: Volcanic Vent from Mt. Konocti in Clear Lake State Park

A **volcano** is a geological feature where molten rock, gas, and debris erupt through the Earth's crust. **Geothermal gases** are naturally occurring gases, such as hydrogen sulfide and carbon dioxide, released from underground volcanic activity through vents, fissures, or hot springs.

California hosts diverse volcano types, with risks dependent on eruption style, lava volume, vent location, duration, and local water conditions. Hazard severity generally decreases with distance from the vent. According to the USGS, California has 15 volcanic centers classified as Low to Very High Threat, monitored by the California Volcano Observatory (CalVO). Seven volcanoes, including the Clear Lake Volcanic Field, have partially molten rock (magma) beneath them, indicating future eruption potential. Refer to The **Clear Lake Volcanic Field** features lava domes, cinder cones, and maars (explosive eruption craters). Its largest feature, Mount Konocti, rises over 3,200 feet above Clear Lake. An active geothermal zone lies beneath, powered by silicic magma approximately 7 kilometers deep. This magma fuels both the Clear Lake Volcanic Field and **The Geysers**, the world's largest geothermal energy facility. The most recent eruptions in the Clear Lake area occurred around 10,000 years ago, and the area remains geologically active.

Geothermal gases escape through natural and man-made structures, potentially entering indoor spaces via foundation cracks or utility openings. High concentrations can cause health risks, including toxicity, suffocation, and explosions.

Figure 47 for a map of California volcanoes including the Clear Lake Volcanic Field as depicted in the *2023 California Hazard Mitigation Plan*.

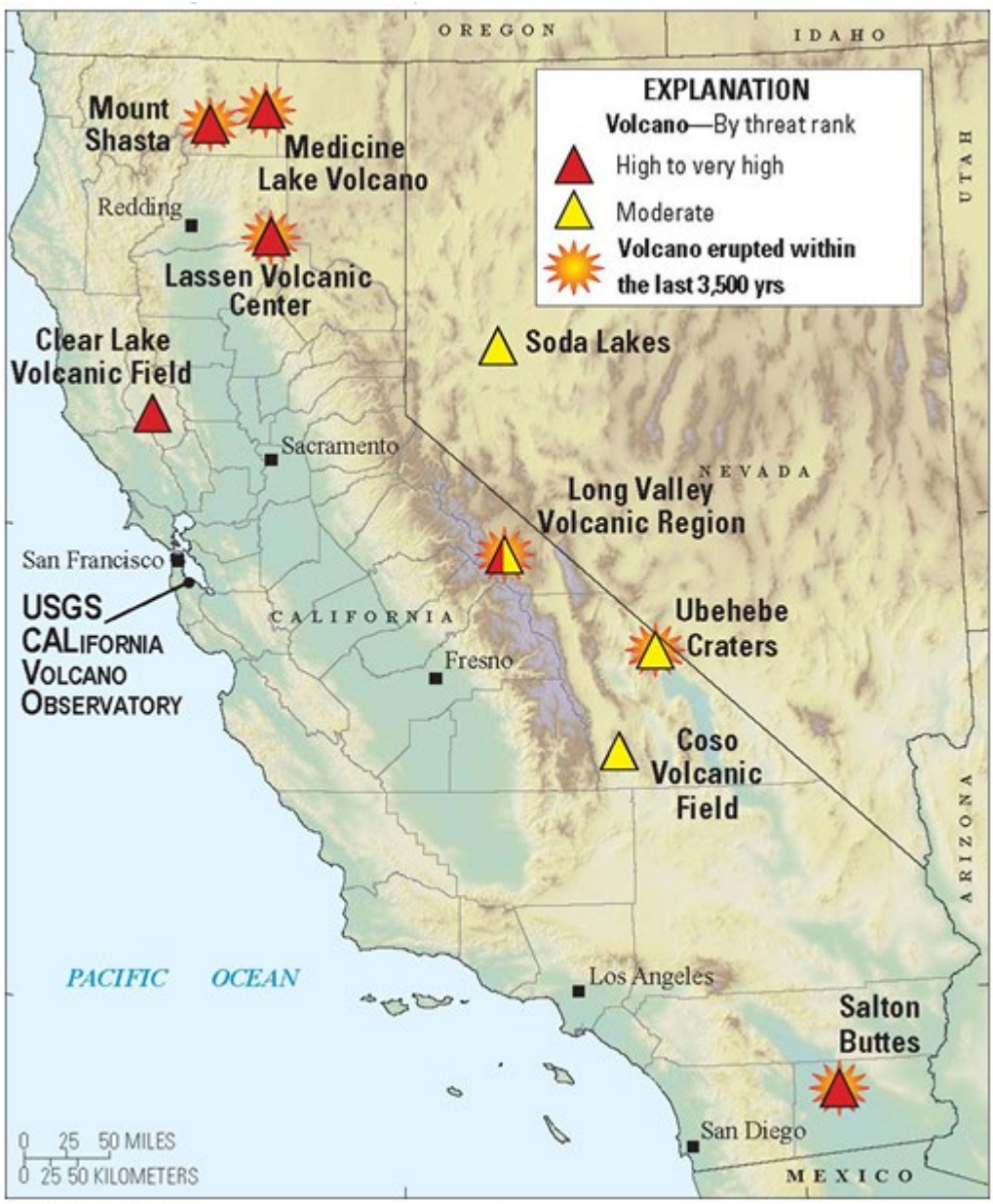
15.1 Hazard Profile

The **Clear Lake Volcanic Field** features lava domes, cinder cones, and maars (explosive eruption craters). Its largest feature, Mount Konocti, rises over 3,200 feet above Clear Lake. An active geothermal zone lies beneath, powered by silicic magma approximately 7 kilometers deep. This magma fuels both the Clear Lake Volcanic Field and **The Geysers**, the world's largest geothermal energy facility. The most recent eruptions in the Clear Lake area occurred around 10,000 years ago, and the area remains geologically active.

Geothermal gases escape through natural and man-made structures, potentially entering indoor spaces via foundation cracks or utility openings. High concentrations can cause health risks, including toxicity, suffocation, and explosions[18].

Figure 47: Active Volcanoes in California and in the Lake County Area
Source: 2023 California State Hazard Mitigation Plan

[18] This is mainly a concern with gas generated from hydrocarbons (natural gas or methane), which are not necessarily part of the volcanic system.



Source: (USGS 2022a)

15.2 Location and Extent

The Clear Lake Volcanic Field includes Clear Lake (43,000 acres) and its surrounding areas, such as the town of Clearlake. While most past eruptions were nonexplosive, the most recent activity involved explosive events near Mount Konocti and the southeastern part of the lake.

Geophysical studies reveal a complex magmatic system.

- A magma chamber approximately 8.7 miles in diameter lies about 4.3 miles below the surface.
- This chamber primarily contains silica-rich magma, responsible for past silicic eruptions.
- Silica-poor magma from deeper within the Earth's mantle likely fueled more recent explosive activity. This type of magma could rise through faults within weeks to months.

The magmatic storage region's actual shape is intricate, with simplified models often representing it as spherical or cylindrical. Figure 48 Magmatic storage region's depiction.provides the most accurate depiction, showing:

- Melt beneath the Geysers and Mount Hannah.
- Solidified magma (plutons) beneath Mount Hannah and Mount Konocti.
- Fault zones connecting these areas within a system extending 7.5 to 12 miles deep.

This dynamic volcanic field underscores the importance of monitoring its potential hazards.

Geothermal gas venting is most common in the southern and eastern regions of Clear Lake, influenced by earthquakes and seasonal changes. Gases include hydrogen sulfide, methane, carbon dioxide, and occasionally radon.

Figure 48 Magmatic storage region's depiction. Captured from Mitchell, et al, "Imagining the magmatic plumbing of the Clear Lake Volcanic Field using 3-D gravity inverstion" printed in the Journal of Volcanic and Geothermal Research (2023).

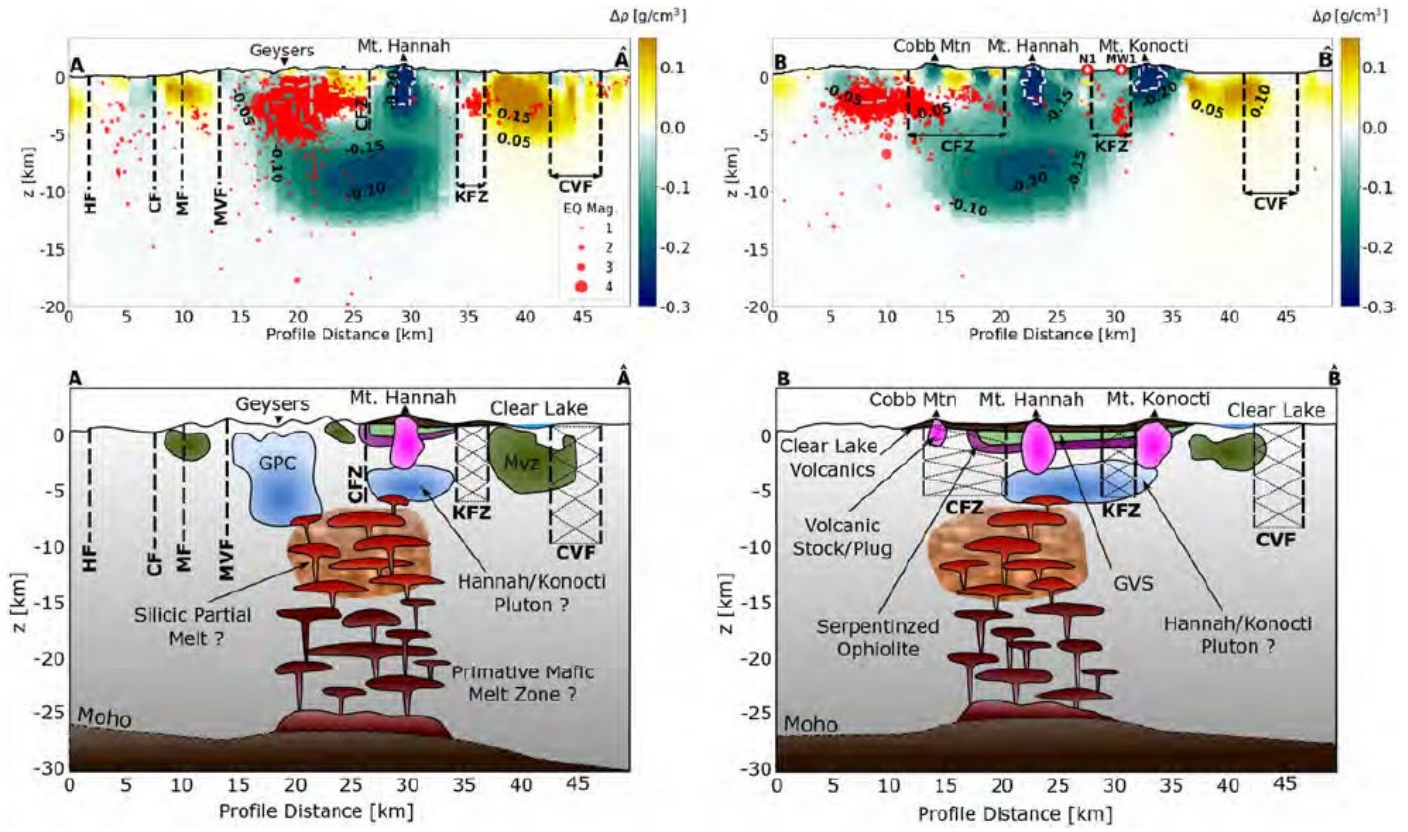
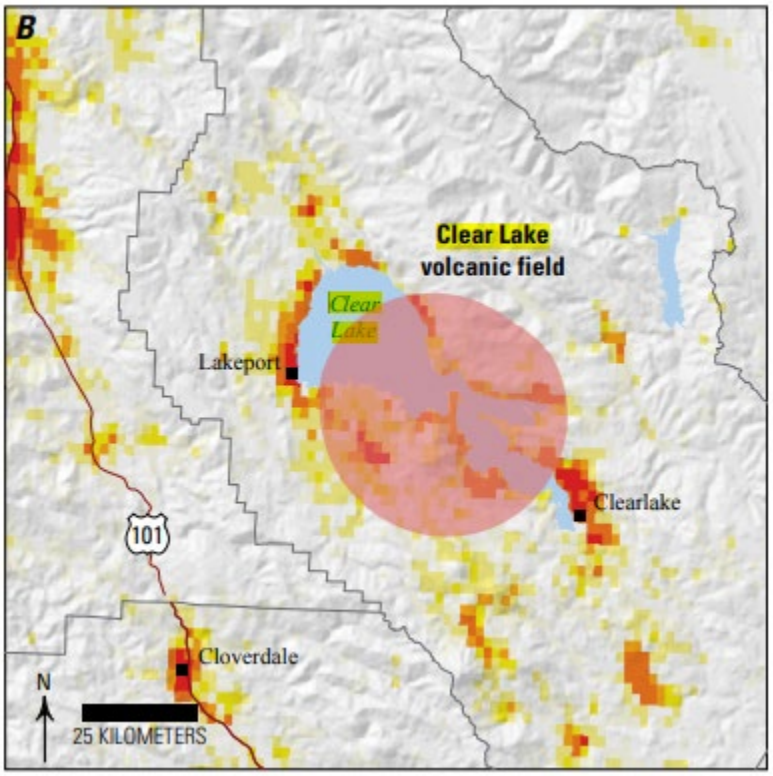


Fig. 23. Interpretive cartoons (bottom row) compared to A-$\hat{A}$ and B-$\hat{B}$ sections from the geologically constrained 5-unit PGI of the field dataset overlaid with the location of faults (vertical black dashed lines) and earthquake hypocenters (red dots) that fall within 1 km on either side of the profile (top row). The cartoons illustrate our interpretation of the subsurface geology based on the inversion results and the findings of previous studies. As in Fig. 1 faults are labeled in the following manner: HF-Healsburg Fault, MF-Maacama Fault, CF-Chianti Fault, MVF-Mercuryville Fault, CFZ-Collayomi Fault Zone, KFZ-Konocti Bay Fault Zone, and CVF-Clover Valley Fault. In the interpretive cartoons, Franciscan Complex rocks are gray, upper mantle rocks are black, the Geysers Plutonic Complex (GPC) is light blue, the Great Valley Sequence (GVS) is pale green, serpentinized ophiolites are purple, Mesozoic volcanics and metavolcanics (Mvz) are dark green, volcanic stocks/plugs are magenta and Clear Lake Volcanics are dark brown. The light brown, textured body overlaid with reddish orange sills between 6 and 13 km depth shows the proposed silicic partial melt zone, and the dark red sills show the inferred primitive mafic melt zone beneath it.

Figure 49 A view of the Clear Lake volcanic field.

(Source: USGS Scientific Investigations Report, "California's Exposure to Volcanic Hazards" page 25)



The potential location and extent of the hazard impacts to volcanoes and geothermic gasses within the City of Clearlake and the City of Lakeport are outlined in their respective annexes.

- Clearlake Annex: Chapter Fifteen: *Volcano and Geothermal Gas Release*
  - 15.1.2 Differences between County and City assessments
  - 15.2 Location and Extent
- Lakeport Annex: Chapter Fifteen: *Volcano and Geothermal Gas Release*
  - 15.1.2 Differences between County and City assessments
  - 15.2 Location and Extent

15.3 Previous occurrences

15.3.1 Disaster Declarations

There have been no disaster declarations related to volcanoes or geothermal gases in Lake County. Historical volcanic activity spans four eruptive episodes over 2 million years, with the last eruptions occurring 10,000 years ago. Tribal oral histories recorded by Lake County historians contain mentions of likely volcanic activity in the form of mythology. Based on archaeological occupation data, this places human-observed eruptions sometime within the last 12-14,000 years. Current monitoring by USGS and Calpine Corporation ensures ongoing assessment of activity.

15.4 Probability of Future Events

For scale detail refer to probability in Section 2.2.1 Priority.

Volcanoes: While future eruptions are likely, for purposes of this Plan (focused on the next 5 years and beyond, rather than thousands of years) this hazard is **unlikely.** Potential hazards include lava flows, ashfall, pyroclastic flows, and localized explosions.

Geothermal Gases: **Likely.** Gas emissions are ongoing, with risks heightened during high lake levels or low-pressure weather systems.

15.5 Impacts of Climate Change

Volcanoes: Climate change is unlikely to have any impact on volcanic activity.

Geothermal Gases: Changes in precipitation and lake levels may alter gas venting patterns. Prolonged drought could expose submerged vents, while increased rainfall may enhance chemical leaching, affecting water quality.

15.6 Secondary Hazards

15.6.1 Air Quality

Volcanic ash and gases like sulfur dioxide (SO_2) can degrade air quality, causing respiratory issues and creating acid rain. Vog (volcanic smog) may blanket nearby areas during eruptions.

15.6.2 Water Quality

Acidic runoff from geothermal activity and volcanic eruptions can contaminate water sources, dissolve toxic metals, and harm aquatic life.

15.6.3 Agricultural Impacts

Volcanic ash and acidic conditions can reduce crop yields and soil fertility. Geothermal gases can further acidify soil and water, disrupting agriculture.

15.7 Exposure & Vulnerability

Vulnerability—Extremely High (Refer to *Section 4.1.2 Vulnerability* for scale detail.)

15.7.1 Population

The Clearlake Volcanic Field[19] has approximately 17,000 residents within the immediate area of impact. The Big Valley Band of Pomo Indians' rancheria is located within this field. Clear Lake State Park, situated at the base of Mount

[19] Data Source: USGS "California's Exposure to Volcanic Hazards Scientific Investigations Report 2018-5159" December 2019

Konocti, hosts over 70,000 visitors annually, and over 25 million vehicles pass through the volcanic field each year.

Populations near the volcanic field face heightened vulnerability to eruptions, lava flows, and ashfall, which can disrupt daily life and compromise health. Volcanic ash, in particular, poses long-range threats to communities and aviation, even miles from the eruption site.

15.7.2 Property & Critical Infrastructure

The area includes 24 critical facilities, including schools and emergency centers. Lava flows, ashfall, and pyroclastic activity threaten infrastructure, while gas intrusions pose risks to homes, public facilities, and transportation systems.

Geothermal Gasses

Geothermal gases pose risks to outdoor workers, wildlife, and aquatic systems. In enclosed spaces, they can cause explosions or suffocation. Specific dangers include:

- **Carbon Dioxide (CO_2):** Can accumulate in basements, depressions, or over still water (e.g., Soda Bay springs), leading to suffocation.
- **Hydrogen Sulfide (H_2S):** Toxic even at low levels; it causes "nose blindness," making high concentrations harder to detect.
- **Methane**: Explosive and odorless, making detection challenging.

CHAPTER SIXTEEN: Mitigation Strategy

The results of the planning process, risk assessment, goal setting, identification of mitigation actions, and the hard work of the Hazard Mitigation Planning Committee (HMPC) led to the mitigation strategy and mitigation action plan for this HMP Update. As part of the HMP Update process, a comprehensive review and update of the mitigation strategy portion of the plan was conducted. The goals from the 2023 plan were refined, and Lake County, Clearlake, and Lakeport aligned goals across all three jurisdictions and identified specific jurisdiction-specific objectives.

16.1 Capabilities

The County of Lake has a long history of successfully administering projects and programs and comprehensive existing building codes, land use, and development ordinances and regulations.

The Fiscal Year 2024-25 budget is $407,607,531, and Position Allocations provide for over 1,000 Full-Time Equivalents (FTEs) across 26 County Departments and an even greater diversity of agencies. Administrative and departmental staff likewise routinely manage tens of millions of dollars in contracts with partner organizations, to meet critical county and community needs. Policies and procedures are in place to effectively provide for the operational capacity of each Department.

For additional details on capabilities and methods to improve, refer to the following tables:

Regulations Related to Hazards	Table 27
Administrative and Technical	Table 28
Financial	Table 29
Education and Outreach	Table 30
Clearlake Capabilities	Annex Tables 19-22
Lakeport Capabilities	Annex Tables 22-25

The cities of Clearlake and Lakeport have outlined the differences specific to their jurisdiction's capabilities in *Chapter Sixteen: Mitigation Strategy* in each respective annex.

Table 27 County of Lake Regulations that Address Hazards

Lake County Municipal Code	
Regulation	**Summary**
Chapter 5 Building Regulations, Article I. In General, Sec. 5-4, 4.1	2016 California Building Standards Code, and 2019 California Building Code, Residential Building Code, Electrical Code, Plumbing Code, Mechanical Code, Energy Code, Green Building Code, Fire Code, Administrative Code, Historical Building Code, Existing Building Code, and 2018 International Property Maintenance Code, Wildland-Urban Interface Code
Chapter 5 Building Regulations, Article I. In General, Sec. 5-4F, 4F.1 through 4F.2(b)4	Fireworks displays require a permit. Violations of the regulations will result in fines. Parents and guardians of minors who violate laws who be held responsible.
Chapter 5 Building Regulations, Article I. In General, Sec. 5-6, 6.6	No building permit shall be issued without a flood plain review by the Lake County Flood Watershed Protection District. Any construction or placement of structures in the one hundred (100) year flood plain shall conform to the requirements of Chapter 24.
Chapter 5 Building Regulations, Article I. In General, Sec. 5-6, 6.10	No building permit shall be issued without review by the local district having jurisdiction over fire protection.
Chapter 5 Building Regulations, Article I. In General, Sec. 5-6, 6.17	All liquefied petroleum gas installations shall comply with the National Fire Protection Agency (NFPA) Standard 58 for the storage and handling of LP Gas.
Chapter 5 Building Regulations, Article I. In General, Sec. 5-6, 6.18	All fuel oil tanks and fuel oil appliance installations shall comply with the National Fire Protection Agency (NFPA) Standard 31 for the installation of oil burning equipment.
Chapter 5 Building Regulations, Article I. In General, Sec. 5-6, 6.23 (a) (C)	All driveways exceeding sixteen (16) percent (one (1) foot vertical to six (6) foot horizontal 1:6) in grade and all ramps shall be approved by CALFIRE if located within State Responsibility Areas.

Lake County Municipal Code	
Regulation	**Summary**
Chapter 5 Building Regulations, Article I, Sec. 5-6, 6.23 (a) (D)	All driveways exceeding sixteen (16) percent (one (1) foot vertical to six (6) foot horizontal 1:6) in grade and all ramps shall be approved by the local district providing fire protection.
Chapter 5 Building Regulations, Article I, Sec. 5-6, 6.24, 4.	Notwithstanding the forgoing, any agricultural building proposed to be located in a FEMA flood hazard area as defined in Chapter 25, shall be constructed in compliance with the requirements of Chapter 25.
Chapter 9 Health and Sanitation, Article IVB, Sec. 9-28B, 28B.81	Any person or entity in possession of a hazardous substance, either as owner, agent, bailee, carrier or otherwise, shall take all action necessary to remedy the effects of the release of a hazardous substance, including notifying the Department of Public Health.
Chapter 13 Nuisances, Article VII, Sec. 13-66	Addresses hazardous vegetation and/or combustible material through enforcement of the abatement procedures in the Hazardous Vegetation/Combustible Material Abatement Program.
Chapter 15 Recreation, Article VII, Sec. 15-45	Restriction on public use of highland Springs Reservoir Dam Primary Spillway.
Chapter 17 Subdivision Regulation, Article XI, Sec. 17-62, 62.1	Any land development to which these FIRE PROTECTION STANDARDS are applied must provide a minimum of two different ingress and egress routes to each homesite.
Chapter 17 Subdivision Regulation, Article XI, Sec. 17-68, 68.1	Subdivisions or other residential developments of land for residential units must comply with Section 4291 of the California Public Resources Code if within or adjacent to areas of the County which fall within the protection of said Section 4291.
Chapter 19 Transportation, Article X, Sec. 19-117, 68.2	Fire safety regulations for airports.
Chapter 22 Burning Regulations, Article II, 22-3 to 22-7	Burning limitations, control of fires, hours of burning, suspension of burning, and use of incinerators.

Lake County Municipal Code	
Regulation	**Summary**
Chapter 25 Floodplain Management, Sec. 25-5	Standards for construction in areas of special flood hazards include: anchoring, construction materials methods, and elevation floodproofing, standards for utilities, subdivision and divisions of land, standards for manufactured homes and recreational vehicles, floodways.
Chapter 28-Groundwater, Article 1, Sec. 28.03, 28.3	Extraction and exportation of groundwater outside the County boundaries requires a permit.
Chapter 29 Storm Water Management Ordinance, Article III, Sec. 29-20 to 29-26	Reduce pollutants in storm water discharges to the maximum extent practicable and by prohibiting non-storm water discharges.
Chapter 30 Grading, Sec. 30-12, 12.3.1)	Use of serpentine material as fill shall require an Asbestos Dust Mitigation Plan. Import of serpentine fill shall require a Lake County Air Quality Management District-issued plan.
Chapter 30 Grading, Sec. 30-13, 13.1 b)	Construction of dams and reservoirs should avoid locations identified on any published geology or soils map as prone to slip or landslide without the preparation of a Geotechnical Report.
LAKE COUNTY MUNICIPAL CODE ZONING ORDINANCE	
Article 25, Sec. 21-25, 25.4. Sec. 21-25-10, 25.11 to 25.15	Development of substandard older subdivision (SOS) lots is subject to performance standards including water, fire, and landslide risk.
Article 27, 27.11.1-Exhibit A-Map a Geothermal Setback Area, and (x) 2.	Required geothermal setback area. 2. An electrical generation facility with a generating capacity in excess of three (3) megawatts shall not be located within that area indicated by Geothermal Setback Area-Map A (Sec. 21-27.11.1).
Article 27, 27.11.1-(n) 1., (o) 1. and (x) 1.	A geothermal exploratory well(s) shall not be drilled within one-half (1/2) mile of any populated area (defined as ten (10) or more dwelling units established within a quarter-mile diameter area) or a recorded major subdivision (defined as five (5) or more lots less than twenty (20) acres in size),

Lake County Municipal Code	
Regulation	**Summary**
	without the written consent of at least seventy-five (75) percent of the property owners.
Article 27, 27.11.1 (x) 3.	An electrical generation facility with a generating capacity in excess of three (3) megawatts shall be limited to a parcel or contiguous parcels of not less than five (5) acres.
Article 35, Sec. 21-35. 35.4, 35.5	Requires minor and major use permits for properties situated in floodways, and along creeks and streams to ensure for an adequate open corridor to safeguard against the effects of bank erosion, channel shifts, increased runoff or other threats to life and property; and to prevent property damage and safeguard the health, safety and general welfare of the people by allowing the passage of the one hundred (100) year flood.
Article 36, Sec. 21-36. 36.4, 36.5	Requires minor and major use permits for properties and their improvements situated in the floodplain to ensure protection from hazards and damage which may result from flood waters.
Article 37, Sec. 21-37 , 37.4	Uses permitted with exceptions.
Article 39, Sec. 21-39, 39.6 to 39.9	Regulates the height of structures and objects of natural growth in the vicinity of the County's airports.
Article 41, 41.4 to 41.9, 41.10, 41.11, 41.13, and 41.15	All uses permitted in Chapter 21 of the Lake County Code shall comply with all applicable performance standards of the base zoning district, combining district, and as set forth herein, except as provided in Section 41.3.
Article 55, Sec. 21-55 , 55.2 (g)	Applications may require: soils reports; drainage plans; geologic, hydrologic, or seismic investigations; archaeological reports;

Lake County Municipal Code	
Regulation	**Summary**
	biological studies; flood hazard reports; market analysis; fiscal impact studies; noise studies; traffic and circulation studies or other pertinent studies of a technical nature
Article 66, Sec. 21-66 (a)	Public utility distribution and transmission line towers and poles, streetlights, public communication systems and structures, and underground facilities for distribution of gas, water, local telecommunications, and electricity shall be subject to the approval of a minor use permit except to the extent that this ordinance is preempted by state or federal regulations.
Article 71, Sec. 21-71. 71.6, to 71.8	Requires minor and major use permits for the collocation of wireless telecommunications facilities on existing towers or poles with no increase in height, and new or replacement wireless telecommunication facilities.
LAKE COUNTY MUNICIPAL CODE OTHER ORDINANCES	
Ordinance 3112	Prohibiting water hauling to commercial agriculture operations including cannabis cultivation sites.
Ordinance 3110	Prohibiting water hauling to unpermitted cannabis cultivation sites.
Ordinance 3106	Requires land use applicants to provide enhanced water analysis during a declared drought emergency.
California Code of Regulations Title 14, Division 6, Chapter 3	
California Environmental Quality Act (CEQA) Statute & Guidelines.	For all discretionary projects defined under the CEQA as a "project".

IMPROVEMENT: Capacity building to increase ability to enforce current codes (including increasing staff, identify additional equipment needed, etc. (Responsible Department: Community Development)

Table 28 County Administrative and Technical Capabilities & Improvement Needs

Administrative and Technical			
CAPABILITY	**YES/NO**	**RESPONSIBLE**	**IMPROVEMENT(S)**
Engineers	Yes	Department of Public Works (DPW)	General improvement for the entire Admin and Technical: • Current staff have expertise and experience, however most departments are short-staffed or understaffed. Enhancing relationships with community organizations and other partners could relieve some of the risk reduction / mitigation action burden from departments. Improvement: identify, develop/enhance and implement agreements between agencies/NGOs to support mitigation activities andrisk reduction. • Also, increase communication and
Planners	Yes	Community Development	
Emergency Manager	Yes	Lake County OES	
GIS Analyst	Yes	Information Technology; limited DPW	
Building Inspector	Yes	Community Development	
Grant Writer	No	*No department has dedicated grant writers. Each department does have staff that also write grants.*	
Floodplain Manager	Yes	DPW/Water Resources	
Climate Coordinator	Yes	Admin – Climate Resiliency Officer	
Various committees that directly or indirectly impact emergency management including risk reduction	Yes	• Healthcare Coalition • Disaster Council • Risk Reduction Authority • Resource Conservation District (Firesafe Council)	

Administrative and Technical			
CAPABILITY	**YES/NO**	**RESPONSIBLE**	**IMPROVEMENT(S)**
		• Fire Chiefs Association • Regional law, medical and emergency management groups	collaboration to encourage NGO long-term planning to include or align with County and community risk reduction needs. (This may include reviewing current committees/groups to identify who is not present and should be or condensing groups who share a common purpose.)

Table 29 County Financial Capabilities and Improvement Needs

Financial		
CAPABILITY	**DETAIL**	**IMPROVEMENT(S)**
Administrative and financial procedures.	The Auditor-Controller's office has extensive policies for reviewing any claims, journals, or deposits submitted to our office. The County is guided by the purchasing policy, the finance chapter of the Countywide Policies and Procedures, and the Fiscal Staff User Packet available on the intranet. Those documents together frame the requirements for what is and is not required on each claim.	Implementation of a formal review, evaluation and revision process. (Responsible: Auditor-Controller)
Personnel	The Auditor-Controller employs a full-time Disaster Finance manager responsible for all	Increase capacity through the addition of one additional position who

Financial		
CAPABILITY	**DETAIL**	**IMPROVEMENT(S)**
	aspects of emergency management finances (including mitigation).	could focus on "blue-sky" disaster finance (i.e. mitigation activities), while the current position focuses on "emergency" finance (i.e. state and federal reimbursements from disaster and local response activities).
Possible Funding Sources	Property, Sales, income or special purpose taxes • NO General Funds • YES – used previously to meet match requirements; could be used in the future. Utility Service, Impact or Other Fees • YES – used previously to meet match requirements; could be used in the future. General Obligation or Special Purpose Bonds • Special Purpose have been used. • Either could be used in the future. Requires extensive time and planning. Federal, State, Private Grants/Funding • YES – used previously; will be used in the future.	No ordinance in place for this purpose. <u>Improvement</u>: draft/implement ordinance(s). (Responsible: Admin)

Table 30 Education and Outreach Capabilities and Improvement Areas

Education and Outreach		
CAPABILITY	**RESPONSIBLE**	**IMPROVEMENT(S)**
Public Information Officer	• County Admin • Lake County OES • Health Services	Unify education and outreach related to risk reduction, hazards and disaster preparedness/ prevention and response across all County Departments with an all-PIO taskforce/meeting at least quarterly, maybe monthly.

Social Media	• County of Lake:
	  • Health Services
	  • OES
	  • Social Services
	  • Probation
	  • Behavioral Health
	  • Library
	  • Public Works
	• Local Fire Districts
	• National Weather Service (Eureka)	

Community Outreach Events/Venues	Risk reduction is promoted or could be promoted at any outreach event. The Lake County OES typically attend annually: • Lake County Fair • Lakeport Night Out • Other Main Street Lakeport functions Town Halls (regionally) Neighborfests North Shore Ready Fest	Lake County OES lacks materials to hand out. Would benefit from implementing an outreach budget. Hosted by NCO. <u>Improvement</u>: Additional lead time in planning and/or communication with partners.

Education and Outreach		
CAPABILITY	**RESPONSIBLE**	**IMPROVEMENT(S)**
	Homeowners Association Events and meetings Disaster Council, Risk Reduction Authority Meetings	
Fire Safe Councils & Firewise Communities	Various around the lake.	Increased presence of the core Lake County Fire Safe Council to help smaller areas develop, implement and maintain community councils.
Community Organizations Active in Disaster (COAD)	In its formative state, COAD's goal is to enhance resilience across the County and is a hub of NGOs, private and government partners.	
Non-Governmental Organizations	Each provides a variety of education and outreach to vulnerable and general population/communities in Lake County. NGOs include, but are not limited to: • Red Cross • North Coast Opportunities (NCO) • Salvation Army	

Although identified actions within the Hazard Mitigation Plan may have unique limitations, the mitigation strategy is administratively achievable. Additional State and Federal funding would strengthen our countywide capacity to meet hazard mitigation-related challenges, and the County of Lake's capacity, as well. The coordinated efforts this document represents have further developed relationships and capacities needed to achieve mitigation, and cultivated even greater public

awareness of this as a matter of urgent priority. The County may seek additional funding via grants or take other measures to increase the identified capabilities to achieve mitigation.

To support the new HMP goals and objectives, the mitigation actions from 2023 were reviewed and assessed for their value in reducing risk and vulnerability to the Planning Area from identified hazards and evaluated for their inclusion in this HMP Update (See *1.2 What's New or Updated*).

Hazard Mitigation actions are essential to weaving long-term resiliency into all community recovery efforts so that at-risk infrastructure, development, and other community assets are stronger and more resilient for the next event. Mitigation measures to reduce the risk and vulnerability of a community to future disaster losses can be implemented in advance of a disaster event, as well as part of post-disaster recovery efforts.

Applying mitigation measures to recovery efforts improves community resilience and sustainability. It is often most efficient to fund all eligible infrastructure mitigation through FEMA's Public Assistance mitigation program if the asset was damaged in a storm event. Mitigation work can be added to project worksheets if they can be proven to be cost-beneficial.

Applying mitigation measures to recovery efforts improves community resilience and sustainability.

All communities should consider integrating mitigation into post-disaster recovery efforts as part of their post-disaster redevelopment and mitigation policies and procedures.

The County Emergency Operations Plans seek to mitigate the effects of hazards, prepare to take measures that will preserve life and minimize damage, enhance response during emergencies and provide necessary assistance, and establish a recovery system to return the community to its normal state of affairs. The Plans emphasize mitigation as a major component of emergency management efforts.

16.2 Goals and Objectives

The working group and both jurisdictions developed the goals and objectives with input from the community, County Departments, and Operational Area partners and approval by the Planning Committee. The goals are consistent across the entire Planning Area, with each jurisdiction having its own objectives. The MJHMP to this point was reviewed to identify gaps, barriers, needs and capabilities that goals, objectives, and actions could achieve, meet, or rectify.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community
- Encompass all aspects of community, public and private
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome
- Are future-oriented, in that they are achievable in the future
- Are time-independent, in that they are not scheduled events.

Objectives are identified strategies that could meet each goal.

The 2025 Multijurisdictional Hazard Mitigation Plan Update goals and objectives are:

1. **GOAL ONE:** Minimize loss of life, injury and damage to property, the economy, and the environment from natural hazards.
    a. **Objective 1.1:** Promote resilient building and land-use practices by hardening infrastructure to strengthen community resilience, critical infrastructure, and future development.
    b. **Objective 1.2:** Strengthen wildfire prevention and community resilience by addressing tree mortality, enhancing hazard response planning and expanding fuel reduction actions.
    c. **Objective 1.3:** Enhance hazard monitoring and response to improve readiness and reduce vulnerability to natural hazards.
2. **GOAL TWO:** Increase community awareness of natural hazards and shared responsibility in preparedness, response, mitigation, and recovery activities.
    a. **Objective 2.1:** Educate residents and businesses about natural hazards and mitigation practices through targeted outreach tailored to diverse populations.
    b. **Objective 2.2:** Enhance public alert and emergency information systems.
3. **GOAL THREE:** Improve local mitigation capabilities that protect the community from natural hazards.
    a. **Objective 3.1:** Reduce emergency incidents, enhance disaster preparedness and response capacity, and invest in infrastructure, equipment, and facilities to protect public safety and community assets.

16.3 Identification and Analysis of Mitigation Actions

To identify and select mitigation actions to support the mitigation goals, each hazard identified in *Section 2.2 Hazard Identification* was evaluated. Only those hazards that were determined to be a priority hazard were considered further in the development of hazard-specific mitigation actions.

These priority hazards (in alphabetical order) are:

- Aquatic Biological Hazards: Invasive Species
- Drought and Water Shortage
- Dam failure
- Earthquake
- Flood
- Levee Failure
- Severe Weather: Extreme Heat
- Severe Weather: Heavy Rains, Snow, Storms, and High Winds
- Tree Mortality
- Wildfire

Once it was determined which hazards warranted the development of specific mitigation actions, the HMPC analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of categories of mitigation actions, which originate from the Community Rating System:

- Prevention (required to be evaluated)
- Property protection
- Structural projects
- Natural resource protection
- Emergency services
- Public information

In addition to prior mitigation actions, input from the community, County Departments, and Operational Area partners were incorporated into a comprehensive list of potential actions. OES met with Departments individually to examine the comprehensive list and identify other potential actions. Discussion to identify potential actions specifically included brainstorming and consideration for how to best benefit the entire community including our vulnerable populations and underserved. (Review *4.2 Underserved Populations/Communities* for explanation/definition.) Some mitigation actions considered, but ultimately deemed not worthy of inclusion in the plan are:

- Reduce fire risk to congested communities by purchasing a bulk of the homes.

Finally, a list of preferred mitigation actions by hazard was generated. The final list was narrowed to those that are likely to be started within five years.

16.3.1 Prioritization Process

To prioritize mitigation actions, the working group evaluated each action using the following STAPLEE[20] criteria rubric:

STAPLEE CRITERIA	
SOCIAL	
Critical to the entire community?	
Negative Impacts:	-1
Minimal:	0
One Community:	1
1-2 "Shores":	2
Entire Planning Area:	3
Community Acceptance?	
Uniform Support:	1
No Opinion:	0
Opposition:	-1
TECHNICAL	
Technically feasible considering, for example, acquisition of right-of-way, easements or property that may be necessary?	
Feasible with no extraordinary actions:	1
Feasible with extraordinary actions:	-1
Not feasible at all:	-2
Does the proposed project solve the problem or only a symptom?	
Solves the problem:	2
Solves a symptom:	1
How long will it take to complete the project and is the time frame reasonable?	
Less than two years and reasonable time frame:	2
Less than 4 years and reasonable time frame:	1
More than four years but reasonable time frame:	0
Unreasonable time frame:	-1

[20] The STAPLEE evaluation method uses seven criteria for evaluating a mitigation action: Social, Technical, Administrative, Political, Legal, Economic, and Environmental.

STAPLEE CRITERIA	
ADMINISTRATIVE	
Capability? (Staff, time, funding)	
Yes:	1
No:	-1
Maintenance and Operations (staff/resources & funding?)	
Yes:	1
No:	-1
POLITICAL	
Comply with General Plan? Local Champion / BOS Support?	
Yes:	1
No:	-1
LEGAL	
Are there potential legal consequences or is the proposed project likely to be challenged by stakeholders who may be negatively affected?	
No:	1
Maybe:	0
Yes:	-1
ECONOMIC	
Is funding currently available to implement the proposed project?	
Yes, full funding is committed within the first year:	3
Yes, funding is spread over multiple years:	2
Partial funds have been identified:	1
No funds have been identified:	0
Does the cost of the proposed project seem reasonable for the size of the problem and likely benefits?	
Yes, and a cost estimate has been done:	1
Yes, but a cost estimate has not been done:	0
No, the project cost seems to be unreasonable for the size of the problem and the likely benefits:	-1
ENVIRONMENTAL	
Is the proposed project in a floodplain or wetland or will it directly impact the natural and beneficial functions of a floodplain and wetland?	
Will benefit a floodplain or wetland:	1
Not applicable, unknown or no effect:	0
Negative effect on a floodplain or wetland:	-1

A final STAPLEE score was assigned to each proposed action. Priority is ranked as follows:

- **High** given to those scoring 15-18 points
- **Medium** given to those scoring 13-14 points
- **Low** given to those scoring 10-12 points
- Scores of less than 10 are not included.

Section 16.4 Mitigation Actions

shows priority ratings as High, Medium or Low. If details change that increase or decrease the STAPLEE score, the project(s) may be reprioritized at a later date.

Those eliminated due to the prioritization process are listed in Table 31.

Table 31 Mitigation Actions Scoring less than 10 on STAPLEE and therefore, not prioritized.

4. Inter-tie water system Soda Bay and Kelseyville providing additional water sources/redundancy	50. Airport Land Use Compatibility Plan (ALUCP)
5. Additional water storage for North Lakeport water – adding additional tanks new Hill Road tank	51. Climate Action Plan
27. Old Long Valley Road - Low Water Crossing	53. County-Wide Evacuation Plan
28. Encourage use of existing public information channels to increase awareness of hazards, actions to mitigate and preparedness.	54. Resiliency Plan
30. Sheriff Facility Improvements (Response and Prevention)	55. Dam Inundation Zone Study
32. Increase the number of Government/public and private sector entities with a current disaster/emergency operations plans	56. Seismic Retrofit - Feasibility Study
33. Assess critical/key facilities and identify Govt facilities to maintain operations.	63. Wildlands Fire Prevention Project

34. New Long Valley Road Hillside Stabilization	64. Design, implement and enhance lot inspection programs (i.e. LE-100, AB 3074)
35. Cyanobacterial Monitoring	65. Increase number of Firewise Communities
36. Extension of boat ramps (for continued use of lake during drought)	66. Develop and/or enhance capabilities to reduce fuels and harden homes for elderly, low-income and other AFN
37. Protective measures to flood proof	67. Design and implement a "Certified Home" program.
38. Full Circle Effluent Pipeline (Special Districts) -	69. Replant burnt and/or beetle-killed tree areas with native species trees and brush, drought tolerant and Firewise.
40. Anderson Springs Slide	70. Develop funding/incentives for property owners to remove hazardous trees.
41. Identify and support preventative maintenance and mitigation actions for public and private levees.	72. Support development of waste woodybiomass utilization
42. Increase capacity to dispose of hazardous materials	73. Increase existing capability to remove trees
43. Dredge channels of Clear Lake	74. Lake County Special Districts, Spring Valley Lake Reservoir Recovery
45. Public Facility Improvement in Support of Emergency Events	
46. Anderson Springs Secondary Access	

Actions eliminated since the 2023 Plan that are deemed no longer feasible or necessary:

- Actions 26, 28 and 32 are not feasible within hazard mitigation projects and are being pursued with other processes.
- Actions 57, 59, 60, 61 and 62 are combined with project 58.

Other actions eliminated since the 2023 Plan are:

- 2023 Actions 17, 16, 15, 29, 31, 39, 44, 47 because the lead agency, Hidden Valley Lake Community Services District, has their own Hazard Mitigation Plan and no longer requires action item inclusion in this plan.

16.4 Mitigation Actions

Mitigation Actions were determined by jurisdiction. The following actions are for Lake County. Clearlake Actions are within the Clearlake Annex, *16.4 Mitigation Actions*, and the Lakeport Actions are within the Lakeport Annex, *16.4 Mitigation Actions.*

Action 01 (Formerly 68): Continue and enhance local fuels reduction crew.				
This action involves maintaining and expanding the efforts of local fuels reduction crews to manage vegetation in areas prone to wildfires. By clearing excess fuels such as dry brush and overgrown vegetation, these crews play a critical role in reducing the intensity and spread of wildfires. Their work not only enhances the safety of communities but also protects critical infrastructure, reduces property damage, and minimizes the environmental impact of wildfires. This ongoing initiative is vital for creating defensible spaces and fostering long-term wildfire resilience.				
Benefit: Reduces wildfire risk and enhances community safety by managing vegetation. **Comments & Updates, if applicable:** **Financial Option:** General fund. Grants.		**Lead Agency:** Northshore Fire Protection District **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
High	Yes	Yes	No	Pre-Disaster
Action Type:		**Timeframe:**	**Cost Estimate:**	
Property Protection		Ongoing /Annual	TBD	

Action 02 (Formerly 9): Big Valley Groundwater Sustainability Plan Implementation				
Investigation of groundwater resources and strategies to safeguard the Big Valley aquifer.				
Benefit: Ensures long-term groundwater availability and supports water resource resilience. **Financial Option:** TBD			**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):** Big Valley Band of Pomo Indians	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**			**Cost Estimate:**
Property Protection	2042 (Per California's Sustainable Groundwater Management Act and Big Valley Groundwater Sustainability Plan)			6m

Action 03 (Formerly 5): Flood Protection Projects				
2018 HMP Action 24.				
Benefit: Minimizes flood risks and protects lives, property, and infrastructure. **Comments & Updates, if applicable:** **Financial Option:** Flood Zone Distrcit Assessment Fees, FMAP & TBD			**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	Yes	Yes	Pre-Disaster
Action Type:	**Timeframe:**		**Cost Estimate:**	
Property Protection	Continuous		150k	

Action 04 (Formerly 4): Groundwater Management Plan Implementation				
Investigation of groundwater resources and strategies to safeguard them. (2018 HMP Action 29)				
Benefit: Improves water quality and ensures sustainable water use. **Comments & Updates, if applicable:** Received 380k to study groundwater. Could use the smaller study data to compile a County wide plan. **Financial Option:** Blue Ribbon Committee for the Rehabilitation of Clear Lake & Other TBD		**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Prevention	Continuous	4m		

Action 05 (Formerly 21): Inundation Area Mapping & EAP - Update				
This action focuses on updating inundation area maps and the Emergency Action Plan (EAP) for areas at risk of flooding, including those near dams and water bodies. Accurate inundation mapping identifies areas that would be impacted by flooding events, allowing for better emergency response planning and mitigation efforts. Updating the EAP ensures that emergency protocols remain effective and reflect current data, infrastructure, and community needs. This initiative enhances public safety by enabling timely warnings, evacuation planning, and risk reduction measures.				
Benefit: Enhances emergency preparedness and response during flood events. **Comments & Updates, if applicable:** Last completed in 2021. **Financial Option:** TBD		**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	Yes	Yes	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Emergency Services	TBD	100,000		

Action 06 (Formerly 20): Seismic monitoring - (for Dams)				
To ensure safety of dams and public. Surveyors, monuments installation.				
Benefit: Improves dam safety and identifies potential vulnerabilities to earthquakes. **Comments & Updates, if applicable:** **Financial Option:** TBD			**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	No	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Emergency Services	Not yet determined	100,000		

Action 07 (Formerly 19): Middle Creek Flood Damage Reduction and Ecosystem Restoration Project				
Flood damage prevention and ecosystem restoration to wetlands. Barriers- funding; non-willing sellers. (2018 HMP Action 26)				
Benefit: Reduces flood risk and restores natural ecosystems. **Comments & Updates, if applicable:** **Financial Option:** Currently purchasing parcels from willing sellers located within the Middle Creek Project area from the California Department of Water Resources Flood Corridor Grant Program. Additional funding TBD (including local and federal funding).			**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	Yes	Yes	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Property Protection	Ongoing	10m		

Action 08 (Formerly 13): Gravel Extraction from streams (Including levee road repair, infrastructure repair)				
Flood control - stream maintenance. Contractor.				
Benefit: Prevents stream blockage, mitigates flood risks, and supports infrastructure resilience. **Comments & Updates, if applicable:** Plans are being developed. Funding identified. Includes Clover Creek Diversion Channel. Additional channel clearing will be ongoing. **Financial Option:** State DWR Funds		**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	Yes	Yes	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Prevention	3 years	1m/annually		

Action 09 (Formerly 1): Dreissenid Mussel Prevention				
Prevention program. (2018 HMP Action 21)				
Benefit: Protects water resources and aquatic ecosystems from invasive species. **Comments & Updates, if applicable:** **Financial Option:** California Department of Boating and Waterways (Quagga and Zebra Mussel Infestation Prevention Grant Program)		**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
High	Yes	No	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Prevention	Continuous	500,000 annually		

Action 10 (Formerly 23): Develop notification plan & early warning infrastructure (dam failure) - including warning sirens				
Planning & Implementation				
Benefit: Enhances public safety through timely warnings during dam-related emergencies. **Comments & Updates, if applicable:** **Financial Option:** TBD			**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	No	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Emergency Services	Not yet determined	500,000		

Action 11 (Formerly 24): Levee & Dam Rodent Control Planning & Implementation				
Consultant/vendor				
Benefit: Prevents structural damage to levees and dams, maintaining their integrity. **Comments & Updates, if applicable:** **Financial Option:** Flood Zone Distrcit Assessment Fees & TBD			**Lead Agency:** Lake County Water Protection District (LCWPD) **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	No	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Property Protection	Continuous	50,000/annually		

Action 12 (New): Upgrades to SE Wastewater Treatment Plant Headworks to increase capacity/flow volume at the headworks				
Increase capacity/flow volume at the headworks, preventing spills in the system				
Benefit: Improves wastewater management and reduces environmental impact. **Comments & Updates, if applicable:** **Financial Option:** Rates			**Lead Agency:** Lake County Special Districts **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
High	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Prevention; Property Protection	1 year	$1,000,000		

Action 13 (New): Additional water sources to Spring Valley & North Lakeport (2 new wells) adding redundancy and capacity increasing				
Increase water supply; second sources of water; fire protection				
Benefit: Ensures water availability and reliability during emergencies. **Comments & Updates, if applicable:** **Financial Option:** Current Grant Funding			**Lead Agency:** Lake County Special Districts **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
High	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Property Protection; Natual Resouce Protection	1 year	$2,380,500		

Action 14 (New): Fire suppression using purple pipe (non-potable water) - Phase 1				
Fire suppression				
Benefit: Provides alternative water sources for firefighting, reducing demand on potable water. **Comments & Updates, if applicable:** **Financial Option:** Hazard Mitigation and other grants			**Lead Agency:** Lake County Special Districts **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
High	Yes	No	No	Pre-Disaster
Action Type:	**Timeframe:**		**Cost Estimate:**	
Property Protection	2 years		$2,000,000	

Action 15 (New): Fire suppression using Geyser Pipeline - Phase 1				
Fire suppression				
Benefit: Improves firefighting capabilities by utilizing existing infrastructure. **Comments & Updates, if applicable:** **Financial Option:** Hazard Mitigation and other grants			**Lead Agency:** Lake County Special Districts **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	No	No	Pre-Disaster
Action Type:	**Timeframe:**		**Cost Estimate:**	
Property Protection	2 years		$1,000,000	

Action 16 (Formerly 14): Sewer Infiltration & Inflow Mitigation				
Multi-year project. Estimated at $10 million. Project will reduce the effects of flooding/heavy storms, by preventing sanitary sewer overflows (SSOs) from making their way to natural water bodies and affecting human health.				
Benefit: Reduces strain on wastewater systems and prevents environmental contamination. **Comments & Updates, if applicable:** **Financial Option:** State Water Resources Control Board (SWRCB) State Department of Water Resources (DWR) Environmental Protection Agency, FEMA		**Lead Agency:** Lake County Special Districts **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Prevention	5 years	$10M		

Action 17 (New): Kelsey Creek Fish Ladder Project at Main Street Kelseyville				
Kelsey Creek Fish Ladder Project. Aquire land or lease to protect Hitch with updated and functional fish ladder. Bridge stabilization will ensure public safety during evacuations (including updating footers of bridge) and stream bank erosion. Stabilization.				
Benefit: Supports fish migration and enhances local aquatic ecosystems. **Comments & Updates, if applicable:** County needs **Financial Option:** CDFW; Caltrans		**Lead Agency:** County of Lake, Water Resources **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	No	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Natural Resources Protection		TBD		

Action 18 (Formerly 6): Lakebed Hazard Mitigation				
Personnel, removal/abatement, remediation of threats to Clear Lake & Tributaries (i.e. floating trees post-storm, hazmat)				
Benefit: Reduces risks from lakebed hazards and improves public safety. **Comments & Updates, if applicable:** **Financial Option:** Blue Ribbon Committee for the Rehabilitation of Clear Lake; Lakebed Management Funds; Cannabis Revenue			**Lead Agency:** County of Lake, Water Resources **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	No	No	Pre-Disaster
Action Type:	**Timeframe:**		**Cost Estimate:**	
Prevention	Continuous: Prioritization takes place during wet weather season through spring.		100,000 / annually	

Action 19 (Formerly 2): Water Quality Lake Monitoring				
Monitor water quality trends important for public health, recreation and wildllife.				
Benefit: Ensures water quality and protects public health and ecosystems. **Comments & Updates, if applicable:** **Financial Option:** Blue Ribbon Committee for the Rehabilitation of Clear Lake			**Lead Agency:** County of Lake, Water Resources **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
High	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**		**Cost Estimate:**	
Natural Resources Protection	Continuous		$150,000 annually	

Action 20 (Formerly 12): Decon stations for boats (QM Prevention & Response)				
Decon stations for boats to prevent invasive species and contain any introductions.				
Benefit: Prevents the spread of aquatic invasive species and protects water ecosystems. **Comments & Updates, if applicable:** **Financial Option:** California Department of Boating and Waterways (Quagga and Zebra Mussel Infestation Prevention Grant Program)			**Lead Agency:** County of Lake, Water Resources **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	No	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Natural Resources Protection	Continuous	$2m		

Action 21 (Formerly 11): Implement drinking water/dry well remedies				
Extension of water intakes; dry well replacement; water hauling; potable water pipe				
Benefit: Addresses water shortages and ensures access to safe drinking water. **Comments & Updates, if applicable:** **Financial Option:** State Water Resources Control Board and California Department of Water Resources Drought Grant Programs			**Lead Agency:** County of Lake, Water Resources **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Emergency Services	Continuous	3m		

Action 22 (Formerly 10): Post-Fire Water Quality Monitoring				
Post-fire monitoring of water quality to identify fire impacts to drinking water and wildlife habitat.				
Benefit: Identifies and mitigates water quality impacts from wildfire events. **Comments & Updates, if applicable:** Ongoing as needed post-fire. **Financial Option:** Blue Ribbon Committee for the Rehabilitation of Clear Lake		**Lead Agency:** County of Lake, Water Resources **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	Yes	No	Post-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Emergency Services	Continuous	< $10,000/year		

Action 23 (New): Elk Mountain Road Improvement				
The goals of the project are to widen the road in specific locations and perfom pavement rehabilitation to make the road more durable. Elk Mountain Road is the primary access road for emergency response through US Forest Service Land to the Pine Mountain Lookout and Lake Pilsbury area. The road has been and will be heavily used for fighting forest fires and was significatly damaged during past fire.				
Benefit: Improves accessibility and safety for evacuation and emergency response. **Comments & Updates, if applicable:** **Financial Option:** Hazard Mitigation or other grants		**Lead Agency:** County of Lake, Public Works **Supporting Agency(ies):** USFS		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Property Protection	1-5 Years, Depending on environmental findings	$3m		

Action 24 (Formerly 8): Public Open Space / Regional Parks subject to wildfire Education & Outreach Awareness				
Signage, other materials. Staff time.				
Benefit: Raises public awareness and enhances preparedness for wildfire risks. **Comments & Updates, if applicable:** **Financial Option:** Lake County General Fund			**Lead Agency:** County of Lake, Public Services **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	No	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Public Education and Awareness	6 months	10,000		

Action 25 (Formerly 7): Assess parks/rec for use in response to disaster to be completed in PRT Master Plan.				
Staff time and coordination w/Other Departments, OES & BOS.				
Benefit: Enhances planning for the use of recreational areas during emergencies. **Comments & Updates, if applicable:** **Financial Option:** Lake County General Fund			**Lead Agency:** County of Lake, Public Services **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Emergency Services	6 months	TBD		

Action 26 (Formerly 3): Solid Waste Management Emergency Planning				
Review and potential update to County Integrated Waste Management Plan to identify emergency action plans for solid waste management.				
Benefit: Improves waste management during disasters, reducing health and environmental risks. **Comments & Updates, if applicable:** **Financial Option:** Lake County Solid Waste Enterprise Fund		**Lead Agency:** County of Lake, Public Services **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Emergency Services	1 year	Staff time.		

Action 27 (Formerly 25): Implement or enhance public education drills and other activities (including awareness, prevention, response actions)				
Coordinate with operational area to increase public education drills for awareness.				
Benefit: Improves communication and public access to emergency information. **Comments & Updates, if applicable:** **Financial Option:** CDBG grants, Homeland Security Grant Program, general fund		**Lead Agency:** County of Lake, OES **Supporting Agency(ies):** Office of Ed, other OA agencies		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Public Education and Awareness	Annual - ongoing	<$10,000 per year		

Action 28 (Formerly 52): Grading Ordinance Revisions				
Current grading ordinance is outdated, leaving the County susceptible to hazards related to landslides as well as stormwater management and runoff into Clear Lake. Project Description: Engage a consultant to develop a new grading ordinance that reflects current standards. (2018 HMP Action 38)				
Benefit: Reduces erosion and mitigates flood and landslide risks. **Comments & Updates, if applicable:** Not in progress, will be updated post-Lake County 2050 General Plan and Local Area Plans Update, anticipated 2027. **Financial Option:** Hazard Mitigation or other grants; other TBD			**Lead Agency:** County of Lake, Community Development Department **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Prevention	1 Year	10,000		

Action 29 (Formerly 49): Develop Oak Preservation Policy				
Development of ordinance to amend zoning code to create guidelines and regulations for culling of oak trees. Public outreach needed. Limited staff resources.				
Benefit: Protects local ecosystems and preserves biodiversity. **Comments & Updates, if applicable:** Will be updated post-Lake County 2050 General Plan and Local Area Plans Update. **Financial Option:** Hazard Mitigation or other grants; other TBD			**Lead Agency:** County of Lake, Community Development Department **Supporting Agency(ies):** TERA, Audobon Society, Sierra Club, Lake County Land Trust	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	No	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Prevention	2 Year	75,000		

Action 30 Formerly 48): Update Safety Plan (After the 7th Cycle Housing Element Update)				
Complete update after the 7th Cycle Housing Element Update)				
Benefit: Ensures safety measures align with current housing needs and risks. **Comments & Updates, if applicable:** Estimated completion 2026. **Financial Option:** Hazard Mitigation or other grants; other TBD			**Lead Agency:** County of Lake, Community Development Department **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**		**Cost Estimate:**	
Emergency Services	1 Year		15,000	

Action 31 (Formerly 22): Flood Insurance Outreach				
Public Information and Outreach with billboard, commercials, materials, press, etc.				
Benefit: Educates the public on flood insurance options, increasing resilience. **Comments & Updates, if applicable:** **Financial Option:** TBD. FEMA currently provides brochures, flyers and other publications LCWPD has available for members of the public.			**Lead Agency:** County of Lake, Community Development Department **Supporting Agency(ies):**	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	Yes	Yes	Yes	Pre-Disaster
Action Type:	**Timeframe:**		**Cost Estimate:**	
Public Education and Awareness	Continuous		500,000	

Action 32 (Formerly 71): Enhance Tree Mortality Awareness				
Increase capabilities to inform how to identify dying trees; understanding increasing threat, cause, remedies, etc.				
Benefit: Addresses risks associated with dead trees, reducing wildfire hazards. **Comments & Updates, if applicable:** CLERC has created a survey and trained all of their contractors on how to detect Mediterranean Oak Borer, the RRA held a townhall on MOB with Dr Mike Jones. Need bilingual materials and funding for that. **Financial Option:** CAL FIRE, CCI, USDA		**Lead Agency:** County of Lake, Climate Resilience Office **Supporting Agency(ies):**		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	No	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Public Education and Awareness	3 years and ongoing	$250k		

Action 33 (Formerly 58): CWPP Projects				
Obstacles: funding, right of way, CEQA. (2018 HMP Action 58)				
Benefit: Improves wildfire preparedness and reduces community vulnerability. **Comments & Updates, if applicable:** **Financial Option:** Grants, local budgets.		**Lead Agency:** County of Lake, Climate Resilience Office **Supporting Agency(ies):** Fire Protection Districts, Lake County Resource Conservation District, CAL FIRE, Fire Safe Councils, and Fire Wise Communities.		
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Medium	Yes	Yes	No	Pre-Disaster
Action Type:	**Timeframe:**	**Cost Estimate:**		
Property Protection	1-5 years	$5,000-50,000 each project		

Action 34 (New): Geothermic Gas Released Education and Awareness				
Public signage and education about smells, concerns and history.				
Benefit: Raises awareness of geothermal gas risks and enhances public safety. **Comments & Updates, if applicable:** County needs to aquire property; the rest of the project is in collobarion with other agencies/entities. **Financial Option:** Grants, local budgets.			**Lead Agency:** County of Lake, Air Quality Management **Supporting Agency(ies):** USGS	
Priority:	**Addresses Current Development?**	**Addresses Future Development?**	**Compliant with NFIP?**	**Pre or Post Disaster?**
Low	No	Yes	No	Pre-Disaster
Action Type:		**Timeframe:**	**Cost Estimate:**	
Public Education and Awareness		Continuous	$25,000	

CHAPTER SEVENTEEN: Continued Compliance with the National Flood Insurance Program (NFIP)

17.1 NFIP Compliance

Given the flood hazard in the Planning Area, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP) by all communities and participation by Lake County in the Community Rating System (CRS).

This Hazard Mitigation Plan was prepared following a standard planning process with CRS and NFIP considerations. To enhance clarity, additional information is offered in this section.

Step 1. View the Resolution establishing a committee.

Step 2. Five members of the public are appointed to the Planning Committee. Five public information sessions were held during the project period to solicit public input. Additionally, the library system, website, social media accounts and public notice boards were utilized to share information to solicit information from the public.

All public information sessions were held separately from the committee and working group meetings. Sessions were held in-person within various communities around the County, in both cities and virtually. The first session was held at the onset of the project start, the fifth at the conclusion when the plan was open for public review.

The website (https://www.lakesheriff.com/about/oes/hmp) explains the planning process, offers time and location information for committee meetings and public information sessions, in addition to the agenda, presentation and some recordings, the draft plan, public survey and the previous plan.

A survey inquiring about specific hazards, problems and solutions is made available to the entire County.

Detailed below is a description of Lake County's flood management program to ensure continued compliance with the NFIP. Additional considerable factors are the

numerous flood mitigation actions contained in this LHMP that support the ongoing efforts by the County to minimize the risk and vulnerability of the community to the flood hazard and to enhance their overall floodplain management program.

17.1.1 Lake County's Flood Management Program

Lake County has participated in the Regular Phase of the NFIP since October 17, 1978. Since then, the County has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The County of Lake adopted the current floodplain ordinance, Chapter 25 – "Floodplain Management" (Floodplain Ordinance) into the County Code on May 5, 1987. This ordinance incorporated the Flood Insurance Study performed for Lake County dated September 30, 1992, accompanying Flood Insurance Rate MapsFlood Boundary and Floodway Maps, and all subsequent amendments and/or revisions. Furthermore, the Floodplain Ordinance required a one foot (1') buffer between the finish floor of any structure or equipment servicing the structure and the Base Flood Elevation (BFE).

The Floodplain Ordinance is implemented and enforced through combined effort from the Water Resources Department and the Community Development Department Building Division (CDD). Technical questions, BFE determinations, review of pre-construction, during construction, and post-construction Elevation Certificates are all performed by Water Resources staff, while plan review, permitting and construction inspection are done by the Building Division. The Director of the Water Resources Department is designated as the Floodplain Manager by the Floodplain Ordinance.

Substantial Damages and Substantial Improvements are both defined in the County Floodplain Ordinance. Each is determined by comparing the loss/improvement against the market value of the structure. For improvement projects, "substantial improvement" is evaluated by the Chief Building Official working collaboratively with the Water Resources Director (Floodplain Manager) during the building permitting process. Following a storm event involving damage to structures, the same team works with the affected property owner to establish the appropriate level of damages.

The County of Lake participates in the Community Rating System (CRS) through the NFIP. Currently, Lake County has a Class 7 Rating, which affords Lake County residents a 15% discount on their flood insurance policies. The County received our re-certification in August 2022, which included the notification that we scored a

100% correct rate on the review of a representative sample of our Elevation Certificates. In addition to overseeing and implementing the Floodplain Ordinance requirements, the County also performs public outreach before winter rain seasons to advise property owners to obtain and keep flood insurance.

The County will continue to manage its floodplains in compliance with the NFIP and CRS programs. An overview of the County's NFIP/CRS status and floodplain management programs is discussed on Table 32. Additional information on the County's participation in the CRS program appears after the table.

Table 32 Lake County NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	745 policies $877,102 of insurance in force $1,146,609 in annual premiums
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	1021 closed paid losses totaling $10,497,729 44 substantial damage claims since 1978
How many structures are exposed to flood risk within the community?	3,563 (1% Annual Chance)) 1,045 (0.2% Annual Chance)
Repetitive Loss and Severe Repetitive Loss Properties	113 Repetitive Loss Properties 14 Severe Repetitive Loss Properties Type(s) of properties are not available at the time of this Update.
Describe any areas of flood risk with limited NFIP policy coverage	Undetermined
Administration	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	No
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Permit review, inspections, engineering review, floodplain determination, BFE determination
What are the barriers to running an effective NFIP program in the community, if any?	Public disbelief in the flood threat

NFIP Topic	Comments
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	Yes
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	CAV 3/2/2012 CAC 8/4/2016
Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	1979
Are the FIRMs digital or paper?	Digital
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Yes |3' freeboard for houses on the shoreline without a seawall or other shore protection. 3' freeboard in Anderson Springs.
Provide an explanation of the permitting process.	Applications accepted by Building Division and review by technical staff for floodplain review and determination of need for an elevation certificate or floodplain development permit.
Community Rating System (CRS)	
Does the community participate in CRS?	Yes
What is the community's CRS Class Ranking?	7
What categories and activities provide CRS points and how can the class be improved?	The CRS program has been somewhat overlooked in the past few years due to its transition to different staff. The County is committed to bringing more time to the CRS program.
Does the plan include CRS planning requirements?	Yes

Source: FEMA/Community Development Department 2024

The activities credited by the CRS program provide direct benefits to Lake County and its residents, including:

- Enhanced public safety.

- A reduction in damage to property and public infrastructure.
- Avoidance of economic disruption and losses.
- Reduction of human suffering.
- Protection of the environment.

The activities that Lake County implements and receives CRS credits for include:

- **Activity 310** – **Elevation Certificates**: The Lake County Water Resources Department maintains elevation certificates for new and substantially improved buildings. Copies of elevation certificates are made available upon request. Elevation Certificates are also kept for post-FIRM and pre-FIRM buildings.
- **Activity 320** – **Map Information Service**: Lake County provides inquirers with basic flood zone information from the community's latest Flood Insurance Rate Map (FIRM) and additional FIRM information, information about problems not shown on the FIRM, and as available, historical flood information. Records are maintained.
- **Activity 330** – **Outreach Projects**: Credit is provided for informational outreach projects that include brochures in public buildings, general outreach projects that include mailers to the entire community, posts on social media and community events, and targeted outreach projects that include letters to repetitive loss areas and flood prone properties. These projects are disseminated annually. Credit is also provided for having a pre-flood plan for public information.
- **Activity 340** – **Hazard Disclosure**: Credit is provided for the local real estate agents disclosure of flood hazards to prospective buyers. Credit is also provided for state regulations requiring disclosure of flood hazards. Real estate agents provide a brochure advising prospective buyers about insurance and checking property flood hazards.
- **Activity 350** – **Flood Protection Information**: Documents relating to floodplain management are available in the reference section of the Lake County Public Library. Floodplain information is available on the County website.
- **Activity 360** – **Flood Protection Assistance**: Lake County provides one-on-one advice for property flood protection and performs site visits as needed.
- **Activity 420** – **Open Space Preservation**: Credit is provided for preserving approximately 35% of the Special Flood Hazard Area (SFHA) as open space, protecting open space land with deed restrictions, and preserving open

space land in a natural state. Credit is also provided for regulations and incentives that minimize development in the SFHA.

- **Activity 430** – **Higher Regulatory Standards**: Credit is provided for enforcing regulations that require development limitations, freeboard for new and substantial improvement construction, foundation protection, cumulative substantial improvement, enclosure limits and local drainage protection. Credit is also provided for the enforcement of building codes, a BCEGS Classification of 3/3, other higher standards, state-mandated regulatory standards, and regulations administration.
- **Activity 440** – **Flood Data Maintenance**: Credit is provided for maintaining and using digitized maps in the day-to-day management of the floodplain. Credit is also provided for establishing and maintaining a system of benchmarks and maintaining copies of all previous FIRMs and Flood Insurance Study Reports.
- **Activity 450** – **Stormwater Management**: Lake County enforces the stormwater ordinance for stormwater management, low-impact development, soil and erosion control, and water quality, and has a watershed master plan.
- **Section 502** – **Repetitive Loss Category:** Based on the updates made to the NFIP Report of Repetitive Losses as of December 11, 2011, Lake County, CA has 123 repetitive loss properties and is a Category C community for CRS purposes. The County has a Floodplain Management Plan.
- **Activity 540** – **Drainage System Maintenance**: A portion of the community's drainage system is inspected regularly throughout the year and maintenance is performed as needed. Credit is also provided for listing problem sites that are inspected more frequently, and for implementing an ongoing Capital Improvements Program. The community enforces a regulation prohibiting dumping in the drainage system, and annually publicizes the regulation. The cities inspect their storm drainage systems regularly. Both the cities and the County prohibit dumping into storm drains.
- **Activity 610** – **Flood Warning and Response**: Credit is provided for a program that provides timely identification of impending flood threats, disseminates warnings to appropriate floodplain residents, and coordinates flood response activities.
- **Activity 630** – **Dams**: Credit is provided for a State Dam Safety Program. The two Dams operated by the County (Highland Springs and Adobe Creek) are inspected twice per year and we have existing Emergency Action Plans for each.

- **Activity 710** – County Growth Adjustment: All credit in the 400 series is multiplied by the growth rate of the county to account for growth pressures. The growth rate for Lake County, CA is 0.70.

17.1.2 Clearlake's Flood Management Program

The City of Clearlake has participated in the Regular Phase of the NFIP since October 10, 1978. Since then, the City has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses pay the same flood insurance premium rates as most other communities in the country.

The City does not currently participate in the CRS program, but will evaluate the overall value of joining CRS in the future during the implementation phase of this MJHMP.

Section 16.5, Compliance with the National Flood Insurance Program (NFIP) in the Clearlake Annex, provides additional information on Clearlake's participation in NFIP.

17.1.3 Lakeport's Flood Management Program

The City of Lakeport has participated in the Regular Phase of the NFIP since September 1, 1978. Since then, the City has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses pay the same flood insurance premium rates as most other communities in the country.

The City does not currently participate in the CRS program, but will evaluate the overall value of joining CRS in the future during the implementation phase of this MJHMP.

Section 16.5, Compliance with the National Flood Insuring Program (NFIP) in the Lakeport Annex, provides additional information on Lakeport's participation in NFIP.

CHAPTER EIGHTEEN: Plan Adoption and Maintenance

18.1 Adoption

The *2024 Lake County Multi-Jurisdictional Hazard Mitigation Plan* Update Board of Supervisor's adoption resolution will be included at the start of this Plan once complete. The resolutions for adoption for each jurisdiction are within their respective Annexes.

This plan is a living document, expected to guide actions within the Planning Area over time. As new scientific data or general information becomes available and as actions are processed, it may be updated or revised. By conducting a formal adoption process, the County solidifies its commitment to overall community resilience to disaster and mitigating hazards.

18.2 Implementation

After Cal OES/FEMA review, and approval and local adoption by all jurisdictions, the MJHMP will be ready to implement. All stakeholders will be notified that the Plan is current, and the mitigation strategy ready to begin.

18.2.1 Continued Public Involvement

Residents of Lake County, Clearlake, and Lakeport will stay informed about MJHMP actions through the Lake County OES website and annual progress report updates. Upon the initiation of the MJHMP update process as outlined in 18.3.2, a new public involvement strategy will be initiated based on the guidance from the HMPC. This strategy will be based on the needs and capabilities of the jurisdictions at the time of the update.

18.2.2 Integration with Other Planning Mechanisms

The effectiveness of the MJHMP depends on implementing the plan and incorporating the outlined actions into existing plans, policies, and programs. The MJHMP includes hazard, risk, and vulnerability profiles based on the best data available at the time of the plan. Additionally, the mitigation actions can be implemented through the creation of new educational programs, interagency coordination, or improved public partnership. Planning processes and programs to be coordinated with the recommended of the MJHMP include the following:

- Lake County EOP
- Clearlake EOP
- Lakeport EOP
- Building Codes
- Climate Vulnerability Assessment
- FEMA BRIC Information

- Lake County General Plan

18.3 Maintenance

18.3.1 Ongoing

Not less than annually, and following any significant hazard event or disaster declaration, the Lake County OES in coordination with Clearlake and Lakeport will conduct a maintenance review for effectiveness and progression of the mitigation actions. The review will identify changing community priorities, updated or new planning documents and progress/status identified within the Mitigation Strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in local, state and federal policy?
- Complete status update on all mitigation projects. What strategies should be revised?
- Has the nature or magnitude of risks changed considering both current and expected conditions?
- Are the current resources appropriate for implementing the HMP?
- Are there implementation problems, such as technical, political, legal or coordination issues with other agencies?
- Have the outcomes occurred as expected?
- Did the County and participating agencies and other partners participate in the plan implementation process as assigned?

To accomplish the review, the OES Manager, under the direction of the Deputy OES Director will:

- Coordinate with participating jurisdictions, the City of Clearlake and the City of Lakeport, on the review, update, and approval process.
- (60 days ahead or approximately September each year) Notify each responsible lead agency of the pending review including, but not limited to:
    - Request for completion of a mitigation action update form, which will include items from the bullet points above, and also replicate "Worksheet 9: Action Monitoring Form", from FEMA's *2023 Local Mitigation Planning Handbook* .
    - Request for input regarding community priorities (and supporting data if available), updated or new planning documents.
    - Availability of OES to discuss actions verbally if necessary.
    - (40 days ahead) Deadline for response.

- Compile an electronic document summarizing the information compiled. (i.e. spreadsheet).
- (30 days ahead) Use the compiled information to report to Department heads, Disaster Council meetings, and the public (via social media and website) and any other interested parties, with a request for feedback.
- Incorporate feedback into the final report and publish online with the HMP.
- (November, annually) Issue final report including HMP effectiveness evaluation.
    - Effectiveness metrics may include a review of the risk assessment.

Public information and education about hazards, mitigation and the Plan will continue throughout the year. During each review, public input and participation will be incorporated using the same methods that guided this Update (social media, traditional media, public library, website and inclusion into Disaster Council meetings).

18.3.2 Five-year Update

Lake County OES will initiate the 2029 Update no later than January 30, 2028. If funding is necessary to complete the update, Lake County OES will seek funds in the 2027 grant cycle.

To accomplish the Update, the OES Manager, under the direction of the Deputy OES Director will:

1) (30-24 months ahead of plan expiration) Monitor grant(s) that may fund the Update project. Coordinate grant application(s) when due.
2) (24-12 months ahead of plan expiration) Convene a planning team and complete stakeholder and public outreach that will:
    a. Identify new plans, studies, reports and technical information that pertain to Lake County's vulnerabilities.
    b. Validate or update the hazard list.
    c. Update hazard profiles to include events that occurred since the last plan.
    d. Validate or update community capabilities.
    e. Validate or update community assets.
    f. Update the risk assessment based on the above.
    g. Update the mitigation strategy based on the new risk assessment and completed annual reviews.
    h. Address changes in development and changes in priorities, if any.
    i. Document and describe the plan update process.
    j. Incorporate public comment and input.

CHAPTER NINETEEN: Figures, Tables & Data Sources

19.1 List of Figures

19.2 List of Tables

19.3 Data Sources

The profiles were completed utilizing web-based research and a review of plans, current reports and other available documents. Only high-quality, consistent, peer reviewed and publicly accessible data sources are used. Where possible, other County and State plans were incorporated.

Unless otherwise cited, data sources used frequently include:

- CAFR (Annual Financial Report from the Auditor's Office): https://www.lakecountyca.gov/ArchiveCenter/ViewFile/Item/125
- Map of Lake County in California. By David Benbennick - The maps use data from nationalatlas.gov, specifically countyp020.tar.gz on the Raw Data Download page. The maps also use state outline data from statesp020.tar.gz. Public Domain, https://commons.wikimedia.org/w/index.php?curid=570010
- Intensified burn severity in California's northern coastal mountains by drier climatic condition - IOPscience
- Wildfire and Climate Change | U.S. Geological Survey (usgs.gov)
- Latest Earthquakes (usgs.gov)
- Can Climate Affect Earthquakes, Or Are the Connections Shaky? – Climate Change: Vital Signs of the Planet (nasa.gov)
- Warmwater Aquatic Fauna and Climate Change | Climate Change Resource Center (usda.gov)
- Roghair, C.; Adams, S. B. 2019. Warmwater Aquatic Fauna and Climate Change. (April 2019). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. http://fs.usda.gov/ccrc/topics/aquatic-ecosystems/warmwater-aquatic-fauna
- California Water: Assessment of Toxins for Community Health (Cal-WATCH) Study Calwatch drinking water fact sheet (trackingcalifornia.org)
- The Modified Mercalli Intensity Scale | U.S. Geological Survey (usgs.gov)
- (Page 37, DePalma-Dow & Cowan 2018 https://www.energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-001_NorthCoast_ADA.pdf)
- DePalma-Dow et al. 2022 https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.4271
- Big valley 2021 https://www.bvrancheria.com/_files/ugd/f2d74c_13159c520c1d44ab8a112876ae6a6593.pdf)
- (Kennard 2021) https://watermanagement.ucdavis.edu/files/3816/3364/0833/Kennard_Thesis.pdf

- https://www.doi.gov/sites/doi.gov/files/uploads/dnrc_economic_cost_dreissei d_mussels_0119.pdf
- (Page 37, DePalma-Dow & Cowan 2018 https://www.energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-001_NorthCoast_ADA.pdf)
- DePalma-Dow et al. 2022 https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.4271
- U.S. Quaternary Faults (arcgis.com)
- California Earthquake Map - Fault Lines, Zones & Risks by County | CEA (earthquakeauthority.com)
- Heat Watch vs. Warning (weather.gov)
- Upper Lake Feasibility Study 12.7.21
- https://www.lakecountyca.gov/1239/What-Can-You-Do
- Primrose | Lake County, CA
- QZ Containment & Transition Plan | County Of Lake Dreis
- Lake County | Lake County Mussel Prevention
- Clear Lake Integrated Science Symposium 2024 | Lake County, CA
- https://mywaterquality.ca.gov/habs/what/index.html
- https://www.drought.gov/states/california
- https://nfipservices.floodsmart.gov/reports-flood-insurance-data

Annex 1: Clearlake Annex

Annex 1 is available:

- Lake County OES Website: https://lakesheriff.com/about/oes/hmp
- Clearlake Website: https://clearlake.ca.us/354/HAZARD-MITIGATION-PLAN

Annex 2: Lakeport Annex

Annex 2 is available:

- Lake County OES Website: https://lakesheriff.com/about/oes/hmp
- Lakeport Website: https://www.cityoflakeport.com/news_detail_T14_R568.php

Attachment 1: Public Input Survey Results

Attachment 1 is available on the Lake County OES Website: https://lakesheriff.com/about/oes/hmp