CALAVERAS COUNTY WATER DISTRICT

2023 Local Hazard Mitigation Plan

FINAL PLAN | NOVEMBER 2023

Prepared for:
Calaveras County Water District
120 Toma Court
San Andreas, CA 95249

Prepared by:
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FEMA Region 9
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

March 13, 2024

Kelly Gerkensmeyer
Water Resources Specialist
Calaveras County Water District
120 Toma Court
San Andreas, CA 95249

Dear Kelly Gerkensmeyer:

The *Calaveras County Water District 2023 Local Hazard Mitigation Plan* was officially adopted by the Calaveras County Water District and submitted for final review and approval to the Federal Emergency Management Agency (FEMA). The review is complete, and FEMA finds the plan to be in conformance with the Code of Federal Regulations, Title 44, Part 201, Section 6 (44 C.F.R. 201.6).

This plan approval ensures the Calaveras County Water District continued eligibility for funding under FEMA's Hazard Mitigation Assistance programs, including the Hazard Mitigation Grant Program (HMGP) and the Building Resilient Infrastructure and Communities program (BRIC). All requests for funding are evaluated individually according to eligibility and other program requirements.

FEMA's approval is for a period of five years, effective the date FEMA received the first adoption documentation. For this plan, documentation was received on February 20, 2024 and is considered approved as of then. Prior to **February 20, 2029**, the Calaveras County Water District must review, revise, and submit their plan to FEMA for approval to maintain eligibility for grant funding. The enclosed plan review tool provides additional recommendations to incorporate into future plan updates.

If you have any questions regarding the planning or review processes, please contact the FEMA Region 9 Hazard Mitigation Planning Team at fema-r9-mitigation-planning@fema.dhs.gov.

Sincerely,

KATHRYN J
LIPIECKI

Digitally signed by KATHRYN J
LIPIECKI
Date: 2024.03.13 20:21:51 -07'00'

Kathryn Lipiecki
Director, Mitigation Division
FEMA Region 9

Enclosure (1)

Calaveras County Water District Plan Review Tool, dated February 20, 2024

cc: Alison Kearns, Planning and Implementation Branch Chief, FEMA Region 9
Robyn Fennig, State Hazard Mitigation Officer, California Governor's Office of Emergency Services
Ron Miller, Hazard Mitigation Branch Chief, California Governor's Office of Emergency Services
Victoria LaMar-Haas, Hazard Mitigation Planning Chief, California Governor's Office of Emergency Services

EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Calaveras County Water District (CCWD) developed this Local Hazard Mitigation Plan (LHMP) update to make CCWD's service area (here in referred to as CCWD's planning area) and its water customers less vulnerable and more resilient to future hazard events. This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 so that CCWD would be eligible for the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) Grant programs.

CCWD followed a planning process prescribed by FEMA, which began with the formation of a Hazard Mitigation Planning Committee (HMPC) comprised of key CCWD representatives, Calaveras County staff, other water district staff from Utica Water and Power, and other regional stakeholders. The HMPC conducted a risk assessment that identified and profiled hazards that pose a risk to CCWD, assessed CCWD's vulnerability to these hazards, and examined the capabilities in place to mitigate them. CCWD is vulnerable to several hazards that are identified, profiled, and analyzed in this plan. Dam incidents; drought; expansive soils; extreme heat; extreme cold and winter storms; flood (100/500 year and localized); high winds; landslides and debris flows, severe weather hazards associated with heavy rain, lightning, and hail; and wildfire are among the hazards that can have a significant impact on the CCWD.

Based on the risk assessment review and goal-setting process, the HMPC identified and modified the following five goals from their previous LHMP, which provide the direction for reducing future hazard-related losses within CCWD's planning area:

- **Goal** 1: Protect water supply, transmission, and storage facilities and reduce exposure to hazard-related property and water assets losses from wildfire, extreme heat, flooding, and the effects of climate change.
- **Goal 2:** Increase resiliency of water supply to drought and climate change effects.
- **Goal 3:** Focus on watershed health improvements to reduce vulnerability and risk to critical infrastructure from natural hazards.
- **Goal 4:** Improve collaboration between partner water agencies, first responders, emergency management planners, and the public to maintain water system reliability.
- **Goal 5:** Increase water system redundancy and improve service levels.

To meet identified goals and objectives, the plan recommends 38 mitigation actions, which are summarized in the table that follows. This list includes 19 mitigation actions that were carried over from the 2018 LHMP and 18 new mitigation actions. Once formally approved by the California Office of Emergency Services (Cal OES) and FEMA Region IX and adopted by CCWD, this plan will be updated every five years.

Table ES-1 Mitigation Actions Summarized by Jurisdictions and Hazards Mitigated

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
1	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Wildfire	Implement and Expand Fuel Breaks to Reduce Wildfire Hazards at CCWD Properties	CCWD Engineering Department	Moderate	Sierra Nevada Conservancy Forestry Management implementation grants, US Forest Service Non-Federal Lands Hazard-Fuel Reduction Funding, CAL FIRE Fuel Reduction Activity Funding, California Disaster Assistance Act, FEMA HMA HMGP	Safety and Security	High	Ongoing	Annual Implementation
2	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Avalanche, Wildfire, Severe Weather: Winter Storms and Extreme Cold, Severe Weather: Heavy Rain and Storms Severe Weather: Wind, Volcano	Hardening of Water and Wastewater Facilities (and Associated Electrical and SCADA Communication Systems) Against Wildfire and Other Severe Weather Hazards	CCWD Engineering Department	Very High	FEMA HMA HMGP	Water Systems; Energy	High	Ongoing	Annual Implementation
3	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Implement Other Facility Flood Mitigation Projects	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	High	Ongoing	Annual Implementation
4	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Wildfire	Replace Remaining Redwood Water Storage Tanks	CCWD Engineering Department	High	FEMA HMA HMGP	Food, Hydration, Shelter; Water Systems	High	Short-Term	In Progress
5	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Improve grading and drainage of Wastewater Effluent Storage Ponds	CCWD Engineering Department	Very High	FEMA HMA HMGP	Hazardous Materials; Water Systems	High	Medium Term	Annual Implementation

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
6	Goal 1, Goal 3, Goal 4, Goal 5	Wildfire	Enhance On-Site Coordination with Cal-Fire during Fire Events	CCWD Engineering Department	Moderate	CAL FIRE Wildfire Prevention Grants Program	Safety and Security; Water Systems	High	Short-Term	Annual Implementation
7	Goal 1, Goal 3, Goal 4, Goal 5	Flood	Implement recommendations in service area master plans related to critical sewer facilities	CCWD Engineering Department	Very High	FEMA HMP HMGP, US EPA, USDA Rural Utility Service, California State Water Resources Control Board Small Community Wastewater Grant, State revolving fund grants and/or loans	Hazardous Materials; Water Systems	High	Long-Term	Annual Implementation
8	Goal 1, Goal 3, Goal 4, Goal 5	Wildfire	Implement pipeline improvements identified in water master plans to provide adequate fire flows	CCWD Engineering Department	High	District revenue from rates, fees, property taxes, interest on investments, FEMA HMGP, Department of Housing and Urban Development Community Development Block Grant Program, USDA Rural Utility Service, State revolving fund grants and/or loans	Safety and Security; Water Systems	High	Long-Term	Annual Implementation
9	Goal 1, Goal 3, Goal 4, Goal 5	Wildfire	Strategic Wildfire Protection Improvements in Sheep Ranch and West Point Water Systems	CCWD Engineering Department	Very High	FEMA HMA HMGP, CCWD General Fund/Revenue for Match	Water Systems	High	Short-Term	In Progress
10	Goal 1, Goal 3, Goal 4, Goal 5	Avalanche, Multi-hazard, Flood, Wildfire, Volcano	Evaluate the need for improved redundancy at critical facilities	CCWD Engineering Department	Moderate	CCWD General Fund/Revenue from rates, fees, property taxes, interest on investments	Water Systems	High	Medium Term	Not Started
11	Goal 1, Goal 3, Goal 4, Goal 5	Wildfire, Severe Weather: Heavy Rain and Storms, Severe Weather: Wind	Create and maintain wildfire defensible spaces around facilities identified as in high fire hazard areas	CCWD Engineering Department	Little to No Cost	Staff Time – CCWD revenue from rates, fees, property taxes, interest on investments, FEMA HMP HMGP, US Forest Service Wildland-Urban Interface grants, CAL FIRE Wildfire Prevention	Safety and Security; Water Systems	Medium	Ongoing	Annual Implementation

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
						Grants Program, California State Fire Safe Council or local Fire Safe Council, State revolving fund grants and/or loans				
12	Goal 1, Goal 3, Goal 4, Goal 5	Drought and Water Supply, Flooding	White Pines Lake Storage Restoration Project	CCWD Engineering Department	Very High	FEMA HMA HMGP, DWR Urban Community Drought Relief Grant Program	Food, Hydration, Shelter; Water Systems	Medium	Long-Term	Not Started
13	Goal 1, Goal 3, Goal 4, Goal 5	Multi- Hazard	Participate in the Calaveras County Multi-Jurisdictional Hazard Mitigation Plan by the next 2025 Update Cycle	CCWD, Calaveras County	Moderate	FEMA HMA HMGP	Safety and Security; Food, Hydration, Shelter; Water Systems	Medium	Long-Term	Modified Action in 2023.
14	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought and Water Supply	Highway 4 Community Emergency Water Supply Feasibility Planning Study	CCWD Water Resources Department	High	DWR Urban Community Drought Relief Grant Program	Water Systems	Medium	Long-Term	Not Started
15	Goal 1, Goal 3, Goal 4, Goal 5	Wildfire, Severe Weather: Heavy Rain and Storms, Volcano	Construct Fire Resistant Electrical Control Panels	CCWD Engineering Department	Moderate	CAL FIRE Wildfire Prevention Grants Program,	Energy; Water Systems	Medium	Medium Term	Annual Implementation
16	Goal 1, Goal 3, Goal 4, Goal 5	Flood	Retrofit Manhole Covers	CCWD Engineering Department	Moderate	FEMA HMA HMGP	Water Systems	Medium	Long-Term	Annual Implementation
17	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought	Identify and incorporate strategies for increasing water storage capacity to mitigate impacts of drought and other emergencies in an updated CCWD County Water Master Plan	CCWD Water Resources Department	Moderate	CCWD General Fund/Revenue	Food, Hydration, Shelter; Water Systems	Low	Short-Term	Annual Implementation
18	Goal 1, Goal 3, Goal 4, Goal 5	Dam Failure	Dam Failure Emergency Planning – Regularly coordinate with dam owners and	CCWD Operations Department, Utica Water and Power	Low	FEMA HHPD Program	Food, Hydration, Shelter: Energy;	Low	Medium Term	Annual Implementation

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
			operations on dam evaluations, inspections, rehabilitation activities, and Emergency Action Plan updates				Water Systems			
19	Goal 1, Goal 3, Goal 4, Goal 5	Avalanche, Drought, Multi-hazard, Wildfire, Volcano	Develop mutual aid agreements with other water providers and county agencies for support during emergencies	CCWD, Utica Water and Power, Calaveras Public Utility District, City of Angels, Union Public Utility District	Little to No Cost	Staff Time, CCWD General Fund/Revenue	Water Systems	Low	Ongoing	Annual Implementation
20	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Multi-hazard, Wildfire	Electrical Grid and Electrical Vehicle Charging Station Implementation Project	CCWD Engineering Department, Calaveras County, Calaveras Council of Governments	High	FEMA HMA HGMP, BRIC, APGP	Water Systems	High	Long-Term	New Action in 2023
21	Goal 1, Goal 4, Goal 5	Flood	Penn Gulch Culvert	CCWD Engineering Department, Calaveras County Public Works Department	High	FEMA HMA HMGP	Water Systems	Medium	Short-Term	New Action in 2023
22	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought	Implementing Disinfection Byproducts (DBPs) Mitigation	CCWD Engineering Department, Water Resources Department	High	DWSRF	Water Systems	High	Medium Term	New Action in 2023
23	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Stormwater Management Regulations	Calaveras County Public Works Department	Moderate	General Fund, DWR Funds	Water Systems	High	Short-Term	New Action in 2023
24	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Critical Facility Consolidation Project	CCWD Engineering Department	High	FEMA HMA HMGP, USDA, DWSRF	Water Systems	High	Medium Term	New Action in 2023
25	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Evaluate Plans and Designs for Huckleberry Lift Station Flood Protection Project and Need for Equipment Elevation or Dry Floodproofing	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	High	Medium Term	New Action in 2023

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
			Measures to Address Flood and Dam Inundation Risk and Infiltration and Inflow (I&I) Issues							
26	Goal 2, Goal 3, Goal 5	Flood, Wildfire	Copper Cover Collections System Lift Station Consolidation Project	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	High	Medium Term	New Action in 2023
27	Goal 1, Goal 4, Goal 5	Flood, Wildfire	Cross Lake Pipeline Mitigation Project	CCWD Engineering Department	Moderate	FEMA HMA HMGP, General Funds	Water Systems	Medium	Long Term	New Action in 2023
28	Goal 1, Goal 3, Goal 4, Goal 5	Drought, Flood	Middle Fork of the Mokelumne River Infiltration Gallery and Pump Station Replacement Project	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	Medium	Long Term	New Action in 2023
29	Goal 2, Goal 4	Flood	Middle Fork Mokelumne River Transmission Pipeline Replacement	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems, Safety and Security	High	Long Term	New Action in 2023
30	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought, Flood, Severe Weather, Wildfire	Sheep Ranch Water System Replacement	CCWD Engineering Department	High	FEMA HMA HMGP, DWRSRF	Water Systems, Safety and Security	High	Long Term	New Action in 2023
31	Goal 1, Goal 2	Drought, Flooding (Localized Stormwater), Soil Hazards, Severe Weather	Jenny Lind WTP Infiltration Gallery Replacement Project	CCWD Engineering Department	Moderate	FEMA HMA HMGP, USDA DWSRF	Water Systems, Safety and Security	Medium	Medium Term	New Action in 2023
32	Goal 3, Goal 5	Drought, Flood, Severe Weather, Soil Hazards	White Pines Reservoir Cleaning and Capacity Plan	CCWD Engineering Department	Moderate	FEMA HMA HMGP	Water Systems	Medium	Long Term	New Action in 2023
33	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought	Storage Tank Rehabilitation	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	Medium	Medium Term	New Action in 2023
34	Goal 1, Goal 4, Goal 5	Drought, Severe Weather, Wildfire	Wastewater Lift Station Hardening Projects	CCWD Engineering Department	High	FEMA HMA HMGP, BRIC	Water Systems	Medium	Medium Term	New Action in 2023

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
35	Goal 3, Goal 5	Drought, Flood, Severe Weather, Wildfire	Hunters Pump Station Improvement Project	CCWD Engineering Department	Moderate	FEMA HMA HMGP	Water Systems	High	Short Term	New Action in 2023
36	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought, Flood, Severe Weather, Wildfire	West Point Bummerville Reservoir Capacity Improvement Project	CCWD Engineering Department	Moderate	FEMA HMA HMGP, USDA DWSRF	Water Systems	High	Long Term	New Action in 2023
37	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought	West County Burson Area Groundwater Recharge Project	CCWD Engineering Department, San Joaquin Subbasin GSA	High	FEMA HMA HMGP, USDA DWSRF, DWR Urban Community Drought Relief Grant Program	Water Systems	High	Long Term	New Action in 2023
38	Goal 1, Goal 2, Goal 4, Goal 5	Avalanche, Multi Hazard, Severe Weather, Wildfire, Volcano	CCWD Intertie Projects	CCWD Engineering Department, Utica Water and Power, Calaveras Public Utility District, City of Angels, Union Public Utility District	High	FEMA HMA HMGP, General Funds	Water Systems, Safety and Security	High	Long Term	New Action in 2023

KEY:

Cost Estimate

- Little to no cost
- Low: Less than $10,000
- Moderate: $10,000 – $100,000
- High: $100,000 – $1,000,000
- Very High: More than $1,000,000

*Specific cost estimate information is provided, if available.

Potential Funding

- FEMA HMA HMGP – Hazard Mitigation Assistance Hazard Mitigation Grant Program
- BRIC – Building Resilient Infrastructure and Communities Grant
- HHPD – High Hazard Potential Dam Grant
- US Forest Service Wildland-Urban Interface (WUI) Grants – Funds to mitigate risk from wildland fire within the Wildland Urban Interface (WUI) that are awarded annually.
- USDA DWSRF – Program that help water systems finance infrastructure improvements to ensure compliance with drinking water standards and public health objectives.
- CAL FIRE Fuel Reduction Activity Funding – Funds projects in and near fire threatened communities to improve public health and safety while reducing GHG emissions.
- DWR Urban Community Drought Relief Grant Program – Grant program designed to strengthen drought resilience and better prepare communities for dry conditions.
- APGP – California funding to local, regional, and tribal communities in integrated climate adaptation planning; supports climate-resilient projects in California.

FEMA Community Lifelines

- Safety and Security
- Food, Hydration, and Shelter

- Health and Medical
- Energy
- Communications
- Transportation
- Hazardous Materials
- Water Systems

<u>Timeline</u>

- Short-Term: 1-2 years
- Medium Term: 3-5 years
- Long-Term: 5+ years
- Ongoing: Action is implemented every year

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ACS	American Community Survey
APA	Approved Pending Adoption
APG	Adaptation Planning Guide
AR	Atmospheric River
BAM	Best Available Maps
BFE	Base flood elevation
BRIC	Building Resilient Infrastructure and Communities
CBC	California Building Code
CDHS	California Department of Health Services
CFR	Code of Federal Regulations
CGS	California Geological Survey
CRHR	California Register of Historic Resources
CRS	Community Rating System
CVFPB	Central Valley Flood Protection Board
CWS	Community Water Systems
CCWD	Calaveras County Water District
CEQA	California Environmental Quality Act
BPR	Disinfection Byproduct Rules
DFIRM	Digital Flood Insurance Rate Map
DOC	Department of Conservation
DOF	Department of Finance
DSOD	Division of Safety of Dams
DWR	Department of Water Resource
EAL	Expected Annual Loss
EHP	Environmental and Historic Preservation
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
ERP	Emergency Response Plans
EV	Electric vehicle
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHSZ	Fire Hazard Severity Zones
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FRAP	Fire and Resource Assessment Program
GCM	Global climate models
GIS	Geographic Information System
GPS	Geographic Positioning Systems
HI	Heat Index
HIFLD	Homeland Infrastructure Foundation-Level Data
HIRA	Hazard Identification and Risk Assessment
HMA	Hazard Mitigation Assistance
HMPC	Hazard Mitigation Planning Committee
HMGP	Hazard Mitigation Grant Program
I&I	Infiltration and inflow
IPaC	Information for Planning and Consultation
ISO	Insurance Services Office
LFPZ	Levee Flood Protection Zone
LHMP	Local Hazard Mitigation Plan
LOMA	Letter of Map Amendments
LOMR	Letter of Map Revision
LRA	Local Responsibility Area
MAC	Multi-Agency Coordinating Committee
MAPP	Modeling, Analysis, Predictions and Projections
MHI	Median household income

MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
NAPADS	North American Public Avalanche Danger Scale
NCPA	Northern California Power Agency
NEPA	National Environmental Policy Act
NFHL	National Flood Hazard Layers
NFIP	National Flood Insurance Program
NGA	Next Generation Attenuation
NID	National Inventory of Dams
NIDIS	National Integrated Drought Information System
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
OEHHA	Office of Environmental Health Hazard Assessment
OPR	Office of Planning and Research
PDSI	Palmer Drought Severity Index
PRC	Public Resources Code
PSPS	Public Safety Power Shutoffs
PTSD	Post-traumatic stress disorder
RRA	Risk and Resilience Assessment
SDAC	Severely Disadvantaged Communities
SDWA	Safe Drinking Water Act
SHMP	State Hazard Mitigation Plan
SRA	State Responsibility Areas
SVI	Social Vulnerability Index
SWRCB	State Water Resources Control Board
TCU	Tuolumne-Calaveras Unit
TMI	Thornthwaite Moisture Index
UCERF	Uniform California Earthquake Rupture Forecast
UPUD	Union Public Utility District
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
USDA	US Department of Agriculture
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
WSCP	Water Shortage Contingency Plan
WTP	Water Treatment Plant
WUI	Wildland Urban Interface

1 INTRODUCTION

1.1 PURPOSE OF PLAN

CCWD has prepared this Local Hazard Mitigation Plan (LHMP) to guide hazard mitigation planning to better protect the people and property of CCWD from the effects of hazard events. The purpose of this LHMP is to identify policies, actions, and strategies that will help to reduce risk and prevent future losses. Hazard mitigation is best realized when community leaders, businesses, citizens, and other stakeholders join together to undertake a process of learning about hazards that can affect their area and use this knowledge to prioritize needs and develop a strategy for reducing damage. Hazard mitigation is most effective when it is based on a comprehensive long-term plan that is developed prior to a disaster occurring.

This plan demonstrates CCWD's commitment to reducing risks from hazards and serves as a tool to help their Board of Director decision-makers direct mitigation activities and resources. This plan was also developed to make CCWD eligible for certain federal disaster assistance, specifically, the FEMA's HMA grants including the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) and Building Resilient Infrastructure and Communities (BRIC) program, as well as to make CCWD more disaster-resistant. This plan demonstrates CCWD's commitment to reducing risks from hazards and serves as a tool to help decision-makers direct mitigation activities and resources.

1.2 HAZARD MITIGATION PLANNING

FEMA has determined that there is a critical link between hazard mitigation planning and sustainability. This means if CCWD has the foresight to plan ahead to reduce the impacts of hazards, CCWD will be better able to prevent injury, loss of life and damage to its properties, critical water facilities, and water customers. CCWD can use the threat of disaster as a catalyst to act and develop a plan so we can recover more quickly following a disaster.

CCWD has committed to reducing long-term risk to its water customers and damage to property from the effects of natural hazards. By planning, preparing, and adopting a LHMP, CCWD is taking a proactive approach to reduce or eliminate the impacts of hazards before they occur.

FEMA defines "hazard mitigation" as any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. CCWD's plan will serve as a tool for learning from disasters that have already occurred, so they can deal with them more effectively and efficiently with less expenditure than in the past.

Direct benefits include:

- Reduced loss of life;
- Reduced loss of property and essential services;
- Reduced economic hardship;
- Reduced reconstruction costs;

- Increased cooperation and communication within the community through the planning process; and
- Expedited post-disaster funding.

Indirect benefits include:

- Disaster resilience;
- Environmental quality;
- Economic vitality; and
- Improved quality of life.

1.3 FEDERAL REGULATORY FRAMEWORK

Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act ("the Stafford Act"), enacted by Section 104 of the Disaster Mitigation Act of 2000 ("DMA 2000"), provides revitalized approaches to mitigation planning. Section 322 continues the requirement for a State mitigation plan as a condition of disaster assistance and establishes a new requirement for LHMPs. In order to apply for federal aid for technical assistance and post-disaster funding, local jurisdictions must comply with DMA 2000 and its implementing regulations (44 Code of Federal Regulations [CFR] Part 201.6).

Under the 2008 44 CFR update, requirements have changed governing mitigation planning provisions for LHMPs published under 44 CFR §201.6. LHMPs qualify communities and special districts (including water districts) for federal mitigation grant programs including:

- HMA Grants
- HMGP
- BRIC
- FMA
- Severe Repetitive Loss (SRL)
- Repetitive Flood Claim (RFC)

1.4 BACKGROUND AND SCOPE

In the State of California and around the world, natural disasters occur frequently. Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. The time and money needed to recover from these events can strain or deplete local resources. These monies only partially reflect the true cost of disasters because additional expenses to insurance companies and non-governmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $6 in avoided future losses in addition to saving lives and preventing injuries (Multihazard Mitigation Council 2017).

Hazard mitigation planning is the process through which hazards that threaten communities are identified; likely impacts are determined, prioritized, and implemented. This LHMP update continues the hazard mitigation planning process for CCWD. The plan identifies natural hazards and risks within CCWD's planning area, which is defined by the jurisdictional boundaries of Calaveras County. The plan then identifies the hazard mitigation strategy to reduce vulnerability and make the communities of CCWD's planning area more disaster-resistant and sustainable. Information in this plan can be used to help guide and coordinate mitigation activities and local land use decisions. Proactive mitigation planning will help reduce the cost of disaster response and recovery to CCWD, and the communities it serves by protecting critical facilities, reducing liability exposure, and minimizing overall community impacts and disruption. CCWD's planning area has been affected by hazards in the past and CCWD is thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

1.5 PLAN UPDATE

This plan underwent a comprehensive update in 2023 in fulfillment of the five-year update requirement. Several factors underscore the need for this planning effort:

- CCWD is exposed to hazards that have caused past damage.
- Limited local resources make it difficult to be pre-emptive in reducing risk. Eligibility for federal financial assistance is paramount to promote successful hazard mitigation in the planning area.
- CCWD and its partners recognize the probability of certain future hazards is increasing and want to identify and implement mitigation actions that will address the needs of CCWD's water customers (populations) most vulnerable to these hazards' impacts.
- CCWD and its partners participating in this plan want to be proactive in preparing for the probable impacts of natural hazards.

CCWD's 2018 LHMP was developed pursuant to the regulations of DMA 2000, and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR Section 201.6). While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that LHMPs must meet in order 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). Because the CCWD planning area is subject to many kinds of hazards, access to these programs is vital. As a result, CCWD must complete a comprehensive plan update every five years. For the current plan update in 2023, CCWD completed the update to bring the LHMP into compliance with recent federal legislation and new guidance related to climate change probability, underserved and socially vulnerable populations ("climate equity"), increased stakeholder engagement, and the need to address emerging hazard concerns. The CCWD 2018 LHMP was adopted by CCWD on November 14, 2018.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community and its property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. CCWD's planning area, which was previously defined as the jurisdictional boundaries of Calaveras County, has been affected by hazards in the past and is thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

This LHMP identifies resources, information, and strategies for reducing risk from natural hazards. Elements and strategies in the plan were selected because they meet a program requirement and because they best meet CCWD's needs and the needs of their water customers. One of the benefits of hazard mitigation planning is the ability to pool resources within a planning area that has uniform risk exposure and vulnerabilities. This plan will help guide and coordinate mitigation activities throughout the planning area, and in coordination with Calaveras County and other water districts that serve the residents of Calaveras County. The plan was developed to meet the following objectives:

- Meet or exceed the requirements of the DMA.
- Enable CCWD to use federal grant funding to reduce risk through mitigation.
- Meet the needs of CCWD as well as state and federal requirements.
- Create a risk assessment that focuses on CCWD hazards of concern.
- Update the risk assessment with a consequence analysis that assesses the risk and vulnerability of people, property, critical water facilities and infrastructure, natural and cultural resources, future development from these hazards of concern.
- Create a single planning document that integrates a framework that supports partnerships within Calaveras County.
- Meet the planning requirements of FEMA's Community Rating System (CRS), allowing planning partners that may choose to participate in the CRS program to enhance their CRS classifications.
- Coordinate existing plans and programs so that high-priority initiatives and projects to mitigate possible disaster impacts are funded and implemented.

All citizens and businesses that are water customers of CCWD are the ultimate beneficiaries of this LHMP. The plan reduces the risk for those who live in, work in, and visit Calaveras County. It also provides a viable planning framework for all foreseeable natural hazards that may impact the CCWD's planning area. Participation in the development of the plan by key stakeholders helps ensure that outcomes will be mutually beneficial. The resources and background information in the plan are applicable countywide given the CCWD's planning area is contiguous with the County's planning area. As such, the plan's goals and recommendations can lay the groundwork for the development and implementation of local mitigation activities and partnerships.

The CCWD LHMP is a customized single-jurisdictional plan tailored for a water district that geographically covers people (water customers), property, and critical water assets within CCWD's service area (hereinafter referred to as the planning area) that is same as the Calaveras County jurisdictional boundary.

1.6 PLAN ORGANIZATION

The sections that comprise the CCWD's LHMP include:

Executive Summary – This section includes the executive summary of the LHMP and addresses the formal adoption of the plan by the CCWD's Board of Directors to demonstrate the commitment of the community and elected officials to CCWD's goal of becoming disaster-resistant.

Section 1: Introduction – This section describes the purpose of the LHMP update, the benefits of hazard mitigation planning, the federal and state regulatory requirements, and the background of CCWD's hazard mitigation planning process.

Section 2: Community Profile and Capability Assessment – This section provides the history and background of CCWD, including population trends and the demographic and economic conditions that have shaped the service area and the CCWD's water customers, and the community's water demands. This section also includes CCWD's capability assessment.

Section 3: Planning Process – This section identifies the planning process, the Hazard Mitigation Planning Committee (HMPC) members, the meetings held as part of the planning process, documents the outreach efforts, and the review and incorporation of existing plans, reports, and other appropriate information.

Section 4: Hazard Identification and Risk Assessment (HIRA) –This section describes the process through which the HMPC and local partners identified, screened, and selected the hazards to be profiled. The hazard analysis includes the description, location, extent, and probability of future events for each hazard. This section also includes a Vulnerability Assessment. The Vulnerability Assessment covers all hazards and considers the impact on the following assets: property; people (water customers); critical water facilities and infrastructure (CCWD assets); natural and cultural resources; economic conditions of CCWD; and future development trends that may influence water demand and CCWD resources.

Section 5: Mitigation Strategy – The mitigation strategy section provides a plan for reducing the potential losses identified in the vulnerability analysis. Mitigation goals and potential actions to minimize the risks and losses associated with each hazard will be described along with a strategy for implementation.

Section 6: Plan Adoption, Implementation and Maintenance – This section describes the method for plan adoption and the schedule for monitoring, evaluating, and updating the plan to ensure it remains an active and applicable document.

Section 7: References – This section lists the sources cited in the plan.

1.7 APPENDICES

- Appendix A: Hazard Mitigation Planning Committee
- Appendix B: Planning Process Documentation
- Appendix C: Approval and Adoption Documentation
- Appendix D: Mitigation Categories and Alternatives
- Appendix E: Annual Progress Meeting Agenda and Report Template
- Appendix F: Outreach Strategy

2 DISTRICT PROFILE AND CAPABILITY ASSESSMENT

2.1 District Profile

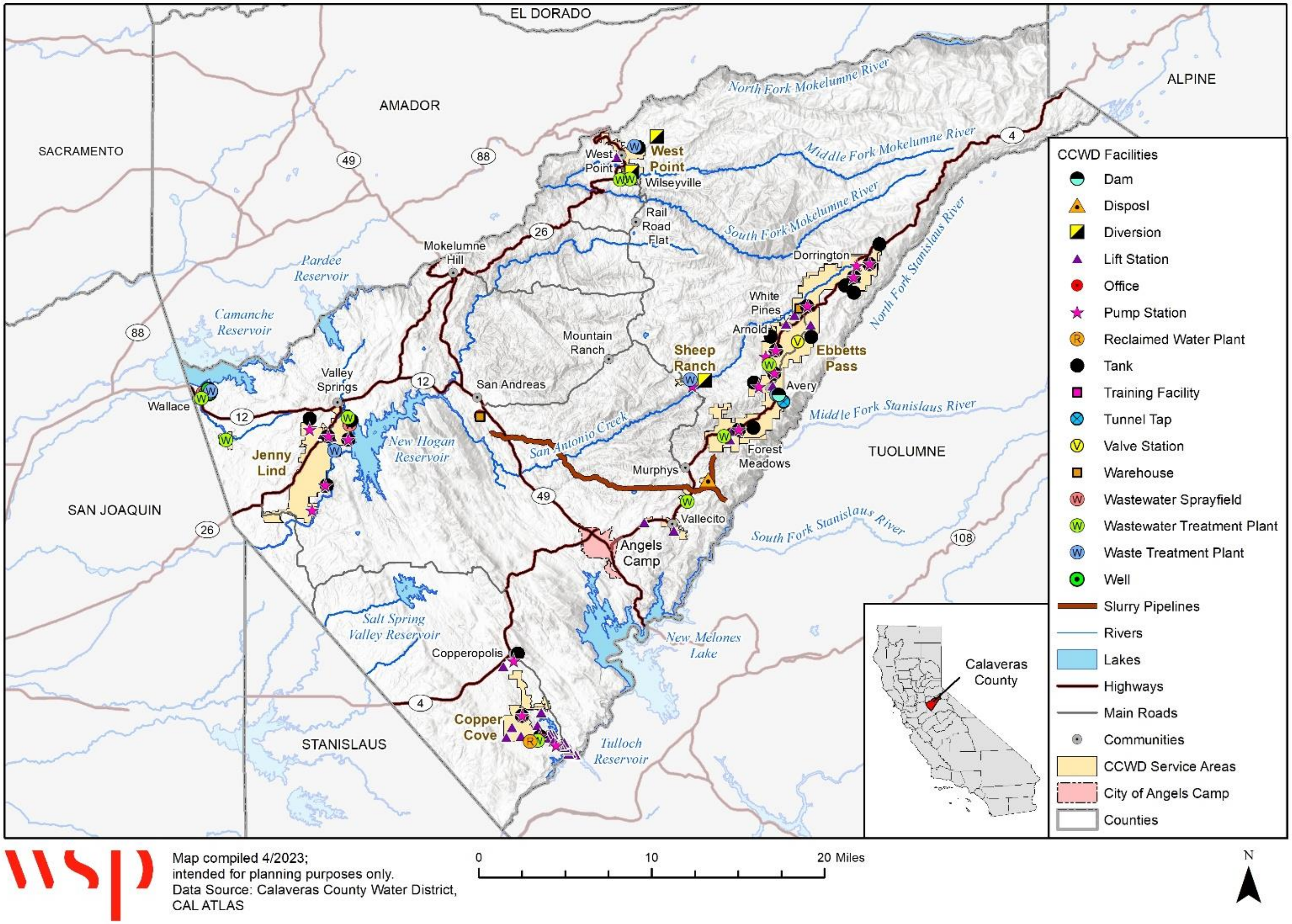
CCWD's service area defines the "planning area" for the CCWD and includes all of Calaveras County in the central Sierra Nevada foothills in the northeastern portion of California. CCWD's planning area is the same as the Calaveras County jurisdictional boundaries and encompasses approximately 657,920 acres of land ranging from the San Joaquin Valley to the Sierra Nevada Mountains. Figure 2-1 shows CCWD's planning area.

It is a rural area with many small communities, some of which are urbanized along its western border. San Andreas, the County seat, is approximately 100 miles east of San Francisco and 60 miles southeast of Sacramento. The City of Angels is the only incorporated community in Calaveras County. The population currently resides in many of the County's small, historic communities that were established during the Gold Rush period. These residential communities are located along the historic routes of State Highway 49 and 12 and include the unincorporated communities of Mokelumne Hills, San Andreas, Valley Springs.

Other residential areas are located along State Route 4 and include Copperopolis, Murphys, and Arnold. Other communities include Wallace, Burson in the western portion of the County, West Point, Wilseyville, and Mountain Ranch in the north-central part of the County, and Avery and Dorrington along Highway 4. Many new residential projects were proposed and built leading up to the economic crisis of 2007-2008, targeting housing for commuters to cities in the San Joaquin Valley and other nearby communities. Since the economic collapse, new construction has been stagnant, with the County experiencing a population decline for several years.

As noted in the Calaveras County 2020 General Plan Land Use Element, the 1996 General Plan land use map accommodated this prior growth by identifying large areas of land designated "Future Single-Family Residential" throughout the western and central portions of the County, and "Community Center" in areas around existing communities. In addition, six Community Plans (Valley Springs, San Andreas, Mokelumne Hill, Murphys-Douglas Flat, Avery-Hathaway Pines, and Arnold) were adopted, along with two Special Plans (Rancho Calaveras and Ebbetts Pass).

Figure 2-1 CCWD Planning Area



2.2 History and Organization

CCWD was organized in November 1946 under the laws of the State of California as a public agency for developing and administering water resources and wastewater services in Calaveras County. CCWD owns two hydropower projects: the North Fork Stanislaus Hydroelectric Development Project (FERC 2409), completed in 1990; and the New Hogan Power Project (FERC 2903) on the Calaveras River, completed in 1986.

CCWD is a non-profit governmental agency also known as a “special district”, conducting business in the performance of public services for Calaveras County, and is governed by an elected five-member Board of Directors that is elected by qualified voters in the CCWD to four-year terms. CCWD’s service area includes all of Calaveras County, but it is administratively and fiscally independent from the Calaveras County government.

CCWD is the largest public water purveyor in Calaveras County in terms of service area, number of customers served, and amount of water delivered. As a special district, CCWD’s authority includes providing public water service, water supply development and planning, wastewater treatment and disposal, and recycling. CCWD maintains broad general powers over the use of water within its boundaries, including the authority to acquire, control, distribute, store, spread, treat, purify, reclaim, process, and salvage water for beneficial use; provide wastewater service; sell treated or untreated water; and acquire or construct hydroelectric facilities and sell the power and energy produced to public agencies or public utilities engaged in distributing power. As a special water district, the CCWD can contract with the United States or other political subdivisions, public subdivisions, public utilities, or other persons; and, subject to Article XIIIA of the Constitution of the State of California, the CCWD can levy taxes and improvements. CCWD also maintains certain administrative authorities through the adoption and maintenance of its groundwater management plan and monitoring program for the Camanche/Valley Springs area, which is a portion of the California Department of Water Resources (DWR) Bulletin 118 recognized as the Eastern San Joaquin Groundwater Subbasin.

As of 2022, CCWD provides water service to approximately 27,980 municipal, residential, and commercial customers via 13,219 connections through the following six independent water systems located throughout Calaveras County:

- Ebbetts Pass (served by the Stanislaus River)
- Copper Cove/Copperopolis (served by the Stanislaus River)
- Jenny Lind (served by the Calaveras River)
- West Point (served by the Mokelumne River and Bear Creek, a Mokelumne River tributary)
- Wallace (served by the Eastern San Joaquin Groundwater Subbasin)
- Sheep Ranch (served by San Antonia Creek, a tributary of the Calaveras River)

CCWD also provides water and/or wastewater service to approximately 13,627 customers via 5,104 connections with nine different service areas throughout Calaveras County.

2.3 GEOGRAPHY AND CLIMATE

Topography varies from ranch land to foothills in the western and southern portions of the County to high mountainous areas typical of the Sierra Nevada in the northern and eastern portions. Elevations range from 200 feet above mean sea level (msl) in the northwestern region of the County to a peak at 8,170 msl above Corral Hollow near Alpine County. Warm, dry summers and temperate winters prevail in the western foothills, with temperatures ranging from the middle 30s˚F to the high 90s˚F, occasionally exceeding 100˚F during the summer. Mild summers and cold winters characterize the mountainous eastern region with temperatures ranging from the low 20s˚F to the middle 80s˚F. Annual precipitation generally increases with altitude and occurs in the form of rain or snow depending upon the elevation. Table 2-1 summarizes the average maximum and minimum temperatures by month and associated average rainfall.

Table 2-1 Average Maximum & Minimum Temperatures by Month and Associated Average Rainfall

Average Maximum/Minimum Temperature	Average Rainfall
January 52.2˚F/34.3˚F	January 6.66 inches
August 89.9˚F/57.5˚F	August 0.05 inches
Annual 70.4˚F/44.9˚F	Annual 34.35 inches

Note: The time frame for both temperature and precipitation is from 1950 to 2023.
Source: NOAA, 2023

2.4 Population & Housing Characteristics

According to the US Census Bureau 2017-2021 American Community Survey (ACS), Calaveras is the 44th largest county in terms of population in California with an approximate population of 46,563 people. As mentioned previously, as of 2022 CCWD provides water service to approximately 27,980 municipal, residential, and commercial customers via 13,219 connections. CCWD also provides water and/or wastewater service to approximately 13,627 customers via 5,104 connections with nine different service areas throughout Calaveras County.

Select demographic and social characteristics for CCWD from the 2017-2021 ACS and the California Department of Finance (DOF), are shown in Table 2-2. Increases in population growth also increase exposure to severe weather-related hazards, as well as earthquakes. This increase in growth also puts more demand on water resources and can increase vulnerability to drought.

Table 2-2 CCWD Demographic and Social Characteristics, 2017-2021

Characteristic	CCWD
Gender/Age	
Male	49.8%
Female	50.2%
Median age (years)	52.3
Under 5 years	4.3%
Under 18 years	17.0%
65 years and over	28.0%

Characteristic	CCWD
Race/Ethnicity	
White	79.2%
Asian	2.2%
Black or African American	1.0%
American Indian/Alaska Native	0.6%
Hispanic or Latino (of any race)	13.1%
Native Hawaiian and Other Pacific Islander	0.0%
Some other race	0.0%
Two or more races	3.8%
Education*	
% High school graduate or higher	90.8%
% with Bachelor's Degree or Higher	19.9%
Social Vulnerability	
% with Disability	20.1%
% Language other than English spoken at home	8.7%
% Speak English less than "Very Well"	2.1%
% of households with a computer	93.5%
% of households with an Internet subscription	85.9%
% of households with no vehicle available	1.5%

Source: CA Department of Finance U.S. Census Bureau ACS 2015-2019 5-Year Estimates, www.census.gov/

* Population 25 years and over

The following table summarizes information from the ACS 5-year estimates (2017-2021) related to housing occupancy in CCWD. More than 80% of the County residents own the home they live in.

Table 2-3 CCWD Housing Occupancy and Units, 2017-2021

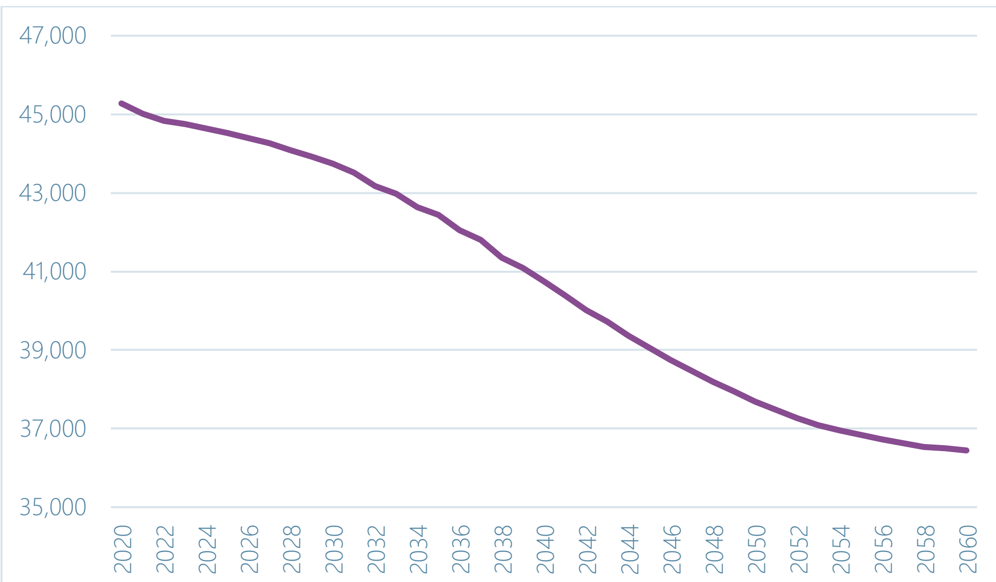
Housing Characteristic	Estimate	Percentage
Housing Occupancy		
Total Housing Units	27,476	100%
Units Occupied	16,809	61.2%
Vacant	10,667	38.8%
Housing Units		
1-unit detached	23,606	85.9%
1-unit attached	441	1.6%
2 units	280	1.0%
3 or 4 units	301	1.1%
5-9 units	302	1.1%
10-19 units	129	0.5%
20 or more units	276	1.0%
Mobile Home	2,113	7.7%
Boat, RV, van etc.	28	0.1%
Housing Tenure		

Housing Characteristic	Estimate	Percentage
Owner Occupied	13,698	81.5%
Renter Occupied	3,111	18.5%

Source: U.S. Census Bureau ACS 2017-2021 5-Year Estimates, www.census.gov/

Moreover, according to the DOF, the 2020 population of CCWD was 45,277 (DOF 2023). The DOF projects the total population will decrease by 3.4% to 43,735 by 2030 (DOF 2023). These projections are shown in Figure 2-2. Total households in the County are also projected to decrease from 18,368 in 2020 to 17,740 in 2030. People per household is projected to slightly decrease from 2.38 in 2020 to 2.37 persons per household in 2030 (DOF 2023).

Figure 2-2 CCWD Observed and Projected Population (2020 – 2060)



Source: DOF 2023

2.5 Economy

The County's origins and early economic development can be traced to the "gold rush era" of the 1800s when historic placer mining occurred mainly in areas east of the modern-day alignment of Highway 49. Over time, asbestos, gold, industrial minerals, limestone, and sand and gravel became the most active segments of the mineral industry. Tourism and recreation, forest products, mineral resources, and agricultural products now comprise significant elements of the area's economic base. As a result, a variety of land uses are found within CCWD's service area, including residential, forested, industrial, agricultural, and recreational land uses. In the foothills, much of the land is used for cattle ranching, while orchards, vineyards, and row crops are grown at lower elevations. The County's economy is also based on educational services, public administration and municipalities, and private businesses. Major employers include Calaveras County, the California Department of Forestry and Fire Protection (CalFIRE), Mark Twain St. Joseph's Hospital, and Bret Harte High School (EED 2023). Comprehensive economic data for Calaveras County comes from the US Census

Bureau, as an excerpt from the ACS. Select estimates of economic characteristics for Calaveras County are shown in Table 2-4.

Table 2-4 Calaveras County Economic Characteristics

CHARACTERISTIC	CALAVERAS COUNTY
In civilian labor force, total, percent of population age 16 years+	46.2%
In civilian labor force, female, percent of population age 16 years+	43.8%
Median household income	$70,119
Per capita income in past 12 months	$34,791
Families below Poverty Level (%)	9.1%
All People below Poverty Level (%)	14.1%
Population Employed (%)	58.6%
Unemployment Rate	6.8%

Source: U.S. Census Bureau ACS 2017-2021 5-Year Estimates, www.census.gov/

The boom-and-bust cycles of mining, timber harvesting, and tourism have left many rural communities in the County perennially disadvantaged with median household income well below the state threshold. The median household income for Calaveras County has increased over the past 11 years, from about $54,971 in 2010 to $69,717 in 2020. In comparison with other Sierra Nevada counties, the median household income is average. The County falls significantly short of the state median household income (84,097). The County has a similar or slightly higher state median household income than other counties in the Sierra Nevada ($69,955 in Amador County and $66,846 in Tuolumne County).

Table 2-5 and Table 2-6 show the labor force breakdown by industry and occupation and are based on estimates from the 2017-2021 five-year ACS.

Table 2-5 CCWD Employment by Industry Sector, 2017-2021

Industry Sector	Percent of Workforce
Agriculture, forestry, fishing and hunting, and mining	4.3%
Construction	11.3%
Manufacturing	6.1%
Wholesale trade	2.2%
Retail trade	12.1%
Transportation and warehousing, and utilities	5.7%
Information	1.7%
Finance and insurance, and real estate and rental and leasing	5.4%
Professional, scientific, and management, and administrative and waste management services	12.5%
Educational services, and health care and social assistance	18.1%
Arts, entertainment, and recreation, and accommodation and food services	8.6%
Other services, except public administration	4.2%

Public administration	7.9%

Source: US Census Bureau ACS 2017-2021 5-Year Data Profile

Table 2-6 CCWD Employment by Occupation, 2017-2021

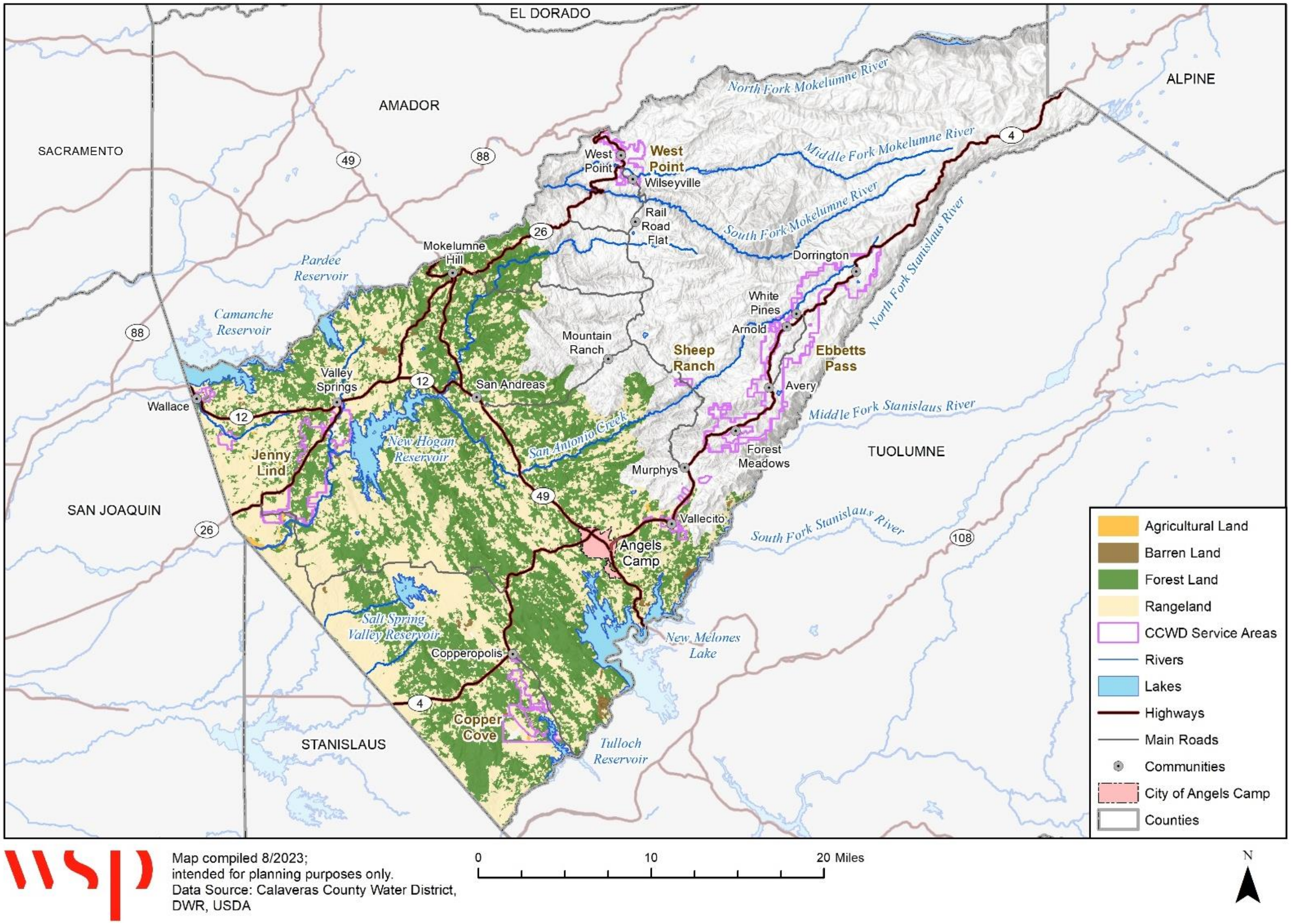
Occupation	# Employed	% Employed
Management, business, science, and arts occupations	5,106	31%
Service occupations	4,058	24%
Sales and office occupations	3,742	23%
Natural resources, construction, and maintenance occupations	2,096	13%
Production, transportation, and material moving occupations	1,630	10%
Total	16,631	25%

Source: U.S. Census Bureau American Community Survey 2017-2021 5-Year Estimates, www.census.gov/

2.6 Natural and Recreation Resources

As shown in Figure 2-3, the majority of the County's land cover is rangeland and forest land, which is similar to other nearby counties in the Northern San Joaquin Valley and Sierra Nevada. Further details on the County's natural resources can be found in Section 4.3.3 Cultural, Historical and Natural Resources.

Figure 2-3 CCWD Land Cover



2.7 CCWD's Mitigation Capabilities

The following section assesses CCWD's existing capabilities to pursue hazard mitigation. The capability assessment analyzes CCWD's capabilities that can be leveraged to mitigate hazards. Combining the risk assessment with the mitigation capability assessment results in CCWD's "net vulnerability" to disasters, and more accurately focuses the goals, objectives, and proposed actions of this plan.

The HMPC used a two-step approach to conduct this assessment for CCWD. First, an inventory of common mitigation activities was made using a matrix. The purpose of this effort was to identify policies and programs that were either in place, needed improvement, or could be undertaken if deemed appropriate. Second, the HMPC conducted an inventory and review of existing policies, regulations, plans, and programs to determine if they contributed to reducing hazard-related losses or if they inadvertently contributed to increasing such losses.

This assessment is divided into four sections: regulatory mitigation capabilities; administrative and technical mitigation capabilities; fiscal mitigation capabilities; and mitigation outreach and partnerships.

2.7.1 Regulatory Mitigation Capabilities

The regulatory and planning capabilities listed in Table 2-7 outline planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicate those that are in place in CCWD. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities. Given the CCWD is a special water district, not all the regulatory mitigation capabilities apply.

Table 2-7 CCWD's Regulatory Mitigation Capabilities

REGULATORY TOOL (ORDINANCES, CODES, PLANS)	YES/NO	COMMENTS
General Plan	N/A (County)	The *Calaveras County General Plan* (adopted November 12, 2019) is the County's blueprint for land use in the unincorporated County. It provides the basis for development while maintaining the quality of life in Calaveras County. The current plan addresses the natural hazards in the following elements: Resource Production, Conservation and Open Space, Noise, Safety, and Public Facilities. The Safety Element addresses the majority of the natural hazards in the County, specifically flood hazards, dam failure inundation, fire hazards, geotechnical hazards, hazardous materials, and emergency evacuation. The County also implements the *2021 Calaveras County Multi-Jurisdictional Hazard Mitigation Plan* (MJHMP) to guide hazard mitigation planning activities. The current plan addresses the following

REGULATORY TOOL (ORDINANCES, CODES, PLANS)	YES/NO	COMMENTS
		natural hazards: climate change, dam failure, debris flow, drought, earthquake, flooding, land subsidence/sinkholes, severe weather: extreme heat, severe weather: high wind/tornado, severe weather: winter storms/extreme cold, volcano, and wildfire. The County's MJHMP was also incorporated by reference into the Safety Element of the *Calaveras County General Plan*.
Zoning Ordinance	N/A (County)	Calaveras County implements the *Calaveras County Zoning Code* (Chapter 17 of the Municipal Code). The Zoning Code provide a way to implement the policies of the County's General Plan; classify and ensure adequate development of property; ensure that there are adequate services available to meet the needs of residents, businesses, and commerce; establish fair and consistent development standards; and provide a means of prompt and fair project consideration and review.
Subdivision Ordinance	N/A (County)	Chapter 16 of the *Calaveras County Municipal Code* contains the general provisions of the County's subdivision ordinance. Major and minor subdivisions in the County are also governed by the Subdivision Map Act (California Government Code, Section 55410, et. Seq.). The Subdivision Ordinance regulates and controls property, including subdivisions of land into four or fewer parcels, subdivisions of five or more parcels, boundary line adjustments, creation of five or more "time shares," and the conversion of existing multiple-family residential structures or mobile homes into condominiums, planned-unit developments, or stock cooperative ownerships, among other subdivisions.
Growth Management Ordinance	N/A (County)	The County does not have a Growth Management Ordinance; however, the *Calaveras County General Plan* is designed to guide growth and development in a way that balances the needs of the individual property owners with the needs of the County residents by encouraging economic growth, while also advocating for stewardship of the County's natural and recreational resources. The General Plan can accomplish this by providing a range of housing choices for all income levels and promoting orderly and cost-effective expansion of public infrastructure.
Floodplain Ordinance	N/A (County)	Chapter 15.06 of the *Calaveras County Municipal Code* contains the Flood Damage Prevention Ordinance that includes building regulations and flood damage preventions measures that are required before the construction and development of structures within any area of special flood hazard (e.g., elevation requirements of the lowest floor

REGULATORY TOOL (ORDINANCES, CODES, PLANS)	YES/NO	COMMENTS
		structures, elevations of structures that require floodproofing, certification that floodproofing methods meet criteria, description of extent to which water course altered due to development). These regulations promote public health and safety and general welfare of the County residents and are an effective way to reduce flood hazards.
Other special purpose ordinance (e.g., stormwater, steep slope, wildfire)	N/A (County)	The *Calaveras County Municipal Code* contains Chapter 8, Health and Safety that addresses other safety issues related to nuisances, unsafe structures, hazardous fire areas, fireworks, and solid waste removal. Chapter 15.09 contains the County's Fire Regulations for State Responsibility Areas, which comply with the Public Resources Code Section 4290 Fire Safe Regulations for State Responsibility Areas, commencing with Sections 1270 through 1275, Article 5.5, Chapter 7, Division 1.5, Title 14, California Code of Regulations. Additionally, the County implements Chapter 13.01 to protect stormwater quality.
Building Code	N/A (County)	The County's Building Code is set forth in Title 15 – Buildings and Construction of the *Calaveras County Municipal Code*. The building standards for work authorized by a new permit shall be governed by the codes in force at the time of a new permit application as described in the California Building Code (CBC).
Fire department Insurance Services Office (ISO) rating	Yes	The Angels Camp Fire Department has an Insurance Services Office (ISO) rating of Class 4. Calaveras County Consolidated Fire Districts are rated 5 and 5Y, respectively, the Copper Fire Department rating is Class 5 and 5Y. Ebbetts Pass Fire Department has a rating of Class 2 and 2Y, Murphy's Fire Department has a rating of Class 5 and 5Y, and West Point Fire Department has a rating of 4 and 4Y.
Erosion or Sediment Control Program.	N/A (County)	Calaveras County implements Chapter 12.02.220 to protect stormwater quality and ensure erosion controls. The District can integrate erosion and stormwater management policies into District plans to better protect water supply facilities and infrastructure.
Storm Water Management Program	N/A (County)	The *Calaveras County Code Title 13 – Public Services* (Chapter 13.01) outlines the purpose and scope of the Storm Water Quality Ordinance (adopted October 2019) to protect public health and property by controlling the discharge of pollutants into County-maintained stormwater collection and conveyance

REGULATORY TOOL (ORDINANCES, CODES, PLANS)	YES/NO	COMMENTS
		systems, provide legal authority to fulfill discharge permit obligations for regulated municipal small storm water sewer systems (MS4), and to minimize increases in stormwater runoff from any development site in order to reduce flooding, siltation, and increases in stream temperature.
Site Plan Review Requirements	N/A (County)	The County requires an Administrative Design and Review Permit prior to construction. The County provides a Site Plan Checklist for accessory buildings and additions. The CCWD also has engineering and construction standards in place for water and wastewater projects here: https://ccwd.org/doing-business-with-ccwd/engineering/construction-standards/.
Capital Improvements Plan	Yes	The CCWD's 2022-2023 through 2024-2025 Capital Improvement Program contains capital improvements for water projects, including specific projects such as the Copper Cover Tank B/Clearwell, Jenny Lind Clearwell #2, and the Larkspur Tank Replacement. The CCWD's 2022-2023 through 2024-2025 Capital Improvement Program contains capital improvements for wastewater projects, including specific projects such as the CC Lift Station 6, 8, and Force Main Bypass, CC Lift Station 15 and 18 Rehabilitation/Replacement, and the Wallace Treatment Plant renovations.
Economic Development Plan	No	The CCWD does not have an Economic Development Plan.
Local Emergency Operations Plan (EOP)	N/A (County)	The CCWD does not have an EOP in place. However, the CCWD has Emergency Response Plans (ERPs) in place for several dam facilities. Calaveras County implements their *Calaveras County Emergency Operations Plan – Base Plan*, adopted September 2019.
Other special plans	Yes	The 2021-2026 CCWD Strategic Plan, adopted in April 2021 by the CCWD Board of Directors outlines several of the Water Department's long- and short-term objectives related to hydropower, water supply reliability, new water storage, and water reliability and resilience. The Strategic Plan also aims to protect the County's watersheds to adapt to climate change, promote healthy forests and water yield, protect water quality, and ensure sustainability. Key resources related to water supply, watershed management, shortage and drought response, regional coordination, groundwater management, and local and statewide hydrologic conditions.

REGULATORY TOOL (ORDINANCES, CODES, PLANS)	YES/NO	COMMENTS
		The CCWD also contains numerous engineering plans and reports related to hazard mitigation and the effective delivery of water and wastewater treatment services to water customers. These include the Copper Cove Water and Wastewater System Master Plan, La Contenta Wastewater System Master Plan, Copper Cove Wastewater System Master Plan, Jenny Lind Water System Master Plan, and the 2018 Final Draft Supplemental West Point Water System Master Plan. The CCWD updates the CIP each fiscal year, with the 2022-2023 through 2024-2025 Capital Improvement Program for water and wastewater projects the most recent CIP. The CCWD has the Arnold Sewer System Master Plan (May 2005), Ebbetts Pass Water Master Plan (May 2005), and Wastewater Facilities Master Plan for Vallecito, Douglas Flat, and Six-Mile Village (2005). They also implement the West Point Water System Master Plan, Ebbetts Pass System Evaluation (2013), and Forest Meadows Wastewater Facility Plan (September 2004). The 2020 Urban Water Management Plan (UWMP) describes and evaluates how the current and future water resources and demands within the CCWD's service area will be managed to provide an adequate and reliable water supply. The 2020 Water Shortage Contingency Plan (WSCP) is required under the Urban Water Management Planning Act, which states that each water supplier outline how the supplier will prepare for and respond to water shortages. This plan establishes six numbered shortage stages of response based on water supply conditions within the CCWD's service areas.
Flood Insurance Study (FIS) or other engineering study for streams	Yes	The County has participated in the National Flood Insurance Program (NFIP) since 1990, but they do not participate in the Community Rating System (CRS). The latest FIS applicable to the CCWD was the Calaveras County Flood Insurance Study (FIS); this report was completed on May 16, 2017. Like the FIS, the latest effective date for the DFIRMS in the County is January 3, 2020.

REGULATORY TOOL (ORDINANCES, CODES, PLANS)	YES/NO	COMMENTS
		Chapter 15.06 of the *Calaveras County Municipal Code* (Flood Damage Prevention Ordinance) sets forth regulations to reduce flood hazards by regulations and restricting development in flood-prone areas by establishing specific review requirements and performance standards in conformance with the NFIP regulations. These procedures have been in place since 1992 (Ordinance 2294) and have been repealed and updated in 2008.
Elevation certificates	Yes (County)	Calaveras County's Standards for Manufactured Homes and other development implements structural elevations as an efficient and cost-effective way to mitigate against future flood losses. According to Chapter 15.06 of the *Calaveras County Municipal Code* all new construction (manufactured homes, other standard construction) in Zones AE, AH, and A1-30 must be elevated above the base flood elevation (BFE) by at least 2 feet.
Other	Yes	2021-2026 Strategic Plan, 2020 UWMP, 2020 WSCP

Source: Hazard Mitigation Planning Committee 2023; Calaveras County MJHMP 2021

2.7.2 Related Plans and Regulations

CCWD Strategic Plan (2021-2026)

The CCWD Strategic Plan includes discussions on the history and current situation of CCWD. The Strategic Plan outlines CCWD's mission, vision, and values. Moreover, the Strategic Plan discusses CCWD's goals and objectives from six perspectives: Customer Experience, Fiscal Responsibility, Operational Integrity, Programs, Projects, and Initiatives, people & Partnerships, and Enduring Organization. The programs discussed that are related to hazard mitigation planning include:

- Responsible management of groundwater resources countywide and evaluating opportunities for conjunctive use.
- Evaluate feasibility of and implement plan to secure new water storage (e.g., conjunctive use) for water supply reliability and resiliency.
- Protect our watersheds to adapt to climate change, promote healthy forests for wildfire protection and water yield, protect water quality, and ensure sustainability.
- Pursue sustainable water supply projects such as recycled water.
- Continue to implement water conservation initiatives such as customer outreach, leak detection, and infrastructure replacement.

Urban Water Management Plan (2020)

The UWMP documents CCWD's best efforts to develop the local planning and coordination necessary to make informed decisions about long-term water supply availability, demand trends, and actions needed under water supply shortage conditions. This Strategic Plan shows the commitment of CCWD to ensure the availability of adequate future supplies by efficiently using its current supplies to protect both its customers and the water and natural resources of Calaveras County, in several planning scenarios and considering climate change impacts. By preparing this UWMP, CCWD also meets the necessary regulatory planning requirements pursuant to the Urban Water Management Planning Act.

America's Water Infrastructure Act of 2018 Risk and Resilience Assessment (2020)

America's Water Infrastructure Act of 2018 (AWIA) is a United States federal law that requires community (drinking) water systems serving more than 3,300 people to conduct a Risk and Resilience Assessment (RRA). AIWA mandates that the RRA be updated and re-certified, to address changes in federal legislation and/or updates to CCWD system infrastructure every five years.

CCWD prepared the RRA to comply with the requirements associated with AWIA, the EPA guidelines for small Community Water Systems, and to meet the following planning objectives:

- Improve understanding of risks to CCWD from malevolent acts and natural hazards.
- Define improvements to the resiliency of pipes and constructed conveyances, physical barriers, source water, water collection and intake, pretreatment, treatment, storage, and distribution facilities, electronic, computer, or other automated systems (including the security of such systems) which are utilized by CCWD.
- Review CCWD infrastructure monitoring practices.
- Review CCWD financial infrastructure risk and vulnerabilities.
- Review CCWD's use, storage, or handling of various chemicals, and
- Define CCWD systems operations and maintenance.

Moreover, the 2021 CCWD RRA references the CCWD 2018 LHMP, noting that several of the concepts and analyses in this RRA were borrowed from broader LHMP materials.

Emergency Response Plans

CCWD has four Emergency Response Plans (ERPs) for the West Point Water System from 2004, the Copper Cover Water System (2006), Ebbetts Pass Water System (2006), and the Jenny Lind Water Treatment Plan (2006). The purpose of each ERP is to provide the water system with a standardized response and recovery protocol to prevent, minimize, and mitigate injury and damage resulting from emergencies or disasters of manmade or natural origin. The ERPs describe how CCWD will respond to potential threats or actual terrorist scenarios identified in the vulnerability assessment, as well as additional emergency response situations. Each ERP also includes specific action plans that are used to respond to events and incidents.

This ERP has been designed to comply with Section 1433(b) of the Safe Drinking Water Act as amended by the Public Health Security and Bio-terrorism Preparedness and Response Act of 2002 (Public Law 107-188, Title IV – Drinking Water Security and Safety), California Government Code Section 8607.2 – Public Water System Plans, California Health and Safety Code, Sections 116460, 116555 and 116750, and California Waterworks Standards, Section 64560.

Each ERP also includes the required certification to the US Environmental Protection Agency) that the ERP incorporates the results of a vulnerability assessment completed for the relevant system and includes plans, procedures, and identification of equipment that can be implemented or used in the event of a terrorist attack on the water system.

The plans also not that CCWD has provided a copy of the ERP to the local California Department of Health Services Drinking Water Field Operations Branch District Office.

Other Plans

CCWD has numerous other plans, programs, and procedures in place that support hazard mitigation, public health and safety, hazardous materials management, and emergency operations. Related partner agency plans were also reviewed to inform the LHMP to update risk assessment and mitigation strategies based on public availability, as they relate to flooding, drought, and water supply events. These plans are listed below.

- Calaveras County General Plan
- Calaveras County 2021 Multi-Jurisdictional Hazard Mitigation Plan (includes City of Angels and Murphys Sanitary District)
- CCWD 2018 LHMP
- Copper Cover Water and Wastewater System Master Plan (2018)
- La Contenta Wastewater System Master Plan (2017)
- Jenny Lind Waster System Master Plan
- Supplemental West Point Water System Master Plan (2018)
- Capital Improvement Report (2013)
- Arnold Sewer System Master Plan (2005)
- Ebbetts Pass Water Master Plan (2005)
- Wastewater Facilities Master Plan (2005)
- West Point Water System Master Plan (2005)
- Ebbetts Pass System Evaluation (2013)
- Forest Meadows Wastewater Facility Plan (2004)
- City of Angels General Plan (2020)
- Union Public Utility District (UPUD) and Utica Water and Power Authority (Utica) Multi-Jurisdictional Hazard Mitigation Plan (2021)

2.7.3 Administrative and Technical Mitigation Capabilities

Table 2-8 below identifies CCWD personnel responsible for activities related to mitigation and loss prevention in CCWD. Many positions are full-time and/or filled by the same person. A summary of technical resources follows.

Table 2-8 CCWD Administrative and Technical Mitigation Capabilities

PERSONNEL RESOURCES	YES/NO	DEPARTMENT/POSITION
Planner/engineer with knowledge of land development/land management practices	Yes	Engineering Department
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Engineering Department
Planner/engineer/scientist with an understanding of natural hazards	Yes	Engineering Department
Personnel skilled in Geographic Information System (GIS)	Yes	Engineering Department

PERSONNEL RESOURCES	YES/NO	DEPARTMENT/POSITION
Full time building official	N/A	Engineering Department implements Standard Building and Engineering standards
Floodplain manager/Floodplain Administrator	N/A	Not applicable for District
Emergency manager	Yes	Water Resources Manager/General Manager/Emergency Manager
Grant writer	Yes	Handled within each department; HMGP grants are tracked and prepared by the Engineering and Water Resource Departments
Other personnel	Yes	Customer Service, Finance, Human Resources
GIS Data Resources (Hazard areas, critical facilities, etc.)	Yes	Engineering Department, GIS Technician
Warning Systems/Services	Yes	Emergency Contact Numbers, "Report a Leak" function, etc.
Other	N/A	

Source: HMPC 2022-2023

CCWD has emergency generation capabilities at all its critical facilities and can improve their administrative and technical capabilities through better coordination with Calaveras County, partner water agencies, regular updates to their GIS data (with support from consulting staff, if necessary), scheduling regular review meetings on plan implementation (e.g. LHMP implementation and maintenance), and providing more training opportunities for staff to ensure they are well-informed of changing regulations.

Calaveras County Water District

A five-person Board of Directors oversees all CCWD operations by setting goals for the District's General Manager and management. The five-member Board adopts policies to guide the General Manager and CCWD staff in providing efficient and effective services to present and future CCWD customers. The CCWD consists of the following seven departments:

Administration Department

The Administration Department is made up of the General Manager, an Executive Assistant, and the Human Resources Manager. The General Manager is responsible for organizing, supervising, and directing activities of the CCWD and carrying out policies set by the Board to ensure that efficient and effective services are provided through the approved policies and budget.

Customer Service

The Customer Service Department consists of three staff that handle senior customer relations and business services. There is a Senior Customer Service Representative, Customer Service Representative I, and a Business Services Manager.

Engineering Department

The Engineering Department consists of sour staff, including one District Engineer, two Senior Civil Engineers, and a Senior Engineering Technician.

Finance Department

The Finance Department is responsible for cash management, investment portfolio, debt management, and management of the district's banking and other financial services relationships. The Administrative Department consists of an Accountant II, Director of Administrative Services, and Accounting Technician for a total of three staff employees. Responsibilities of this group include accounting, office services, project administration, public information, and Board administration.

Human Resources

The Human Resources Department consists of two full-time employees.

Operations Department

The Operations Departments consists of four full-time employees including a Director of Operations, Plant Operations Manager, Construction and Maintenance Manager, and a Senior Administrative Technician.

Water Resources Department

CCWD's water resource department is comprised of two staff members – one Water Resources Manager and one Water Resources Specialist. The Water Resources Department also leads the preparation of the LHMP during the 2022-2023 planning process.

2.7.4 Fiscal Mitigation Capabilities

Table 2-9 identifies financial tools or resources that CCWD could potentially use to help fund mitigation activities.

Table 2-9 CCWD Financial Capabilities

FINANCIAL RESOURCES	ACCESSIBLE/ ELIGIBLE TO USE	COMMENTS/HAS THIS BEEN USED FOR MITIGATION IN THE PAST?
Authority to levy taxes for specific purposes	Yes	
California Disaster Assistance Act	Yes	
California Rapid Response Fund	No	
Capital improvements project funding	Yes	Grants from FEMA HMA Program can fund some CIP water and wastewater projects.
Community Development Block Grants	No	
Federal Grant Programs (HMGP)	Yes	The CCWD has received HMGP grant funds since the 2018 LHMP was completed for two projects: DR-4344-0074 in 2018 to retrofit public structures for wildfire protection and DR4431-0006 in 2019 to elevate public infrastructure in the riverine floodway.
Fees for water, sewer, gas, or electric services, new development	Yes	
FEMA's Public Assistance Program	Yes	

FINANCIAL RESOURCES	ACCESSIBLE/ ELIGIBLE TO USE	COMMENTS/HAS THIS BEEN USED FOR MITIGATION IN THE PAST?
Incur debt through general obligation bonds	Yes	
Incur debt through private activities	Yes	
Incur debt through special tax bonds	No	

Source: HMPC 2022-2023

2.7.5 Other Mitigation Programs and Partnerships

Table 2-10 below summarizes some of the mitigation partnerships and education or outreach capabilities available to CCWD.

Table 2-10 CCWD Education and Outreach Capabilities

EDUCATION & OUTREACH	YES/NO	COMMENTS
Local Citizen Groups That Communicate Hazard Risks	Yes	
Firewise USA	No	
StormReady	No	
Other	No	

Source: HMPC 2022-2023

American Red Cross: The American Red Cross identified several capability enhancements through collaboration with CCWD. Such programs include but are not limited to outreach campaigns for preparedness education and updating existing points of contact for shelter sites. These efforts will improve the American Red Cross' ability to conduct mitigation, preparedness, and response efforts within CCWD's service area.

Dam Owners and Operators Coordination: CCWD owns, operates, and coordinates with numerous dam owners and operators, including owners upstream of the County. Coordination involves partnerships with federal, state, and local officials, agency engineers, emergency managers, emergency preparedness coordinators, dam owners and operators, and property owners near areas that can be potentially affected by dam incidents. Key agencies within CCWD's partnership include the FEMA's National Dam Safety Program (NDSP), US Army Corps of Engineers (USACE), Bureau of Reclamation, California Division of Safety of Dams (DSOD), and other companies and entities who own various dams in the County like Utica Power Authority. Given there is a range of mitigation actions that can be taken to reduce the risk of dam incidents and the effects of dam failure, CCWD keeps an ongoing partnership with key dam owners and operators to ensure each agency is aware of each other's actions and to coordinate them effectively, recognizing that working together maximizes risk reduction. As a result, many of these dam owners and operators were invited as stakeholders to inform and support the update of CCWD's LHMP. Information on these dam owners and operators is shown in the table below.

Table 2-11 CCWD Dams of Concern Owner/Operator & Emergency Information

DAM NAME	COUNTY	DAM OWNER	WHETHER OR NOT AN OFFICE, DEPARTMENT, OR AGENCY SUPPORTS DAM MITIGATION ACTIONS
Copperopolis	Calaveras	Jon & Angelita Janofsky	Yes
CPUD Middle Fork	Calaveras	Calaveras Public Utility District	Yes
Goodwin	Calaveras	Tri-Dam Project	Yes
Hunters	Calaveras	Utica Power Authority	Yes
Jackson Creek Spillway[1]	Amador, Calaveras	East Bay Municipal Utility District	Yes
Jeff Davis	Calaveras	Calaveras Public Utility District	Yes
La Contenta	**Calaveras**	**Calaveras County Water District**	Yes
Murphys Afterbay	Calaveras	Utica Power Authority	Yes
Murphys Forebay South	Calaveras	Utica Power Authority	Yes
Murphys Forebay West	Calaveras	Utica Power Authority	Yes
New Hogan Dam	Calaveras	Cespk	Yes
Pardee	Amador, Calaveras	East Bay Municipal Utility District	Yes
Pardee South Spillway	Amador, Calaveras	East Bay Municipal Utility District	Yes
Tiger Creek Afterbay	Amador, Calaveras	Pacific Gas and Electric Company	Yes
Tulloch	Calaveras	South San Joaquin Irrigation District	Yes
Andrew Cademartori	Calaveras	Union Public Utility District	Yes
Ferrario	Calaveras	Robert & Lynn Wilson	Yes
Flowers	Calaveras	Oak Canyon Ranch, LLC	Yes
Fly-In-Acres	Calaveras	Blue Lakes Springs Homeowners	Yes
Holman	Calaveras	City of Angels	Yes
McKays Point Diversion	**Tuolumne, Calaveras**	**Calaveras County Water District**	Yes
Murphys Wastewater	Calaveras	Murphys Sanitary District	Yes
Redhawk Lake	Calaveras	Calaveras Public Utility District	Yes
Salt Springs Valley	Calaveras	Rock Creek Water District	Yes
Skyrocket	Calaveras	Meridian Gold Company	Yes
Stevenot	Calaveras	Sutton Enterprises	Yes
Tanner	Calaveras	Lake Mont Pines Homeowners	Yes
Wallace	Calaveras	Wallace Community Services District (now CCWD)	Yes
West Point Regulating	**Calaveras**	**Calaveras County Water District**	Yes

Note: Dams owned by CCWD are bolded.
Sources: NID, DWR

Other Planning Capabilities. The HMPC noted the following additional mitigation outreach efforts during planning sessions:

- **CCWD Website.** The CCWD's website provides public information and resources on water supply planning in Calaveras County, including information on water conservation effort, hazard mitigation, and emergency water supply. The CCWD's social media accounts (Facebook, etc.) are used to disseminate public information.

2.7.6 Opportunities for Enhancement

The 2023 LHMP update provided CCWD an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

Training: Provide training opportunities to help inform CCWD staff on how best to integrate hazard information and mitigation projects into their departments. There are also several financial resources that CCWD could leverage in the future for funding mitigation efforts. In particular, the LHMP provides eligibility for FEMA HMA grants. CCWD staff can attend workshops and training regarding the grant application process and how to develop successful grant applications under the HMGP. Cal OES periodically hosts related training and webinars. Understanding the types of projects that can be funded, and the components of a successful application will enhance the chances of a successful grant award.

Hazard Mitigation Specialist: CCWD could appoint or assign someone to oversee hazard mitigation grant opportunities. This could be a follow-up goal to the Cal OES grant training. This specialist can notify CCWD of upcoming grant cycles, and support tracking and completing the Notice of Intent applications, grant applications, and final grant management reporting requirements. Related financial opportunities for enhancement should include applying for HMA grants, such as BRIC and HMGP funding as it becomes available. The Hazard Mitigation Specialist should also focus on funding mitigation actions that help mitigate hazards impacts on CCWD's critical infrastructure, as well as actions that address overall climate change, and extreme heat, flooding, and other climate-related hazards. These mitigation actions can also be those that support needed and related climate adaptation strategies.

HMGP Technical Assistance: HMGP funding opportunity provides support for communities to implement mitigation activities to reduce risk to life and property from natural hazards. In California, natural hazards include wildfire, earthquake, drought, extreme weather, flooding, and other impacts of climate change. Cal OES technical subject matter experts are available to discuss project eligibility, benefit cost analysis, technical feasibility, and Environmental and Historic Preservation requirements.

Firewise: Firewise USA® is a voluntary program that provides a framework to help neighbors get organized, find direction, and take action to increase the ignition resistance of their homes and community. The program is co-sponsored by the US Department of Agriculture (USDA), the US Forest Service, the US Department of the Interior, and the National Association of State Foresters. As of August 2023, CCWD was not a participant in the program. To become a Firewise USA site, a neighborhood, community, city, or county must form a board or committee comprised of residents and stakeholders, obtain a written wildfire risk assessment, develop, and maintain an action plan, and contact the applicable state liaison to the program.

3 PLANNING PROCESS

Requirement §201.6(b) and §201.6(c)(1):

An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process; and

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

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

3.1 INTRODUCTION

The primary purpose of the CCWD LHMP update is to reduce or eliminate long-term risk to people and property from natural hazards and their effects on CCWD's planning area. CCWD recognized the need for and importance of a LHMP and initiated a comprehensive update in 2022 in order to keep their 2018 LHMP current and ensure CCWD remained eligible for HMA grant funds. The 2023 LHMP builds upon the 2018 LHMP and the plan previously updated in 2012 and the plan originally developed in 2006.

WSP USA Environment & Infrastructure Solutions, Inc. (WSP) was procured to assist with the 2023 LHMP update. The process is described further in this section and documented in Appendix B.

3.2 WHAT'S NEW IN THE PLAN UPDATE

DMA Requirement §201.6(d)(3):

A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

The 2023 LHMP update complies with the latest FEMA guidance and Cal OES guidelines for LHMPs, specifically FEMA's 2022 Local Mitigation Planning Policy Guide. The update followed the requirements noted in the DMA of 2000 and FEMA's 2023 Local Hazard Mitigation Planning Handbook.

The 2023 LHMP update involved a comprehensive review and update of each section of the 2018 LHMP, the integration of a detailed risk assessment, and an assessment of the progress in evaluating, monitoring, and implementing the mitigation strategy outlined in the initial plan. The planning process provided an opportunity to review new CCWD priorities related to hazard significance and mitigation actions, and revisions were made where applicable to the plan. Only the information and data still valid from the 2018 LHMP was carried forward to the 2023 LHMP update.

The 2018 LHMP assessed the following 18 hazards: avalanche, dam failure, drought and water shortage, earthquake, flood (100-/500-year and localized stormwater flooding), levee failure, severe weather (general, extreme heat, heavy rain and storms, wind, winter storms and extreme cold), soil hazards (landslides and debris flows, subsidence, erosion, expansive soils), volcanoes, and wildfires.

The 2023 LHMP update assessed the following nine natural hazards: avalanche, dam failure, drought and water shortage, earthquake, flood (1% & 0.2% and localized stormwater flooding), severe weather (general, extreme heat, heavy rain and storms, lightning, hail, tornado and wind, winter storms and extreme cold), soil hazards (erosion, expansive soils, landslides and debris flows, subsidence), volcanoes, and wildfires. Levee failure was removed as it is no longer a hazard in the planning area.

3.2.1 Plan Section Review and Analysis – 2023 Update

During the 2023 LHMP update, CCWD and WSP staff updated each of the sections of the previously approved plan to include new information. WSP developed a summary of each section in the plan and guided the HMPC through the elements that needed updating during the kick-off HMPC Meeting #1 in April 2023. This included analyzing each section using FEMA's 2023 Local Mitigation Planning Handbook and the 2022 Local Mitigation Planning Policy Guide (Effective April 19, 2023) to ensure that the plan met the latest requirements. In addition, the FEMA Local Mitigation Plan Review Tool from the 2018 version of the plan was reviewed and referenced. This means the previous 2018 FEMA comments on opportunities for improvement were also considered and addressed in the 2023 update. A detailed summary of the changes in this plan update is highlighted in Table 3-1 below.

Table 3-1 CCWD Hazard Mitigation Plan Update Highlights

PLAN SECTION	SUMMARY OF PLAN REVIEW, ANALYSIS, AND UPDATES
1. Introduction	• Revised to reflect updated plan and 2023 planning process
2. District Profile and Capability Assessment (previously called What's New)	• Removed the What's New chapter and replaced with the District Profile and Capability Assessment • New section includes the mitigation plan highlights • Updated land use and development trends • Updated using latest 2022 UWMP service connection and population served numbers
3. Planning Process	• Described and documented the planning process for the 2023 update, including coordination among agencies • Described how the 2018 plan was integrated with/into other planning efforts, like CCWD's 2022 UWMP and the 2022 Risk and Resilience Assessment • Removed 2018 planning process information • Described 2023 update public participation process • Described the HMPC • Described the 10-step process followed for the update
4. Hazard Identification and Risk Assessment	• Climate change information has been added to each hazard profile • Updated list of disaster declarations to include recent data • Updated tables to include recent National Center for Environmental Information data • Updated past occurrences for each hazard to include recent data • Vulnerability Assessment is now included with the Risk Assessment and an integrated section organized by hazard; previously a detailed vulnerability assessment was only included for flooding, landslide, and wildfire hazards.

PLAN SECTION	SUMMARY OF PLAN REVIEW, ANALYSIS, AND UPDATES
	• The Vulnerability Assessment considers the impacts on the following assets: (1) people; (2) property; (3) critical water facilities and lifelines; (4) economy; (5) cultural, historic, and natural resources; (6) development trends. • The critical assets analyzed was updated and expanded and now includes 123 critical water facilities organized by FEMA's Community Lifeline. While some CCWD facilities are still missing spatial data, CCWD and WSP added several additional facilities that were not fully evaluated in the 2018 plan. • The Vulnerability Assessment includes a discussion on impacts on population assets, including socially vulnerable populations and underserved communities. • Updated growth and development trends to include recent Census and local data sources from CCWD, specifically with 2022 UWMP data • Updated historic and cultural resources using local/state/national sources • Updated estimate flood losses using the latest Digital Flood Insurance Rate Map (DFIRM) and assessor's data • Incorporated new hazard loss estimates since 2018 for critical water facilities, as applicable • Used updated GIS inventory data to assess wildfire threat to the County • Updated HAZUS-MH Level I earthquake vulnerability analysis data with one scenario performed • Flood was consolidated into one section that covers both 100-year and 500-year flood risk and localized stormwater flooding • Levee failure was removed from the risk assessment as it is no longer a hazard in Calaveras County. • Updated information regarding specific vulnerabilities to hazards, including maps and tables of specific assets at risk, specific critical facilities at risk, and specific populations at risk • Revisited and updated hazard significance/priority levels • Updated maps in the plan where appropriate
5. Mitigation Strategy	• Indicated what actions have been implemented that may reduce previously identified vulnerabilities • Updated mitigation strategy based on the results of the updated risk assessment, completed mitigation actions, and implementation obstacles and opportunities since the completion of the 2018 plan • Reviewed and updated goals and objectives based on HMPC input • Included updated information on how actions are prioritized, or how priorities changed • Reviewed mitigation actions from the 2018 plan and developed a status report for each • Identified if actions have been completed, deleted, or deferred/carried forward • Updated priorities on actions • Summarized successful implementation to highlight the implementation of actions identified in the 2018 plan • Identified new mitigation actions proposed by the HMPC with more detail on implementation than the previous plan • Five new mitigation actions were added to address existing hazards and new hazards
6. Plan Review, Evaluation, and Implementation	• Reviewed and updated procedures for monitoring, evaluating, and updating the plan • Revised to reflect current methods

PLAN SECTION	SUMMARY OF PLAN REVIEW, ANALYSIS, AND UPDATES
	• Updated the system for monitoring the progress of mitigation activities by identifying additional criteria for plan monitoring and maintenance • Added a process for incorporation of the LHMP update into existing mechanisms • Clarified future public involvement activities and tied them to the Outreach Strategy in Appendix F
7. Plan Adoption	• Updated to reflect the 2023 adoption process
8. Appendices	• Appendix A: Hazard Mitigation Planning Committee • Appendix B: Planning Process Documentation • Appendix C: Approval and Adoption • Appendix D: Mitigation Categories and Alternatives • Appendix E: Annual Progress Meeting Agenda and Report Template • Appendix F: Outreach Strategy

3.3 CCWD PARTICIPATION

The DMA planning regulations and guidance stress that special districts seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC
- Detail areas within the planning area where the risk differs from that facing the entire area
- Identify potential mitigation actions
- Formally adopt the plan

For CCWD's HMPC, "participation" meant the following:

- Providing facilities for meetings
- Attending and participating in the HMPC meetings
- Completing and returning WSP Plan Update Guide worksheets
- Collecting and providing other requested data (as available)
- Identifying mitigation actions for the plan
- Reviewing and providing comments on plan drafts and jurisdictional annexes
- Informing the public, local officials, and other interested parties about the planning process and providing the opportunity for them to comment on the plan
- Coordinating, and participating in the public input process
- Coordinating the formal adoption of the plan by the governing boards

CCWD must meet all these participation requirements and one or more representatives with CCWD must attend the HMPC webinars/meetings and workshops described in Table 3-4. CCWD brought together the HMPC to help collect data, identify mitigation actions and implementation strategies, and review and provide data on drafts.

In some cases, some of the HMPC representatives had limited capacity to attend or had conflicts with the HMPC meetings; in these cases, alternative forms of communication were used to provide input into the process. Appendix B provides additional information and documentation of the planning process.

3.4 PLANNING PROCESS

WSP established the planning process for the CCWD LHMP using the DMA planning requirements and FEMA's associated guidance. The original FEMA planning guidance is structured around a four-phase process:

1. Organize Resources
2. Assess Risks
3. Develop the Mitigation Plan
4. Implement the Plan and Monitor the Progress

Into this process, WSP integrated a more detailed 10-step planning process used for FEMA's CRS and FMA programs. Although not applicable to a water district, the modified 10-step process can also be used for this plan to meet the requirements of major grant programs including FEMA's HMGP, BRIC program, and FMA Program.

In May 2023, FEMA released the Local Mitigation Planning Handbook that has become the official guide for local governments, including special districts, to develop, update and implement LHMPs. While the requirements under CFR Title 44 – Emergency Management and Assistance Section 201.6, Local Mitigation Plans have not changed, the Handbook guides local governments on developing or updating hazard mitigation plans to meet these requirements and gain eligibility to apply for FEMA HMA grant programs. It also offers practical approaches, tools, worksheets, and local mitigation planning examples for how communities can engage in effective planning to reduce long-term risk from natural hazards and disasters. The Handbook complements and liberally references the Local Mitigation Plan Review Guide (October 1, 2011), which is the official guidance for federal and state officials responsible for reviewing local mitigation plans in a fair and consistent manner.

Table 3-2 shows how the modified 10-step process fits into FEMA's four-phase process, and how these elements correspond to the tasks in the FEMA Mitigation Planning Handbook.

Table 3-2 CCWD Hazard Mitigation Planning Process

FEMA's 4-Phase DMA Process	Modified 10-Step CRS Process	FEMA Local Mitigation Planning Handbook Tasks
1) Organize Resources		
201.6(c)(1)	1) Organize the Planning Effort	1: Determine the planning area and resources
201.6(b)(1)	2) Involve the Public	2: Build the planning team – 44 CFR 201.6 (C)(1)
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies	3: Create an outreach strategy – 44 CFR 201.6(b)(1) 4: Review community capabilities – 44 CFR 201.6 (b)(2)&(3)
2) Assess Risks		
201.6(c)(2)(i)	4) Identify the Hazards	5: Conduct a risk assessment – 44 CFR 201.6 (C)(2)(i) 44 CFR 201.6(C)(2)(ii)&(iii)
201.6(c)(2)(ii)	5) Assess the Risks	
3) Develop the Mitigation Plan		
201.6(c)(3)(i)	6) Set Goals	

FEMA's 4-Phase DMA Process	Modified 10-Step CRS Process	FEMA Local Mitigation Planning Handbook Tasks
201.6(c)(3)(ii)	7) Review Possible Activities	6: Develop a mitigation strategy – 44 CFR 201.6(c)(3)(i); 44 CFR 201(c)(3)(ii) and 44 CFR 201.6(c)(3)(iii)
201.6(c)(3)(iii)	8) Draft an Action Plan	
4) Implement the Plan and Monitor Progress		
201.6(c)(5)	9) Adopt the Plan	7: Review and adopt the plan
201.6(c)(4)	10)Implement, Evaluate, and Revise the Plan	8: Keep the plan current
		9: Create a safe and resilient community – 44 CFR 201.6(c)(4)

3.4.1 Phase 1: Organize Resources

3.4.1.1 Planning Step 1: Organize the Planning Effort

WSP worked with CCWD to get organized for the plan update. Organizational efforts were initiated with CCWD in February 2022 to inform and educate the plan participants of the purpose and need for updating the 2018 LHMP. An initial meeting between WSP and CCWD Water Resources staff was held to discuss the organizational aspects of this plan update process. Invitations to the kick-off meeting for this plan update were extended to key CCWD departments including administration, operations, and water resources. Representatives and HMPC members of the 2018 plan were used as a starting point for the invite list, with additional invitations extended as appropriate throughout the planning process. The list of initial invitees is included in Appendix A.

The representatives listed in Table 3-3 from CCWD and stakeholder groups participated in the HMPC and the development of the plan update. Other local, state, federal, and agencies and stakeholders invited to participate in the HMPC are discussed under Planning Step 3.

Table 3-3 List of HMPC Participants for 2022-2023 LHMP Update

ROLE	NAME	DEPARTMENT OR AGENCY
Water Resources Specialist	Kelly Gerkensmeyer*	CCWD Water Resources
Water Resources Manager	Brad Arnold	CCWD Water Resources
Senior Civil Engineer	Charles Palmer	CCWD Engineering
District Engineer	Mark Rincon-Ibarra	CCWD Engineering
Director of Operations	Damon Wyckoff*	CCWD Operations
Human Resources Data Analyst	Jennifer Hannum	California Highway Patrol
Plant Operations Manager	Jesse Hampton	CCWD Operations
Manager	Jessica Self	CCWD External Affairs
General Manager	Joel Metzger	Utica Water and Power Authority
Manager	John Osbourn	CCWD External Affairs
Permit Analyst	Joshua Ksenzulak	Calaveras County Public Works
Director	Kathy Gallino	Calaveras County Economic and Community Development
Division Chief	Kevin Patton	CAL FIRE
Battalion Chief	Nathan Gorham	CAL FIRE Tuolumne Calaveras Unit
City Administrator	Rebecca Callen	City of Angels Camp
Senior Engineering Technician	Sam Singh*	CCWD Engineering
General Manager	Travis Small	Calaveras Public Utilities District
	Tyler Mayo	Need Organization

ROLE	NAME	DEPARTMENT OR AGENCY
Emergency Services Coordinator	Cameron Bardwell	Calaveras County Office of Emergency Services

Source: HMPC 2023

Planning Meetings

The planning process officially began with a kick-off meeting on January 6, 2023, which involved CCWD staff and the WSP's team. On March 2, 2023, the HMPC convened for the first time. The first HMPC meeting covered the scope of work and an introduction to the DMA requirements. Participants were provided with a Plan Update Guide, which included worksheets to facilitate the collection of information necessary to support the update of the plan. Using FEMA guidance, WSP designed these worksheets to capture information on past hazard events, identify hazards of concern to each of the participating jurisdictions, quantify values at risk to identified hazards, inventory existing capabilities, and record possible mitigation actions. A copy of WSP's Plan Update Guide for this project is included in Appendix B.

During the planning process, the HMPC communicated through in-person, virtual, and hybrid meetings, as well as email, telephone conversations. The first HMPC meeting was held virtually, while the last two HMPC meetings were held both in hybrid format. Draft documents were emailed so that the HMPC members could easily access and review them.

District staff and HMPC formally met four times during the planning period (January 6, 2023 – August 16, 2023). The purposes of these meetings are described in Table 3-4. The planning consultant sent meeting handouts ahead of time to the participants to review and provide feedback before or at the meetings. The District and WSP worked with the HMPC participants to obtain necessary information and input into the planning process. This was done through direct emails from the planning consultant and follow-up phone conversations where necessary.

Table 3-4 Summary of Planning Meetings

MEETING NUMBER	MEETING TOPIC	DATE	LOCATION
1	Kick-off/HMPC Roles and Expectations	January 6, 2023	Virtual/Webinar – Microsoft Teams
2	Overview of DMA 2000 & Hazard Mitigation Planning Process / Review 2018 LHMP	March 2, 2023	Virtual/Webinar – Microsoft Teams
3	Hazard identification and Risk Assessment	June 9, 2023	Hybrid – CCWD Administrative Office & Microsoft Teams
4	Mitigation Strategy and Goals Update / New Mitigation Actions Brainstorm	August 16, 2023	Hybrid – CCWD Administrative Office & Microsoft Teams

Internal Kick-off Meeting

On January 6, 2023, CCWD staff and the WSP team convened and discussed the project background and the overall LHMP update process, as well as the scope of work and project goals. District staff and the WSP team also discussed potential hazards to be profiled in this LHMP. The team also discussed potential additional HMPC members, partners, and stakeholders, as well as GIS data needs.

HMPC Meeting #1 – Overview of DMA 2000 & Hazard Mitigation Planning Process

On March 2, 2023, the HMPC convened to discuss the process for completing the update of this plan. This first HMPC meeting was attended by ten representatives. The HMPC consisted of a mix of District departments, local agencies, special districts, and stakeholders. A complete list of those in attendance at the first HMPC meeting can be found in the meeting minutes in Appendix B.

Following introductions, WSP reviewed the DMA requirements and the suggested planning process to meet the requirements as well as the expected schedule of the process for the LHMP update. The roles of the HMPC and stakeholders were discussed including the participation requirements for the different roles.

The HMPC validated the identified hazards within the 2018 plan. The group also discussed other agencies that should be part of the planning process, as well as related planning efforts to be coordinated with and recent studies to be incorporated. The meeting ended with WSP sharing handouts to assist in the planning process. These handouts included the Plan Update Guide, which outlined data collection needs for each participating jurisdiction.

HMPC Meeting #2 –Risk Assessment and Mitigation Goal Refinement

On June 9, 2023, the HMPC convened virtually to discuss the results of the risk and vulnerability assessment. Fifteen members of the HMPC were present for the discussion. WSP began the meeting with a presentation of the results of the risk assessment findings. The group went through each hazard together and discussed the results as well as shared any insight to inform the HIRA update. Refer to the meeting summary in Appendix B for notes related to each hazard discussed.

Following the discussion on the results of the risk assessment findings, WSP explained that this update process provides an opportunity to review the previous plan's goals to determine if they reflect current priorities and the updated risk assessment. Inputs on mitigation goals were collected, and the group was encouraged to think of mitigation objectives and actions prior to the next HMPC meeting. The meeting ended with a review of the next steps and the planning process schedule.

HMPC Meeting #3 –Mitigation Strategy

The HMPC convened for a hybrid workshop on August 16, 2023, with seven people participating to update the plan's mitigation strategy. The group finalized the plan's goals and objectives (Step 6) and reviewed the progress made on the previous mitigation actions from the 2018 LHMP. The group then discussed the criteria for mitigation action selection and prioritization using a worksheet provided by WSP. The group reviewed each possible new mitigation action. Additional details were provided by the HMPC (Step 7). This was followed by a group activity to elicit the development of new mitigation actions followed by another group activity to prioritize (rank) the top mitigation actions using the "connect the dots" exercise. WSP then briefly explained the plan implementation and maintenance process. The meeting ended with a review of the next steps and planning process schedule. Figure 3-1 shows the HMPC participating in the two group activities during HMPC Meeting #3.

Figure 3-1 HMPC Meeting #3 Group Exercises

Source: WSP 2023

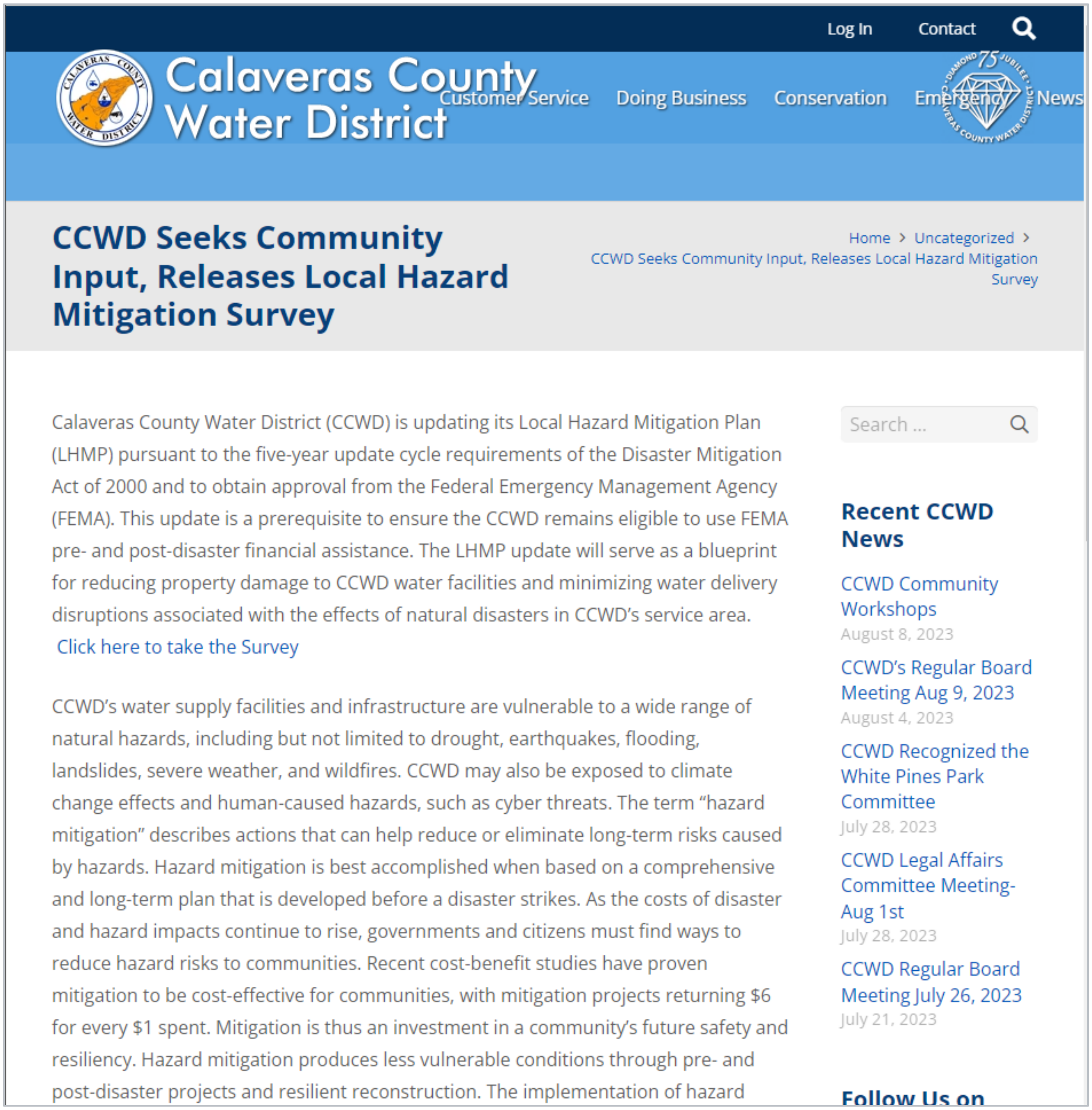
3.4.1.2 Planning Step 2: Involve the Public

Involving the public assures support from the community at large and is a required part of the planning process per the DMA 2000. Early discussions with CCWD and input received in the first HMPC meeting established the initial plan for public involvement in the plan update. Public outreach began with the development of an online public survey that was shared on the District's website and disseminate via email to local stakeholders. Additional public involvement activities included press releases, website postings, and flyer development and distribution.

Plan Facts

The WSP team provided the District with a Webpage Backgrounder document that included LHMP update information. Figure 3-1 includes a screenshot of the District's website. As shown in the screenshot, an announcement post was distributed seeking participation in the LHMP online public survey.

Figure 3-2 CCWD's Announcment Page



Log In Contact

Calaveras County Water District

Customer Service Doing Business Conservation Emergency News

CCWD Seeks Community Input, Releases Local Hazard Mitigation Survey

Home > Uncategorized > CCWD Seeks Community Input, Releases Local Hazard Mitigation Survey

Calaveras County Water District (CCWD) is updating its Local Hazard Mitigation Plan (LHMP) pursuant to the five-year update cycle requirements of the Disaster Mitigation Act of 2000 and to obtain approval from the Federal Emergency Management Agency (FEMA). This update is a prerequisite to ensure the CCWD remains eligible to use FEMA pre- and post-disaster financial assistance. The LHMP update will serve as a blueprint for reducing property damage to CCWD water facilities and minimizing water delivery disruptions associated with the effects of natural disasters in CCWD's service area.

Click here to take the Survey

CCWD's water supply facilities and infrastructure are vulnerable to a wide range of natural hazards, including but not limited to drought, earthquakes, flooding, landslides, severe weather, and wildfires. CCWD may also be exposed to climate change effects and human-caused hazards, such as cyber threats. The term "hazard mitigation" describes actions that can help reduce or eliminate long-term risks caused by hazards. Hazard mitigation is best accomplished when based on a comprehensive and long-term plan that is developed before a disaster strikes. As the costs of disaster and hazard impacts continue to rise, governments and citizens must find ways to reduce hazard risks to communities. Recent cost-benefit studies have proven mitigation to be cost-effective for communities, with mitigation projects returning $6 for every $1 spent. Mitigation is thus an investment in a community's future safety and resiliency. Hazard mitigation produces less vulnerable conditions through pre- and post-disaster projects and resilient reconstruction. The implementation of hazard

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Recent CCWD News

CCWD Community Workshops
August 8, 2023

CCWD's Regular Board Meeting Aug 9, 2023
August 4, 2023

CCWD Recognized the White Pines Park Committee
July 28, 2023

CCWD Legal Affairs Committee Meeting- Aug 1st
July 28, 2023

CCWD Regular Board Meeting July 26, 2023
July 21, 2023

Follow Us on

Source: CCWD 2023

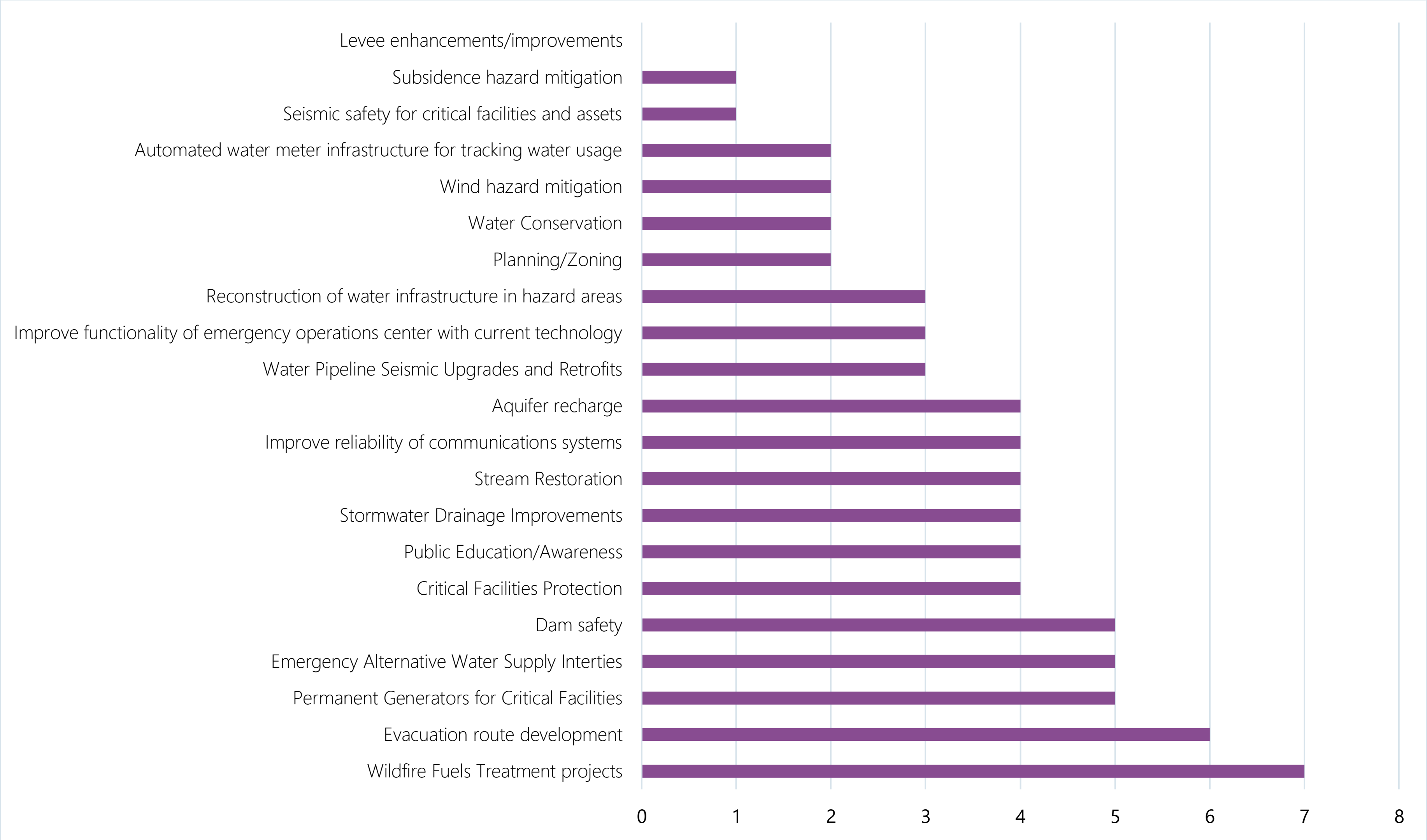
Online Public Survey

During the plan update's initial drafting stage, an online, bi-lingual public survey was used to gather public input for the HMPC. The survey provided an opportunity for public input during the planning process before the finalization of the plan update. The survey gathered public feedback on concerns about hazards and input on mitigation strategies to reduce their impacts. The survey was released on March 30, 2023. The usual input period for the public survey is one month, but the public survey was left open for an extended period to allow the CCWD to circulate additional advertisements during public meetings and outreach events to seek more input from the public. The HMPC provided links to the public survey by distributing it using social media, email, and posting the link on websites.

A total of seven people filled out the survey online. Results showed that the public perceives the most significant hazards to be drought, wildfire, power outages, heavy rain, and landslide. Figure 3-2 shows the results of a question from the survey, which asked the public's opinion on what mitigation actions should have the highest priority in the updated LHMP. Wildfire fuels treatment projects, evacuation route development, permanent generators for critical facilities, emergency alternative water supply interties, and dam safety were cited as the most popular mitigation actions.

This information was shared with the HMPC during the update of the mitigation strategy to consider when evaluating hazard rankings and as a source of potential mitigation ideas. A summary of the survey data and documentation of the public feedback can be found in Appendix B.

Figure 3-3 Results from Question 4: The following types of mitigation actions may be considered in CCWD. Please indicate the types of mitigation actions that you think should have the highest priority in the CCWD LHMP.



Source: WSP 2023

Geographic Information System (GIS) Data Collection

During the 2023 LHMP update, the WSP team prepared a GIS data list to request the GIS data needed for the plan update. CCWD's GIS staff was then able to compile and provide the WSP team with access to CCWD's latest GIS data layers for critical water assets.

During the project kick-off meeting, the CCWD and WSP team discussed the LHMP update process and schedule, plan review, data, and GIS hazard mapping for the plan update. The GIS team proceeded to discuss the details of the GIS mapping requirements, such as including inventory and valuation information for public infrastructure for each of the five identified hazards that are assessed quantitatively (earthquake, landslide, dam failure, flood, and wildfire). Other related comprehensive inventory information that was discussed included: dam facilities, lift stations, water treatment plants (WTPs), wastewater treatment plants (WWTPs), and water conveyance system infrastructure.

Most of the inventory and risk data can be layered to provide aggregation of asset values within specifically identified risk areas. Additional hazard-specific data and layers were acquired and analyzed to quantify the geographic extent as well as the magnitude and severity of hazards for each of the hazards assessed quantitatively. Data sources include USACE, DWR, Homeland Infrastructure Foundation-Level Data, National Inventory of Dams (NID), FEMA, California Department of Forestry and Fire Protection (CAL FIRE), Fire and Resource Assessment Program (FRAP), Department of Conservation (DOC) and California Geological Survey (CGS). Additional GIS spatial data was integrated to assess severe weather data from NWS and the National Oceanic and Atmospheric Administration (NOAA).

During the HIRA process, to assess hazards' potential impacts on the County's critical facilities, a critical facilities GIS database was established. While building the critical facilities GIS database, each participating jurisdiction's assistance was requested to validate the critical facilities GIS data. There were two primary aspects of this: data completeness/correctness and alignment/classification with FEMA Lifelines framework. The County and four participating jurisdictions each reviewed the critical facility database and were encouraged to edit descriptive attributes and add new point data for critical facilities. This process engaged participating jurisdictions that saw the value of the LHMP and long-term use and maintenance of the critical facility data moving forward. The result was an updated comprehensive critical facilities database with 130 facilities.

Risk Assessment and GIS Methodology

The GIS methodology for the risk assessment is summarized below.

1. Identify critical facilities and infrastructure both for present assets and those planned—categorized by CCWD facility type.
2. Estimate potential facility losses and damage. The development of the LHMP includes an inventory of assets coordinated by CCWD and an assessment of all the hazard risks.
3. During an update to the risk assessment, CCWD must consider current and expected future vulnerability to all hazards and integrate new hazard data such

as flood studies. CCWD was asked to incorporate replacement costs for vulnerable facilities and infrastructure in vulnerable areas. WSP staff integrated this information, if available, after the critical facilities assessment was complete. This process helped CCWD understand what facilities were vulnerable to hazards and gather replacement value for these facilities.

4. For hazards that are not assessed quantitatively, the vulnerability assessment includes qualitative analysis that addresses the hazard's impact on property, people, critical facilities and infrastructure, economy, natural and cultural resources, and future development.

Public Review Period

The District department circulated the Public Review Draft LHMP for a 14-day period from September 5, 2023 through September 18, 2023. The Public Review Draft was released for comment and made available for download via the District's website. The Public Review Draft LHMP was advertised through social media, mass emailing, and an advertisement through the media mechanisms noted previously. The CCWD also emailed a notice of availability announcement and a save the date flyer for the public workshop to neighboring jurisdictions includes Calaveras County and the City of Angels. Two public comments were received on the Public Review Draft LHMP. These comments were verbal comments provided during the public workshop. The comments received were shared with the HMPC and incorporated into the plan. The comment and response are briefly summarized in Table 3-5.

Table 3-5 Summary of Comments Received during Public Review

Comment	Response
Public Comment #1	
The commenter asked what in the CCWD LHMP has changed since the last plan update?	Refer to Section 3.2, What's New in the Plan Update. The CCWD explained during the workshop that the CCWD updated the Critical Facility database; it now includes additional facilities that were not included in the 2018 LHMP. The Consultant Team added that they expanded the climate change considerations section under each hazard profile, which summarizes how climate change may intensify or exacerbate the natural hazards in the future.
Public Comment #2	
The commenter sated that drought conditions will worsen in the future with climate change. They asked how does the plan update address climate change and drought condition impacts on groundwater and surface water resources?	Refer to Section 4.4.3, Drought, and Water Shortage in the Plan Update and to Subsection 4.4.3.6, Climate Change Considerations. These sections summarize the probability of future drought events and how increases in temperatures, a changing snowpack, and earlier snowmelt and runoff will impact the CCWD's water supply. Increasing temperatures and an earlier runoff will decrease the availability of water during the peak summer demands and result in increased flooding risk earlier in the season. The Consultant Team and CCWD stated these conditions could overload and possibly contaminate water infrastructure and supply. The CCWD and Consultant Team added that as the snowpack decreases earlier during the winter/spring season,

Comment	Response
	this could result in a decreased capacity for water storage within the CCWD's reservoirs.

3.4.2 Planning Step 3: Coordinate with Other Departments and Agencies

Early in the planning process, state and local agencies and organizations were invited to participate as stakeholders. Stakeholders include local and regional agencies involved in hazard mitigation activities or those beyond CCWD that have the authority to regulate development. CCWD worked with the WSP team to come up with a list of potential HMPC participants and stakeholders. Stakeholders could participate in various ways, either by contributing input at HMPC meetings, being aware of planning activities through an email group, providing information to support the effort, or reviewing and commenting on the draft plan. Based on their involvement in other hazard mitigation planning efforts, and status in the County, representatives from the following agencies and organizations were invited to participate as stakeholders in the process by email; an asterisk indicates they participated in HMPC meetings. More specifics on stakeholder agency representatives can be found in Appendix A and documentation in Appendix B.

Federal, State, and Local Agencies

- CAL FIRE
- Calaveras Band of Miwuk Indians
- Calaveras County
- California Department of Parks and Recreation
- California Department of Transportation (Caltrans)
- California DWR
- California Highway Patrol (CHP)
- City of Angels Camp
- NOAA
- USACE
- Pacific Gas & Electric

Businesses, Academia, Utility Providers, Dam Owners and Operators and Non-Profits

- Amador Water Agency
- Blue Lake Springs Mutual Water Company
- Calaveras Consolidated Fire District
- Calaveras Public Utility District (CPUD)
- Copperopolis Fire Protection District
- Ebbetts Pass Fire District
- Ebbetts Pass Property Owners Council
- Murphys Sanitary District
- Northern California Power Agency
- The Resource Connection of Amador & Calaveras Counties
- Sierra Water Work Group
- The Sierra Institute

- Tri-Dam Project (Partnership between Oakdale Irrigation District South San Joaquin Irrigation District)
- Tuolumne Utilities District
- Union Public Utility District
- Utica Water
- Valley Springs Public Utility District
  West Point Fire Protection District

3.4.2.1 Incorporation or Existing Plans and Other Information

The coordination and synchronization with other community planning mechanisms and efforts are vital to the success of this plan. To have a thorough evaluation of hazard mitigation practices already in place, appropriate planning procedures should also involve identifying and reviewing existing plans, policies, regulations, codes, tools, and other actions designed to reduce a community's risk and vulnerability from natural hazards. CCWD uses a variety of mechanisms to guide growth and development. Integrating existing planning efforts, mitigation policies, and action strategies into this plan establishes a credible, comprehensive document that weaves the common threads of a community's values together. The development and update of this plan involved a comprehensive review of existing plans, studies, reports, and initiatives that relate to hazards or hazard mitigation in the planning area. A high-level summary of the key plans, studies and reports is summarized in Table 3-6. Information on how they informed the update is noted and incorporated where applicable.

Table 3-6 Summary of Review of Key Plans, Studies and Reports

PLAN, STUDY, REPORT NAME	HOW PLAN INFORMED LHMP
Strategic Plan	Key focus areas described in the 2021-2026 Strategic Plan were incorporated into LHMP update, specifically as they relate to hazard mitigation.
2020 UWMP	The 2020 UWMP was relied on in the LHMP update to integrate updated information on water supply and demand projections, particularly as this information related to the CCWD's water customers' needs and drought scenarios.
CCWD 2018 LHMP	The plan was reviewed to provide a basis for the current update.
GIS for numerous base map shapefiles such as cities, counties, parcels, rivers, and roads	Used as base maps and for establishing critical facilities GIS database.
FEMA Flood Insurance Rate Map	1% and 0.2% annual chance floodplain data was acquired to profile flood hazard and carry out the related vulnerability assessment.
USACE Comprehensive Study; DWR Awareness Floodplain Mapping project	USACE 100-year flood event layer and DWR best available maps in 200-year flood event layer were acquired to profile flood hazard and carry out the related vulnerability assessment.
National Flood Insurance Program (NFIP)	This program aims to reduce the impact of flooding on private and public structures by providing affordable insurance to property owners and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures.

PLAN, STUDY, REPORT NAME	HOW PLAN INFORMED LHMP
	NFIP data was incorporated into the vulnerability assessment for flood hazard.
California Geological Survey, USGS	Data was acquired to profile and carry out vulnerability assessment for earthquake, land subsidence, and landslide hazards.
California Code of Regulations, Title 24, Part 9 (California Building Standards Code) (Fire Code)	CCR Title 24 governs the design and construction of all building occupancies and associated facilities and equipment throughout California and is also known as building standards. It contains requirements for the structural, mechanical, electrical, and plumbing systems, and requires measures for energy conservation, green design, construction and maintenance, fire and life safety, and accessibility. The code is used as a reference to design mitigation actions and projects.
Alquist-Priolo Earthquake Fault Zoning Act	The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. Relevant data was acquired to profile earthquake hazard.
California Environmental Quality Act (CEQA)	CEQA is a California statute passed in 1970 (shortly after the United States Federal Government passed the National Environmental Policy Act (NEPA)), to institute statewide policy of environmental protection. The County will complete supporting CEQA documentation prior to board approval and adoption.
California Public Resources Code (PRC) Section 4291 – Structures in Fire Hazard Areas	This code provides direction for persons owning, leasing, controlling, operating, or maintaining any building or structure in, upon, or adjoining any mountainous area of forest-covered lands, brush-covered lands, or grass-covered lands, or any lands which are covered with flammable material. The code is used as a reference to design mitigation actions and projects.
2018 State of California Multi-Hazard Mitigation Plan	Reviewed information on climate change and hazard assessment data to ensure consistency with this plan update. This review also included a comparison of the existing CCWD LHMP goals to the goals included in the 2023 Draft SHMP. Reviewed list of hazards to inform risk assessment and consequence analysis (Section 4). Reviewed goals for consistency (see above)
CAL FIRE and FRAP	Data was acquired to profile and carry out vulnerability assessment for wildfire hazard.
NOAA National Centers for Environmental Information-State Climate Summaries	Reviewed information on climate change to inform risk assessment and consequence analysis. Data was acquired to profile and carry out vulnerability assessment for severe weather hazard.
California DOF/US Census Bureau, ACS, 2015-2019	Informed the background of the community including demographic trends and the calculation of population at risk.
California Climate Adaptation Strategy, and California Extreme Temperature Response Plan	Informed the Extreme Heat profile and climate change considerations in the risk assessment and consequence analysis.

PLAN, STUDY, REPORT NAME	HOW PLAN INFORMED LHMP
All relevant plans, codes, and ordinances currently in place such as building codes, zoning ordinances, subdivision ordinances, special purpose ordinances, site plan review requirements, growth management ordinances, economic development plans, and emergency response plans were reviewed	Reviewed and used to profile and carry out vulnerability assessment for hazards. Used as references to design mitigation actions and projects.

In the process of preparing the 2023 LHMP update many other existing plans, studies, reports, and technical information were evaluated or used as guidance. The Planning Committee members work to ensure that local plans are integrated with the LHMP and provide expertise for the integration of other local, state, and federal plans, codes, and regulations.

Other technical data, reports and studies were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include hazard identification, vulnerability assessment, and capability assessment. Information from the following agencies and groups was reviewed in the development and update of this plan. Specific references relied on in the development of this plan are also sourced throughout the document as appropriate.

- CAL FIRE
- California Department of Parks and Recreation Office of Historic Preservation
- California Department of Public Health
- California Department of Transportation
- California DSOD
- California DWR
- California Geological Survey
- California Natural Resources Agency
- Center for Western Weather and Water Extremes
- FEMA
- National Register of Historic Places
- Natural Resource Conservation Service
- NOAA National Climatic Data Center
- NWS
- US Fish and Wildlife Service
- US Geological Survey
- Western Regional Climate Center

3.4.2.2 Integration of 2018 Plan into Other Plans and Planning Mechanisms

The CCWD's 2018 LHMP was integrated into subsequent planning mechanisms such as the 2021 AWIA RRA and the 2020 UWMP. While the County's General Plan incorporated the 2021 MJHMP that includes the City of Angeles and Murphys Sanitation District, this multi-jurisdictional plan did not cover the CCWD.

3.4.3 Phase 2: Assess Risks

3.4.3.1 Planning Step 4: Identify the Hazards

WSP led the HMPC to review the list of hazards identified in the 2018 plan and document all the hazards that have, or could, impact the planning area. The review included documenting recent drought, flood, land subsidence, wildfire and severe storm events that were not included in the 2018 LHMP. The Plan Update Guide worksheets were used to aid in determining hazards and vulnerabilities and to determine where risk varies across the planning area.

The profile of each of these hazards was then updated during the 2022-2023 process with information from the HMPC and additional sources. Web resources, existing reports and plans, and existing GIS layers were used to compile information about past hazard events and determine the location, previous occurrences, probability of future occurrences, and magnitude/severity of each hazard. GIS was used to display, analyze, and quantify hazards and vulnerabilities where data was permitted. The potential for climate change to affect the frequency and intensity of the hazards was summarized based on the latest available science, where applicable. A more detailed description of the HIRA process and the results are included in Section 4: Hazard Identification and Risk Assessment.

3.4.3.2 Planning Step 5: Assess the Risks

After updating the profiles of the hazards that could affect the County, the HMPC collected information to describe the likely impacts of future hazard events on the participating jurisdictions. This step included two parts: a vulnerability assessment and a capability assessment.

Vulnerability Assessment – The District updated their assets at risk to natural hazards—overall and in identified hazard areas. These assets included the total number and value of structures; critical facilities and infrastructure; natural, historic, and cultural assets; and economic assets. The HMPC also analyzed development trends in hazard areas. Population at risk, specifically socially vulnerable populations and underserved communities were also assessed and calculated for dam incidents, earthquake, flood, landslide, and wildfire hazards. The latest DFIRM was used to refine the estimated flood losses during the update, where available for the NFIP participating communities.

Capability Assessment – The HMPC conducted a capability assessment update to review and document the planning area's current capabilities to mitigate risk and vulnerability from hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC can assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. This information for the District is included in Section 6. This addressed FEMA planning task 4: Review community capabilities – 44 CFR 201.6 (b)(2) & (3).

Results of the risk assessment were presented, and comments were discussed at the second HMPC meeting in March 2023. A more detailed description of the risk assessment process and the results are included in Section 4: Hazard Identification and Risk Assessment.

3.4.4 Phase 3: Develop the Mitigation Plan

3.4.4.1 Planning Step 6: Set Goals

WSP facilitated a discussion session with the HMPC to review the 2018 LHMP's goals and objectives. The HMPC discussed definitions and examples of goals, objectives, and actions and considered the goals of the 2023 Draft California SHMP and other relevant local plans when reviewing and revising the goals and objectives. The resulting updated goals and objectives are presented in Section 5: Mitigation Strategy. For the 2023-2028 LHMP, several goals were modified; three new objectives were added.

3.4.4.2 Planning Step 7: Review Possible Activities

WSP facilitated a discussion at an HMPC meeting to review the alternatives for mitigating hazards. This included a group activity with the HMPC to identify a comprehensive range of mitigation actions for each identified hazard, and a group activity to select and rank mitigation actions using selection criteria. More specifics on the process and results are captured in Section 5: Mitigation Strategy.

As part of the review of mitigation options, long-term climate change adaptation strategies were also discussed. HMPC members were encouraged to incorporate climate change adaptation measures into the mitigation strategy of their respective jurisdictions by utilizing resources and guidance available on the Cal-Adapt website and the California Adaptation Planning Guide.

3.4.4.3 Planning Step 8: Draft an Action Plan

Based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, WSP produced a complete first draft of the plan. This complete Administrative Draft LHMP was shared electronically with the HMPC for review and comment. Other agencies were invited to comment on this draft, specifically surrounding counties. HMPC and agency comments were integrated into the second draft, which was advertised and distributed to collect public input and comments. Neighboring utility providers, jurisdictions (including Calaveras Public Utility District [CPUD], Utica Water and Power Authority [UWPA], and Union Public Utility District [UPUD], Calaveras County, City of Angels) and interested stakeholders identified under Step 3 were also solicited to provide comments on the draft plan during the public review period; Two comments were received during the public workshop. WSP integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for Cal OES and FEMA Region IX to review and approve, contingent upon final adoption by the governing boards of each participating jurisdiction.

3.4.5 Phase 4: Implement the Plan and Monitor Progress

3.4.5.1 Planning Step 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan was adopted by the District on the date included in the adoption resolutions in Appendix C. This adoption makes the District eligible for consideration for part or all its local costs on eligible public assistance to be provided by State share funding through the CDDA.

3.4.5.2 Planning Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the plan update process, all the HMPC's efforts have been directed at researching data, coordinating input from participating entities, and updating and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as hazard(s) addressed, agency responsible for implementation, and priority, to help initiate implementation. An overall implementation strategy is described in Section 6: Plan Adoption, Implementation, and Maintenance.

Finally, there are numerous organizations within CCWD's planning area whose goals and interests' interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the ongoing success of this plan and mitigation in CCWD and is addressed further in Section 6. A plan update and maintenance schedule is also included in Section 6.

Implementation and Maintenance Process: 2018 LHMP

The 2018 LHMP included a process for implementation and maintenance which was generally followed, with some variation. Implementation of the plan including the status of mitigation actions is captured in Section. In general, the County and participating jurisdictions have made progress in the implementation of the plan. Successes of note are detailed in the mitigation strategy in Section 5. An updated implementation and maintenance section can be referenced in Section 6.

4 HAZARD IDENTIFICATION AND RISK ASSESSMENT

Requirement §201.6(c)(2)(i):

[The plan shall include] a risk assessment that provides the factual basis for activities proposed in the strategy to reduce the losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment builds upon the methodology described in the 2023 FEMA Local Mitigation Planning Handbook, which recommends a five-step process for conducting a risk assessment:

- 1. Identify Hazards
- 2. Describe Hazards
- 3. Identify Community Assets
- 4. Analyze Impacts
- 5. Summarize Vulnerability

Data collected through this process has been incorporated into the following sections of this chapter:

Section 4.1 Hazard Identification identifies the hazards that threaten the Calaveras County Water District's (CCWD) Planning Area, which is the same as the County's jurisdictional boundaries (CCWD's jurisdictional areas for planning purposes) and describes why some hazards have been omitted from further consideration.

Section 4.2 Hazard Profiles discusses the threat to the Planning Area and describes previous occurrences of hazard events, the likelihood of future occurrences, and the CCWD's vulnerability to particular hazard events.

4.1 HAZARD IDENTIFICATION

Requirement §201.6(c)(2)(i):

[The plan shall include] a description of the type of all natural hazards that can affect the jurisdiction.

Risk to natural hazards is a combination of hazard, vulnerability, and capability. This section of the Local Hazard Mitigation Plan (LHMP) will look at both hazards and vulnerabilities. The risk assessment process identifies and profiles relevant hazards and assesses CCWD's service area and facilities' exposure to these hazards. The goal of the risk assessment is to estimate the potential losses in CCWD from a hazard event. This process also allows CCWD to better understand their potential risk to natural hazards and provides a foundation for developing and prioritizing mitigation actions to reduce the risks from future hazard events. These mitigation actions can then be designed to reduce damage from natural disasters through increased preparedness and focus resources on assets that have the greatest vulnerability.

Using existing natural hazards data from federal and state disaster declaration history, the State of California Draft Hazard Mitigation Plan (SHMP) (2023), the previous CCWD LHMP (2018), the CCWD 2020 Urban Water Management Plan (UWMP), the CCWD AWIA Risk and Resiliency Assessment (2021), and interviews of CCWD staff during planning meetings, the CCWD and HMPC agreed upon a list of natural hazards that could affect CCWD. Hazards data from FEMA, the National Oceanic and Atmospheric Administration (NOAA), Cal-Adapt, and other sources were examined to assess the significance of these hazards to the Planning Area. Other data used included the CCWD's Geographic Information Systems (GIS) data (facility location and replacement data) and various datasets from the California Department of Forestry and Fire Protection (CAL FIRE). The significance of each identified hazard was measured in general terms and focused on key criteria such as frequency and resulting damage, including facility, property, and economic damage. The natural hazards evaluated as part of this plan include those that have occurred historically and/or have the potential to cause significant human and/or monetary losses in the future.

The hazards in Table 4-1, listed alphabetically were identified and investigated for this plan update. All hazards from the 2018 plan were profiled in the LHMP update.

Table 4-1 Hazard Identification and Comparison

2023 – 2027 Update Hazards	2018 Hazards	Comment
Avalanche	Avalanche	Similar analysis was performed
Dam Failure	Dam Failure	Newer data used & quantitative analysis was performed
Drought and Water Shortage	Drought and Water Shortage	Similar analysis was performed
Earthquake	Earthquake	Similar analysis was performed
Expansive Soils	Soil Hazards: Expansive Soils	Soil hazards are profiled individually in this plan
Extreme Heat	Severe Weather: Extreme Heat	Profiled as stand-alone hazard
Extreme Cold and Winter Storms	Severe Weather: Winter Storms and Extreme Cold	Similar analysis was performed
Flood: 100/500 year	Flood: 100/500 year	Newer data set used
High Winds & Tornadoes	Severe Weather: Tornadoes	Tornado and High Wind hazards were combined into one hazard profile. Similar analysis was performed
	Severe Weather: Wind	
Landslide and Debris Flows	Soil Hazards: Landslide and Debris Flows	Soil hazards are profiled individually in this plan
Levee Failure	Levee Failure	Hazard profile removed
Severe Weather: Heavy Rain, Thunderstorms, Lightning, Hail	Severe Weather: Heavy Rain, Thunderstorms, Lightning, Hail	Similar analysis was performed
Soil Erosion	Soil Hazards: Erosion	Soil hazards are profiled individually in this plan

2023 – 2027 Update Hazards	2018 Hazards	Comment
Subsidence	Soil Hazards: Subsidence	Soil hazards are profiled individually in this plan
Volcano	Volcano	Similar analysis was performed
Wildfire	Wildfire	Newer data set used for fire threat; additional data set on fire history

4.1.1 Other Hazards Considered but not Profiled

As part of the hazard identification process, the CCWD and HMPC also noted other hazards that could impact the CCWD's Planning Area but are not further profiled as impacts tend to be more isolated or do not result in local, state or federal disaster declarations. These hazards either lack past occurrences in the CCWD's planning area or have negligible impacts. Also, potential human-caused and human-health hazards were dismissed from further study, as most of those hazards are thoroughly addressed by other regulatory programs or in other plans. Air quality and missions are currently addressed by other federal, state, and local laws and regulations. Aquatic invasive species are currently addressed by the Calaveras County Environmental Management Department. Energy shortage hazards and related Public Safety Power Shutoffs (PSPS) events are addressed as a secondary hazard impact under High Winds & Tornadoes. Tree mortality is addressed as a secondary hazard under Drought. Also, the CCWD has acknowledged gas pipeline hazards, oil spills, radiological incidents, and transportation accidents, but agreed these human-caused hazards are also addressed by other state, regional, and County programs. Further, tsunami and coastal hazards are not addressed given the County is not located along the coast. Most natural hazards common in the Sierra Nevada region and the foothills and Central Valley of California were profiled and evaluated in the risk assessment.

4.2 METHODOLOGY

Requirement §201.6(c)(2)(i):

[The plan shall include] a description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The HMPC prioritized hazards based on a process that combines criteria on the hazard problem, where the hazard occurs in the Planning Area, past occurrences, the likelihood of future occurrence, and the magnitude of the hazard if it were to cause damage. Each hazard profile includes the following subsections:

HAZARD DESCRIPTION – This section gives a description of the hazard problem and associated issues followed by details on the hazard specific to the CCWD Planning Area.

GEOGRAPHIC AREA – This section provides a spatial description of the potential location or areas of the CCWD Planning Area where the hazard is expected to impact. CCWD Planning Area in this plan refers to Calaveras County.

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

PAST OCCURRENCES – This section contains information on historical incidents, including impacts where known events occurred. Historical incident worksheets were used to capture information from participating jurisdictions on past occurrences.

LIKELIHOOD OF FUTURE OCCURRENCE – The frequency of past events is used in this section to gauge the likelihood of future occurrences. Where possible, frequency was calculated based on existing data. It is determined by dividing the number of events observed by the number of years on record and multiplying by 100.

$$\frac{\text{\# of known events}}{\text{years of historic record}} \text{X } 100$$

This gives the percent chance (probability) of an event happening in any given year (e.g., three droughts over a 30-year period equates to a 10 percent chance of a drought in any given year). The likelihood of future occurrences is categorized into one of the following classifications:

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

CLIMATE CHANGE CONSIDERATIONS – This describes the potential for climate change to affect the frequency and intensity of the hazard in the future. The HIRA describes two Greenhouse Gas (GHG) emissions scenarios that reflect different projections for how global emissions and atmospheric GHG concentrations may change over time but selects a high emissions scenario (Representative Concentration Pathway [RCP] 8.5) for each natural hazard affected by climate change. The Governor's Office of Planning and Research recommends that agencies use RCP 8.5 for analyses considering impacts through 2050 because there are minimal differences between emissions scenarios during the first half of the century. The HIRA also uses Cal-Adapt's default settings that provide outputs for subsets of 10 and 4 global climate models (GCMs) and integrates projections for mid-century (2040-2060) and through the end-of-century (2070-2090); however, mapped climate projections using GIS data were only included for the mid-century.

MAGNITUDE AND SEVERITY – This section describes the potential strength or magnitude of the hazard as it pertains to the CCWD Planning Area. It describes how much damage could occur as a result of a hazard event.

- **Catastrophic**: More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
- **Critical**: 25-50 percent 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 percent 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 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

VULNERABILITY ASSESSMENT – Vulnerability is the measurement of exposed structures, critical facilities, or populations (water customers) relative to the risk of the hazard. For most hazards, vulnerability is a best estimate. Some hazards, such as flood, affect specific areas so that exposure can be quantified, and vulnerability assessments result in a more specific approximation. Other hazards, such as tornadoes, are random and unpredictable in location and duration that only approximate methods can be applied. The vulnerabilities are summarized for all natural hazards. The vulnerability assessment is used to inform strategic decision-making by identifying the assets or portions of the Planning Areas most vulnerable to natural hazards. The assessment was conducted through the study of potential impacts to the following specific assets:

- People
- Property
- Critical Facilities and Lifelines
- Economy
- Cultural, Historic and Natural Resources

DEVELOPMENT TRENDS – This section describes how future development and growth could impact vulnerability to each hazard.

RISK SUMMARY – Overall hazard significance is based on a combination of geographic area, probability of future occurrence and magnitude/severity. Each risk summary includes key issues and problems based on threat, vulnerability and impacts to the CCWD Planning Area and jurisdictions from the specific hazard. Significance rankings are defined by the following:

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

Overall hazard significance is based on a combination of information on how much of the hazard covers the Planning Area, historical data, disaster potential and relevance to CCWD's Planning Area, magnitude and severity, and the probability of future occurrences. Each metric was used to identify and prioritize the list of hazards most relevant to CCWD and the individual rankings are based on or interpolated from the analysis of the hazards in the risk assessment. This process helps CCWD compare and rank hazards that pose the greatest risk.

The CCWD and HMPC members were also asked to complete a Plan Update Guide worksheet to initiate the process of screening and ranking hazards for the LHMP update. The Plan Update Guides require ranking of the hazards based on the geographic extent, magnitude/severity of the hazard, past occurrences, the frequency/probability of future occurrences, and overall significance, as shown in Table

4-2 below. The results of the Plan Update Guides were collected to help determine the rankings, and these rankings were reviewed again with the HMPC for further input. Public input was also integrated based on feedback from the bi-lingual survey and two public workshops.

Table 4-2 CCWD Hazard Ranking Summary

HAZARD	GEOGRAPHIC EXTENT	PROBABILITY OF FUTURE OCCURRENCES	MAGNITUDE/ SEVERITY	SIGNIFICANCE	Priority Hazard?
Avalanche	Limited	Occasional	Limited	Low	No
Dam Failure	Significant	Occasional	Critical	Medium	Yes
Drought and Water Shortage	Extensive	Likely	Critical	Medium	Yes
Earthquake	Extensive	Occasional	Limited	Low	No
Expansive Soils	Significant	Likely	Limited	Medium	Yes
Extreme Heat	Extensive	Highly Likely	Critical	Medium	Yes
Extreme Cold and Winter Storms	Extensive	Highly Likely	Critical	Medium	Yes
Flood: 100/500 year & Localized Stormwater Flooding	Significant	Occasional	Critical	Medium	Yes
	Extensive	Highly Likely	Critical	High	Yes
High Wind & Tornado	Extensive	Highly Likely	Critical	Medium	Yes
Landslide & Debris Flows	Significant	Likely	Limited	Medium	Yes
Severe Weather: Heavy Rains and Storms, Lightning, Hail	Extensive	Highly Likely	Critical	Medium	Yes
Soil Erosion	Limited	Highly Likely	Negligible	Medium	Yes
Subsidence	Limited	Occasional	Negligible	Medium	Yes
Volcano	Limited	Unlikely	Critical	Low	No
Wildfire	Extensive	Highly Likely	Critical	High	Yes

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

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent 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 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability

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

Probability of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the 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 a recurrence interval of greater than every 100 years.

HAZARD	GEOGRAPHIC EXTENT	PROBABILITY OF FUTURE OCCURRENCES	MAGNITUDE/ SEVERITY	SIGNIFICANCE	Priority Hazard?
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid					

Source: CCWD, Cal OES and FEMA

4.2.1.1 Disaster Declaration History

One method to identify hazards based on past occurrences is to look at what events triggered federal and/or state disaster declarations within the Planning Area. Disaster declarations are granted when the severity and magnitude of the event's impact surpass the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state government's capacity is exceeded, a federal disaster declaration may be issued allowing for the provision of federal disaster assistance.

Calaveras County has experienced 25 federal and 19 state declarations since 1950. Among the 25 federal declarations, twenty were associated with flood events. Flood-related federal declarations are also associated with severe storm and landslide as well as mudslide events. In addition, three federal declarations are related to fire events, and one is related to a drought event.

Among the 19 state declarations, ten were associated with flood events. Similar to federal declarations, flood-related state declarations are also associated with severe storm, landslides, and mudslide events. Three state declarations are related to drought events, and four are related to fire events. It is important to note that not all state declarations resulted in federal declarations, and vice versa. A summation of federal and state disaster declarations is shown in Table 4-3 below.

Table 4-3 Calaveras County Federal and State Disaster Declaration History

HAZARD TYPE	DISASTER NAME	DISASTER NUMBER	STATE DECLARATION	FEDERAL DECLARATION
Flood	Floods	CDO 50-01	11/21/50	–
Flood	Floods	DR-47	12/22/55	12/23/55
Flood	Storm/Flood Damage	DR-82	04/02/58	04/04/58
Flood	1969 Storms	DR-253	02/08/69	01/26/69
Drought	Drought	N/A	02/09/76	–
Drought	California Drought	EM-3023-CA		01/20/1977
Flood	1980 April Storms	80-01 – 80-25	4/1/1980	–
Flood	Heavy Rains and Flooding	DC 82-03	4/1/1982	–
Severe Storm & Flooding	California Severe Storms, Flooding	DR-758-CA	02/20/86	02/18/86

HAZARD TYPE	DISASTER NAME	DISASTER NUMBER	STATE DECLARATION	FEDERAL DECLARATION
Fire	Wildfire	N/A	07/21/88	–
Fire	California Old Gulch, Fountain Fires	DR-958-CA	08/02/92	08/29/92
Severe Storm & Flood & Landslide, Mud Flows	California Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1046-CA	–	03/12/95
Severe Storm & Flood	California Severe Storms/flooding	DR-1155-CA	1/2/97-1/31/97	1/4/1997
Flood	January 1997 Floods	–	01/03/97	–
Severe Winter Storms & Flooding	California Severe Winter Storms and Flooding	DR-1203-CA	–	02/09/98
Fire	Wildfire	–	09/10/01	–
Fire	California Calaveras Fire Complex	FM-2540-CA	–	8/7/2004
Fire	California Pattison Fire	FM-2553-CA	–	9/3/2004
Hurricane	California Hurricane Katrina Evacuation	EM-3248-CA	–	9/13/2005
Severe Storm & Flood & Landslides, Mudslides	California Severe Storms, Flooding, Landslides, and Mudslides	DR-1646-CA	–	06/05/06
Drought	Central Valley Drought	-	6/12/2008	–
Severe Storm & Flood & Landslides, Mudslides	California Severe Winter Storms, Flooding, and Debris and Mudflows	DR-1884-CA	1/27/2010	3/8/2010
Storms	November Storms	GP 2010-14	11/30/2010; 12/09/2010	--
Winter Storms	Winter Storms	38-Proc-2010-16	1/27/2010	--
Drought	California Drought	GP 2014-13	1/17/2014	--
Wildfire	California Butte Fire	FM-5111-CA	9/11/2015	9/10/2015

HAZARD TYPE	DISASTER NAME	DISASTER NUMBER	STATE DECLARATION	FEDERAL DECLARATION
Wildfire	California Valley Fire and Butte Fire	DR-4240-CA		9/22/2015
Severe Winter Storm & Flood & Mudslides	California Severe Winter Storms, Flooding, and Mudslides	DR-4301-CA		02/14/2017
Severe Winter Storm & Flood & Mudslides	California Severe Winter Storms, Flooding, and Mudslides	DR-4305-CA		03/16/2017
Severe Winter Storms & Flooding & Mudslides	California Severe Winter Storms, Flooding, Mudslides	DR-4308-CA		04/01/2017
Severe Winter Storms & Flooding & Landslides, Mudslides	California Severe Winter Storms, Flooding, Landslides, and Mudslides	DR-4431-CA		05/01/2019
Biological	California Covid-19	EM-3428-CA		03/13/2020
Biological	California Covid-19 Pandemic	DR-4482-CA		03/22/2020
Severe Winter Storms & Flooding & Landslides, Mudslides	California Severe Winter Storms, Flooding, Landslides, and Mudslides	DR-4683-CA		01/14/2023
Severe Winter Storms & Flooding & Landslides, Mudslides	California Severe Winter Storms, Flooding, Landslides, and Mudslides	EM-3592-CA		03/10/2023
Severe Winter Storms & High Wind & Flooding & Landslides, Mudslides	California Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides	DR-4699-CA		04/03/2023

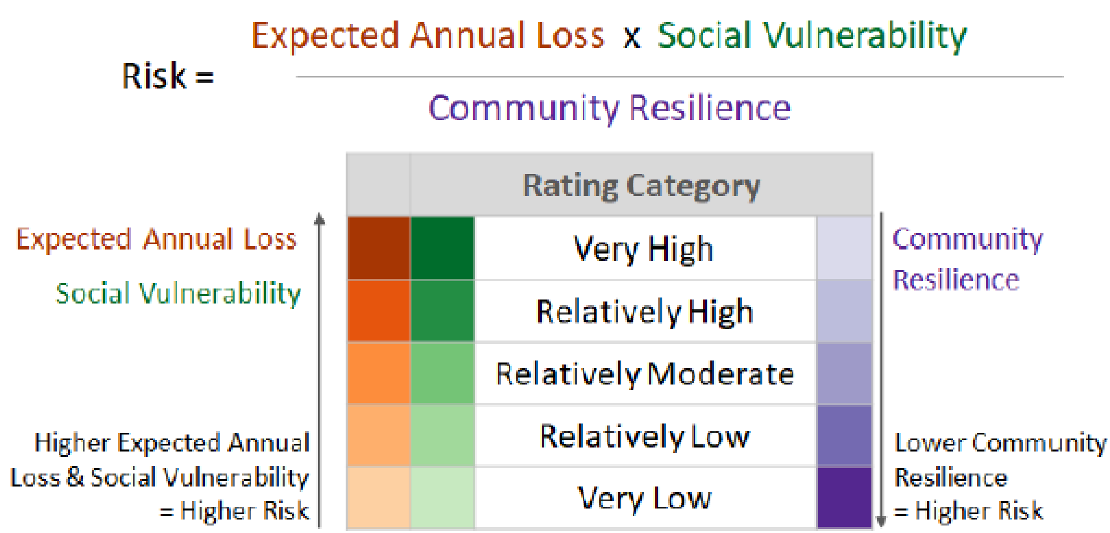
Sources: Cal OES, FEMA

4.2.1.2 National Risk Index Overview

The National Risk Index (NRI) is a dataset and online tool that helps illustrate the United States communities most at risk for 18 natural hazards. It was designed and built by FEMA in close collaboration with various stakeholders and partners in academia; local, state, and federal government; and private industry. The NRI leverages available source data for natural hazard and community risk factors to develop a baseline relative risk measurement for each United States county and census tract. The NRI's interactive mapping and data-based interface enables users to visually explore individual datasets to better understand what is driving a community's natural hazard risk. Users can create reports to capture risk details on a community or conduct community-based risk comparisons, as well as export data for analysis using other software. Intended users of the NRI include planners and emergency managers at the local, regional, state, and federal levels, as well as other decision-makers and interested members of the general public.

The NRI provides relative Risk Index scores and ratings based on data for Expected Annual Loss (EAL) due to natural hazards, social vulnerability, and community resilience. Separate scores and ratings are also provided for each component: EAL, Social Vulnerability, and Community Resilience. Figure 4-1 illustrates the NRI risk equation and components that define risk based on the EAL times the social vulnerability divided by a community's resilience to that potential hazard.

Figure 4-1 Generalized National Risk Index Risk Equation and Components



Source: FEMA NRI Technical Documentation 2021

For the Risk Index and EAL, scores and ratings can be viewed as a composite score for all hazards or individually for each of the 18 hazard types. These 18 hazard types are listed below:

- Avalanche
- Coastal Flooding
- Cold Wave
- Drought

- Earthquake
- Hail
- Heat Wave
- Hurricane
- Ice Storm
- Landslide
- Lightning
- Riverine Flooding
- Strong Wind
- Tornado
- Tsunami
- Volcanic Activity
- Wildlife
- Winter Weather

An added benefit of leveraging NRI data for the regional plan included standardized methods for assessing risk on a county-by-county scale for most of the natural hazards in the HIRA. This included composite risk indicators for hazards previously lacking necessary data, consisting of subsets of summer and winter storms including cold wave, lightning, wind, and ice storms. The other benefit is that moving forward, FEMA will be periodically updating and improving the NRI, which should provide a valuable and standardized resource for future HIRA updates.

The HIRA sections for Drought, Severe Weather, and High Winds and Tornadoes contain the following aggregate risk products, mapped by WSP using NRI data:

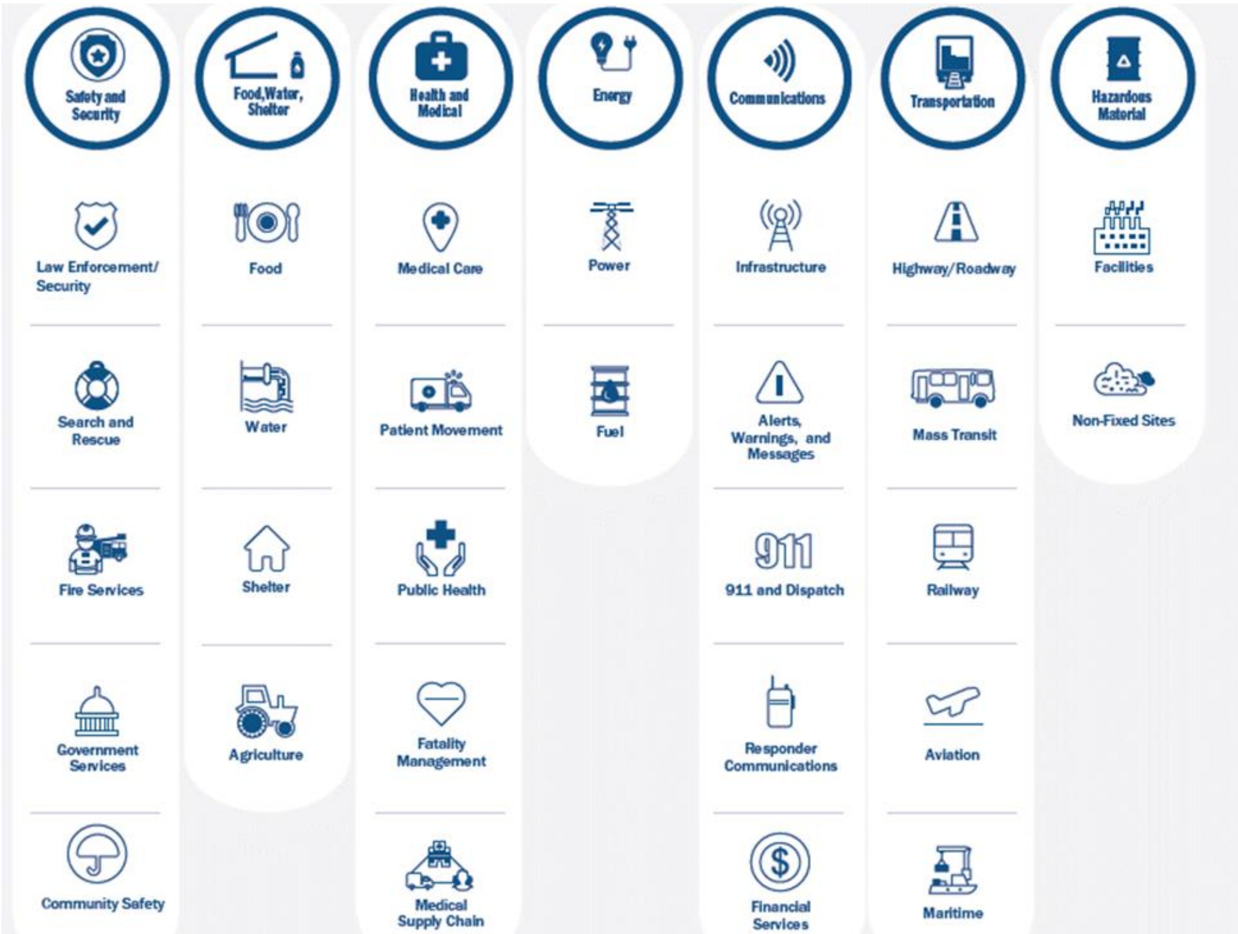
- Annualized Frequency
- Composite Risk Index Rating
- Expected Annual Loss

Sources of hazards and exposure data includes SHELDUS, National Oceanic and Atmospheric Administration (NOAA), US Geological Survey (USGS), National Weather Service (NWS), and the USDA. Consequences of hazard occurrences are categorized into three different types: buildings, population, and agriculture. Additional details can be referenced in the FEMA NRI Technical documentation 2021, available at https://hazards.fema.gov/nri/.

4.2.1.3 Calaveras County Water District's Vulnerability and Assets at Risk

Assets inventoried for the purpose of determining vulnerability include people, buildings, critical facilities, and lifelines, and natural, historic, or cultural resources. A critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. FEMA organizes critical facilities into seven lifeline categories as shown in Figure 4-2.

Figure 4-2 FEMA Lifeline Categories



These lifeline categories standardize the classification of critical facilities and infrastructure that provide indispensable service, operation, or function to a community. A lifeline is defined as providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security. These categorizations are particularly useful as they:

- Enable effort consolidations between government and other organizations (e.g., infrastructure owners and operators).
- Enable integration of preparedness efforts among plans; easier identification of unmet critical facility needs.
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization.
- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets.
- Highlight lifeline related priority areas regarding general operations as well as response efforts.

As a starting point for analyzing the Planning Area's vulnerability to identified hazards, the HMPC used a variety of data to define a baseline against which all disaster impacts could be compared. If a catastrophic disaster was to occur in the Planning Area, this section describes significant assets at risk in the Planning Area. Data used in this baseline assessment included:

- Total CCWD assets at risk;
- Populations affected (water customers);
- Cultural, historical, and natural resources; and
- Growth and development trends.

The total CCWD assets at risk is based on a GIS database developed in close coordination with CCWD GIS staff. This database also builds off the GIS critical facility database developed in 2018. Where applicable, this information was used in an overlay analysis for hazards such as flood, landslide, and wildfire.

4.3 ASSET SUMMARY

The HMPC used the most recent infrastructure valuation provided by CCWD for the fiscal year 2023 to determine values for CCWD's assets. Table 4-4 shows the total values of CCWD capital assets by facility type. Land values have been purposely excluded because land remains following disasters, and subsequent market devaluations are frequently short-term and difficult to quantify. Additionally, state, and federal disaster assistance programs generally do not address the loss of land or its associated value.

Table 4-4 Summary of CCWD Asset Values by Facility Type

FACILITY TYPE	FACILITY COUNT	REPLACEMENT VALUE
Dam	4	$20,000,000
Disposal	1	$500,000
Diversion	3	$5,300,000
Lift Station	48	$52,350,000
Office	1	$3,519,231
Pump Station	24	$35,025,000
Reclaimed Water Plant	1	$5,000,000
Tank	25	$39,442,690
Training Facility	1	$ 500,000
Tunnel Tap	1	$-*
Warehouse	1	$3,355,000
Wastewater Sprayfield	2	$ 30,000
Wastewater Treatment Plant (WWTP)	8	$38,155,397
Water Intake	1	$3,000,000
Water Treatment Plant (WTP)	6	$53,500,000
Well	2	$500,000
Shop	1	$845,000
Grand Total	**130**	**$261,022,318**

*The HMPC chose not to disclose the replacement value of this facility during the plan update process.

Note: North Fork Hydroelectric Project facilities (e.g., North Fork Diversion Dam, NSM Dam, McKay's Point Dam, and Beaver Creek Dam) are not included within the scope of this plan but are owned by CCWD under the Federal Energy Regulatory Commission (FERC) Project 2409.

Source: CCWD 2023

4.3.1.1 Detailed Asset Inventory

CCWD provides a critical lifeline utility, water, to thousands of people in Calaveras County. As such, all facilities owned by CCWD are considered critical facilities. There are 130 facilities owned and operated by the CCWD. The detailed facility list is listed in Table 4-5 and the facilities are shown in Table 4-5.

Table 4-5 CCWD Detailed Facilities Owned by Service Area and Facility Type

SERVICE AREA	FACILITY TYPE	FACILITY NAME
Ebbetts Pass	TANK	60K TANK (Big Trees 2)
West Point	PUMP STATION	Acorn Booster Pump Station
Ebbetts Pass	WASTEWATER TREATMENT PLANT	ARNOLD WASTEWATER TREATMENT
Jenny Lind	PUMP STATION	A-TANK PS
Ebbetts Pass	TANK	AVERY TANK
Ebbetts Pass	PUMP STATION	AVERY TANK PUMP STATION
West Point	DIVERSION	BEAR CREEK DIVERSION
Jenny Lind	PUMP STATION	BEUNA VISTA HYDROPNEUMATIC PS
Ebbetts Pass	TANK	BIG TREES 4 TANK
Ebbetts Pass	PUMP STATION	BIG TREES 1 PS
Ebbetts Pass	TANK	BIG TREES 1 TANK
Ebbetts Pass	PUMP STATION	BIG TREES 4&5 PS
Ebbetts Pass	TANK	BIG TREES 8 TANK
Jenny Lind	PUMP STATION	B-TANK HYDROPNEUMATIC PS
Copper Cove	PUMP STATION	B-TANK PS
West Point	DAM	BUMMERVILLE DAM
West Point	TANK	BUMMERVILLE TANK
Calaveras County	WAREHOUSE	CCWD CENTRAL WAREHOUSE
Calaveras County	OFFICE	CCWD HEADQUARTERS
Copper Cove	TANK	CCWTP Clearwells (Both Tanks)
Copper Cove	DAM	COPPER COVE DAM (SEWER)
Copper Cove	RECLAIMED WATER PLANT	COPPER COVE RECLAIMED WATER PLANT
Copper Cove	WASTEWATER TREATMENT PLANT	COPPER COVE WASTEWATER TREATMENT PLANT
Copper Cove	WATER TREATMENT PLANT	COPPER COVE WATER TREATMENT PLANT
Copper Cove	PUMP STATION	COPPER COVE WTP PS
Copper Cove	PUMP STATION	COPPEROPOLIS PS (Reeds Turnpike)
Copper Cove	TANK	COPPEROPOLIS TANK
Copper Cove	PUMP STATION	C-TANK HYDROPNEUMATIC PS
Jenny Lind	PUMP STATION	DENNIS COURT PS
Ebbetts Pass	PUMP STATION	DORRINGTON PS

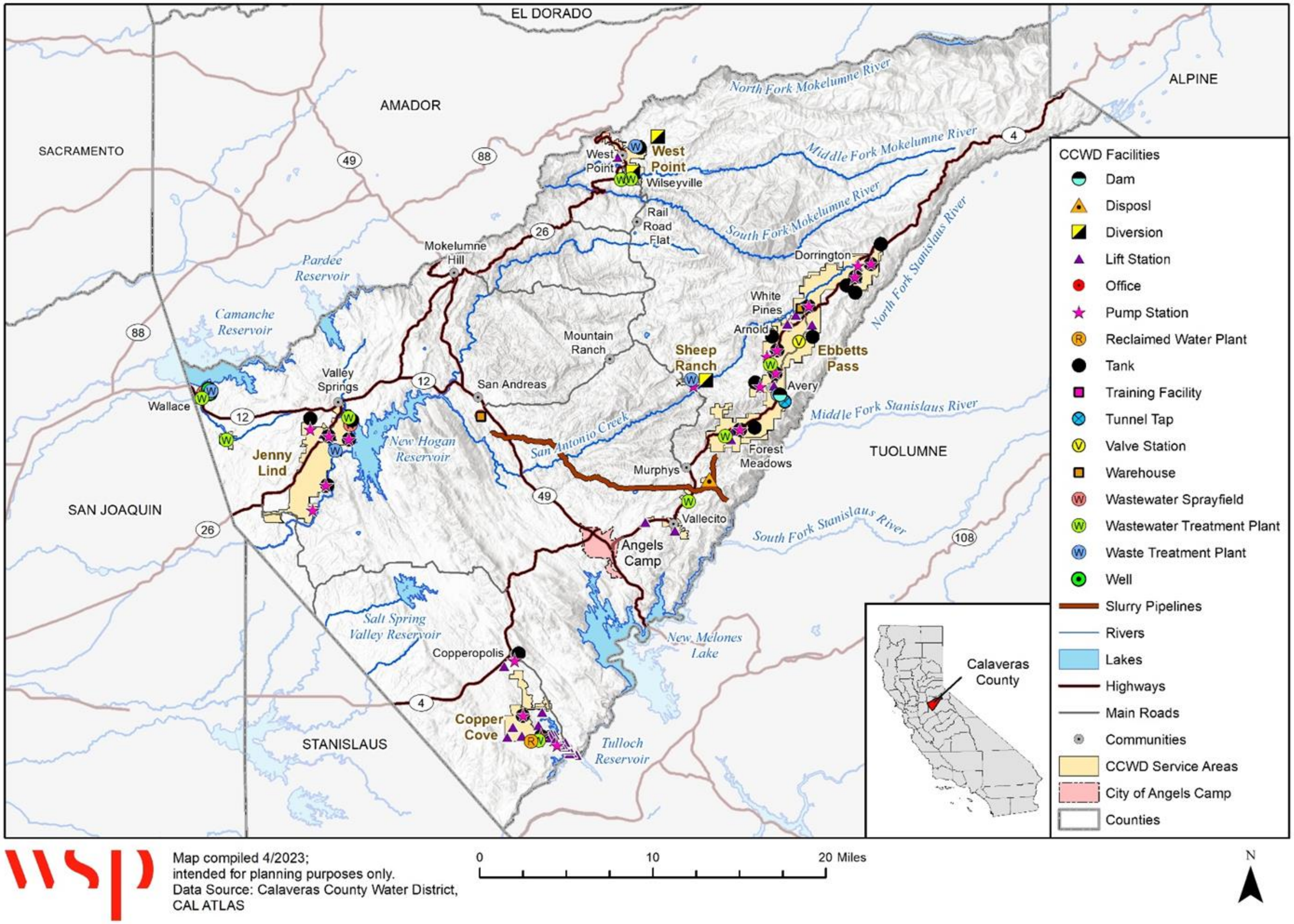
SERVICE AREA	FACILITY TYPE	FACILITY NAME
Wallace	TANK	ELEVATED TANK – STEEL WELDED
Jenny Lind	PUMP STATION	E-TANK HYDROPNEUMATIC PS
Ebbetts Pass	WASTEWATER TREATMENT PLANT	FOREST MEADOWS SEWER TREATMENT
Wallace	TANK	GROUND TANK- STEEL WELDED
Ebbetts Pass	TANK	HEATHER TANK
Ebbetts Pass	PUMP STATION	HUNTERS Clearwell Pump Station
Ebbetts Pass	PUMP STATION	Hunters Raw Water Pump Station
Ebbetts Pass	WATER TREATMENT PLANT	HUNTERS WATER TREATMENT PLANT
Ebbetts Pass	DISPOSAL	INDIAN ROCK DISPOSAL
Jenny Lind	TANK	JENNY LIND "A" TANK
Jenny Lind	WATER INTAKE	Jenny Lind Raw Water Intake
Jenny Lind	TRAINING FACILITY	JENNY LIND TRAINING FACILITY
Jenny Lind	WATER TREATMENT PLANT	JENNY LIND WATER TREATMENT
Jenny Lind	PUMP STATION	JENNY LIND WTP PS
La Contenta	WASTEWATER SPRAYFIELD	LA CONTENTA WASTEWATER SPRAYFIELD
La Contenta	WASTEWATER TREATMENT PLANT	LA CONTENTA WASTEWATER TREATMENT
Ebbetts Pass	PUMP STATION	LAKEMONT PS
Ebbetts Pass	PUMP STATION	LARKSPUR PS
Ebbetts Pass	TANK	LARKSPUR TANK
Copper Cove	LIFT STATION	LIFT STATION 1
Ebbetts Pass	LIFT STATION	LIFT STATION 1 (Cedar Ridge)
Copper Cove	LIFT STATION	LIFT STATION 10
Copper Cove	LIFT STATION	LIFT STATION 11
Copper Cove	LIFT STATION	LIFT STATION 12
Copper Cove	LIFT STATION	LIFT STATION 13
Copper Cove	LIFT STATION	LIFT STATION 14
Copper Cove	LIFT STATION	LIFT STATION 15
Copper Cove	LIFT STATION	LIFT STATION 16
Copper Cove	LIFT STATION	LIFT STATION 17
Copper Cove	LIFT STATION	LIFT STATION 18
Copper Cove	LIFT STATION	LIFT STATION 19
Ebbetts Pass	LIFT STATION	LIFT STATION 2
Copper Cove	LIFT STATION	LIFT STATION 2
Copper Cove	LIFT STATION	LIFT STATION 20
Copper Cove	LIFT STATION	LIFT STATION 21
Copper Cove	LIFT STATION	LIFT STATION 22
Ebbetts Pass	LIFT STATION	LIFT STATION 3
Copper Cove	LIFT STATION	LIFT STATION 3
Copper Cove	LIFT STATION	LIFT STATION 4
Copper Cove	LIFT STATION	LIFT STATION 40
Copper Cove	LIFT STATION	LIFT STATION 42
Copper Cove	LIFT STATION	LIFT STATION 43

SERVICE AREA	FACILITY TYPE	FACILITY NAME
Copper Cove	LIFT STATION	LIFT STATION 44
Copper Cove	LIFT STATION	LIFT STATION 45
Copper Cove	LIFT STATION	LIFT STATION 46
Copper Cove	LIFT STATION	LIFT STATION 5
Copper Cove	LIFT STATION	LIFT STATION 6
Copper Cove	LIFT STATION	LIFT STATION 7
Copper Cove	LIFT STATION	LIFT STATION 8
Copper Cove	LIFT STATION	LIFT STATION 9
Ebbetts Pass	LIFT STATION	LIFT STATION AVERY
La Contenta	LIFT STATION	LIFT STATION HWY 26
Ebbetts Pass	LIFT STATION	LS FM AZ
Ebbetts Pass	LIFT STATION	LS FM HWY 4
Ebbetts Pass	LIFT STATION	LS FM LAKESIDE
La Contenta	LIFT STATION	LS HUCKLEBERRY
Ebbetts Pass	LIFT STATION	LS MOUNTAIN RETREAT
Ebbetts Pass	LIFT STATION	LS SEQUOIA WOODS
Ebbetts Pass	LIFT STATION	LS SIX-MILE
West Point	LIFT STATION	LS WESTPOINT
La Contenta	LIFT STATION	LS WOODGATE 1
La Contenta	LIFT STATION	LS WOODGATE 2
Ebbetts Pass	TANK	MEADOWMONT 13 TANK
Ebbetts Pass	TANK	MEADOWMONT TANK
Ebbetts Pass	PUMP STATION	MEADOWMONT TANK PS
West Point	DIVERSION	MIDDLE FORK MOKULMNE RIVER DIV
Ebbetts Pass	TUNNEL TAP	NORTH FORK HYDROELECTRIC TUNNEL TAP
Ebbetts Pass	TANK	PINEBROOK TANK
Copper Cove	PUMP STATION	RAW WATER PS
Wallace	WELL	RAW WATER SUPPLY WELL #2
Wallace	WELL	RAW WATER SUPPLY WELL #3
Copper Cove	LIFT STATION	SADDLE CREEK LS1
Copper Cove	LIFT STATION	SADDLE CREEK LS2
Copper Cove	LIFT STATION	SADDLE CREEK LS3
Ebbetts Pass	TANK	SAWMILL TANK
Ebbetts Pass	PUMP STATION	SAWMILL TANK PS
Sheep Ranch	DIVERSION	SHEEP RANCH DIVERSION
Sheep Ranch	PUMP STATION	SHEEP RANCH RAW WATER PS
Sheep Ranch	WATER TREATMENT PLANT	SHEEP RANCH WATER TREATMENT
Southworth	WASTEWATER TREATMENT PLANT	SOUTHWORTH WASTEWATER PLANT
Jenny Lind	TANK	TANK 602
Jenny Lind	TANK	Tank B #
Copper Cove	TANK	TANK B (Both Tanks)
Copper Cove	TANK	Tank C (Both Tanks)
Jenny Lind	TANK	TANK E/HOGAN LAKE
Jenny Lind	TANK	TANK F
Ebbetts Pass	PUMP STATION	TIMBER TRAIL PS
Ebbetts Pass	TANK	TIMBER TRAIL TANK

SERVICE AREA	FACILITY TYPE	FACILITY NAME
Ebbetts Pass	LIFT STATION	VALLECITO MAIN LIFT STATION
Vallecito	WASTEWATER TREATMENT PLANT	VALLECITO WASTEWATER TREATMENT
Wallace	WASTEWATER SPRAYFIELD	WALLACE WASTEWATER SPRAYFIELD
Wallace	WASTEWATER TREATMENT PLANT	WASTEWATER PLANT
Wallace	WATER TREATMENT PLANT	WATER PLANT
West Point	WASTEWATER TREATMENT PLANT	WEST POINT WASTEWATER TREATMENT
West Point	WATER TREATMENT PLANT	WEST POINT WATER TREATMENT
West Point	TANK	WEST POINT WATER TREATMENT CLEARWELL & PS
Ebbetts Pass	SHOP	WHITE PINES BARN/SHOP
Ebbetts Pass	DAM	WHITE PINES DAM
West Point	LIFT STATION	WILSEYVILLE (LIFT STATION)

Source: CCWD 2023

Figure 4-3 Calaveras County Water District Critical Facilities



Lifeline utility systems for water and wastewater are critical facilities, so on this basis, all CCWD facilities are critical. In addition, the HMPC identified their own critical facilities – those that are essential to maintaining their operations. HMPC participants also identified critical facilities owned by CCWD, but operated by other water and power utilities (i.e., Utica Water and Power Authority [UWPA]). CCWD has emergency generation capabilities at all its critical facilities.

4.3.2 Populations Affected

Table 4-6 shows the number of customers that CCWD's provides water and wastewater service services. For both water and wastewater system data, the number of connections is provided by the HMPC during the 2022-2023 plan update process. The persons per connection data is obtained from the 2016 – 2020 American Community Survey (ACS) 5-year estimate, which is 2.67 as in average household size for Calaveras County.

Table 4-6 CCWD Critical Facilities and Populations Served

SERVICE AREA	NUMBER OF CONNECTIONS	POPULATION SERVED
Copper Cove	2,714	5,187
West Point	569	1,043
Ebbetts Pass	5,956	11,545
Jenny Lind	3,825	9,861
Sheep Ranch	47	89
Wallace	108	255
Wastewater Areas	**Number of Connections**	**Population Served**
La Contenta	1,047	2,795
Copper Cove	1,968	5,255
Forest Meadows	611	1,631
Arnold	697	1,861
Douglas Flat/Vallecito	347	926
Others in Sub-Region B	68	182
West Point and Wilseyville	199	531
Wallace	107	286
Southworth	60	160

Sources: CCWD 2023, 2016 – 2020 American Community Survey 5-year estimate

Note that populations served by CCWD's wastewater service can partially overlap with populations served by CCWD's water service.

The CCWD provides water supply via 13,219 service connections. Table 4-7 provides information on CCWD's water systems' sources and the volume of water supplied as of 2020.

Table 4-7 CCWD Public Water System Municipal Connections

PUBLIC WATER SYSTEM	SOURCE	VOLUME OF WATER SUPPLIED (2020) (ACRE-FEET)
Sheep Ranch	Calaveras River	12
Jenny Lind	Calaveras River	2,043
West Point	Mokelumne River	154
Cooper Cove / Copperopolis	Stanislaus River	1,385

PUBLIC WATER SYSTEM	SOURCE	VOLUME OF WATER SUPPLIED (2020) (ACRE-FEET)
Ebbetts Pass	Stanislaus River	1,407
Wallace	Groundwater	61
Total	-	5,062

NOTES: Wastewater served population areas have some overlap with water service areas but not entirely.
Source: CCWD 2020

4.3.3 Cultural, Historical, and Natural Resources

Assessing the vulnerability of CCWD and the County it serves to disaster also involves inventorying the natural, historic, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant more protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing ahead of time allows for more prudent care in the immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitats, which help absorb and attenuate floodwaters.

4.3.3.1 Natural Resource Assets

Calaveras County has a variety of natural resource assets that to a large extent serve as the basis for the county's economy and quality of life. These assets include water, critical species, and wildlife and plant habitat. Natural resource assets are important to include in benefit-cost 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 habitats as well as attenuates and stores floodwaters.

Critical Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the Planning Area. An endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Candidate species are plants and animals that have been proposed as endangered or threatened but are not currently listed.

There are 18 federally endangered, threatened, or candidate species in Calaveras County, together with four critical habitats. These species and habitats are listed in Table 4-8.

Table 4-8 Calaveras County Critical Species

LATIN NAME	COMMON NAME	STATUS
Listed Endangered or Threatened Species and/or Habitat		
Mammals		
Vulpes macrostis mutica	San Joaquin Kit Fox	E
Vulpes necator	Sierra Nevada Red Fox	E
Birds		
Strix occidentalis	California Spotted Owl	Proposed T
Amphibians		
Rana aurora draytonii	California red-legged frog	T
Ambystoma californiense	California tiger salamander	T
Rana sierra	Foothill Yellow-legged Frog	Proposed E
Rana sierrae	Sierra Nevada Yellow-legged Frog	E
Fishes		
Hypomesus transpacificus	Delta Smelt	T
Insects		
Danaus plexippus	Monarch Butterfly	C
Desmocerus californicus dimorphus	Valley Elderberry Longhorn Beetle	T
Crustaceans		
Branchinecta conservation	Conservancy Fairy Shrimp	E
Branchinecta lynchi	Vernal Pool Fairy Shrimp	T
Lepidurus packardi	Vernal Pool Tadpole Shrimp	E
Flowering Plants		
Brodiaea pallida	Chinese Camp brodiaea	T
Neostapfia colusana	Colusa Grass	T
Pseudobahia bahiifolia	Hartweg's Golden Sunburst	E
Arctostaphylos myrtifolia	Ione manzanita	T
Verbena californica	Red Hills Vervain	T
Conifers and Cycads		
Pinus albicaulis	Whitebark Pine	T
Critical Habitats		
Rana draytonii	California Red-legged Frog	Final
Ambystoma californiense	California Tiger Salamander	Final
Tuctoria greenei	Greene's Tuctoria	Final
Rana sierra	Sierra Nevada Yellow-legged Frog	Final

Sources: US Fish and Wildlife Service, Information for Planning and Consultation (IPaC). Available at: https://ecos.fws.gov/ipac/

Key:
(E) Endangered – Listed as being in danger of extinction.
(T) Threatened – Listed as likely to become endangered within the foreseeable future.
(C) Candidate – Candidate to become a proposed species.
(Final) Critical Habitat designated for this species was finalized.

Wildlife and Plant Habitat

The majority of Calaveras County is undeveloped and contains natural habitat areas for a variety of species unique to the eastern San Joaquin Valley and foothills of the Sierra Nevada. Of the approximate 663,453 acres in the County there are approximately 12 major land use types including: drainages (0.01%), seasonal wetlands (0.01%), coniferous forests (31.7%), chaparral (11.5%), montane hardwood (12%), riparian woodland (0.03%), valley oak woodland (0.04%), foothill woodland (18%), anthropogenic (0.3%), non-native annual grassland (23%), urban (1.1%), and lakes and rivers (2.1%) (Calaveras County 2016).

Critical habitat areas for California Red-legged Frog are located in the northwestern portion of the county within the Youngs and Spring Valley Creek drainages east of Valley Springs and north of New Hogan Reservoir. Critical habitat areas for the California tiger Salamander are in the western portions of the county near the San Joaquin Valley, west of Rancho Calaveras and along the edge of the county line west of Milton Road. Critical habitat areas for the Sierra Nevada Yellow-legged Frog are to the northeast of the county in the Sierra Nevada along Bear Creek, Cole Creek, etc. Critical habitat areas for Greene's Tuctoria are to the south of the County near Stanislaus River, and Tuolumne River.

4.3.3.2 Historic and Cultural Assets

Historical resources are buildings, structures, objects, places, and areas that are eligible for listing in the National Register of Historic Places (NRHP), the California Register of Historic Resources, or Calaveras County's List of Historic Resources; or that have an association with important persons, events in history, or cultural heritage; or that have distinctive design or construction method.

For the purpose of federal actions, a qualified historic resource is defined as a property listed in or formally determined eligible for listing in the NRHP before a disaster occurs. The NRHP is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the US Department of the Interior National Park Service. Local and state agencies may consider a broader definition of qualified historic properties in the review, evaluation, and treatment of properties damaged during a disaster.

The State of California Office of Historic Preservation can provide technical rehabilitation and preservation services for historic properties affected by a natural disaster. Depending on the hazard, protection could range from emergency preparedness, developing a fire safe zone around sites susceptible to wildfires, or seismically strengthening or structurally reinforcing structures.

State and local registers of historic resources provide designated Historical Landmarks, Points of Historical Interest, and Historic Buildings. These resources include, but are not limited to:

- The California Register of Historical Resources

- The California Historical Landmarks
- The California Inventory of Historical Resources
- The California Points of Historical Interest

Historical Resources designated on a federal, state or local level are listed in Table 4-9 below.

Table 4-9 Calaveras County Historical Resources

SITE/BUILDING	NATIONAL REGISTER	STATE HISTORICAL LANDMARK	CALIFORNIA REGISTER	POINT OF INTEREST	ADDRESS	TOWN
Altaville				√	Town of Altaville	Altaville
Altaville Grammar School	√				125 N. Main Street	Altaville
Angels Camp		√			City of Angels Camp	Angels Camp
Angels Hotel	√	√			Main Street at Birds Way	Angels Camp
Avery Hotel-Halfway House				√		Avery
Birthplace of Archie Stevenot		√				Angels Camp
Calaveras County Bank aka Calaveras Meat Market	√				1239 Main Street	Angels Camp
Calaveras County Courthouse	√				Main Street	San Andreas
Calaveritas		√				San Andreas
California Caverns at Cave City		√				San Andreas
Camanche		√				Burson
Campo Seco		√				Camp Seco
Carson Hill		√				Angels Camp
Chili Gulch		√				Mokelumne Hill
Choy, Sam, Brick Store (Angels Camp Jail)	√				Bird Way	Angels Camp
Congressional Church		√				Mokelumne Hill
Copperopolis		√				Copperopolis

SITE/BUILDING	NATIONAL REGISTER	STATE HISTORICAL LANDMARK	CALIFORNIA REGISTER	POINT OF INTEREST	ADDRESS	TOWN
Copperopolis Armory	√				695 Main Street	Copperopolis
Courthouse of Calaveras County, 1852-1866 and Ledger Hotel		√			Main Street	Mokelumne Hill
Copperopolis Congregational Church aka Copperopolis Community Center	√				411 Main Street	Copperopolis
Dorrington Hotel and Restaurant				√		Dorrington
Double Springs		√				Valley Springs
Douglas Flat		√				Douglas Flat
Douglas Flat School					Northeast of Vallecito on SR 4	Douglas Flat
El Dorado		√				Mountain Ranch
Fourth Crossing		√				San Andreas
Glencoe Mosquito Gulch		√				Glencoe
Honigsberger Store aka Calaveras Copper Mining Company Warehouse	√				665 Main Street	Copperopolis
I.O.O.F. Hall		√			Center Street	Mokelumne Hill
Jenny Lind		√				Valley Springs
Jesus Maria		√				Mokelumne Hill
Mercer Caverns (The New Calaveras Cave)				√		Murphys
Milton		√				Milton
Mitchler Hotel		√				Murphys
Mokelumne Hill		√				Mokelumne Hill
Murphys						

SITE/BUILDING	NATIONAL REGISTER	STATE HISTORICAL LANDMARK	CALIFORNIA REGISTER	POINT OF INTEREST	ADDRESS	TOWN
Murphys Grammar School	√				Jones Street	Murphys
Murphys Hotel aka Mitchler Hotel	√				Main and Algiers Streets	Murphys
O'byrne Ferry		√				Copperopolis
Old Mining Camp of Brownsville		√				Murphys
Paloma		√				Mokelumne Hill
Peter L. Traver Building		√				Murphys
Pioneer Cemetery		√				San Andreas
Prince-Garibardi Building		√				Altaville
Railroad Flat		√				Railroad Flat
Red Brick Grammar School		√				Altaville
Reed's Store aka Copperopolis Copper Mining Company Office	√				679 Main Street	Copperopolis
Robinson's Ferry		√				Angels Camp
San Andreas		√				San Andreas
Sandy Gulch		√				West Point
Stone Corral		√				Valley Springs
Synder, John J., House aka. Snyder House					247 W. St. Charles Street	San Andreas
Telegraph City Site, Napoleon, and Quail Hill Mines				√		Copperopolis
Thorn House					87 E. St. Charles Street	San Andreas
Utica Mansion aka Charles D. Lane Mansion					1103 Bush Street	Angels Camp
Vallecito		√				Vallecito
Vallecito Bell Monument		√				Vallecito

SITE/BUILDING	NATIONAL REGISTER	STATE HISTORICAL LANDMARK	CALIFORNIA REGISTER	POINT OF INTEREST	ADDRESS	TOWN
Valley Springs District		√				Valley Springs
West Point		√				West Point

Source: California Office of Historical Preservation 2023. Available at: http://ohp.parks.ca.gov/ListedResources/?view=county&criteria=5

Lists of designated historical resources change periodically, and they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Cultural resources defined in California Environmental Quality Act (CEQA) Section 15064.5 include prehistoric and historic archeological resources; historic-period resources (buildings, structures, areas, places, or objects). Archeological resources reflect past human activity extending from Native American prehistoric cultures throughout the early 20th century. The artifacts left by previous occupants may be encountered in small to large residential sites, or special use areas.

Many cultural and historical resources in the County are vulnerable to several hazards due to their location and the nature of their construction. Some of these risks include earthquakes, wildfires, or adverse weather.

4.3.4 Growth and Development Trends

According to the US Census data, Calaveras County's population has been steadily increasing in the past five decades, despite almost no change between 2010 and 2020. Table 4-10 below shows the County's population and population change on a 10-year basis since 1980.

Table 4-10 US Decennial Census for Calaveras County (1980 – 2020)

YEAR	1980	1990	1980-1990 CHANGE	2000	1990-2000 CHANGE	2010	2000-2010 CHANGE	2020	2010-2020 CHANGE
Population	20,710	31,998	54.5%	40,554	26.7%	45,578	12.4%	45,292	-0.6%

Source: US Decennial Census

Table 4-11 below shows the population projections for the County compiled by the DOF. Based on the projection data, the County's future population will be fluctuating without a significant increase or decrease.

Table 4-11 Calaveras County Population Projection

YEAR	2020	2030	2020-2030 CHANGE	2040	2030-2040 CHANGE	2050	2040-2050 CHANGE	2060	2050-2060 CHANGE
Population	45,292	44,919	-0.8%	44,860	-0.01%	43,941	-2.0%	44,106	0.4%

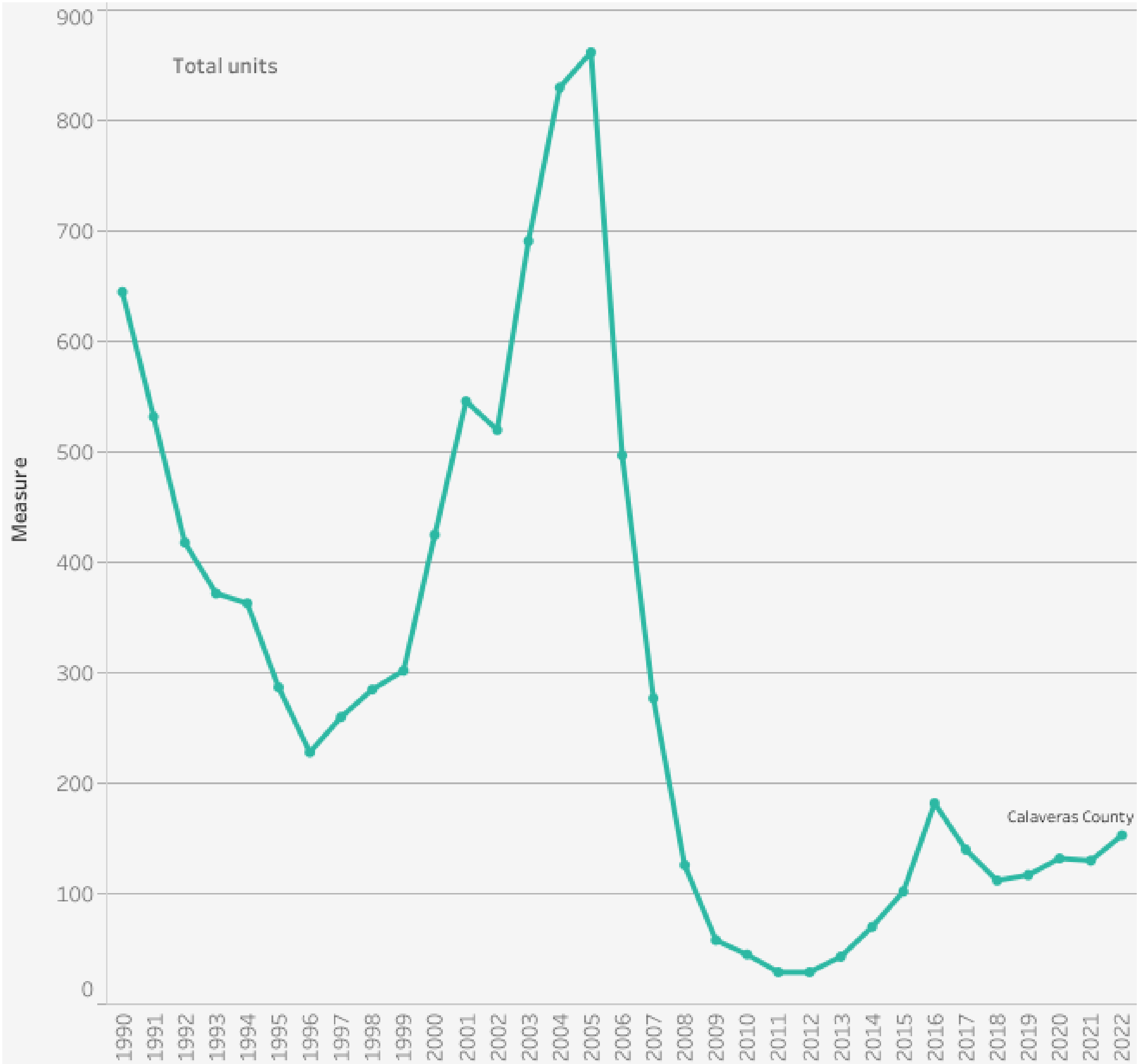
Source: Department of Finance, July 2021

As mentioned in the 2019 Calaveras County General Plan Land Use Element, Calaveras County's communities lie primarily along the historic routes of Highways 49 and 12. These include Mokelumne Hill, San Andreas, Valley Springs, and the incorporated City of Angels Camp. State Route (SR) 4 is the only trans-Sierra route in the County and along it lies Copperopolis, Murphys, and Arnold. Other smaller communities include Wallace and Burson in the western end of the County, West Point, Wilseyville, and Mountain Ranch in the north-central part, and Avery and Dorrington on Highway 4. The Element also mentions that since the economic collapse of 2007-2008, new construction has been stagnant, with the County experiencing a population decline for several years.

In 2018 Calaveras County had a population of approximately 45,155 people according to the California DOF and as of January 2023 the County had a population of approximately 44,890 people, which represents a 0.6% decline in population since the previous plan update (DOF 2020). However, while population has generally decreased in the County, according to the U.S. Census Bureau Building Permit Survey there has been new privately owned housing unit authorizations since 2018. The U.S. Census Bureau Building Permit Survey provides information and local statistics on new privately-owned residential construction. Figure 4-4 displays the new privately-owned housing unit authorizations by year in Calaveras County. The U.S. Census Bureau data indicates that there was a gradual increase in housing units since 2018 from 112 units in 2018 to 153 units in 2023, which could indicate an increase in the total number of buildings exposed to hazard events.

CCWD does not have exact numbers of population served but uses a general rule of thumb of 2.75 persons per water connection in Jenny Lind and Copper Cover and 2.5 persons per water connection in Ebbetts Pass and West Point. The persons per connection data is based on the U.S. Census for Calaveras County and the California DOF data. Based on the 2018 LHMP update there were 13,075 municipal connections in the CCWD's service area, in 2022 there were 13,219 connections, and as of 2023 there are 13,359 connections (Kelly 2023). This represents a 2.1% increase in new connections for water service.

Figure 4-4 New Privately Owned Housing Unit Authorizations in Calaveas County



Source: US Census Bureau, https://www.census.gov/construction/bps/data_visualizations/index.html

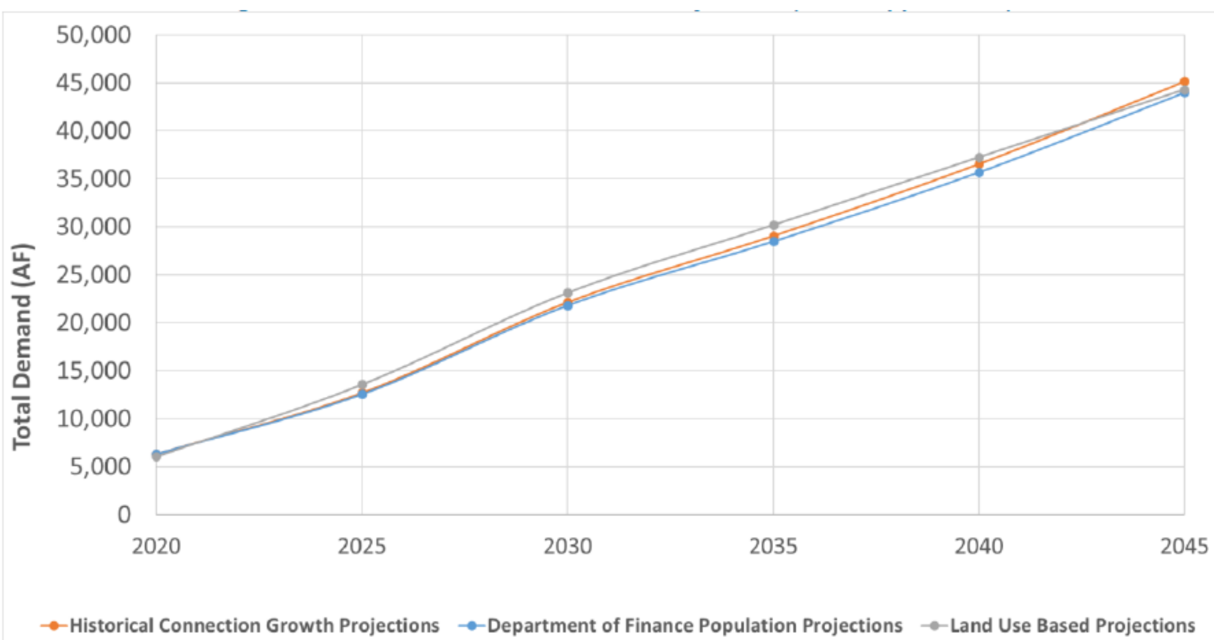
Regarding land use development, the Element also states that land uses are widely distributed throughout the County. Higher density residential, commercial, and industrial uses follow the historical development pattern in and around the existing communities, where infrastructure and services are available, including fire protection services. Areas around these communities have been designated to provide for expansion of commercial, industrial, and residential uses to take advantage of that infrastructure, and to reduce the costs of providing services to a more widely scattered population. Land use policies are intended to encourage development within and nearby existing communities while maintaining their character and economic vitality. However, according to the CCWD, new development has occurred throughout the CCWD's Planning Area over the past 5 years and the 284 new water connections have not been concentrated in any one water system. Residential and commercial development is directed away from the flood zone in Calaveras County based on the land use policies described above, and as a result there has not been any new CCWD facilities built in or near the flood zone or other hazard prone areas.

The CCWD has also replaced redwood water tanks over the years and hardened several existing lift stations and water system infrastructure to withstand flood, severe weather, and wildfire hazards. Most of the CCWD's service areas fall within areas with high to very high wildfire risk. However, the County has floodplain regulations and defensible space inspection programs in place to minimize new development's vulnerability to specific hazards, such as flooding and wildfire. These plans, programs, and regulations reduce the vulnerability of CCWD's water and wastewater systems to hazards.

4.3.4.1 CCWD Future Water Demand Projection

As noted in the 2020 CCWD UWMP, reviewing water use trends and forecasting future service area demands is critical to the CCWD's planning and water supply management objectives. CCWD has implemented three separate approaches to project future water uses to better prepare for changes to water demands. These approaches are based on: 1) historical connection trends and growth forecasts, 2) future land use projections, and 3) estimated population growth in the service areas. The water use projections also take into account agricultural demands and groundwater considerations. CCWD's total demand projections are shown below in Figure 4-5. As shown in the figure, the total water demand is projected to continue increasing from a bit over 5,000 acre-feet to nearly 45,000 acre-feet in 2045.

Figure 4-5 District-Wide Total Demand Projections (Three Approaches)



Source: CCWD 2020

Table 4-12 below shows the CCWD-wide projected demand by customer sector based on estimated population growth in the service areas. The projected water use will increase through 2045.

Table 4-12 District-Wide Use for Potable and Raw Water – Projected (AFY)

USE TYPE	LEVEL OF TREATMENT WHEN DELIVERED	PROJECTED WATER USE (AF)				
		2025	2030	2035	2040	2045
Single-Family	Drinking Water	2,625	3,012	3,345	4,107	5,741
Multi-Family	Drinking Water	11	11	10	10	10
Commercial	Drinking Water	195	189	183	174	165
Institutional/Governmental	Drinking Water	75	73	70	67	63
Landscape	Drinking Water	182	176	171	162	155
Landscape	Raw Water	215	210	203	193	183
Groundwater Recharge[1]	--					
Agricultural Irrigation[2]	Raw Water	7,730	16,539	22,842	29,145	35,447
Sales/Transfers/Exchanges to Other Agencies	Drinking Water	135	135	134	133	132
Other	Drinking Water	9	9	9	9	9
Losses[3]	--	1,211	1,301	1,370	1,549	1,955
Total		12,388	21,656	28,337	35,548	43,861

NOTES: 1) As a use of the Subbasin, CCWD may be required to participate in some form of groundwater recharge program as part of SGMA compliance; however, future demands associated with such activities are currently unknown. 2) This is a conservative estimate of agricultural demand that the District could serve in the future. CCWD will continue to evaluate the agricultural potential and the impact on demand. 3) Losses were calculated by determining the percent of losses as a total of the demand for FY 2020 and applying that percentage to the projected demand. Losses represent real and apparent losses; 4) California Department of Finance indicates that, between 2020 and 2045, Calaveras County may experience a 4.9% decrease in population.

Source: CCWD 2020

Based on the information in Table 4-12, CCWD's future water demand is projected to increase steadily.

4.3.5 Social Vulnerability

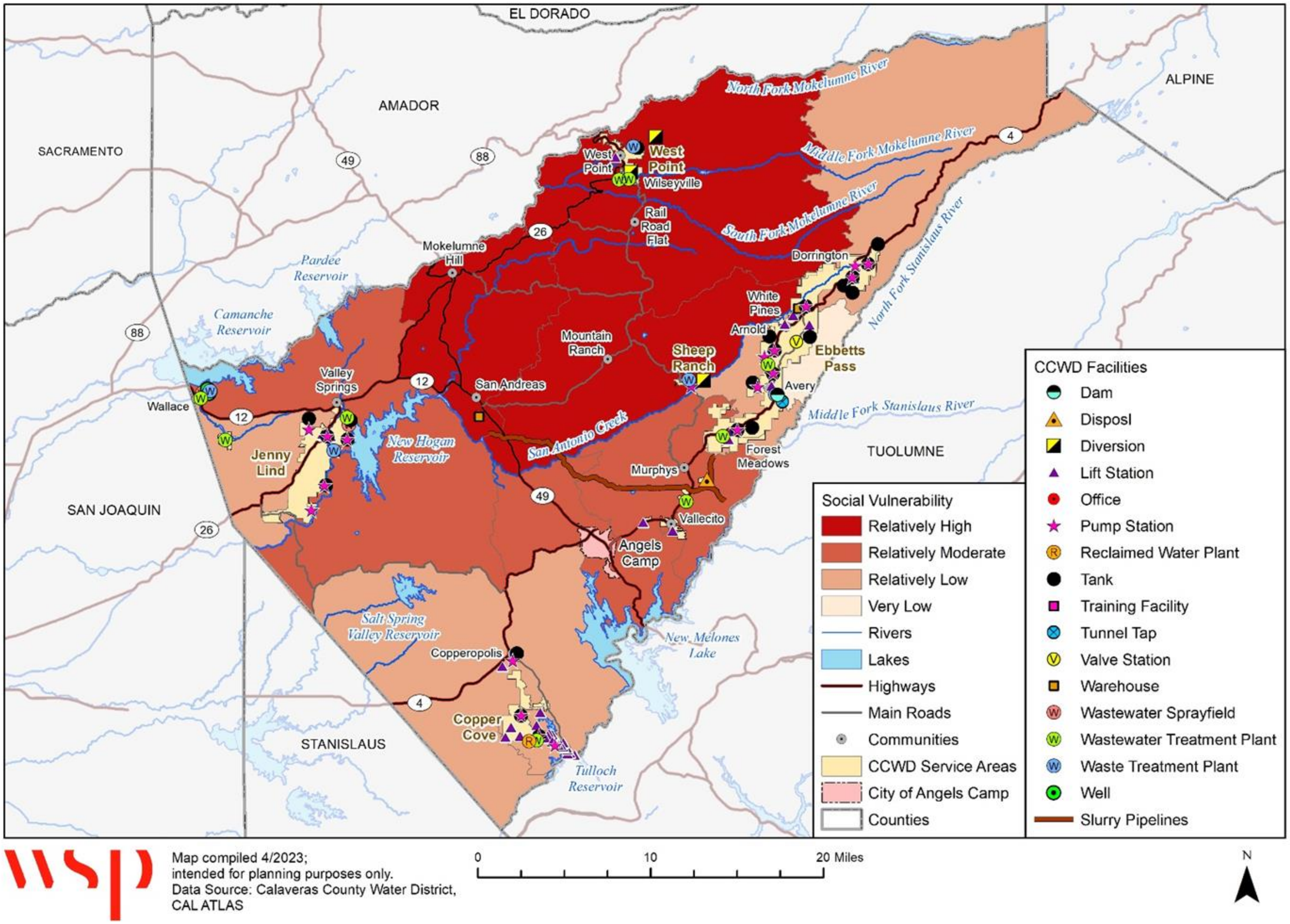
Social vulnerability is broadly defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Social vulnerability is also one of the main three components of calculating FEMA's NRI level. As documented in the March 2023 NRI Technical Documentation, among various social vulnerability indices, the Center for Disease Control Agency for Toxic Substances and Disease Registry (CDC/ATSDR) Social Vulnerability Index (SVI) was selected to be used in the NRI calculation. SVI is a location-specific assessment of social vulnerability that utilizes 16 socioeconomic variables deemed to contribute to a community's reduced ability to prepare for, respond to, and recover from hazards. Examples of these variables include racial & ethnic minority status, no high school diploma, and no health insurance. The comparison of SVI values between counties around Calaveras County allows for a more detailed depiction of variances in risk and vulnerability.

Figure 4-6 below shows the overall social vulnerability of the County according to FEMA NRI and CDC/ATSDR's SVI. The darker the color, the higher social vulnerability the census tract possesses. Several census tracts located in the central and northern portions of the County have relatively high social vulnerability. A few census tracts to the west and south of these relatively high socially vulnerable census tracts have relatively moderate social vulnerability. The rest of the census tracts within the County have either relatively low or very low social vulnerability. None of the County's census tracts have very high social vulnerability; however, CCWD's West Point service area is within a census tract that has relatively high social vulnerability.

Social vulnerability considerations were included in the update of this 2022-2027 plan update to identify areas across the Planning Area that might be more vulnerable to hazard impacts based on many factors. In California, socially vulnerable populations, also referred to as disadvantaged communities (DACs) are mapped through State mapping tools, including but not limited to the California's DWR Mapping Tools (DAC and Economically Distressed Areas [EDAs]) and the California Office of Environmental Health Hazard Assessment's (OEHHA) CalEnviroScreen. FEMA's NRI and DWR's DAC mapping tools are used to identify and assess socially vulnerable populations in CCWD's LHMP update.

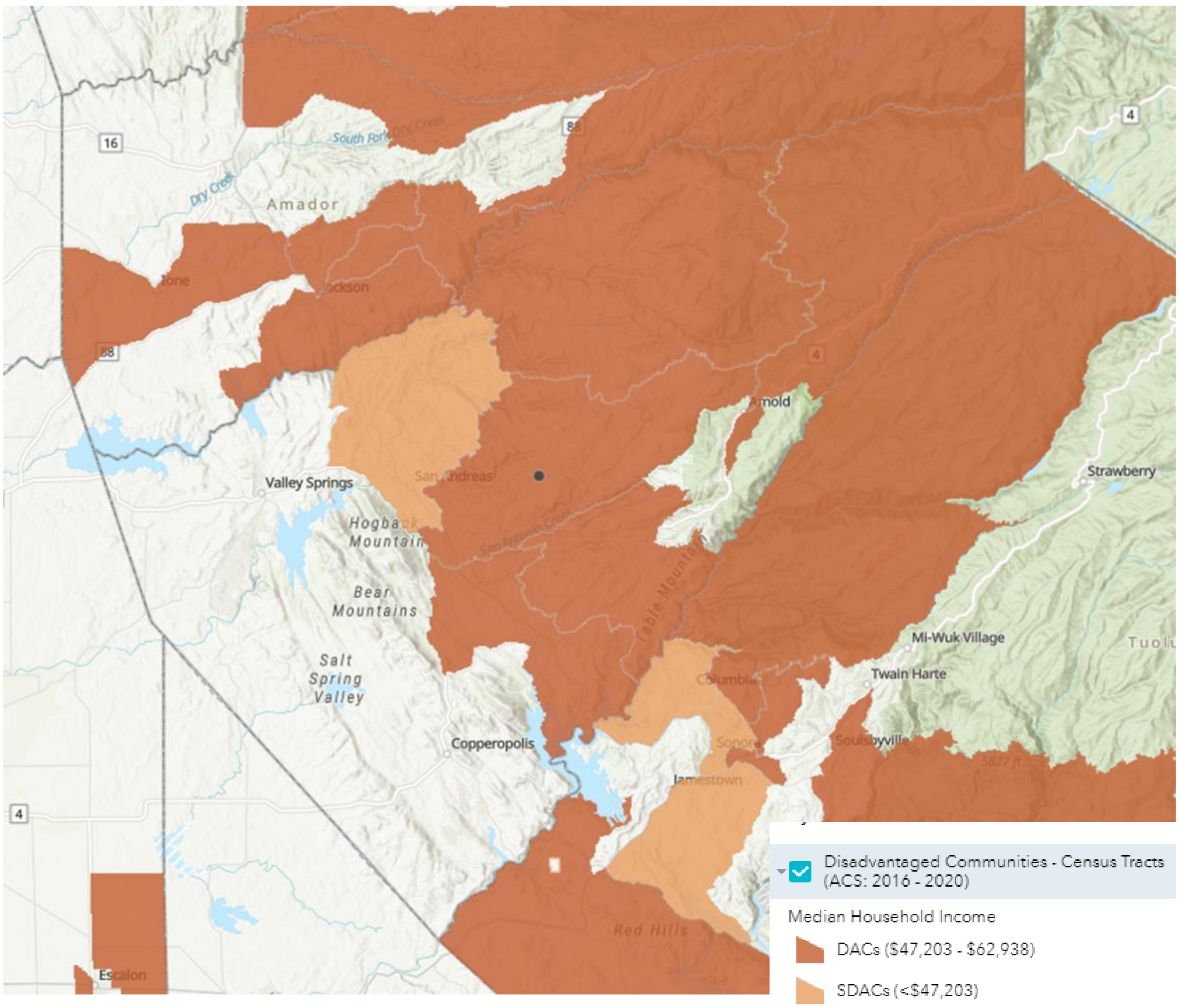
Figure 4-6 Social Vulnerability in Calaveras County – FEMA NRI and CDC/ATSDR SVI



4.3.5.1 DWR DAC Mapping Tool

DWR defines DAC as census geographies with an annual median household income (MHI) that is less than 80% of the statewide annual MHI. In addition, those census geographies with an annual MHI that is less than 60 percent of the Statewide annual MHI are shown as "Severely Disadvantaged Communities" (SDAC). As shown Figure 4-7, nearly all the County's census tracts, except the ones that make up the County's southwestern and western parts, are either DACs or SDACs, Therefore, several portions of the County are considered to be DACs and even EDACs. CCWD's service areas including Ebbetts Pass, Sheep Ranch, and West Point are all located within these vulnerable areas.

Figure 4-7 DACs & EDACs within Calaveras County – DWR DAC Mapping Tool



Source: DWR 2023

4.4 HAZARD PROFILES

Requirement §201.6(c)(2)(i):
[The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.]

The hazards identified in Section 4.2.1 are profiled individually in this section. In general, the information provided by HMPC members is integrated into this section with information from other data sources. These profiles set the stage for the Vulnerability Assessment section of each hazard profile, where the vulnerability is quantified for each of the priority hazards. Given that most disasters that affect the Planning Area are directly or indirectly related to severe weather events, this section begins with a discussion on severe weather hazards, and the individual hazard profiles follow alphabetically.

4.4.1 Avalanche

4.4.1.1 Hazard/Problem Description

An avalanche is a fall, release, or slide of a mass of snow in a sufficient enough amount to cause damage to infrastructure or to threaten the safety of people. Avalanches are possible when weak layers of snow within the cumulative seasonal snowpack fail to support the weight of the snow above and collapse. The result causes the overlying snow to break free and flow downhill. There are two destructive elements at work within an avalanche. Primarily, the actual impact of the displaced snow and ice is a concern. Embedded within the snow, debris such as broken-off trees, branches, and rocks are just as dangerous as the snow itself. Secondly, the avalanche wind, caused by air pushed ahead of the moving mass of snow, can cause additional damage. The effects of an avalanche are confined to the areas within and around the avalanche path.

Avalanches can be triggered by human activity or environmental factors, such as wind loading, precipitation, or warm weather, and they are usually isolated occurrences that happen in the backcountry. The terrain most susceptible to avalanches is typically in sheltered regions of mountains where snow is most prone to accumulate and along steep slope angles ranging from 30 to 45 degrees. The most sheltered aspects in the Sierra Nevada, where snow can most greatly accumulate, are upon north and northeast-facing slopes.

4.4.1.2 Geographic Area

Limited – The majority of avalanches occur during or shortly after storms. This hazard generally affects a small number of people, such as snowboarders, skiers, and hikers, who venture into backcountry areas during or after winter storms. Roads and highway closures, damaged structures, and the destruction of forests are also a direct result of avalanches. The combination of steep slopes, abundant snow, weather, snowpack, and an impetus to cause movement creates avalanches. Areas prone to avalanche hazards include hard-to-access areas deep in the backcountry within Calaveras County, and the extent of these hazards may be most common in areas along Highway 4 near Ebbetts Pass. CCWD facilities along Highway 4 include pump stations, valve stations, and tanks in Dorrington and Arnold, disposal, wastewater treatment plan and lift station near Murphys, as well as tank and pump stations near Copperopolis. There are also several

CCWD facilities near West Point along SR 26. However, none of these facilities are located in remote areas near the backcountry, nor near known or potential avalanche hazard areas. Avalanche hazards exist in eastern Calaveras County where combinations of the above criteria occur. No spatial data was available to map potential avalanche areas within the County.

4.4.1.3 Extent (Magnitude and Severity)

Limited – The North American Public Avalanche Danger Scale shown below in Figure 4-8 is a system that rates avalanche danger and provides general travel advice based on the likelihood, size, and distribution of expected avalanches. It consists of five levels, from least to highest amount of danger: 1 – Low, 2 – Moderate, 3 – Considerable, 4 – High, 5 – Extreme. Danger ratings are typically provided for three distinct elevation bands. Although the danger ratings are assigned numerical levels, the danger increases exponentially between levels. In other words, the hazard rises more dramatically as it ascends toward the higher levels on the scale.

Figure 4-8 North American Public Avalanche Danger Scale

North American Public Avalanche Danger Scale

Avalanche danger is determined by the likelihood, size, and distribution of avalanches.
Safe backcountry travel requires training and experience. You control your risk by choosing when, where, and how you travel.

Danger Level	Travel Advice	Likelihood	Size and Distribution
5 - Extreme	**Extraordinarily dangerous avalanche conditions.** Avoid all avalanche terrain.	Natural and human-triggered avalanches certain.	Very large avalanches in many areas.
4 - High	**Very dangerous avalanche conditions.** Travel in avalanche terrain not recommended.	Natural avalanches likely; human-triggered avalanches very likely.	Large avalanches in many areas; or very large avalanches in specific areas.
3 - Considerable	**Dangerous avalanche conditions.** Careful snowpack evaluation, cautious route-finding, and conservative decision-making essential.	Natural avalanches possible; human-triggered avalanches likely.	Small avalanches in many areas; or large avalanches in specific areas; or very large avalanches in isolated areas.
2 - Moderate	**Heightened avalanche conditions on specific terrain features.** Evaluate snow and terrain carefully; identify features of concern.	Natural avalanches unlikely; human-triggered avalanches possible.	Small avalanches in specific areas; or large avalanches in isolated areas.
1 - Low	**Generally safe avalanche conditions.** Watch for unstable snow on isolated terrain features.	Natural and human-triggered avalanches unlikely.	Small avalanches in isolated areas or extreme terrain.

Source: Avalanche.Org

Avalanches are extremely destructive if they cross highways or railway systems impeding the path of vehicles or trains and potentially injuring or killing the occupants. The impact pressure of an avalanche ranges from relatively harmless blasts of powder-snow clouds, to a dense and highly destructive mix of snow and debris capable of destroying reinforced concrete structures. Engineers determine what type of mitigation method should be utilized based on possible impact pressure calculations in the runout zone, which is shown in Table 4-13.

Table 4-13 Avalanche Impact Pressure Related to Damage

IMPACT PRESSURE		POTENTIAL DAMAGE
kPa	lbs/ft²	
2-4	40-80	Break windows
3-6	60-100	Push in doors, damage walls, roofs
10	200	Severely damage wood frame structures
20-30	400-600	Destroy wood frame structures, break trees
50-200	1000-2000	Destroy mature forests
>300	>6000	Move large boulders

Source: FEMA

As mentioned in the Past Occurrences section, only a few occurrences of avalanche incidents that happened within the County were recorded. However, during the 2022-2023 plan update, the HMPC mentioned that avalanche events can damage water infrastructure and Northern California Power Agency (NCPA) hydropower infrastructure, which is owned but not operated by CCWD. Avalanche events can also impact water quality. CCWD's facilities are also not located in avalanche-prone areas. Therefore, a Limited rating is assigned for magnitude and severity. Potential avalanche events can also block water transport to New Spicer Meadow Reservoir, McKay's Point Diversion Dam, and the North Fork Diversion Dam, impacting hydroelectric power from the North Fork Stanislaus River Project.

4.4.1.4 Past Occurrences

Historically, avalanches occur in California between December and March, following snowstorms. Although avalanches have occurred on slopes of many angles, they most often occur on slopes ranging between 30 degrees and 45 degrees, as mentioned above. Therefore, ski resorts, residences, roads, businesses, and other structures and activities in these areas are vulnerable.

The NCEI shows two past occurrences of avalanches in the County, which did not result in any fatalities/injuries or property/crop damage. Most of the events listed in the NCEI database occurred near Lake Tahoe and Donner Pass (i.e., Interstate 80). The HMPC noted that no avalanches have affected the District. Details on these two past occurrences are as follows:

- **January 19-20, 1999:** On 01/19/99 and 01/20/99, portions of Highway 50 were closed in both directions due to multiple avalanches.
- **December 24, 2012:** A series of pacific storms tracked across Northern California bringing periods of moderate to heavy snow in the mountains and gusty winds. Low snow levels brought snow as low as 500 ft before snow levels rose to 3000 to 4500 ft by the weekend. Significant rainfall was brought to the lower elevations. Winds gusted up to 40-55 mph in the Northern, Central, and Southern Sacramento Valley, as well as the northeast foothills and northern Sierra Mountains, on December 23rd. These winds caused an estimated 10,000 to 30,000 power outages and also resulted in downed trees and tree branches.

Probability of Future Occurrence

Occasional – there have been two occurrences of avalanche recorded in the County during a 28-year period, which equates to a 7% chance of an avalanche event in any given year, or in other words, one avalanche event every 14 years. On the other hand, based on the location of CCWD facilities and according to the HMPC, avalanche events are unlikely to affect CCWD facilities in the future. The likelihood and nature of future avalanches in the County, which encompasses CCWD's service area, may be affected by climate change due to increased precipitation variability in the Sierra Nevada. Refer to the Climate Change Considerations section for more details.

4.4.1.5 Climate Change Considerations

As winters become shorter, the potential for weak snow accumulations at the bottom of the snowpack increases. As snow piles on top of the weak layer, and temperatures remain warm, the upper, moisture-laden layers become vulnerable to sliding. More extreme precipitation events that deposit large amounts of snow in a short period may also increase the potential for recurrent large avalanches. Research suggests that with ongoing climate change, the characteristics of avalanches may change, affecting the rates of avalanche burial and survival (Strapazzon et al 2021). With a wetter and warmer snow climate, the consequences of burial may become more severe. Higher snow densities in avalanche debris may interfere with the respiration of completely buried victims, and blunt trauma and secondary injuries may become more frequent as snow cover becomes thinner (Strapazzon et al. 2021).

4.4.1.6 Vulnerability Assessment

Property

Avalanches can damage homes, buildings, and other infrastructure, resulting in significant repair costs. This can include damage to roofs, windows, siding, fences, and other structures.

People

Backcountry recreationists and road crews are the most at risk of avalanche dangers. Rising numbers of outdoor enthusiasts may lead to an increase in fatal avalanche occurrences. Beyond backcountry skiing, there has been a growing interest in other forms of recreation, and an introduction of new recreation equipment like snowmobiles that are bigger, heavier, and intensify avalanche susceptibility. Avalanche risks may also intensify when there is weak snow accumulation at the bottom of the snowpack and temperatures remain warm making the upper layers of the snowpack more vulnerable to sliding. Climate change may increase the potential for these weak snow layers to develop if extreme and warmer precipitation events result in considerable snowfall in a short period of time that is followed by warm rain-on-snow events. The key actions to limiting impacts to individuals recreating in hazardous areas include spreading knowledge and awareness of the hazard and being properly equipped for self-rescue, if necessary, with tools such as locater beacons, shovels, Geographic Positioning Systems (GPS) units and other communication tools and probes.

Critical Facilities and Infrastructure

Avalanches can cause several types of secondary effects, such as blocking roads, which can isolate residents and businesses and delay commercial, public, and private transportation. Other potential problems resulting from avalanches are power and communication failures. It is unlikely that there are critical facilities exposed to avalanche hazards, although there may be some facilities, in particular, the possibility of disruption to the electrical grid network. Avalanche events may also intensify in size and scale because of climate change, and if weak layers develop, subsequent warmer and wetter snow accumulation that is heavier has the potential to increase avalanche risk.

Economy

As mentioned above, avalanches can damage homes, buildings, and other infrastructure, resulting in significant repair costs. Avalanche hazards can also disrupt business operations, causing lost revenue and profits. Moreover, if someone is caught in an avalanche, search and rescue operations can be costly. This can include the cost of personnel, equipment, and other resources needed to locate and rescue individuals. Moreover, avalanche activity inside or outside the County's avalanche-prone areas can disrupt transportation into and out of the local communities, which could result in temporary economic impacts. Closures of transportation routes could prevent the import and export of goods and services.

Historic, Cultural, and Natural Resources

Avalanches are a natural event, but they can negatively affect the environment, including trees located on steep slopes. A large avalanche can knock down many trees and kill the wildlife that lives in and under them. In spring, this loss of vegetation in the mountains may weaken the soil, causing landslides and mudflows. If significant woody debris reaches the valley bottoms, it could also cause a potential for ponding and flooding.

The impact on historic or cultural resources would be similar to avalanche hazard's impact on general properties. However, the exact damage should be evaluated on a case-by-case basis, for example, worn-out structures are more prone to potential damage from avalanche and heavy snow hazards.

4.4.1.7 Development Trends

New critical facilities should be built to withstand potential avalanche impact if built within avalanche-prone areas. As CCWD's Planning Area increases in population, the number of people and housing developments exposed to the hazard increases. Property education on knowledge and awareness of the hazard can reduce the increased vulnerability.

4.4.1.8 Risk Summary

- None of CCWD's facilities are located in remote areas near the backcountry, nor near known or potential avalanche hazard areas.
- Avalanche hazards exist in eastern Calaveras County where combinations of the above criteria occur.
- Two historical avalanche events were recorded.

- Avalanches can cause several types of secondary effects, such as blocking roads and power and communication failures.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Limited	Occasional	Limited	Low

4.4.2 Dam Failure

4.4.2.1 Hazard/Problem Description

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 and fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failures can also result from any one or a combination of the following causes:

- Earthquake;
- Inadequate spillway capacity resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity;
- Improper design;
- Improper maintenance;
- Negligent operation; and/or
- Failure of upstream dams on the same waterway.

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 on 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 on 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.

Controlled release or spillway flooding – Spillways are designed to relieve pressure on dams and prevent dam failures. Flooding downstream often results when spillways flow, though the potential for flooding as a result of discharge from dam outlet structures can also result from excessive rain events. However, controlled releases of water from dams are a measure that can prevent or minimize spillway flooding or structure failure, by regulating capacity in a managed way. Even controlled releases can lead to unwanted or unpredicted flooding, depending on environmental and weather conditions, or even human error.

In general, there are three types of dams: concrete arch or hydraulic fill, earth-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 and then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach: the downstream flood wave will build gradually to a peak and then decline until the reservoir is empty. And a concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

4.4.2.2 Geographic Area

Significant – According to the California DWR Jurisdictional Dams and the National Inventory of Dams (NID) database, there are 29 dams of concern to Calaveras County. All these 29 dams are located within Calaveras County. Table 4-14 lists the high and significant hazard dams within Calaveras County. Dams that are owned by CCWD are bolded.

Table 4-14 High and Significant Hazard Dams in Calaveras County

DAM NAME	NID HAZARD RATING	CA DSOD HAZARD RATING	RIVER	COUNTY	NEAREST CITY/DISTANCE	MAX STORAGE (ACRE-FEET)	DAM HEIGHT	DAM OWNER
Copperopolis	High	High	Penney Creek	Calaveras	Copperopolis/ 0.5 miles	225	33	Jon & Angelita Janofsky
CPUD Middle Fork	High	N/A	Middle Fork Mokelumne River	Calaveras	West Point/ 5 miles	2,525	102	Calaveras Public Utility District
Goodwin	High	High	Stanislaus River	Calaveras	Knights Ferry/ 4 miles	1,893	101	Tri-Dam Project
Hunters	High	High	Mill Creek	Calaveras	Arnold/ 4 miles	260	59	Utica Power Authority
Jackson Creek Spillway[1]	High	N/A	Mokelumne River	Amador, Calaveras	Buena Vista/ 4 miles	198,000	37	East Bay Municipal Utility District
Jeff Davis	High	High	Tributary of Wet Gulch Creek	Calaveras	Glencoe/ 3 miles	2,200	114	Calaveras Public Utility District
La Contenta	**High**	**High**	**Tributary of Cosgrove Spring**	**Calaveras**	**Rancho Calaveras/ 2 miles**	**239**	**43**	**Calaveras County Water District**
Murphys Afterbay	High	High	Angels Creek	Calaveras	Murphys/ 1 mile	31	43	Utica Power Authority
Murphys Forebay South	High	High	Angels Creek	Calaveras	Murphys/ 1 mile	60	27	Utica Power Authority
Murphys Forebay West	High	High	Angels Creek	Calaveras	Murphys/ 1 mile	60	67	Utica Power Authority
New Hogan Dam	High	N/A	Calaveras River	Calaveras	Jenny Lind/ 4 miles	317,100	155	Cespk
Pardee	High	Extremely High	Mokelumne River	Amador, Calaveras	Clements/ 20 miles	198,000	352	East Bay Municipal Utility District
Pardee South Spillway	High	N/A	Mokelumne River	Amador, Calaveras	Clements/ 20 miles	198,000	10	East Bay Municipal Utility District

DAM NAME	NID HAZARD RATING	CA DSOD HAZARD RATING	RIVER	COUNTY	NEAREST CITY/DISTANCE	MAX STORAGE (ACRE-FEET)	DAM HEIGHT	DAM OWNER
Tiger Creek Afterbay	High	High	North Fork Mokelumne River	Amador, Calaveras	Pioneer/ 5 miles	2,607	120	Pacific Gas and Electric Company
Tulloch	High	Extremely High	Stanislaus River	Calaveras	Knights Ferry / 4 miles	68,400	205	South San Joaquin Irrigation District
Andrew Cademartori	Significant	High	Seasonal Stream	Calaveras	Murphys/ 1 mile	171	80	Union Public Utility District
Ferrario	Significant	High	Tributary of Bear Creek	Calaveras	Wallace/ 3.5 miles	384	25	Robert & Lynn Wilson
Flowers	Significant	High	Little Johns Cr	Calaveras	Oakdale/ 26 miles	1,164	41	Oak Canyon Ranch, LLC
Fly-In-Acres	Significant	Significant	Moran Creek	Calaveras	Avery/ 4 miles	108	41	Blue Lakes Springs Homeowners
Holman	Significant	Low	Tributary of Angels Creek	Calaveras		317	101	City of Angels
Mckays Point Diversion	**Significant**	**High**	**North Fork Stanislaus River**	**Tuolumne, Calaveras**	**Murphys/ 8 miles**	**2,930**	**242**	**Calaveras County Water District**
Murphys Wastewater	Significant	High	Offstream	Calaveras	Arab/ 6 miles	185	24	Murphys Sanitary District
Redhawk Lake	Significant	High	North Fork Calaveras River	Calaveras	San Andreas/ 15 miles	3,160	33	Calaveras Public Utility District
Salt Springs Valley	Significant	Significant	Rock Creek	Calaveras	Milton/ 5 miles	16,250	47	Rock Creek Water District
Skyrocket	Significant	High	Little John Creek	Calaveras	Telegraph City/ 5 miles	1,895	44	Meridian Gold Company
Stevenot	Significant	High	Tributary of Carson Creek	Calaveras	Angels City/ 3 miles	187	70	Sutton Enterprises

DAM NAME	NID HAZARD RATING	CA DSOD HAZARD RATING	RIVER	COUNTY	NEAREST CITY/DISTANCE	MAX STORAGE (ACRE-FEET)	DAM HEIGHT	DAM OWNER
Tanner	Significant	High	Cowell Creek	Calaveras	Sheep Ranch/ 6 miles	214	35	Lake Mont Pines Homeowners
Wallace	Significant	Significant	Tributary of Bear Creek	Calaveras	Wallace/ 0.3 miles	700	29	Wallace Community Services District (now CCWD)
West Point Regulating	**Significant**	**High**	**Ruse Creek**	**Calaveras**	**West Point/ 1.5 miles**	**86**	**36**	**Calaveras County Water District**

Source: NID 2020, DWR 2022

- Note that North Fork Hydroelectric Project facilities (e.g., North Fork Diversion Dam, NSM Dam, McKays Point Dam, and Beaver Creek Dam), which are owned by CCWD under FERC Project 2409, are not included in the table above as they are out of the scope of this LHMP update.

There are also dams located outside of Calaveras County that may potentially affect the County. Details of high and significant hazard dams outside the County that may affect the County are shown in Table 4-15.

Table 4-15 High and Significant Hazard Dams That May Affect Calaveras County

NAME	NID HAZARD RATING	CA DSOD HAZARD RATING	COUNTY	DAM OWNER	RIVER	NEAREST CITY	EAP (YES/NO)
Alpine	High	High	Alpine	Northern California Power Agency	Silver Creek	Bear Valley, Alpine	Y
Beardsley	High	High	Tuolumne	South San Joaquin and Oakdale Irrigation District	Middle Fork Stanislaus River	Sonora, Tuolumne	Y
Donnells	High	High	Tuolumne	South San Joaquin and Oakdale Irrigation District	Middle Fork Stanislaus River	Sonora, Tuolumne	Y
Lower Bear	High	Extremely High	Amador	Pacific Gas and Electric	Bear River	Pioneer, Amador	Y
Lyons	High	High	Tuolumne	Pacific Gas and Electric	South Fork Stanislaus River	Long Barn, Tuolumne	Y
New Spicer Meadow	High	High	Tuolumne	Calaveras County Water District	Highland Creek	Big Meadow, Calaveras	Y
Reba	High	High	Alpine	Lake Alpine Water Company	Bloods Creek Tributary	Lombardi, Calaveras	Y
Relief	High	Extremely High	Tuolumne	Pacific Gas and Electric	Summit Creek	Baker Station, Tuolumne	Y
Salt Springs	High	Extremely High	Amador/ Calaveras	Pacific Gas and Electric	North Fork Mokelumne River	Pioneer, Amador	Y
Strawberry	High	High	Tuolumne	Pacific Gas and Electric	South Fork Stanislaus River	Strawberry, Tuolumne	Y
Tabeaud	High	High	Amador	Pacific Gas and Electric	South Fork Jackson Creek – Tributary	Jackson, Amador	Y
Upper Bear	High	N/A	Amador	Pacific Gas and Electric	Bear River	Pioneer, Amador	Y
Upper Blue Lake	High	High	Alpine	Pacific Gas and Electric	Blue Creek	Kirkwood, Alpine	Y

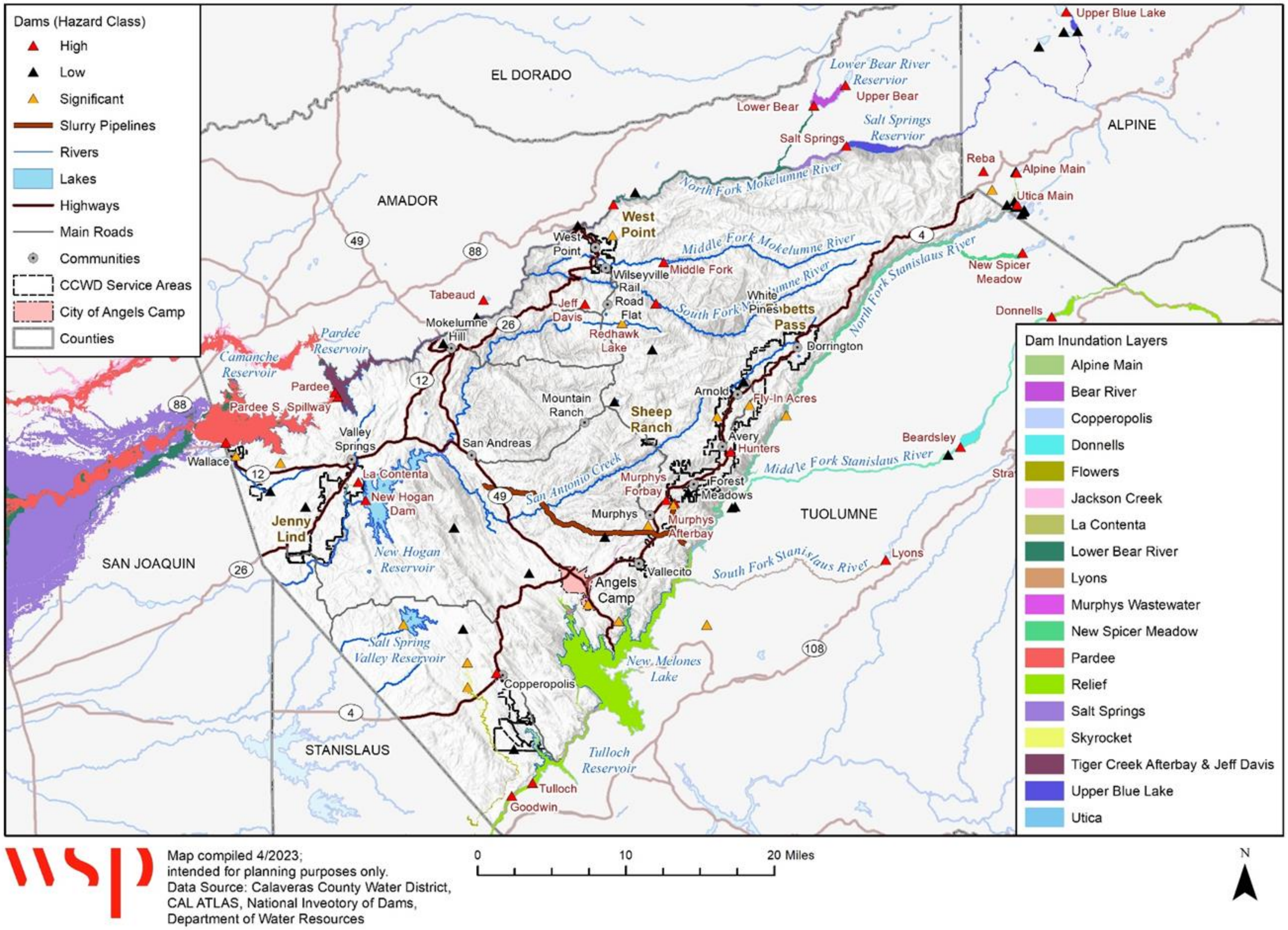
NAME	NID HAZARD RATING	CA DSOD HAZARD RATING	COUNTY	DAM OWNER	RIVER	NEAREST CITY	EAP (YES/NO)
Utica	High	High	Alpine/ Tuolumne	Northern California Power Authority	North Fork Stanislaus – Tributary	Bear Valley, Alpine	Y
Bear River	Significant	Extremely High	Amador	Pac Gas and Electric	Bear River	Kirkwood, Alpine	Y
Bear Valley SH	Significant	High	Alpine	Bear Valley Water District	Tr Bloods Creek	Bear Valley, Alpine	Y
Herring Creek Reservoir	Significant	N/A	Tuolumne	USDA FS	Herring Creek	Oakdale, Stanislaus	Not Required
San Diego Reservoir	Significant	High	Tuolumne	Yosemite Community College District	Tr Mormon Cr	Columbia, Tuolumne	N
Tiger Cr Regulator	Significant	High	Amador	Pac Gas and Electric	Tiger Creek	Pioneer, Amador	Y

NOTE: The Copper Cove and White Pines dams are owned by CCWD, but not listed above because they are rated by NID as Low Hazard.

Source: NID, DWR

Table 4-15 shows where the high and significant hazard dams are located, and the potential inundation areas based on the best available data. It is important to note that the inundation areas shown do not represent all dams that pose a risk; some of this information is not available in GIS or allowed for release in a public document. According to the available inundation data, as shown in Figure 4-9, virtually most areas within Calaveras County would not be inundated if any of the dams of concern to breach, except the areas near New Melones Lake and Tulloch Reservoir, which are to the south of the County, as well as Pardee Reservoir and Camanche Reservoir, which are to the west of the County. These reservoirs then correspond to New Melones, Tulloch, Pardee, Camanche dams. If any of these dams were to breach, the failure could result in property damage and loss of life. Moreover, there are CCWD facilities downstream of dams and some could be damaged in the event of a dam breach. Foremost, are injuries, loss of life, limited transportation routes and a decrease in vital utilities.

Figure 4-9 Dams of Concern to Calaveras County & Best Available Inundation Mapping



4.4.2.3 Extent (Magnitude/Severity)

Critical – Standard practice among federal and state dam safety offices is to classify a dam according to the potential impact a dam failure (breach) or mis-operation (unscheduled release) would have on downstream areas. The hazard potential classification system categorizes dams based on the probable loss of human life and the impacts on economic, environmental and lifeline facilities. The US Army Corp of Engineers (USACE) uses three categories to classify a dam's potential hazard to life and property: (these ratings are shown in Table 4-14 and Table 4-15)

- 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.
- Undetermined hazard dams have not been rated or their hazard rating is not known.

In addition to these, high, significant, and low hazard classifications the California DSOD adds the fourth category of "Extremely High". The DSOD defines this fourth category as "expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more (DSOD 2020)". As shown in Table 4-14 and Table 4-15, six dams – Pardee, Tulloch, Lower Bear, Relief, Salt Springs, and Bear River are classified as "Extremely High". Copperopolis is now rated as High Hazard while it was rated as Significant during the 2018 update. Moreover, during the 2023 update of the LHMP, it is observed that the USACE hazard ratings of a few dams were updated:

- Fly-in-Acres dam is now rated as Significant Hazard, whereas it used to be rated as High Hazard.
- The following dams used to be rated as High or Significant Hazard, however, they are now all rated as low and therefore, are not included in the tables: Cherokee, Copper Cove, Forest Meadows, Hein, Ross, and White Pines. Among these dams, note that Copper Cove and White Pines are owned by CCWD. However, since they are rated by NID as Low Hazard, they are not included in the above tables or figures.

Since the County has several high and significant hazard dams, there is potential for loss of life and property damage. The inundation areas for each of the dams are generally downstream and include large rural and urban areas on the valley floor below the dams. Adjacent jurisdictions could also be affected by a dam failure. The extent of the impact depends on the nature of the failure and the location of the dam. As mentioned previously, the susceptible areas include New Melones Lake and Tulloch Reservoir, which are to the south of the County in the Stanislaus River Watershed, as well as Pardee Reservoir and Camanche Reservoir, which are to the northwest of the County in the Upper Mokelumne River Watershed. These reservoirs then correspond to New Melones, Tulloch, Pardee, Camanche dams. A few urban communities including Mokelumne Hill, Copperopolis and the City of Angels Camp are also potentially at risk.

A severe storm, earthquake or erosion of the embankment and foundation leakage may cause the collapse and structural failure of dams in the County or other nearby counties. Seismic activity may also cause inundation by the action of a seismically induced wave that overtops the dam without causing failure of the dam, but significant flooding downstream. Landslides flowing into lakes and reservoirs may also cause dams to fail or overtop.

4.4.2.4 Past Occurrences

There is a history of dam failure in Calaveras County. In 1895, the Angels Dam collapsed, resulting in one fatality. The cause cited for the failure was flooding that undermined the poorly constructed dam foundation. In 1997, the Don Pedro Dam in neighboring Tuolumne County overtopped, resulting in flooding across a 300-square-mile area that included parts of western Calaveras County. Also, in April of 2006, flooding caused significant damage and threat of failure to a small dam at Peachtree Pond near Valley Springs.

According to the HMPC, other dams and diversion infrastructure (e.g., culverts) have come close to uncontrolled release: New Hogan Dam came close to an uncontrolled release on the spillway in 2006 and some high surface water runoffs that have resulted in damage near White Pines Lake (e.g., road damage, reduced pool volume). On the other hand, the National Performance of Dams Program database hosted by Stanford University only shows a few minor incidents including outlet/valve/flume failure, minor breach, maintenance error, embankment slide, and equipment malfunction events, which did not result in any actual breaching or flooding events.

4.4.2.5 Probability of Future Occurrence

Occasional—With only a couple of previous occurrences, the probability of future occurrence is difficult to accurately estimate for dam failure. Because dam failure is a manmade hazard, the methodology for calculating probability based on past occurrences does not necessarily reflect the actual risk of future occurrence. Another way to estimate future occurrence is to consider the probability of other hazards that are considered causes or contributing factors of dam failure. These include flooding and earthquake, which are classified as likely and unlikely respectively. Based on historical conditions and input from the HMPC, a primary concern of the Planning Area is not just a dam failure, but heavy rains and flooding causing flood control gates to be opened, resulting in uncontrolled releases that could cause substantial damage in the County.

4.4.2.6 Climate Change Considerations

UC Davis researchers discussed the effects of climate change on reservoir operations in a journal published in 2014 (Rheinheimer and Viers 2014). This journal and other relevant studies imply that climate change will impact the traditional operation measures and flow regimes used for dams because river conditions and water levels will fluctuate due to climate change. For example, climate change may worsen drought conditions, which lessen the water available while climate change can also produce intense sudden storms that cause water levels to suddenly increase. Therefore, reservoir operators may need to change operations to mitigate climate change’s impact on rivers and overall water levels (Rheinheimer and Viers 2014).

However, the potential for climate change to affect the likelihood of dam failure is not fully understood now. With a potential for more extreme precipitation events as a result of climate change, this could lead to large inflows to reservoirs. However, this could be offset by generally lowering reservoir levels if storage water resources become more limited or stretched in the future due to climate change, drought and/or population growth.

4.4.2.7 Vulnerability Assessment

Property

In the unlikely event of a complete dam failure, the susceptible areas in CCWD's Planning Area include New Melones Lake and Tulloch Reservoir, which are to the south of the County, as well as Pardee Reservoir and Camanche Reservoir, which are also to the south of the County. Urban communities including Mokelumne Hill, Copperopolis and the City of Angels Camp are also potentially at risk. Climate change is expected to result in more extreme precipitation events, which will lead to greater inflows to reservoirs, but it would also result in lower reservoir levels during drought years. However, it is important to note that catastrophic failure or flood release of water from multiple dams at a single point in time is considered to be extremely unlikely.

People

Persons located underneath or downstream of a dam are at risk of a dam failure, though the level of risk can be tempered by topography (specifically where populations are located within the inundation path of a dam), amount of water in the reservoir and time of day of the breach. Injuries and fatalities can occur from debris, bodily injury, and drowning. Once a dam has breached, standing water presents all the same hazards to people as floodwater from other sources. People in the inundation area may need to be evacuated, cared for, and possibly permanently relocated. Impacts could include thousands of evacuations and likely hundreds of casualties, depending on the dam involved. Climate change is expected to result in extreme precipitation events, which will lead to greater inflows to reservoirs. However, changes in climate will also result in lower reservoir levels when water supplies are limited, which will offset large inflows from larger precipitation events.

The populations most vulnerable are those that have the least time to evacuate and need assistance. Populations that may need assistance to evacuate include the elderly, disabled and young. The vulnerable population also includes those who may not have an adequate warning to evacuation from emergency notification systems. The loss of life is impacted by the amount of early warning time first responders and the public have prior to the incident.

Critical Facilities and Lifelines

A total dam failure can cause catastrophic impacts to areas downstream of the water body, including critical infrastructure and essential facilities. Dam incidents may result in less severe downstream impacts, depending on the severity of the incident. Any critical asset located under the dam in an inundation area would be susceptible to the impacts of a dam incident. Of particular risk would be roads and bridges that could be vulnerable to washouts, complicating response, and recovery by cutting off impacted areas. The risk to specific facilities could be considered sensitive information, especially those such as water treatment facilities or water delivery systems which may provide potable water for the local population. Many of the critical facilities would also be at greater risk due to climate change since it is expected to result in greater precipitation events and surface water runoff. This runoff could exacerbate downstream impacts to water system infrastructure associated with washouts, in-stream flooding, and streambank erosion around pump stations and other aboveground water facilities.

To assess if any of the CCWD facilities are located within inundation areas, CCWD's critical facilities and infrastructure assets were intersected (GIS spatial overlay) with the dam inundation mapping data that is available for the dams of concern noted in the Geographic Area section. Based on the GIS analysis, a total of seven CCWD-owned facilities are located within dam inundation areas. These facilities are shown in Table 4-16 below. Four out of these seven facilities can potentially be inundated by Relief dam. These facilities have a total replacement value of $ 11,650,000. It is important to note that dam inundation data is not available for all the dams of concern. In addition, 0.09 mile of CCWD's slurry pipeline is also located in dam inundation areas. Note that CCWD's slurry pipeline is used for non-potable irrigation customers. While the impact on slurry pipeline is not zero, the impact would not be as critical as domestic water service areas. This also applies to other similar slurry pipeline analyses in this Plan Update.

Table 4-16 CCWD Facilities Located in Dam Inundation Areas

NAME	CCWD JURISDICTION	DAM OF CONCERN
Jenny Lind Raw Water Intake	Jenny Lind	La Contenta
LIFT STATION 9	Copper Cove	Relief
LIFT STATION 1	Copper Cove	Relief
LIFT STATION 42	Copper Cove	Relief
LIFT STATION 16	Copper Cove	Relief
LS HUCKLEBERRY	Jenny Lind	La Contenta
LS SIX-MILE	Ebbetts Pass	Murphys Wastewater

Source: DWR 2022, NID 2020, WSP GIS Analysis 2023

During the 2022-2023 plan update, the HMPC mentioned that CCWD owns the hydroelectric plant on New Hogan Dam (FERC Project No. 2903), although the plant is operated by Modesto Irrigation District. The plant is, however, located in the inundation area of New Hogan Dam. Therefore, the hydroelectric plant would be inundated if New Hogan Dam were to breach. The HMPC also noted that CCWD's Bear Creek Diversion is located downstream of Wilson Dam and could be inundated if Wilson Dam were to breach.

Economy

Extensive and long-lasting economic impacts could result from a major dam failure including the long-term loss of water in a reservoir after a failure event. A major dam incident and loss of water from the associated reservoir could result in damages and indirect disruption of the local economy. Moreover, if the inundation area includes roads, bridges, or other transportation infrastructure, the disruption to these systems can have a significant impact on the local economy. This can make it difficult for businesses to transport goods and for people to access essential services.

4.4.2.8 Development Trends

Areas slated for future development should take into consideration potential impacts from dam failure risk upstream and should overlay the existing dam inundation maps with proposed future development.

In the case of a dam failure, inundation would likely follow existing FEMA-mapped floodplains, which contain development restrictions for areas in the 1% annual chance floodplain, but it could exceed those floodplains and affect areas that are not regulated for flood hazards. Also, future development below a hazard dam could increase its hazard rating. Finally, added development could compromise dams and reservoir resources if populations depend on them for critical needs such as potable water during or after a dam failure event. Vulnerable populations that rely on these water resources could also be a greater risk if added development compromises the reservoir resources.

4.4.2.9 Risk Summary

- There are 29 dams of concern to Calaveras County located in Calaveras County
- GIS analysis shows that a total of seven CCWD-owned facilities are located within dam inundation areas; Relief dam can inundate four out of these seven dams
- A total dam failure can cause catastrophic impacts to areas downstream of the water body, including critical infrastructure and essential facilities.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Significant	Occasional	Critical	Medium

4.4.3 Drought and Water Shortage

4.4.3.1 Hazard/Problem Description

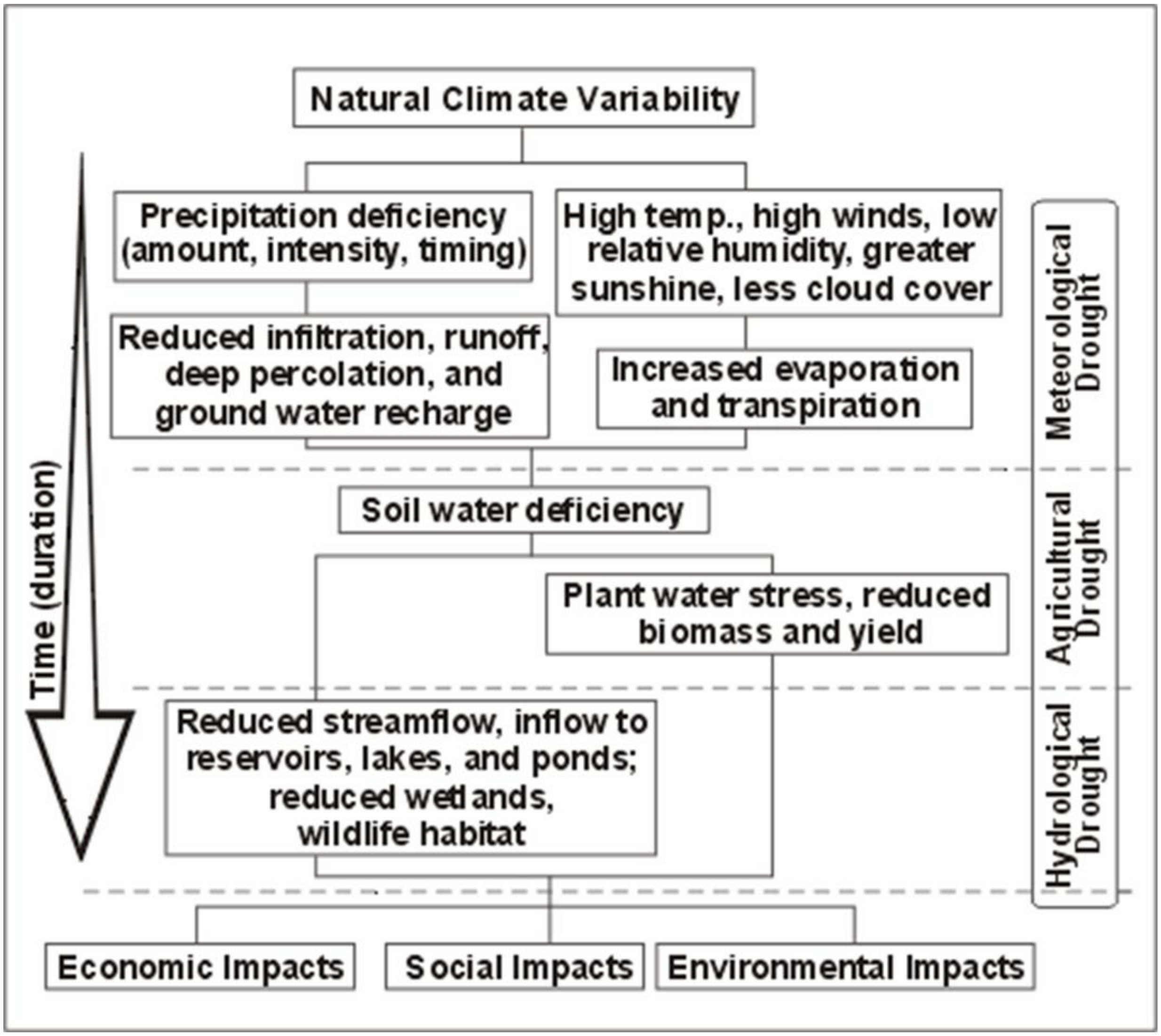
Drought is a gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends.

Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities (see Figure 4-10). 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 there are impacts to health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Figure 4-10 Causes and Impacts of Drought



Source: National Drought Mitigation Center

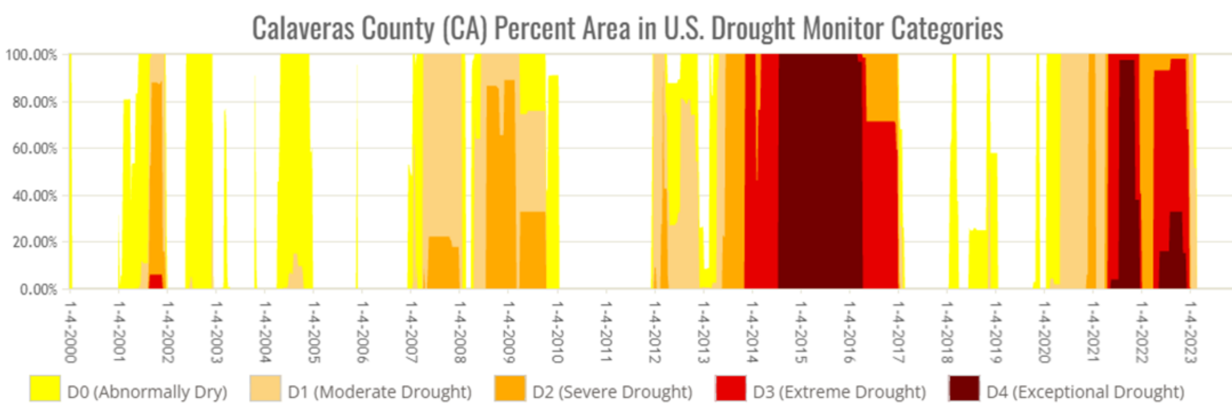
The California DWR says the following about drought:

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

4.4.3.2 Geographic Area

Extensive – Drought in the United States is monitored by the National Integrated Drought Information System. A major component of this portal is the US Drought Monitor. The Drought Monitor was developed jointly by the NOAA's Climate Prediction Center, the NDMC, and the USDA's Joint Agricultural Weather Facility in the late 1990s as a process that synthesizes multiple indices, outlooks, and local impacts, into an assessment that best represents current drought conditions. The outcome of each Drought Monitor is a consensus of federal, state, and academic scientists who are intimately familiar with the conditions in their respective regions. A time series of the drought conditions in California and the Planning Area can be found in Figure 4-11. As shown in this figure, all of Calaveras County has experienced abnormally dry conditions within the last year.

Figure 4-11 Drought Time Series in Calaveras County



Source: US Drought Monitor

4.4.3.3 Extent (Magnitude and Severity)

Critical – Drought impacts are wide-reaching and may be economic, environmental, and/or societal. Drought affects all portions of the County. 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. Also, during a drought, allocations go down, which results in reduced water availability. Voluntary conservation measures are typically implemented during extended droughts. A reduction in electric power generation and water quality deterioration 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.

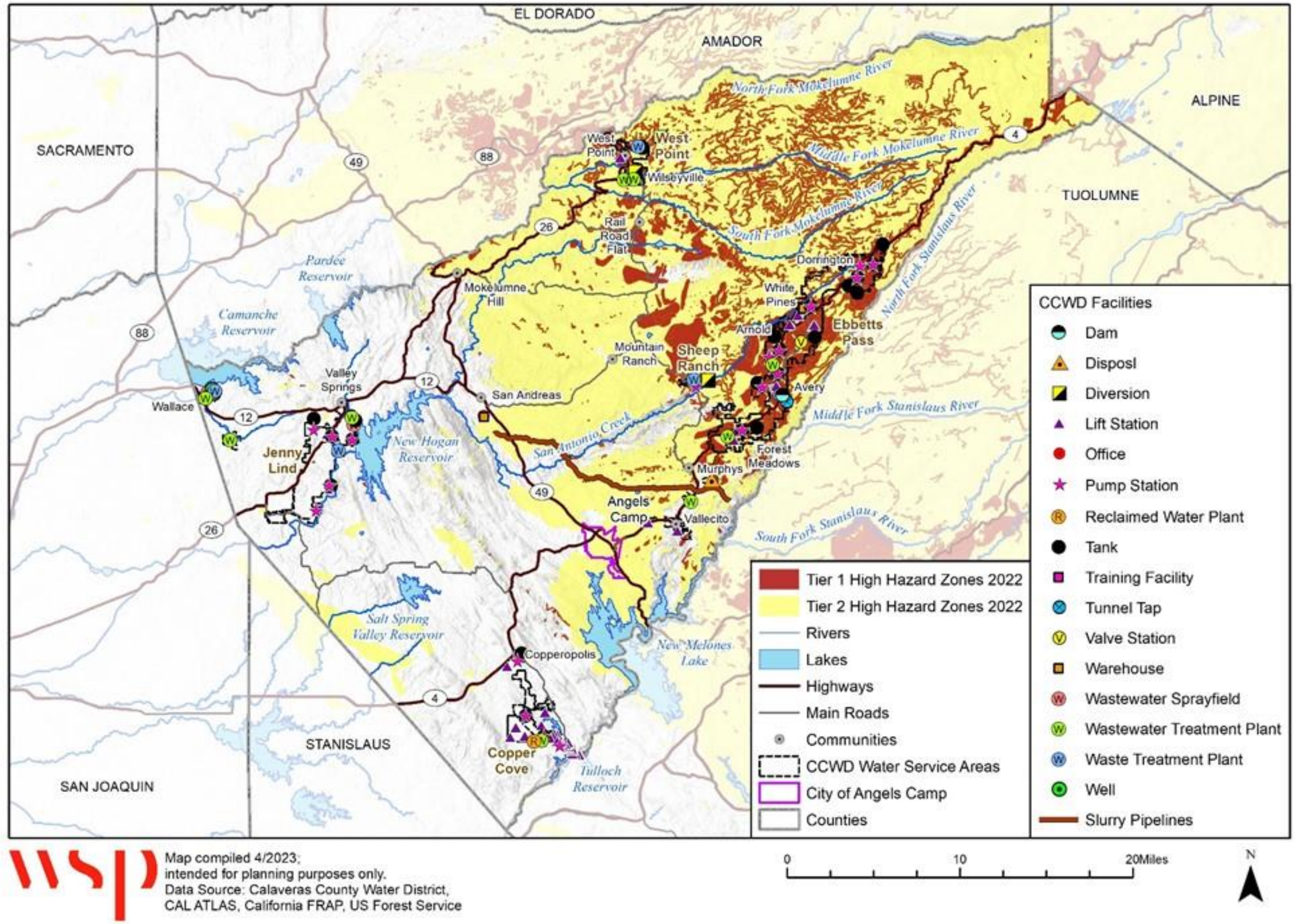
Drought can have secondary impacts. For example, drought is a major determinant of wildfire hazard, in that it creates a greater propensity for fire starts and larger, more prolonged conflagrations fueled by excessively dry vegetation, along with reduced water supply for firefighting purposes. Drought is also an economic hazard. Significant economic impacts on California's agriculture industry can occur because of short- and long-term drought conditions; these include hardships to farmers, farm workers, packers, and shippers of agricultural products. In some cases, droughts can also cause significant increases in food prices to the consumer due to shortages. Drought can also result in a lack of water and subsequent feed available to grazing livestock, potentially leading to the risk of livestock death, and resulting in losses to the State's and Calaveras County's agricultural economy. These indirect impacts on the agricultural industry may mean an increase in water demand by agricultural users in the CCWD's Planning Area.

Tree Mortality

In recent years, due to the multi-year drought throughout the Planning Area and statewide, a vast number of trees have been (and continue to be) impacted in Calaveras County. Standing dead trees could fall and pose a risk to people, buildings, power lines, roads, and other water infrastructure. In addition, drought-impacted trees become susceptible to diseases and insect infestations (i.e., bark beetle) further adding to the risk of tree mortality and related potential impacts.

The location, extent, and probability of occurrence for tree mortality can be viewed as a sub-set to the drought hazard. Those areas of the natural environment susceptible to drought comprise a larger area, since tree mortality is related to other sub-factors specific to the species impacted such as tree age and soil composition. Figure 4-12illustrates the extent of the impact of drought and tree mortality in Calaveras County. The Tier 1 High Hazard Zones (as indicated in red) depict areas where tree mortality directly coincides with critical infrastructure.

Figure 4-12 Drought-Related Tree Mortality in Calaveras County



4.4.3.4 Past Occurrences

California has experienced multiple severe droughts. According to the DWR, droughts exceeding three years are relatively rare in Northern California, the source of much of the State's developed water supply. The 1929-34 drought established the criteria commonly used in designing storage capacity and yield of large northern California reservoirs. Table 4-17 compares the 1929-34 drought in the Sacramento and San Joaquin Valleys to the 1976-77, 1987-92, 2007-09, 2012-16, and 2020-22 droughts.

Table 4-17 Severity of Extreme Droughts in the Sacramento and San Joaquin Valleys

DROUGHT PERIOD	SACRAMENTO VALLEY RUNOFF		SAN JOAQUIN VALLEY RUNOFF	
	(MAF*/YR)	(PERCENT AVERAGE 1901-96)	(MAF*/YR)	(PERCENT AVERAGE 1906-96)
1929-34	9.8	55	3.3	57
1976-77	6.6	37	1.5	26
1987-92	100	56	2.8	47
2007-09	11.2	64	3.7	62
2012-2016	11.6	65	2.8	47
2020-2022	8.9	50	2.7	45

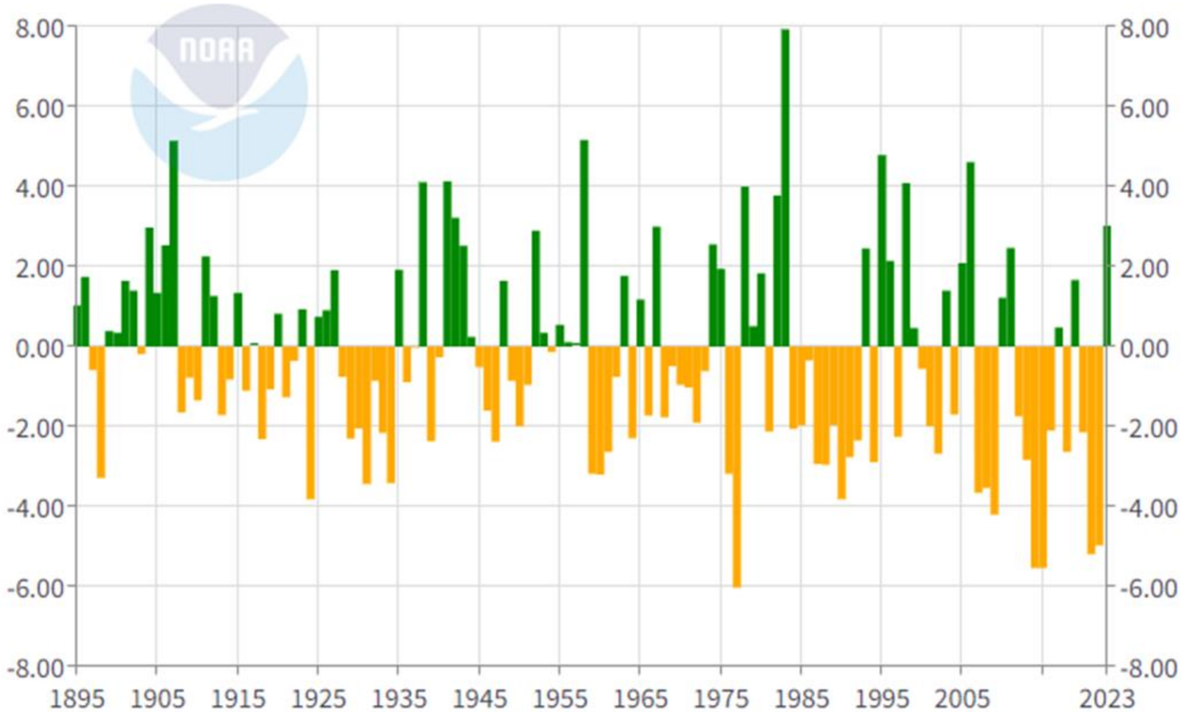
Source: CDEC: WSIHIST (ca.gov)

*maf=million-acre feet

Figure 4-13 depicts the California Palmer Drought Severity Index (PDSI) in April from 1895 to 2023. The Palmer Drought Severity Index (PDSI) is a widely used method to assess drought conditions by measuring the degree of dryness of soils over an extended period. The PDSI takes into account several factors, including temperature, precipitation, and evapotranspiration, to calculate a standardized index of moisture deficiency over time. A positive value indicates a wetter-than-normal condition, while a negative value indicates a drier-than-normal condition. The PDSI is useful for assessing the severity of drought over a wide range of timescales.

The water years of 2020-22 were California's driest three consecutive years in terms of statewide precipitation (Smith 2022). The 2012-14 period marked the second time a statewide proclamation of emergency was issued for drought (DWR 2015).

Figure 4-13 California Palmer Drought Severity Index for April, 1895-2023



Source: California Department of Water Resources, www.water.ca.gov/

Notes: Dry periods prior to 1900 estimated from limited data; covers dry periods of statewide or major regional extent

According to the State of California Hazard Mitigation Plan, the County has experienced two droughts that resulted in a state disaster declaration. The severity of these droughts can be seen in Figure 4-13 above.

On January 17, 2014, the governor declared a State of Emergency for drought throughout California. This declaration came on the heels of a report that stated that California had the least amount of rainfall in its 163-year history. Californians were asked to voluntarily reduce their water consumption by 20 percent. Drought conditions worsened through 2014 and into 2015. The governor directed the State Water Resources Control Board (SWRCB) to implement mandatory water reductions in cities and towns across California to reduce water usage by 25 percent. This savings amounts to approximately 1.5 million acre-feet of water through the end of 2015.

An additional statewide State of Emergency for drought was declared by Governor Gavin Newsom on October 19, 2021. With this declaration, Newsom called for a voluntary 15 percent reduction in water use, and a requirement that urban water suppliers activate Level 2 of their water shortage contingency plans. These provisions were rolled back in March 2023, although some requirements of the declarations, such as those focused on groundwater supply, remain in place.

Data compiled by the USDA displays state and county records of disaster declarations made by the US Secretary of Agriculture. Table 4-18 below identifies the declarations related to Calaveras from 2008-2017.

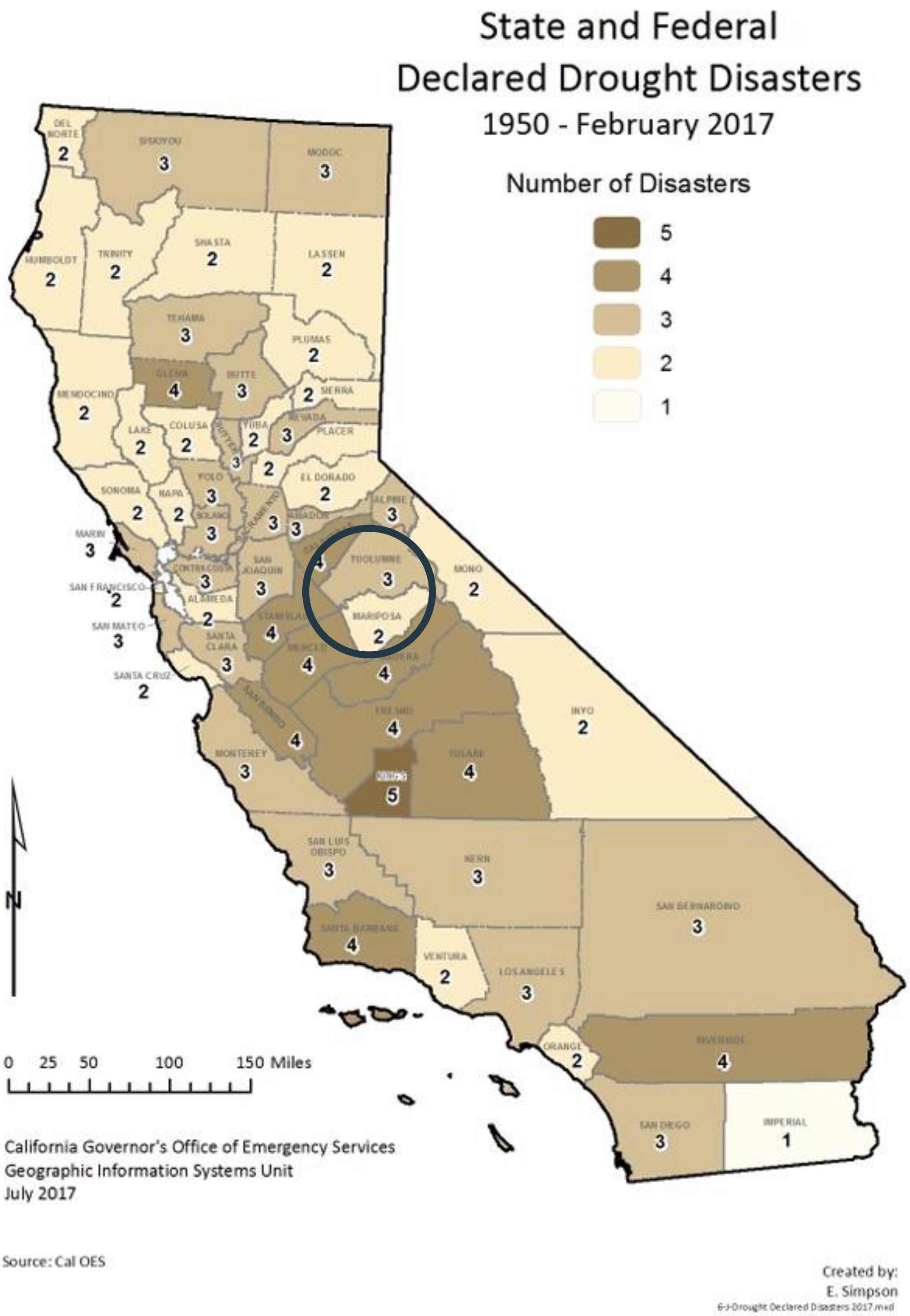
Table 4-18 Calaveras County Secretarial Disaster Designations

DISASTER DESIGNATION	DESIGNATION DATE	DISASTER TYPE	PRIMARY OR CONTIGUOUS COUNTY
S3351	9/22/2012	Drought	Contiguous
S3379	9/5/2012	Drought	Contiguous
S3452	12/29/2012	Drought	Contiguous
S3547	7/3/2013	Drought	Contiguous
S3558	7/31/2013	Drought	Primary
S3569	8/21/2013	Drought	Contiguous
M4158	12/13/2013	Drought	Contiguous
S3626	1/15/2014	Drought	Primary
S3743	9/17/2014	Drought	Primary
S3784	2/4/2015	Drought	Primary
S3952	02/17/2016	Drought	Primary
S4697	6/16/2020	Drought	Primary
S4916	3/5/2021	Drought	Primary

Source: USDA

Figure 4-14 shows declared drought declarations in California between 2012 and 2021.

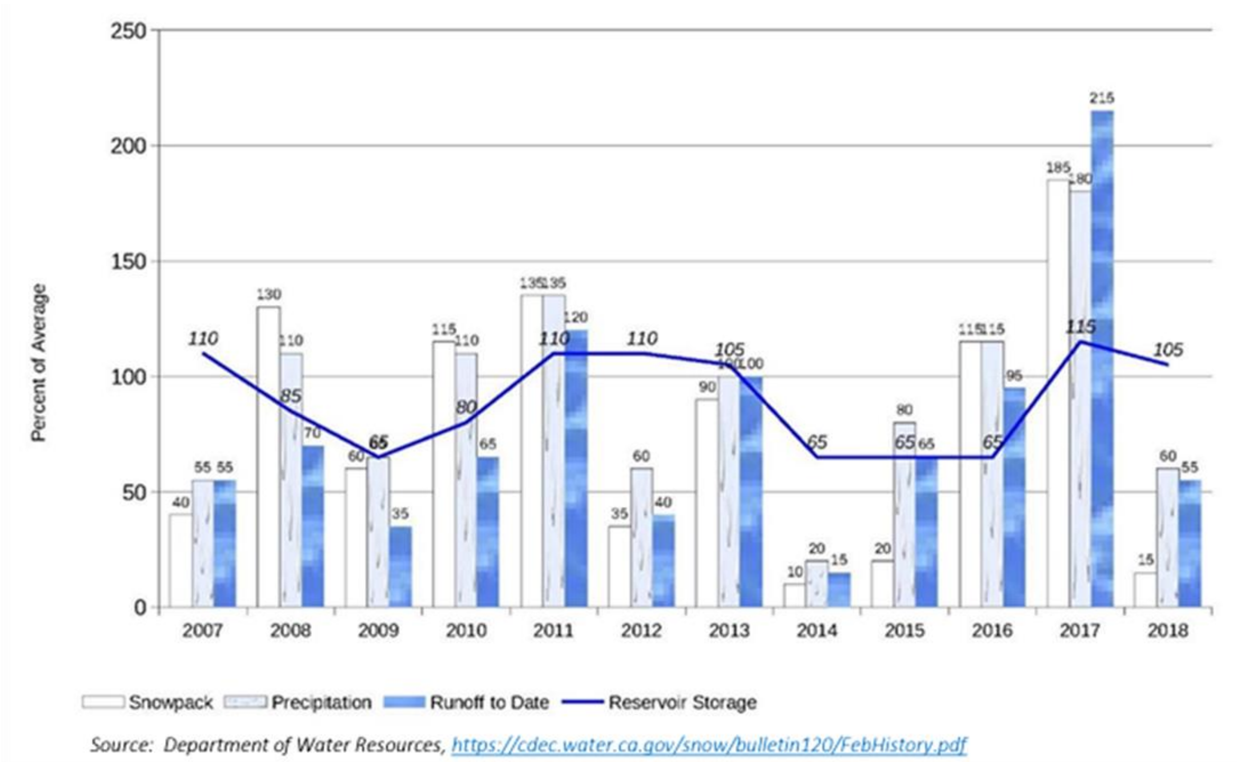
Figure 4-14 Declared Drought Disasters in Calaveras County



Water Shortage

Figure 4-15 illustrates a graph from the 2018 SHMP that shows several indicators commonly used to evaluate water conditions in California. The percent of average values is determined by measurements made in each of the ten major hydrologic regions. The chart describes water conditions in California between 2005 and 2018, illustrating the cyclical nature of weather patterns in Calaveras County.

Figure 4-15 February 1 Statewide Water Supply Conditions, 2005 to 2018



Source: 2013 State of California Hazard Mitigation Plan

Snowpack measurements have been kept in California since 1950, and noticeable deficits occurred in 2012, 2014, and 2018. The previous record for the lowest snowpack level in California, 25 percent of normal, was set both in 1976-77. According to DWR, in "normal" years, the snowpack supplies about 30 percent of California's water needs. With a reduction in water, water supply issues based on water rights become more evident. Some agricultural uses, such as grapes and walnuts, are severely impacted by limited water supply.

Drought and water supply issues will continue to be a concern to the Planning Area. Irrigation of agricultural lands along the County's western slope will also continue to be a concern in the Planning Area. California Title 22 Code of Regulations (CFR) allows for reclaimed water to be applied to vineyards and other agricultural areas; however, transporting reclaimed water from a facility to a field is challenging and can be expensive.

The District's 2020 Urban Water Management Plan (UWMP) addresses drought and water shortage and outlines the District's commitment to reducing the per capita demand of its water customers. To address drought conditions and water supply shortage scenarios, the UWMP outlines the District's multiple water supply sources and water conservation programs (CCWD 2020). The UWMP also determines potential shortages that could occur during a severe drought event, and in some scenarios, considers state-mandated water use restrictions. New regulations also required multiple-year drought shortage planning scenarios to be included in CCWD's 2020 UWMP.

Additionally, the CCWD adopted a comprehensive Water Shortage Contingency Plan (WSCP) on June 23, 2021. Through this resolution, the District revised their previous WSCP to include multiple stages of water conservation measures tied to tiered levels of water use reductions implemented to meet statewide drought planning requirements. The stages of response based on water supply conditions are detailed in Table 4-19 below.

Table 4-19 WSCP Stages, Reductions, and Conditions

STAGE	PERCENT SUPPLY REDUCTION	WATER SUPPLY CONDITION
1: Advisory Stage (Voluntary Conservation)	Up to 10%	The District is generally still able to meet the water demands of its customers in all service areas.
2: Alert Stage (Mandatory Conservation)	Up to 20%	Consumption must be reduced by at least 20% for the District to meet the water demands of its customers. Conservation mandates are applied consistently across service areas regardless of localized conditions.
3: Moderate Stage (Mandatory Conservation)	Up to 30%	Consumption must be reduced by at least 30% for the District to meet the water demands of its customers. Conservation mandates are applied consistently across service areas regardless of localized conditions.
4: Significant Stage (Mandatory Conservation)	Up to 40%	Consumption must be reduced by 40% for the District to meet the water demands of its customers. Conservation mandates are applied consistently across service areas regardless of localized conditions.
5: Critical Stage (Mandatory Conservation)	Up to 50%	Consumption must be reduced by 50% for the District to meet the water demands of its customers. Conservation mandates are applied consistently across service areas regardless of localized conditions.
6: Emergency Stage (Mandatory Conservation)	More than 50%	Stage 6 indicates a catastrophic supply interruption.

Source: 2020 Calaveras County Water Shortage Contingency Plan

Based on the CCWD's Water Supply Projections Report, which provides an overview of hydrologic conditions, available water supplies, and projected demands for the District's water service areas, the available water supplies and contractual rights remain adequate for the District to meet its water service demands in current and subsequent years (CCWD 2023). As noted by the report, the District continues to rely on its reservoir storage systems and contract water supplies at New Spicer Meadow Reservoir for Ebbetts Pass and Copper Cover Service Areas, and the New Hogan Reservoir for Jenny Lind (CCWD 2023).

Vulnerable service areas include Sheep Ranch and West Point. Sheep Ranch relies on water stored in White Pines Lake, which although adequate from volume available, may have issues with releases to diversion facilities downstream if San Antonio Creek is dry. West Point may also be reliant on supplemental water supply purchases for much of the year if Bear Creek diversions become unavailable due to dry conditions and/or SWRCB curtailments (CCWD 2023).

4.4.3.5 Probability of Future Occurrences

Drought

Highly Likely—Historical drought data for Calaveras County indicate there have been 5 significant droughts in the last 86 years. This equates to a drought every 17.2 years on average or a 5.8 percent chance of a drought in any given year.

Water Shortage

Occasional— Recent historical data for water availability indicates that Calaveras County is at risk to both short and prolonged periods of droughts. However, while Calaveras County is at risk to drought conditions, CCWD benefits from several water storage water rights and other sources which should continue to provide adequate water supplies. That said, CCWD will respond to statewide water use efficiency or reduction measures as needed to collectively address drought conditions.

4.4.3.6 Climate Change Considerations

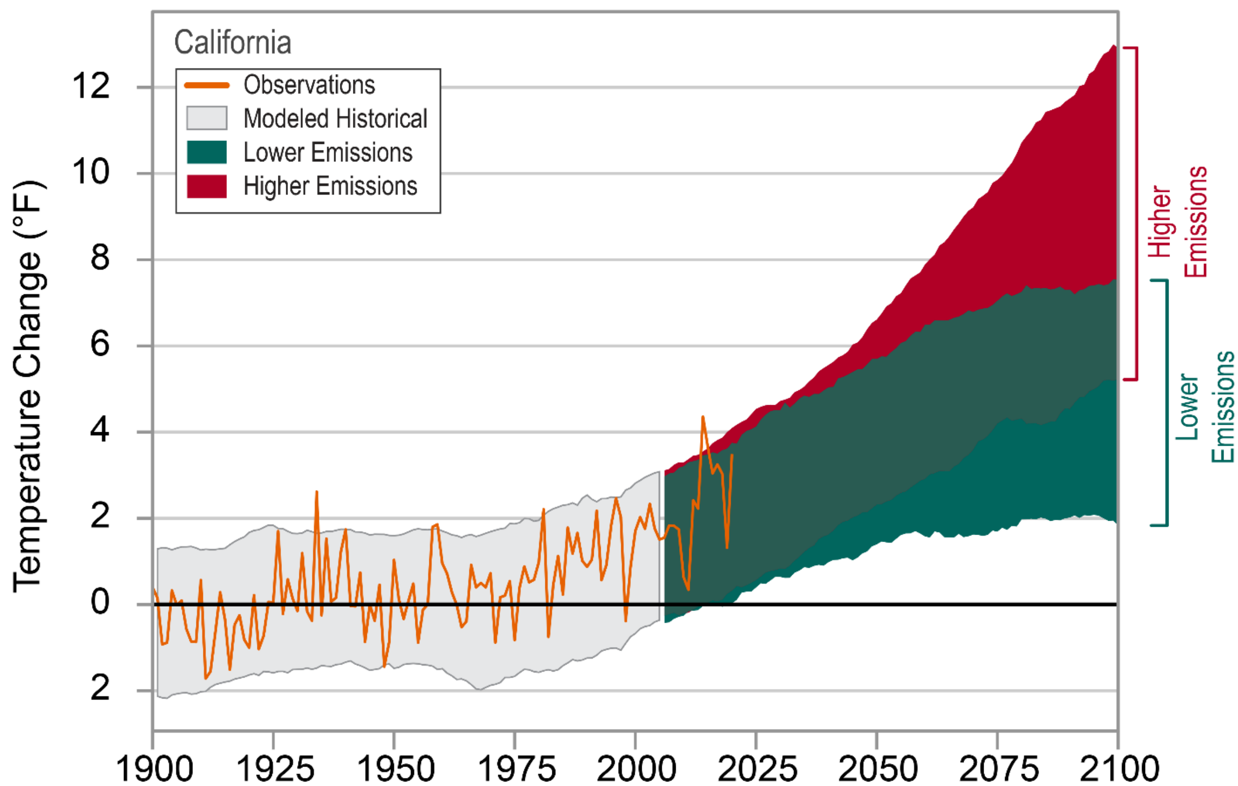
Temperatures in California have risen nearly 3˚F since 1900, and the six warmest years since records began in 1895 have all occurred in the past decade (Frankson et al 2022). Observed and projected temperature change in California is shown in Figure 4-16. Rising temperatures will result in a decreased snowpack and increased evapotranspiration, both of which may result in negative consequences for California's water supply.

Snowpack acts as a natural reservoir for water in California. During cold winter months, snowpack accumulates, then during warm summer months, snowpack slowly melts – resulting in a steady, year-round supply of water for rivers, lakes, and reservoirs. Increasing temperatures causes snowpack to melt earlier in the season. Instead of a slow, extended release of water, an increased amount of water is released at the beginning of the warm season, resulting in decreased availability during the peak demands of summer. Additionally, the increased water release during the early season results in increased flooding risk, which brings with it the potential to damage or contaminate current water infrastructure and supply.

Projected rising temperatures are also expected to raise the snowline, which is the lowest elevation at which snow falls. As the snowline increases in elevation, the area in which snowpack can accumulate decreases, resulting in a decreased capacity for water storage, especially in lower elevation mountainous terrains which are already on the margins of reliable snowpack accumulation. Additionally, a higher snow-line results in a larger area in which precipitation will likely fall as rain instead of snow, resulting in both a decreased capacity for water storage and an increased likelihood of flooding.

Increased evapotranspiration is the intensifying of liquid water turning into a gaseous vapor. Through this process, the content of surface water sources, such as lakes, rivers, and reservoirs slowly decreases as water is evaporated at an increasing rate. Groundwater sources are also depleted as plants and soils increasingly require more water to replace the moisture which has been extracted through evapotranspiration. Additionally, evapotranspiration can affect regional weather patterns, as air that is dense with water vapor is able to hold more heat, potentially leading to a hotter and drier climate, impacting rainfall patterns and water availability.

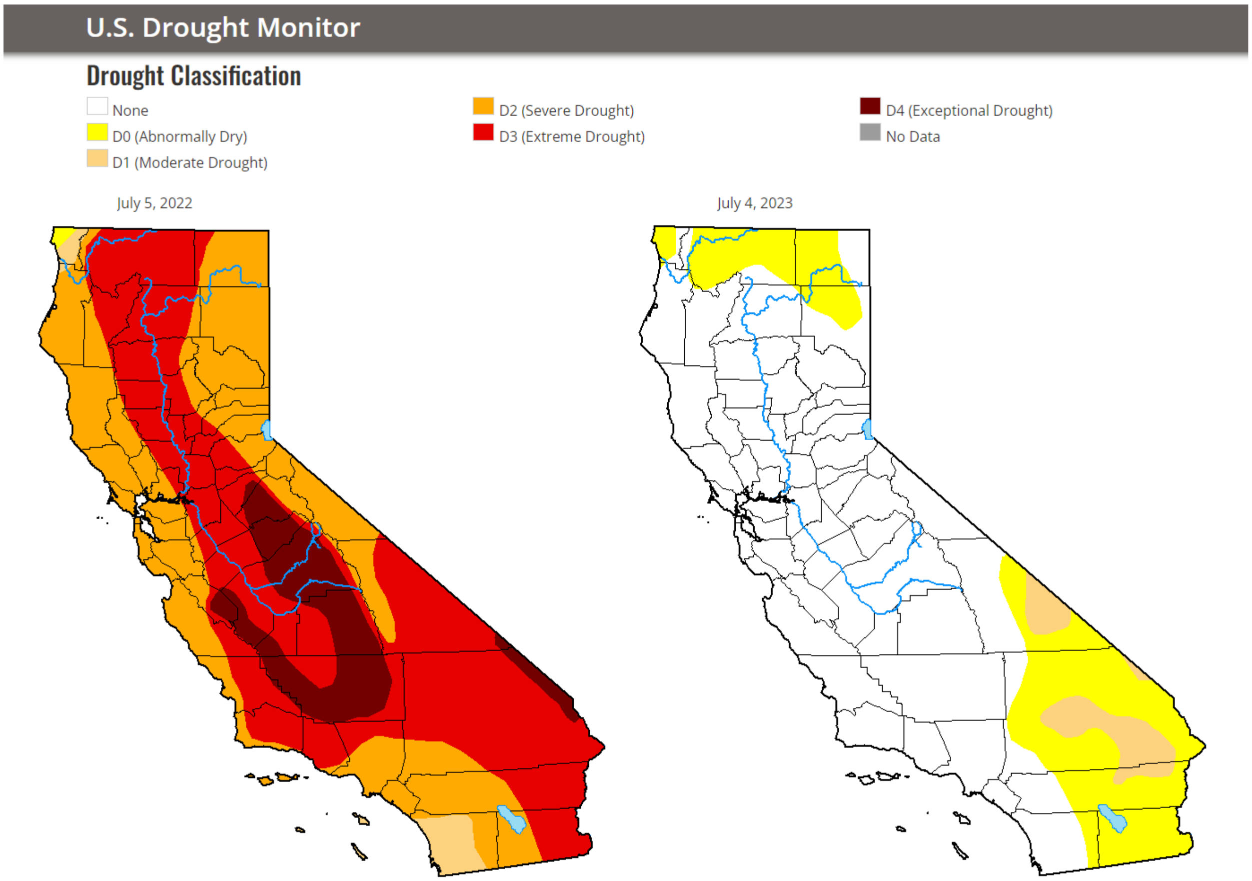
Figure 4-16 California Observed and Projected Temperature Change



Sources: CISESS and NOAA NCEI

As noted previously, the water years 2020-2022 were the three driest consecutive years on California record. This streak ended by a series of atmospheric rivers that battered the State in late 2022 to early 2023. Figure 4-17 shows the US Drought Monitor maps from July 2022 and July 2023, displaying the drastic change in water availability throughout the state. This rapid and drastic shift in weather conditions is known as weather whiplash, also sometimes referred to as climate or meteorological whiplash. Intense periods of low precipitation parch soil, decreasing its capacity to absorb water. When long dry spells are broken by intense periods of precipitation, the decreased capacity of soils to absorb water results in an increased likelihood of flooding. This is especially true following wildfire events, as vegetation which may have absorbed precipitation or slowed the flow of flood waters will have been lost. Short and intense periods of precipitation are also likely to overwhelm current water infrastructure, which was not designed for such events.

Figure 4-17 US Drought Monitor maps from July 2022 and July 2023



According to the 2020 UWMP and 2017 Mokelumne River Long-Term Water Needs Study, specific studies on the Calaveras and Mokelumne River watersheds indicate that changes in climate in these areas can modify the timing, amount, and form of precipitation, as well as water demands and the quality of surface runoff. Therefore, climate change could impact the District's water supplies by changing the levels of water demand, impacting reservoir water quality and storage capacity, and stressing conveyance systems and treatment plants (CCWD 2020). According to the California Climate Adaptation Strategy, climate change is likely to significantly diminish California's future water supply, creating greater competition for limited water resources. Recent drought conditions underscore the need to closely understand and examine water supply and distribution, management, conservation, and use policies.

4.4.3.7 Vulnerability Assessment

People

As a water district, drought can be one of the most detrimental hazards on customers and requires the most substantive planning as local conditions change and populations grow. As the CCWD supplies a majority of its water to residential users, the CCWD's residential customers would in turn be most impacted by water use restrictions put in place during drought years. Climate change is expected to further exacerbate water use restrictions on customers as the timing and amount of precipitation shifts, which could change the levels of water demand and the water quality in the CCWD's reservoirs.

Drought can also cause secondary impacts, such as public health problems related to poor water quality, and respiratory health problems can become exacerbated due to dust and poor air quality. The CCWD's water customers may also exhibit a range of abilities to prepare for, respond to, and recover from drought hazards, as these conditions impact populations with health-related issues related to heat-related illness, respiratory problems, and people who work outdoors.

These conditions can impact lower-income populations, as food and water utility rates increase. There are sensitive and socially vulnerable populations residing in the Planning Area that may be the most susceptible to water restrictions, and health-related illnesses. Socially vulnerable populations may also be sensitive to increases in water utility rates and in turn, increased food prices. These socially vulnerable populations likely reside in the rural and mountainous CCWD service areas, like West Point and Sheep Ranch.

Property

The most direct impact of drought will be on the CCWD's water supply, as drought conditions can directly affect the water storage, treatment, and distribution and conveyance systems. As previously noted, climate change will also affect the CCWD's water supply by further limiting water supplies during drought years and emphasizing a greater need for careful water resource management and distribution of resources.

Critical Facilities and Lifelines

Severe to exceptional droughts can have significant consequences for water supply, water quality, firefighting, navigation, recreation, and other critical facilities and these impacts are anticipated to worsen with climate change. In some cases, when groundwater levels substantially decline, groundwater wells may need to be deepened in response. Subsidence related to groundwater withdrawal can impact linear infrastructure such as pipelines, roads, and levees. Additionally, a higher demand on the water system infrastructure can lead to disruption of service due to line breakage. Possible losses to infrastructure include the loss of potable water.

Other impacts on CCWD facilities associated with drought are issues with disinfection byproducts (DBPs) as a result of chlorine and carbon interactions; this issue is known to be associated with increased sedimentation and erosion that occurs during dry years. Drinking water must be disinfected to treat microbial pathogens like bacteria, viruses, and parasites. However, these disinfectants can also react with naturally-occurring materials in the water and form DBPs. While the CCWD already monitors DBP levels through various treatment and filtration methods, the CCWD is working to better understand the root causes of the issue and how DBPs are impacted by natural hazards, like drought and severe weather. CCWD staff also noted that DBPs may also be a result of the combination of droughts followed by intense precipitation events, and climate change is anticipated to intensify both of these events.

Water quality will also continue to vary based on surface flows that can dramatically change the water quality composition from year to year. Some years may include higher naturally occurring levels of algae or manganese, increased runoff, nutrients, or other constituents, all of which create long-term nuisance issues for water supply treatment. Wildfires, which are also exacerbated by drought conditions result in biomass changes, which can also cause changes to water quality (CCWD 2021). Wildfires also threaten the natural streamflow in waterways that the CCWD relies on for water supply. Wildfires, and post-wildfire runoff, sedimentation, soil erosion, and landslides can adversely impact the CCWD's reservoirs and other surface water systems. All cascading impacts associated with wildfire events are also expected to worsen with climate change. Lastly, while groundwater in the CCWD's Planning Area has not historically had major water quality issues, continued overdraft in the far western portion could lead to high levels of iron and manganese, nitrates, nutrients, and other constituents associated with agricultural production common to subbasins in the Central Valley.

Economy

Drought impacts to the local and regional economy can be difficult to quantify but can be extensive and long-lasting depending on the circumstances during and after a severe drought event. If water resources are limited, effects would be more severe for industries that rely on large amounts of water.

Cultural, Historic and Natural Resources

The primary sources of water for the CCWD are the Calaveras River Watershed and the Mokelumne River Watershed. Sustained drought reduces waterflow in these areas, resulting in shrinkage of habitat, habitat fragmentation, reduced food supply for wildlife, and possibly the migration of species.

Tree mortality is identified as a cascading impact of drought that can affect (or worsen) other hazards, such as wildfire and wind conditions. For example, drought-impacted trees can become susceptible to diseases and insect infestations that further exacerbate the risk of tree mortality.

4.4.3.8 Development Trends

Future development and water conservation are the focus of each update to the CCWD's UWMP, and this planning process specifically addresses drought conditions and water contingencies. The UWMP describes how current and future water resources and demands within the CCWD's service area will be managed to provide adequate and reliable water supply. Current analysis from the 2020 UWMP predicts the CCWD will have adequate surface water sources to meet demand in every year type through 2040; although current groundwater supplies are not adequate to withstand a year-long drought event (CCWD 2020). As a result increased development pressure in combination with the effects of climate change are expected to increase drought and groundwater supply shortages.

4.4.3.9 Risk Summary

- While droughts lasting more than three years are not common in Northern California, the water years of 2020-22 were California's driest three consecutive years in terms of statewide precipitation. California is currently in the third year of an ongoing drought.

- There have been four state and federal disaster designation due to drought in Calaveras County.
- There have been 13 USDA disaster declarations due to drought in Calaveras County.
- Historical drought data for Calaveras County indicate there have been 5 significant droughts in the last 86 years.
- Studies show that drought conditions in California are likely to become more frequent and persistent over the next century due to climate change.
- Primary impacts of droughts include reduced water quantity and quality, with secondary impacts including water allotment cuts, increased water prices, increased risk of wildfire and flooding, and threats to hydroelectric power.
- The CCWD continues to rely on its reservoir storage systems and contract water supplies at New Spicer Meadow Reservoir for Ebbetts Pass and Copper Cover Service Areas, or the New Hogan Reservoir for Jenny Lind. Although stored water is being depleted, the available supplies and contractual rights remain adequate for the CCWD to meet its water service demands in the current and subsequent years.
- The most vulnerable water customers and services areas include Sheep Ranch and West Point. Sheep Ranch relies on water stored in White Pines Lake, which although adequate from volume available, may have issues with releases to diversion facilities downstream if San Antonio Creek is dry. West Point will also be reliant on supplemental water supply purchases for most of the year.
- Climate change projections indicate the region will experience more frequent and intense droughts due to drier soil conditions in the summer months, leaving less water available for groundwater recharge.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Extensive	Likely	Critical	Medium

4.4.4 Earthquake

4.4.4.1 Hazard/Problem Description

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. The magnitude of earthquakes is usually measured using the Richter Scale; a logarithmic scale calculated from the amplitude of the largest seismic wave recorded for the earthquake.

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. The cities of Monterey, Santa Barbara, Los Angeles, and San Diego are on the Pacific Plate, which is constantly moving northwest past the North

American Plate. The relative rate of movement is about two inches per year. The San Andreas Fault is considered the boundary between the two plates, although some of the motion is taken up on faults as far away as central Utah.

Earthquake Hazards

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, 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. This section briefly discusses issues related to types of seismic hazards.

Ground Shaking

Ground shaking is a motion that occurs because of energy released during faulting. The damage or collapse of buildings and other structures caused by ground shaking is among the most serious seismic hazards. Damage to structures from this vibration, or ground shaking, is caused by the transmission of earthquake vibrations from the ground to the structure. The intensity of shaking and its potential impact on buildings is determined by the physical characteristics of the underlying soil and rock, building materials and workmanship, earthquake magnitude and location of the epicenter, and the character and duration of ground motion. Much of the County is located on alluvium which increases the amplitude of the earthquake wave. Ground motion lasts longer, and waves are amplified on loose, water-saturated materials than on solid rock. As a result, structures located on alluvium typically suffer greater damage than those located on solid rock.

Seismic Structural Safety

Older buildings constructed before building codes were established, and even newer buildings constructed before earthquake-resistance provisions were included in the codes, are the most likely to be damaged during an earthquake. Buildings one or two stories high of wood-frame construction are the most structurally resistant to earthquake damage. Older masonry buildings without seismic reinforcement (unreinforced masonry) are the most susceptible to the type of structural failure that causes injury or death.

The susceptibility of a structure to damage from ground shaking is also related to the underlying foundation material. A foundation of rock or very firm material can intensify short-period motions which affect low-rise buildings more than tall, flexible ones. A deep layer of water-logged soft alluvium can cushion low-rise buildings, but it can also accentuate the motion in tall buildings. The amplified motion resulting from softer alluvial soils can also severely damage older masonry buildings.

Other potentially dangerous conditions include but are not limited to building architectural features that are not firmly anchored, such as parapets and cornices; roadways, including column and pile bents and abutments for bridges and overcrossings; and above-ground storage tanks and their mounting devices. Such features could be damaged or destroyed during strong or sustained ground shaking.

Liquefaction Potential

Liquefaction, known as a secondary effect of a major earthquake, is a process whereby soil is temporarily transformed to a fluid form during intense and prolonged ground shaking. In other words, soils lose their shear strength and flow or behave as liquid. Areas most prone to liquefaction are those that are water saturated (e.g., where the water table is less than 30 feet below the surface) and consist of relatively uniform sands that are loose to medium density. Liquefaction also generally occurs in soft, unconsolidated sedimentary soils. In addition to soil conditions, the ground acceleration and duration of the earthquake must be of sufficient energy to induce liquefaction.

In California, liquefaction has occurred during and after major earthquakes and has caused severe damage to structures on level ground from settling. The 1989 Loma Prieta earthquake caused this type of damage in San Francisco on bay-filled areas, even though the epicenter of the earthquake was several miles away. However, according to California DOC's data, there is no liquefaction zone identified in the County. However, during the 2022-2023 plan update, the HMPC mentioned that there are mine-tailings throughout the County that can result in liquefaction effects. In the case of earthquake liquefaction, these tailings behave differently from generic soil.

Settlement

Settlement can occur in poorly consolidated soils during ground shaking. During settlement, the soil materials are physically rearranged by the shaking to result in a less stable alignment of the individual minerals. Settlement of sufficient magnitude to cause significant structural damage is normally associated with rapidly deposited alluvial soils or improperly founded or poorly compacted fill. These areas are known to undergo extensive settling with the addition of irrigation water, but evidence due to ground shaking is not available.

Other Hazards

Earthquakes can also cause seiches (lake tsunamis), landslides, and dam failures. A seiche is a periodic oscillation of a body of water resulting from seismic shaking or other factors that could cause flooding. Earthquakes may also cause landslides (discussed in Section 4.4.15), particularly during the wet season, in areas of high water or saturated soils. Finally, earthquakes can cause dams to fail (see Section 4.4.7 Dam Failure).

4.4.4.2 Geographic Area

Extensive – The CCWD Planning Area is located in an area with low seismic activity within the Sierra Block of Seismic Risk Zone 3. However, the County is not within or adjacent to an Alquist-Priolo Earthquake Fault Zone. The CCWD's Planning Area is near several potentially active faults including the Bear Mountain and Melones Fault Zones, which are part of the Foothills Fault System (western County near Valley Springs, Mokelumne Hills, and Copperopolis). Other faults include the Sierra Frontal Fault System along the eastern edge of the Sierra Nevada Range, which has a low likelihood of generating seismic risk due to several major faults in the region. Additional information on faults within and adjacent to the CCWD's Planning Area are described below.

Faults

A fault is defined as "a fracture or fracture zone in the earth's crust along which there has been displacement of the sides relative to one another." There are two types of faults, active and inactive. Active faults have experienced displacement in historic times, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

The County is in the Sierra Block, an area of historically low seismic activity that is within Seismic Risk Zone 3 and roughly 100 miles east of the seismically active San Francisco Bay area. Earthquake events can affect the entire County. Identified locations of potential fault activity are near Valley Springs, Mokelumne Hill, and Copperopolis. These faults are part of the Melones-Bear Mountain-Foothills Fault System, which crosses the western portion of the County, but the level of seismic activity associated with this system is unknown.

Potential active faults in the Valley Springs/Mokelumne Hill area are the following:

- Youngs Creek
- Waters Peak
- Poorman Gulch
- Haupt Creek

Potentially active faults in the Copperopolis area are the following:

- Bowie Flat
- Green Springs Run
- Rawhide Flat East
- Rawhide Flat West

According to the County's General Plan Update (Safety Element), the County's other potentially active faults include the Bear Mountain and Melones Fault Zones, part of the Foothills Fault System, which passes through the western County near Valley Springs, and Mokelumne Hill and south of Copperopolis. And, according to the HMPC and the California Division of Mines and Geology County Report No. 2 (1962), another potentially active and local fault includes the Hodson Fault zone, which runs near Salt Spring Valley in the eastern portion of Calaveras County has also been known as a potentially active fault (CDMG 1962).

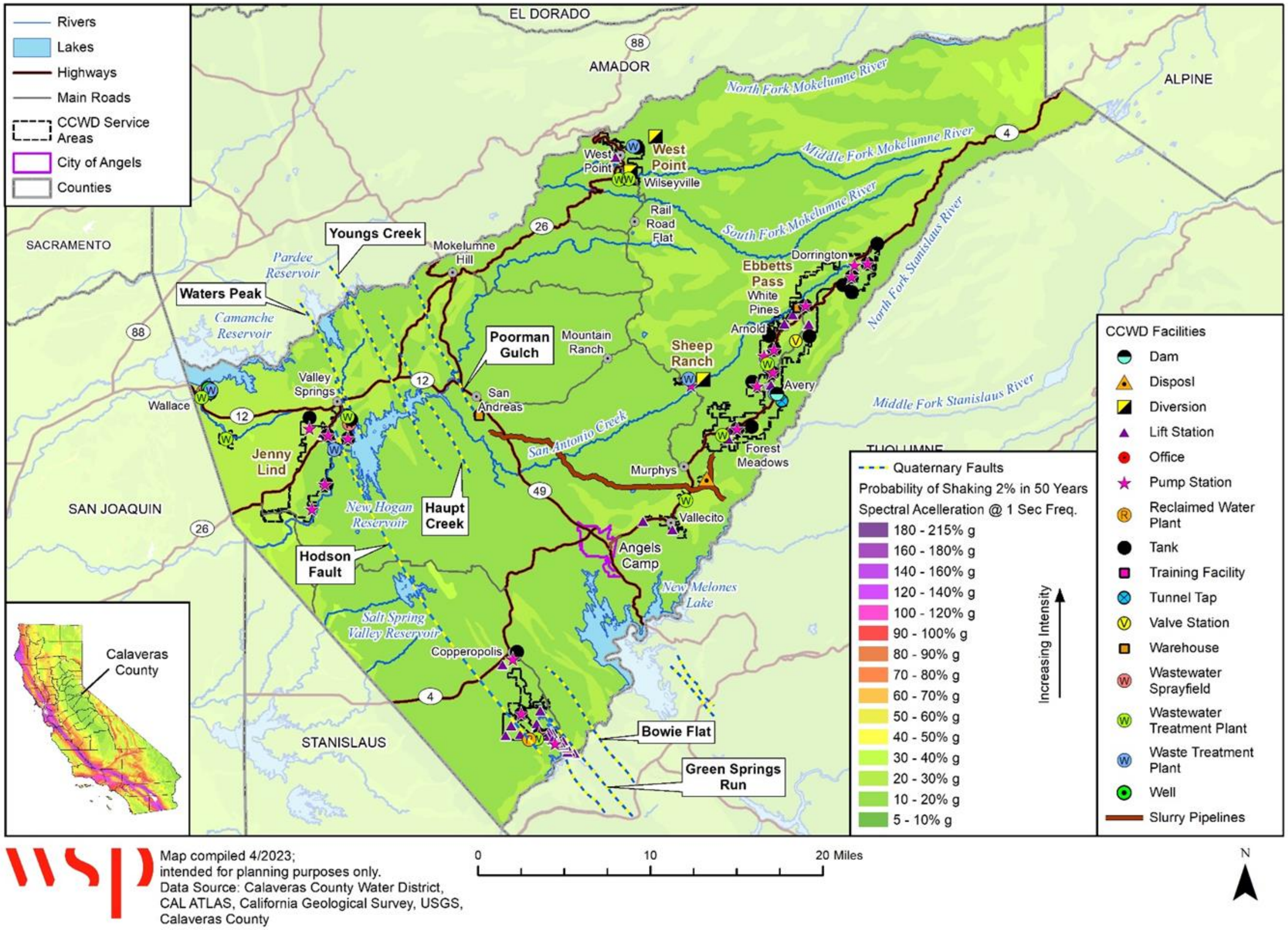
The closest major fault is the Sierra Frontal Fault System along the eastern edge of the Sierra Nevada Range, which includes the Carson Valley fault, located 25 miles northeast of the county. More distant faults located generally to the south across the Central Valley region with the potential to cause ground shaking include the Ortigalita fault, Central Valley Coast Range blind thrust fault, Calaveras fault (Hollister vicinity), Greenville fault, and San Andreas fault.

The Emergency Operations Plan (EOP) noted that there are faults that do not traverse the County that may cause shaking effects to occur inside the County. The following is a breakdown of faults outside the County that can cause ground shaking in Calaveras County.

- The Ortigalita Fault, which has been zoned by the State Geologist under the Alquist-Priolo Earthquake Fault Zoning Act, is located in the western portion of Merced County, approximately 13 miles west of Los Banos. The maximum earthquake magnitude measured with the magnitude (Mw) scale on this fault was 7.9 Mw.
- The Central Valley Coast Range Blind Thrust Fault is located parallel to Interstate-5 along the topographic break-in slope between the Diablo Range and the San Joaquin Valley. This fault system is seismogenically active but is not completely mappable at the surface. It increases the design earthquake ground motion for Gustine, Santa Nella, and Los Banos. This fault is the cause of the 1983 Coalinga Earthquake. The maximum earthquake magnitude measured on this fault was 6.8 Mw.
- The Calaveras Fault is an active fault located in the vicinity of Hollister. It is 16 miles west of Pacheco Pass and it lies outside of Merced County. The maximum earthquake magnitude measured on this fault was 6.2 Mw.
- The Greenville Fault is another fault outside of Merced County. It lies approximately 30 miles northwest of Pacheco Pass. This active fault crosses near Livermore and has a maximum earthquake magnitude measurement of 6.9 Mw.
- The San Andreas Fault is the largest and most active fault in California and is located about 24 miles west of Pacheco Pass. Earthquakes on this fault will be the source of long duration but distant ground motion felt within Calaveras County. The maximum earthquake magnitude measured on this fault was 7.9 Mw.
- The Bear Mountain Fault is also near Merced County. This fault zone is located about 10 miles east of the Merced County line and about 30 miles from Calaveras County along the foothills of the Sierra Nevada. This fault is not an active fault and is not modeled as seismogenically active for purposes of regional earthquake ground motion.

Figure 4-18 below shows the location of faults and ground shaking potential for the region that includes Calaveras County.

Figure 4-18 Ground Shaking and Active Faults in the Calaveras District



The potential for ground shaking is discussed in terms of the percent probability of exceeding peak ground acceleration (% g) in the next 50 years. It varies from 5-40% g throughout the County, which is considered low ground shaking potential. While there is no record of any seismic activity originating in the County, the County has been shaken by earthquakes originating elsewhere. Calaveras County has been very fortunate in the past as it has not suffered any substantial damage or loss of life from earthquakes. The possibility of future earthquakes of equal or greater magnitude than those from previous years could cause a great many casualties and extensive property damage in the County. This could be aggravated by aftershocks and by secondary effects of fire, landslides, and dam failures.

CCWD facilities that may be impacted by fault lines in the County are near San Andreas, Valley Springs, and Copperopolis (based on faults illustrated in Figure 4-18). Within the CCWD's Planning Area this includes the Jenny Lind and Copper Cover service areas, which encompass a total of 6,539 connections that serve 15,048 residents. Of these residents, a portion of them include DACs and other socially vulnerable populations. Additionally, it's important to note that all CCWD facilities may be susceptible to potential impacts from earthquakes, including ground shaking and potential aftershocks stemming from seismic events occurring outside the County. However, because the level of potential ground shaking is low and CCWD designs their water facilities and building structures based on seismic design codes, such as the International Building Code (IBC) and the California Building Code (CBC), and regularly inspects the structural integrity of water distribution systems, these systems are expected to be designed against collapse. Nonetheless, the CCWD's water system does have potential seismic vulnerabilities and major or multiple breaks or cracks in the system could impose significant demands on the water lines both during and after an emergency. Taken together, these geologic and seismic risk demonstrate that all CCWD facilities could be impacted by earthquakes, ground shaking, and aftershocks from earthquake events from outside the County.

4.4.4.3 Extent (Magnitude and Severity)

Limited – For extent, the severity of an earthquake, or the amount of energy released during an earthquake is usually expressed in terms of intensity or magnitude as described further below. As discussed in the Geographic Area section above, the entire Calaveras County is determined to have a low ground shaking potential low. Therefore, a Limited rating is assigned for magnitude and severity.

Magnitude – Magnitude represents the amount of seismic energy released at the hypocenter of an earthquake. It is based on the amplitude of the earthquake waves recorded. Seismologists have developed several magnitude scales; one of the first was the Richter Scale, developed in 1932 by the late Dr. Charles F. Richter of the California Institute of Technology. The Richter Scale is numeric and has a logarithmic relationship between scale factors so that a difference of one scale number represents a tenfold increase in measured amplitude, which in turn corresponds to an approximate 31x energy release difference when compared to the next whole number value. The Moment Magnitude scale (Mw or M) is a measurement of energy released by the movement of a fault and is the modern method used by seismologists to measure earthquakes. Overall, as the amount of energy released by an earthquake increases, the potential for ground-shaking impacts also increases.

Intensity – Intensity represents the observed effects of ground shaking at any specified location and earthquake shaking decreases with distance from the earthquake epicenter. Intensity is an expression of the amount of shaking at any given location on the ground surface based on felt or observed effects. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. Intensity is measured with the Modified Mercalli Intensity (MMI) scale. The intensity of ground shaking at a particular site or structure is a function of many factors including 1) earthquake magnitude, 2) distance from the epicenter, 3) duration of strong ground motion, 4) local geologic conditions (soil type and topography), and 5) the fundamental period of the structure. A brief description of those factors is presented below. The MMI scale is summarized in Table 4-20, along with the effects associated with the MMI scale. Damage typically occurs in MMI of scale VII or above. The associated magnitude scales are also shown in Table 4-20.

Table 4-20 Earthquake Magnitude and Intensity Measurements and Nationwide Intensity and Frequency Characteristics

MAGNITUDE	MERCALLI INTENSITY	EFFECTS	FREQUENCY
Less than 2.0	I	Microearthquakes, not felt or rarely felt; recorded by seismographs.	Continual
2.0-2.9	I to II	Felt slightly by some people; damages to buildings.	Over 1M per year
3.0-3.9	II to IV	Often felt by people; rarely causes damage; shaking of indoor objects noticeable.	Over 100,000 per year
4.0-4.9	IV to VI	Noticeable shaking of indoor objects and rattling noises; felt by most people in the affected area; slightly felt outside; generally, no to minimal damage.	10K to 15K per year
5.0-5.9	VI to VIII	Can cause damage of varying severity to poorly constructed buildings; at most, none to slight damage to all other buildings. Felt by everyone.	1K to 1,500 per year
6.0-6.9	VII to X	Damage to a moderate number of well-built structures in populated areas; earthquake-resistant structures survive with slight to moderate damage; poorly designed structures receive moderate to severe damage; felt in wider areas; up to hundreds of miles/kilometers from the epicenter; strong to violent shaking in epicentral area.	100 to 150 per year
7.0-7.9	VIII<	Causes damage to most buildings, some to partially or completely collapse or receive severe damage; well-designed structures are likely to receive damage; felt across great distances with major damage mostly limited to 250 km from epicenter.	10 to 20 per year
8.0-8.9	VIII<	Major damage to buildings, structures likely to be destroyed; will cause moderate to heavy damage to sturdy or earthquake-resistant buildings; damaging in large areas; felt in extremely large regions.	One per year

MAGNITUDE	MERCALLI INTENSITY	EFFECTS	FREQUENCY
9.0 and Greater	VIII<	At or near total destruction – severe damage or collapse to all buildings; heavy damage and shaking extends to distant locations; permanent changes in ground topography.	One per 10-50 years

Source: USGS Volcanic Hazards Program

Distance from Epicenter – Earthquake energy generally dissipates (or attenuates) with distance from a fault. Over long distances, this loss of energy can be significant, resulting in a significant decrease in ground shaking with increased distance from the epicenter.

Duration of Strong Shaking – The duration of strong ground shaking constitutes a major role in determining the amount of structural damage and the potential for ground failure that can result from an earthquake. Larger magnitude earthquakes have longer durations than smaller earthquakes.

Local Geologic Conditions – The geologic and soil conditions at a particular site have the potential to substantially increase the effects of ground shaking. The thickness, density, and consistency of the soil, as well as shallow groundwater levels, have the potential to amplify the effects of ground shaking depending on the characteristics of the earthquake. In general, the presence of unconsolidated soils above the bedrock surface can amplify the ground shaking caused by an earthquake.

Fundamental Periods – Every structure has its fundamental period or natural vibration. If the vibration of ground shaking coincides with the natural vibration period of a structure, damage to the structure can be greatly increased. The extent of damage suffered during an earthquake can also depend on non-geologic factors. The type of building and its structural integrity will influence the severity of the damage suffered. Generally, small, well-constructed, one- and two-story wood and steel frame buildings have performed well in earthquakes because of their light weight and flexibility. Reinforced concrete structures will also usually perform well. Buildings constructed from non-flexible materials, such as unreinforced brick and concrete, hollow concrete block, clay tile, or adobe, are more vulnerable to earthquake damage.

Effects of Ground Shaking – The primary effect of ground shaking is the damage or destruction of buildings, infrastructure, and possible injury or loss of life. Building damage can range from minor cracking of plaster to total collapse. Disruption of infrastructure facilities can include damage to utilities, pipelines, roads, and bridges. Ruptured gas and water lines can result in fire and produce scour/inundation damage to structures, as can fire from other causes, such as electrical damages. Secondary effects can include geologic impacts such as co-seismic fault movement along nearby faults, seismically induced slope instability, liquefaction, lateral spreading, and other forms of ground failure and seismic response. These secondary effects were demonstrated in Oceano by the San Simeon 2003 earthquake (Hardebeck et al, 2004).

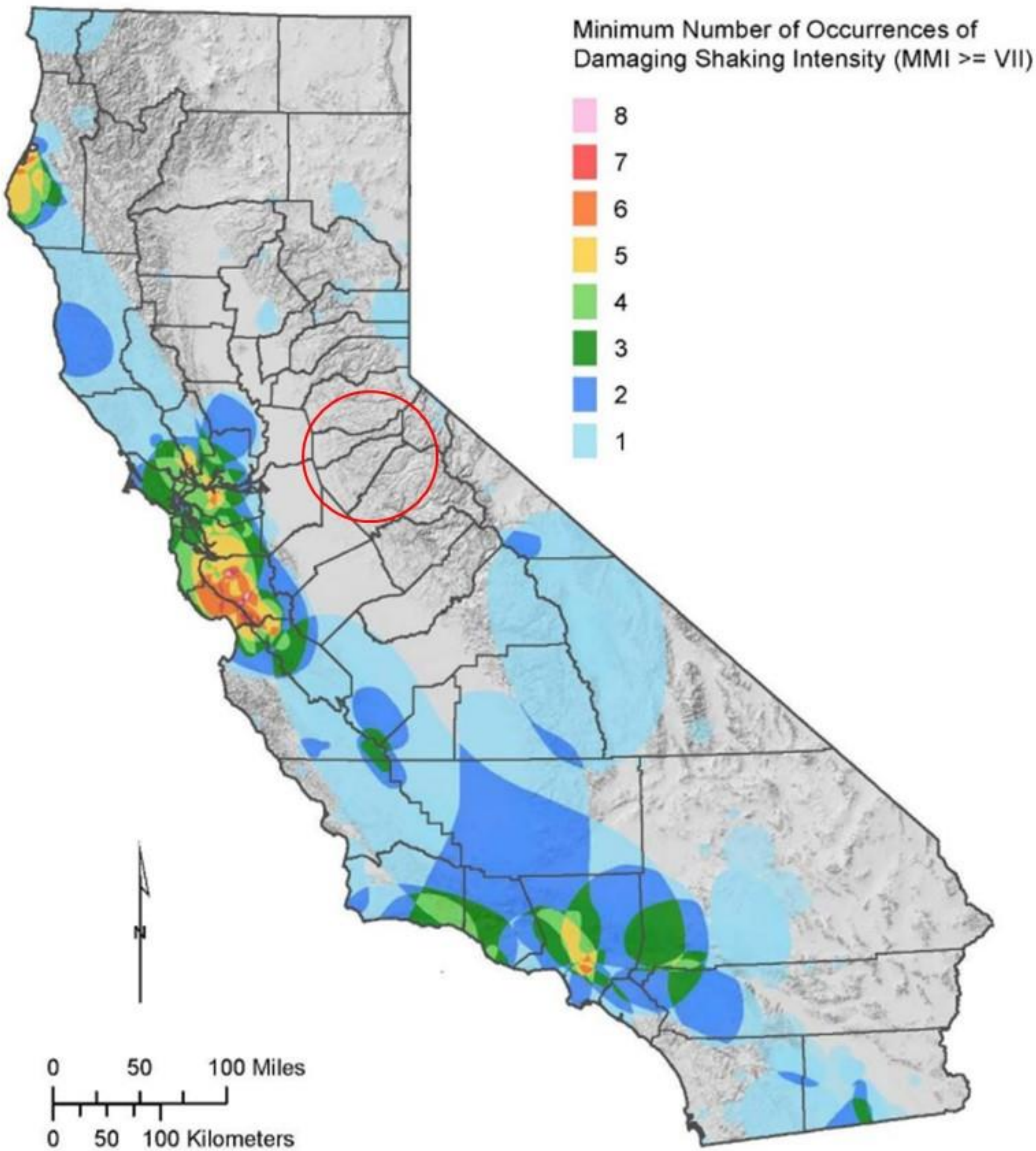
4.4.4.4 Past Occurrences

According to the California Office of Emergency Services (Cal OES) and FEMA, there has never been a state or federal disaster declaration for an earthquake in Calaveras County, and there is no record of damaging earthquakes. However, the Calaveras County

General Plan (2019) notes that ground shaking has been felt in the past, notably during the Mono Lake earthquake in October 1990.

Figure 4-19 is from the 2018 California State Hazard Mitigation Plan, which displays the common areas damaged by earthquakes based on historic evidence dating back to the year 1800. The occurrences are color-coded by damaging shaking intensity across California, and Kings County is enclosed within a red circle. The figure shows that per the MMI scale noting occurrences equal to or greater than an Intensity of VII, the County has not experienced any earthquake events of this kind.

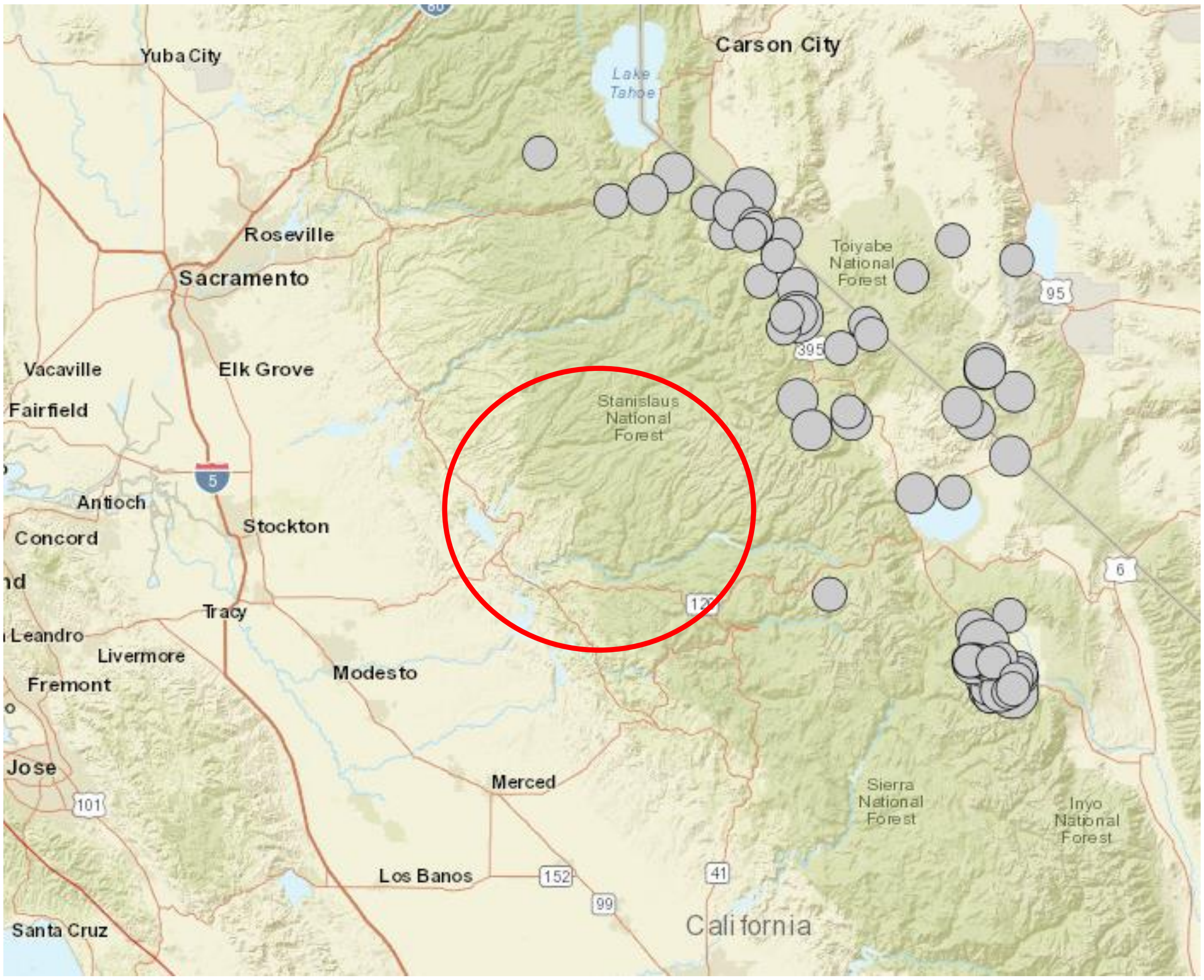
Figure 4-19 Areas Damaged by Earthquakes from 1800 to 2017



Source: California SHMP, 2018

In addition, the USGS Earthquake Database contains data on earthquakes in the Calaveras County area. A search of magnitude 4.5+ earthquake events within Calaveras County returned no results, meaning that there have not been any documented 4.5+ earthquake events that happened within the County. Figure 4-20 below shows the epicenters of documented 4.5 earthquake events (gray circles) near Calaveras County (red circle). Most of these epicenters are to the east of the County near the California and Nevada border.

Figure 4-20 Calaveras County Historic Earthquake Epicenters (M>=4.5): 1900 – 2023



NOTE: Calaveras County is located within the red circle

Source: USGS

In addition, during the 2022-2023 plan update, the HMPC mentioned that a 6.0 magnitude earthquake that resulted from a fault near Gardnerville, Nevada, was felt throughout the County on July 8, 2021.

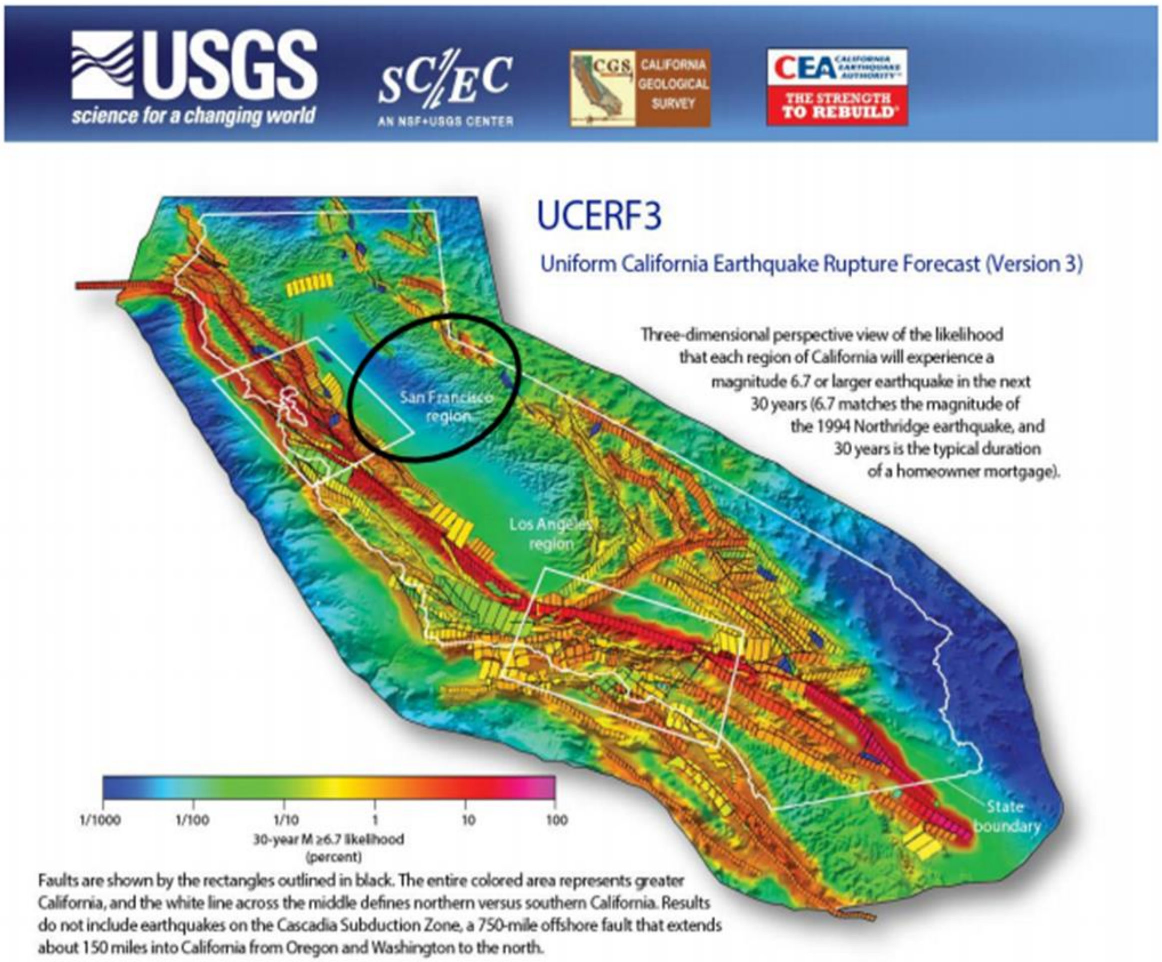
4.4.4.5 Probability of Future Occurrences

Occasional – The California SHMP ranks the earthquake hazard for the majority of Calaveras County at its lowest earthquake risk. The California Geological Survey's probabilistic seismic assessment for Calaveras County estimates that peak ground acceleration could reach or exceed 0.1 to 0.2 g (intensity value I on the MMI Scale with a 0.21 percent chance of being exceeded each year). Thus, based on patterns of previous occurrences, the probability of ground shaking is occasional, with a 1-10 percent chance of occurrence in the next year. The probability of a large, damaging earthquake is unlikely, with less than a 1 percent chance of occurrence in the next 100 years. In sum, the likelihood of future occurrence of minor earthquakes is occasional, and the likelihood of future occurrence of major earthquakes is unlikely.

On the other hand, The National Earthquake Information Center (US) reports 12,000-14,000 earthquakes a year around the world, or 35 a day. Throughout the world, there are one "great" (magnitude 8.0 or more), 18 "major" (7.0-7.9), 120 "large" (6.0-6.9) and 1,000 "moderate" (5.0-5.9) earthquakes in an average year (CA Department of Conservation, n.d.). Each year, California generally gets two or three earthquakes large enough to cause moderate damage to structures (magnitude 5.5 and higher). Moreover, earthquakes can occur at any time of the year. A strong earthquake can cause major damage depending on the epicenter's location with regard to populated areas and can lead to billions of dollars in disasters, deaths, injuries, and disruptions in services and communities' way of life.

In 2014, the United States Geological Survey (USGS) and the California Geological Survey (CGS) released the time-dependent version of the Uniform California Earthquake Rupture Forecast (UCERF II) model. These were the first statewide peer-reviewed forecasts and Next Generation Attenuation ground motion prediction efforts undertaken. The UCERF II results have helped to reduce the uncertainty in estimated 30-year probabilities of strong ground motions in California. The UCERF map is shown in Figure 4-21 and indicates that Calaveras County has a lower risk of earthquake occurrence, which coincides with the likelihood of future occurrence rating of occasional.

Figure 4-21 Probability of Earthquake Magnitudes Occurring in 30 Year Time Frame



Source: United States Geological Survey Open File Report 2015-3009

4.4.4.6 Climate Change Considerations

Climate change is not expected to directly affect earthquake frequency or intensity, nor the Likelihood of Future Occurrence of seismic activity.

4.4.4.7 Vulnerability Assessment

Property

Earthquakes can cause significant structural damage to CCWD buildings and the water distribution system customer's homes, and other structures. These factors include the proximity to the active faults, direction of the rupture, epicentral local and depth , magnitude of the earthquake, local geologic conditions, and types of construction. Ground motions become structurally damaging when average peak accelerations reach 10 to 15 percent of gravity, average peak velocities reach 8 to 12 centimeters per second, and when the MMI Scale is about VII, which is considered to be very strong (general alarm; walls crack; plaster falls). This ground motion can cause damage to walls, foundations, roofs, and other components of a building or underground water lines. In comparison, fault rupture contributes very little damage unless the structure or water system crosses an active fault, and none of the CCWD's facilities currently cross any mapped faults in the County.

Other common impacts from earthquakes include damage to buildings and water infrastructure; for example, building can collapse or become uninhabitable (e.g., crumbling unreinforced masonry, rupturing underground utilities). WTPs, pump stations, and water tanks may also crack and leak. Earthquakes can also cause non-structural damage to buildings, such as damage to electrical and plumbing systems, windows, and doors. This can result in additional repair costs for property owners. Repairing earthquake damage can be expensive, especially if the damage is extensive. In addition to structural repairs, property owners, such as the CCWD may also need to repair or replace damaged contents, such as furniture, equipment, and inventory.

People

During an earthquake, people can be injured by falling objects, debris, and structural collapse. This can result in a range of injuries, from minor cuts and bruises to more serious injuries such as broken bones, head injuries, and even death. Earthquakes can also cause emotional trauma, such as anxiety, fear, and post-traumatic stress disorder. Additionally, earthquakes can result in the displacement of people, as homes and buildings become uninhabitable due to damage. This can lead to homelessness, temporary shelter, or relocation to other areas. Moreover, earthquakes can also result in public health impacts, such as the spread of disease due to disrupted water and sanitation systems, as well as the loss of access to medical care.

While Calaveras County has not experienced any documented 4.5+ magnitude earthquake events within its boundaries, it's important to acknowledge the potential impact on the CCWD's water customers in the event of a seismic event. Despite the absence of historical instances of earthquakes, it is crucial that earthquake preparedness remains a priority for the CCWD operations and delivery of potable water supplies. While the County's ground shaking potential is low, ranging from 5-40% peak ground acceleration (% g) over the next 50 years, and the County has not recorded damaging earthquakes or substantial damage or loss of life from earthquakes, these geologic and seismic events can pose threats to the CCWD water distribution systems and water and wastewater customers.

The CCWD America's Water Infrastructure Act of 2018 (AWIA) Risk and Resiliency Assessment, released in 2021, used FEMA's NRI data to summarize the economic and social impacts from natural hazards at the census tract level to confirm vulnerabilities in the CCWD's Planning Area (see Section 4.2.1.2 and Section 4.3.5 for more information on the NRI and Social Vulnerability). While wildfire risk and resulting damages remains the most potentially catastrophic threat to the County and CCWD facilities, the next highest ranked hazard according to the NRI risk factors is lightning, followed by earthquake and drought. Based on the analysis in the 2021 AWIA Risk and Resiliency Assessment, the communities in the CCWD's Planning Area at most risk to earthquake hazards (by census tract) are Valley Springs and Arnold (Mountain Ranch and Angels Camp are not in the CCWD's Service Area). These two communities also have moderate social vulnerability scores, making them likely to be more vulnerable to hazards and likely to experience greater impacts and longer recovery times during and following an earthquake event.

Significant damages to the CCWD's distribution infrastructure could also lead to lengthy downtime due to the CCWD's ability to operate key water storage facilities and pump stations. This could in turn result in a long-term disruption to water delivered to customers. Power outages due to an earthquake event could also lead to delays in the District's ability to provide water services. Although some of the communities within the CCWD's Planning Area may be more vulnerable to earthquake hazards because there are back-up and redundant water supplies available in most of the service areas, and because the CCWD provides potable water during emergencies, the overall risk to CCWD customers remains low. Lastly, climate change is not expected to directly affect earthquake frequency or intensity.

Critical Facilities and Infrastructure

Similar to earthquakes' impact on properties discussed above, earthquakes can cause structural and non-structural damage to critical facilities, specifically to the CCWD's extensive water distribution system of underground water mains, pump stations, aboveground water tanks, and water intakes. Structural damage to buildings (such as the Office Building or CCWD Warehouse) can include damage to walls, foundations, roofs, and other components of CCWD buildings. Non-structural damage can include damage to electrical and plumbing systems, windows, and doors, and water facility lines, such as water leaks and significant damages to water storage tanks resulting in additional repair costs and downtime for the facility. These impacts are not expected to worsen due to climate change.

During ground shaking from a Magnitude 6.0 earthquake in South Napa in 2014, the City of Napa's water system was severely damaged. There were over 200 water leaks and substantially damaged water storage tanks that resulted in over $6.4 million in damages (SWCA 2018). Critical water facilities provide essential services to the public, such as the community's potable water supply and wastewater conveyance and disposal. Therefore, if these water and wastewater facilities are damaged or disrupted by an earthquake, the CCWD may not be able to provide these services, leading to potential health and safety and water security risks for the public.

Moreover, earthquakes can create safety risks for CCWD critical facility staff, such as falling objects, structural collapse, and electrical hazards. It is important for the facilities to have safety protocols in place to minimize the risk of harm. Earthquakes could also significantly damage groundwater pumping facilities or cause hydrogeologic changes to groundwater levels, meaning no temporary access to groundwater (CCWD 2021). The most severe impact would be the damage to the CCWD's WWTPs (i.e., Arnold WWTP, Copper Cove WWTP) or related infrastructure, which could result in a loss of water treatment or production of recycled wastewater availability (CCWD 2021).

As previously noted, the critical water and wastewater infrastructure in the CCWD's Planning Area is designed for seismic resilience by following strict building codes (IBC and CBC compliance), utilizing advanced engineering, and maintaining regular inspections and safety protocols. These measures reduce the CCWD's water and wastewater's vulnerability to seismic events. The absence of any recorded damaging earthquakes in the County's history further supports the assessment of low risk to the CCWD's facilities. However, a major earthquake event could potentially impact underlying aquifers, storage reservoirs, and CCWD's linear water distribution systems, which could result in significant loss of production capacity. While buried water lines are designed for internal pressure with limited consideration to large relative displacements, they still may be vulnerable at connection points, and from related liquefaction impacts. For example, during the 1971 San Fernando earthquake, the City temporarily lost water, gas, and sewage services due to liquefaction and induced lateral spread within the City's water reservoir. In summary, because the CCWD's ground shaking potential is low, facilities are not sited overactive fault lines, there are no mapped liquefaction zones in the County, and the CCWD's water distribution system should be able to withstand small ground displacements associated with earthquakes based on seismic design standards, overall vulnerabilities and impacts to the CCWD's water systems remains low.

Economy

Earthquakes can damage infrastructure such as roads, bridges, airports, and seaports, which are critical to transportation and commerce, which can then disrupt supply chains, slow down trade, and increase costs for businesses. Earthquakes can also disrupt business operations, causing lost revenue and profits. For example, if a business's facility is damaged by an earthquake, it may need to shut down temporarily while repairs are made. This can lead to lost sales, decreased productivity, and higher costs to get the business back up and running.

4.4.4.8 Development Trends

CCWD's Planning Area has very gradual increases in population since 2018 and a nominal number of new water and wastewater service connections. The CCWD currently has a total of approximately 27,908 customers via 13,219 water connections and 5,104 wastewater connections. Therefore, the number of people and housing developments exposed to earthquake hazards has gradually increased since the previous plan update, particularly when compared to development trends in other counties in California. Future development in the County is likely to occur in the far western portions of the County rather than Sheep Ranch, Ebbetts Pass, or West Point. Projects for new CCWD infrastructure should also consider earthquake hazard at the planning, engineering, and architectural design stages with the goal of reducing vulnerability.

4.4.4.9 Risk Summary

- The overall ground shaking potential for Calaveras County is low, although various faults are located within or near the western portion of Calaveras County
- Ground shaking has been felt in the past in Calaveras County, notably during the Mono Lake earthquake in October 1990.
- Several earthquake faults of concern outside Calaveras County can affect the CCWD: Ortigalita Fault, Central Valley Coast Blind Thrust Fault, Greenville Fault, and the Calaveras Fault.

- Earthquakes can cause structural and non-structural damage to critical water facilities. Structural damage can include damage to walls, foundations, roofs, and other components of the CCWD buildings. Non-structural damage can include damage to aboveground and underground water distribution systems.
- According to the California DOC data, there is no liquefaction zone identified in the County but the CCWD noted that areas with mine-tailings can result in liquefaction effects.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Extensive	Occasional	Limited	Low

4.4.5 Expansive Soils

4.4.5.1 Hazard/Problem Description

Expansive soils are characterized by a high clay content, which swells with increased moisture content and contracts during dry periods. This change in volume, usually associated with seasonal changes, can damage building foundations, roads, and concrete pavement. On slopes, it can bury or break utility lines. Expansive soil types are also known to be associated with landslide risk and rockfall, as the increased volume of expansive soil layers on slopes can create ground shifts and downslope movement of materials. The onset of soil expansion tends to follow the seasons, with expansion occurring in the wetter months of the year and contraction over the summer. Regarding warning time, maps showing the location of expansive soils are available to guide future development on the potential presence of this hazard.

4.4.5.2 Geographic Area

Significant – The specific soil groups with moderate to high shrink-swell potential are listed in Table 4-21. Group 5 soil has the highest shrink-swell behavior.

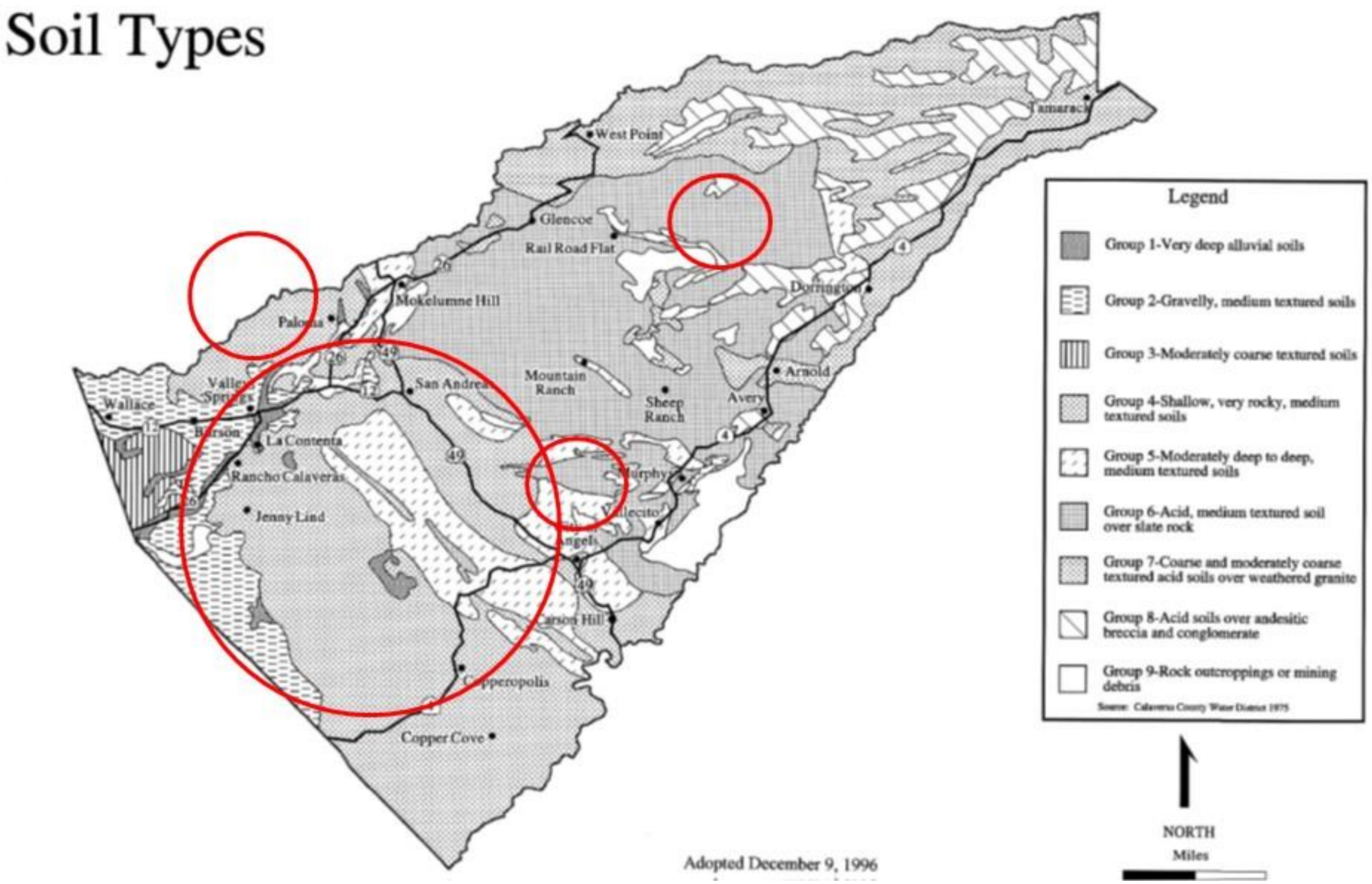
Table 4-21 Soils Groups with Moderate to High Shrink-Swell Potential

SOILS GROUP	DESCRIPTION
Group 1	Very deep alluvial soils, moderately good drainage and slight to moderate erosion hazard. Shrink-swell behavior is moderate.
Group 2	Shallow, well-drained gravelly soils with finer subsoils, good natural drainage and a slight to moderate erosion hazard. Shrink-swell behavior is moderate.
Group 5	Deep to shallow, well-drained, slightly acid, and rocky soils. Drainage is good with slight to moderate erosion hazard. Shrink-swell behavior is high.
Group 6	Acid, rocky, or stony soil over slate rock. Erosion hazard is moderate to severe. Shrink-swell behavior is moderate.

Source: Calaveras County General Plan 2019

The location of each soil group is illustrated in Figure 4-22.

Figure 4-22 Soil Types in Calaveras County



Source: Calaveras County General Plan 2019

As shown in Figure 4-22, in general, expansive soils are most likely to occur in the central part of the county, including the City of Angels, and a few unincorporated areas both east and west of Highway 49.

4.4.5.3 Extent (Magnitude and Severity)

Limited – The potential magnitude of expansive soil events and damages is estimated to be Limited for the County, with limited and isolated impacts. Because damage from expansive soils is difficult to track due to limited reporting, it is difficult to estimate the potential severity of a problem. Expansive soil can create localized damage to individual structures and supply lines, such as roads, railways, bridges, and power lines. As reported by the HMPC, expansive soils have caused problems to building foundations and roads in the County but no specific data on past damages was known. No significant impacts have been reported.

4.4.5.4 Past Occurrences

The HMPC reported that expansive soils have caused problems to building foundations and roads in the County but no specific data on past damages was known. The exact location information was not known due to a lack of spatial data.

4.4.5.5 Probability of Future Occurrences

Likely—Based on the number of vulnerable structures and infrastructure that are located in areas known for having expansive soils, it is likely that this hazard will continue to occur in the future. Although this hazard is pretty widespread across the County as shown in Figure 4-22, it is unlikely to cause loss of life. The HMPC had little information concerning this hazard and past impacts besides that it caused some damage to shallow building foundations and pavement. Certain standard building practices can be used to mitigate damage caused by expansive soils.

4.4.5.6 Climate Change Considerations

There is overwhelming evidence that climate change leads to a wide range of climatic and weather changes that can affect the performance of built infrastructures (Australian Geomechanics 2017). Climate change is likely to have significant impacts on the performance of residential buildings constructed on expansive soils. The Thornthwaite Moisture Index (TMI) as a useful climate parameter has been widely employed to estimate the depth of design soil suction change (Hs), which is needed for the determination of characteristic ground movement (ys). Precipitation and temperature are the primary weather parameters required for the TMI computation. By applying the projected rainfall reduction and temperature increase in 2030, 2050 and 2070 in the TMI calculations, the effects of climate changes on expansive soil movements and site classification can be quantified by the use of the predicted TMI. The results show that both Hs and ys values are expected to increase significantly with climate change, meaning that an increase in predicted soil movement, is expected with climate change.

4.4.5.7 Vulnerability Assessment

Property

While impacts are slow to accumulate, costly damages to roads and other infrastructure could occur. The majority of the hazard's significance is drawn from the exposure of existing development to this hazard. Older construction may not be resistant to the swelling-soil conditions and, therefore, may experience expensive and potentially extensive damages. This includes heaving sidewalks, structural damage to walls and basements, the need to replace windows and doors, or dangers and damages caused by ruptured pipelines. These impacts will worsen with climate change given it will increase predicted soil movement.

People

No direct impacts on people are anticipated. Should an impact occur, it is anticipated to be localized. Expansive soil impacts are also not expected to be intensified enough to have future impacts on people.

Critical Facilities and Infrastructure

Expansive soil events' impacts on critical facilities are similar to their impacts on general properties. Expansive soils tend to swell when they absorb water and shrink when they dry out. This movement can cause significant damage to the foundation and structure of critical facilities, leading to safety hazards and costly repairs. Also, as the soil beneath a critical facility expands and contracts, it can cause cracks to form in walls, floors, and other structural elements, which can allow water to seep into the building, leading to further damage and potential health hazards. Moreover, expansive soils can cause foundations to settle and shift, leading to structural instability and potential collapse. Structural damage caused by expansive soil can also create safety hazards for occupants of critical facilities. Further, increases in predicted soil movement are expected with climate change.

Economy

Buildings and homes located on expansive soil can be more prone to damage and may require more frequent repairs, which can lead to decreased property values. Insurance companies may also charge higher premiums for properties located in areas with expansive soil due to the increased risk of damage from soil movement. Moreover, when expansive soil causes damage to buildings and other infrastructure, it can disrupt business operations and lead to lost productivity.

4.4.5.8 Future Development

The recognition of expansive soils allows it to be mitigated in future development. It is important to take measures to mitigate the potential impacts of expansive soil hazard, such as conducting regular inspections, using appropriate construction techniques and materials, and implementing soil moisture control measures.

On the other hand, while continued public education efforts may help increase compliance for landscaping and interior finishing mitigation actions, physical reconstruction of foundations is probably not feasible in all but the most heavily impacted of existing development. Therefore, damages may be expected in the future for existing structures.

4.4.5.9 Risk Summary

- Expansive soils are most likely to occur in the central part of the county, including the City of Angels, and a few unincorporated areas both east and west of Highway 49
- Specific information and data on expansive soil's past impacts on the County is limited
- Expansive soil events can cause significant damage to the foundation and structure of critical facilities, leading to safety hazards and costly repairs.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Significant	Likely	Limited	Medium

4.4.6 Extreme Heat

4.4.6.1 Hazard/Problem Description

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. According to the National Weather Service (NWS), among natural hazards, only the cold of winter—not lightning, hurricanes, tornadoes, floods, or earthquakes—takes a greater toll. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a salt imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise and heat-related illness may develop. Elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails.

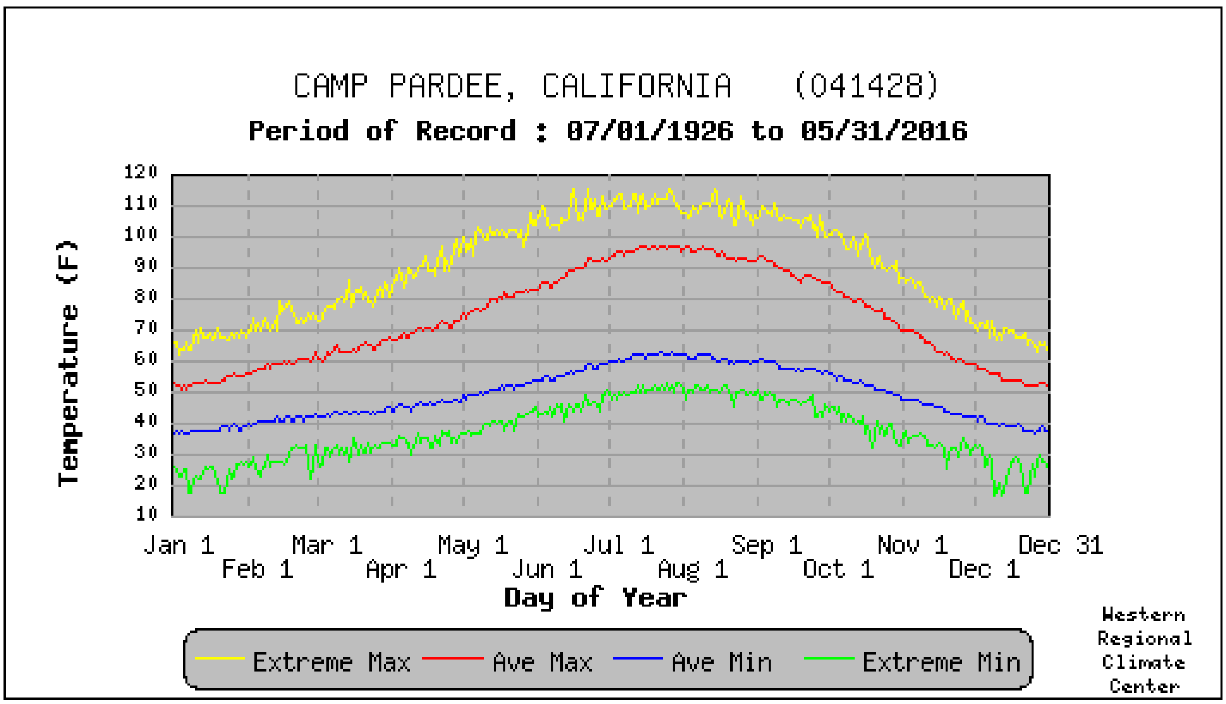
4.4.6.2 Geographic Extent

Extensive – Extreme heat can occur anywhere in the County but is particularly a higher health hazard in the lower elevations and foothills in the western portion of the County.

Heat emergencies are often slower to develop, taking several days of continuous, oppressive heat before a significant or quantifiable impact is seen. Heat waves do not strike victims immediately, but rather their cumulative effects slowly take the lives of vulnerable populations. Heat waves do not cause damage or elicit the immediate response of floods, fires, earthquakes, or other more "typical" disaster scenarios. While heat waves are obviously less dramatic, they are potentially deadlier. According to the 2013 California State Hazard Mitigation Plan, the worst single heat wave event in California occurred in Southern California in 1955, when an eight-day heat wave resulted in 946 deaths. The July 2006 heat wave in California caused the deaths of about 650 people over a 13-day period (CalEPA 2013). And, according to SHELDUS, approximately 47 heat events occurred in California between 1960 and 2008 (Cal OES 2013), and 59 excessive heat events were reported between 1950 and 2023 in Calaveras County (NOAA 2023). 23 of these excessive heat events occurred since the last plan update with most of the heat events occurring in 2021 to 2022 related to heat waves and record heat events when temperatures exceeded 110 degrees (NOAA 2023).

Figure 4-23 shows average and extreme temperatures from the Camp Pardee weather station in the northwest part of the county and the Calaveras Big Trees weather station in the southeast part of the County. The highest temperature on record at Camp Pardee is 115˚F recorded on July 26, 1931. On average, there were 85.5 days annually with a high temperature at or above 90˚F; more than half of these occurred in July and August. At Camp Pardee, temperatures of 102˚F or above are on record for every month May through October (WRCC 2012)[1].

Figure 4-23 Daily Temperature Averages and Extremes, Camp Pardee, 1926 to 2016



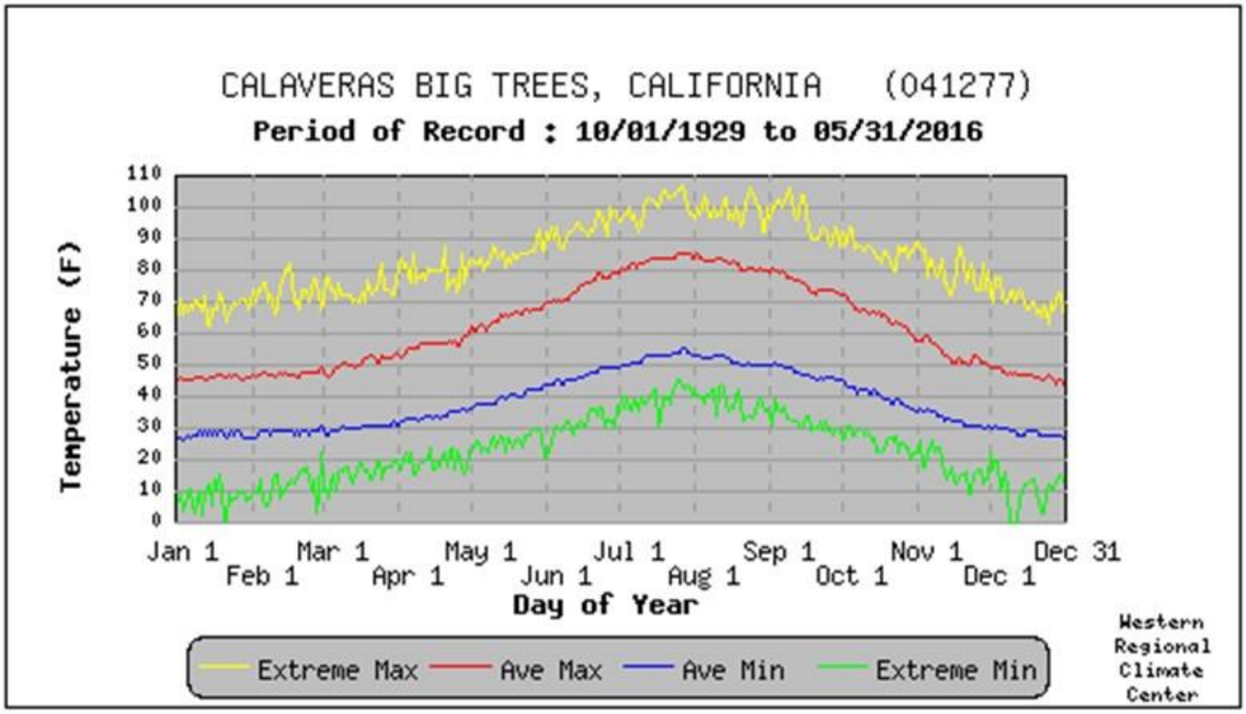
Source: Western Regional Climate Center, www.wrcc.dri.edu/CLIMATEDATA.html

As shown in Figure 4-24, the Calaveras Big Trees station, the highest recorded temperature on record is 107˚F on July 27, 1933. On average, there are 11.4 days annually that are above 90˚F, most occurring in July and August. Extreme heat hazards are located throughout Calaveras County. The extent of the hazards and the highest temperatures may be concentrated in the lower elevation areas during the summer

1 The last map and graphs generated by the WRCC were in April 2006; these are the same figures included in the 2018 LHMP.

months due to extremely high temperatures that can sometimes exceed 115˚F (WRCC 2012).

Figure 4-24 Daily Temperature Averages and Extremes, Calaveras Big Trees, 1929 – 2016



Source: Western Regional Climate Center, www.wrcc.dri.edu/CLIMATEDATA.html

In July 2006, the NWS Forecast Station in Sacramento reported 11 consecutive days of temperatures over 100˚F. In Stockton, California, approximately 30 miles from Calaveras County, temperatures reached 115˚F on July 23, 2006. The US Department of Agriculture (USDA) declared 16 California counties, including Calaveras, as primary natural disaster areas due to the record-setting heat wave that occurred July 1-31, 2006. The declaration made farmers in the county eligible for low-interest emergency loans from USDA's Farm Service Agency.

Figure 4-25 shows the Heat Index (HI) as a function of heat and relative humidity. The HI describes how hot the heat-humidity combination makes it feel. As relative humidity increases, the air seems warmer than it is because the body is less able to cool itself via evaporation of perspiration. As the HI rises, so do health risks, as shown in Figure 4-26.

- When the HI is 90˚F, heat exhaustion is possible with prolonged exposure and/or physical activity.
- When it is 90˚-105˚F, heat exhaustion is probable with the possibility of sunstroke or heat cramps with prolonged exposure and/or physical activity.
- When it is 105˚-129˚F, sunstroke, heat cramps or heat exhaustion is likely, and heatstroke is possible with prolonged exposure and/or physical activity.
- When it is 130˚F and higher, heatstroke and sunstroke are extremely likely with continued exposure. Physical activity and prolonged exposure to the heat increase the risks.

Figure 4-25 Heat Index

Temperature (°F)

Relative Humidity (%)

	80	82	84	86	88	90	92	94	96	98	100	102	104	106	118	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution   Extreme Caution   Danger   Extreme Danger

Source: National Weather Service

Note: Since HI values were devised for shady, light wind conditions, exposure to full sunshine can increase HI values by up to 15˚F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

Figure 4-26 Possible Heat Disorders by Heat Index Level

CLASSIFICATION	HEAT INDEX	EFFECT ON THE BODY
Caution	80˚F – 90˚F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90˚F – 103˚F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103˚F – 124˚F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125˚F or higher	Heat stroke highly likely

Source: National Weather Service

The NWS has in place a system to initiate alert procedures (advisories or warnings) when the HI is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for the issuance of excessive heat alerts is when the maximum daytime high is expected to equal or exceed 105˚F and a nighttime minimum high of 80˚F or above is expected for two or more consecutive days. The NWS office in Sacramento can issue the following heat-related advisories as conditions warrant:

- **Excessive Heat Outlook**: issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead time to prepare for the event, such as public utilities, emergency management and public health officials.
- **Excessive Heat Watch**: issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. A Watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat event mitigation plans.
- **Excessive Heat Warning/Advisory**: issued when an excessive heat event is expected in the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurring. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

4.4.6.3 Magnitude & Severity

Critical – As discussed above, 21 extreme heat incidents were recorded in the County since 1993, which resulted in nine deaths. Potential secondary impacts of extreme heat events include lost time, maintenance costs, and damaged building contents. Even a minor event of extreme temperatures can have a significant impact on CCWD resources and County resources, necessitating the activation of shelters, severe weather plans, and other measures.

During the 2022-2023 plan update process, the HMPC expressed concern about employee safety and the impacts on electrical systems during extreme heat events. The HMPC also emphasized on increased water usage and installation of additional air conditioning units as the impacts of extreme heat events. The HMPC also mentioned that CCWD operates a robust capacity designed for fire flow, although extreme heat could cause capacity issues in mid-term.

4.4.6.4 Past Occurrences

The NCEI data shown in Table 4-22 lists 21 extreme heat incidents in the County since 1993.

Table 4-22 NCEI Excessive Heat Events in Calaveras County, 1993 to 2023

HAZARD TYPE	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Excessive Heat	5/8/2007	0	0	$0	$0
Excessive Heat	7/5/2007	0	0	$0	$0
Excessive Heat	5/31/2021	0	0	$0	$0
Excessive Heat	5/31/2021	0	0	$0	$0
Excessive Heat	5/31/2021	0	0	$0	$0
Excessive Heat	6/1/2021	0	0	$0	$0
Excessive Heat	6/1/2021	0	0	$0	$0
Excessive Heat	6/16/2021	0	0	$0	$0
Excessive Heat	6/16/2021	0	0	$0	$0
Excessive Heat	7/9/2021	0	0	$0	$0

HAZARD TYPE	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Excessive Heat	7/9/2021	0	0	$0	$0
Excessive Heat	7/9/2021	0	0	$0	$0
Excessive Heat	8/14/2021	0	0	$0	$0
Excessive Heat	8/14/2021	0	0	$0	$0
Excessive Heat	9/7/2021	0	0	$0	$0
Excessive Heat	9/7/2021	0	0	$0	$0
Excessive Heat	9/7/2021	0	0	$0	$0
Excessive Heat	6/10/2022	0	0	$0	$0
Excessive Heat	9/4/2022	0	0	$0	$0
Excessive Heat	9/4/2022	0	0	$0	$0
Excessive Heat	9/4/2022	0	0	$0	$0
Total		0	0	$0	$0

NOTES: Heat events are not included in this table, but accounted for an additional 38 events, two of which resulted in deaths.

Source: NCEI

4.4.6.5 Probability of Future Occurrences

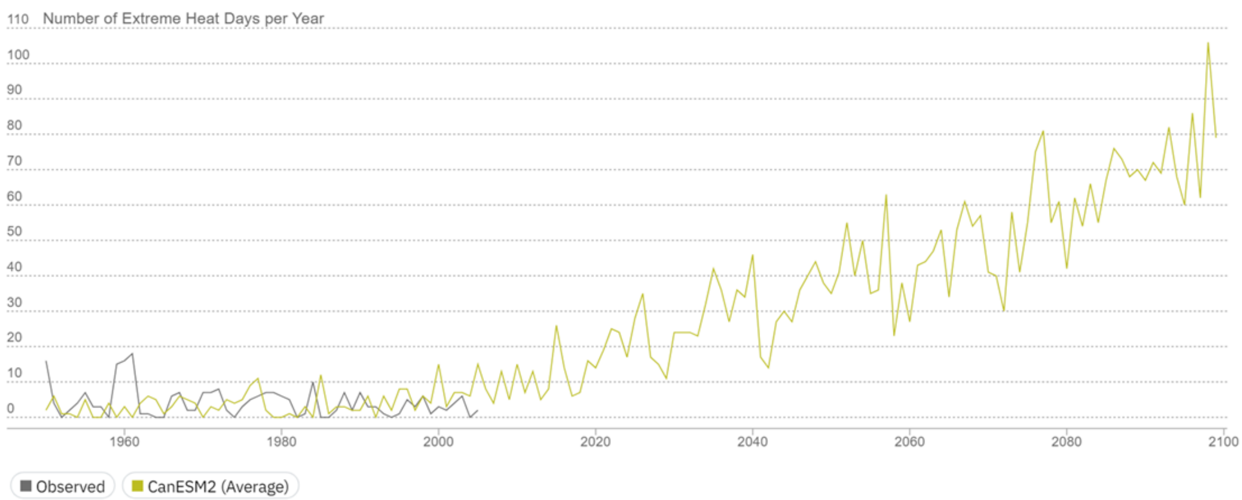
Highly Likely— Although not always documented in the NCEI database, extreme heat events occur annually in Calaveras County. As previously mentioned, extreme heat is less likely in eastern portions of the county at higher elevations, than in the western portion. Temperatures at or above 90°F are common most summer days in the western part of the County. As a result, the extent of extreme heat hazards covers the western portion of the County and may affect all CCWD facilities in those areas. Electrical systems in CCWD facilities can be vulnerable to extreme heat events. These impacts would specifically affect water tanks, pump stations, water treatment plants, and wastewater treatment plants near Burlson, Valley Springs, Wallace, and the area south of Copperopolis. Most of these facilities contain electrical systems that could be affected by heat waves, which could in turn impact control operations.

4.4.6.6 Climate Change Considerations

Temperatures in California have already risen almost 3°F since the beginning of the 20th century. The six warmest years on record have all occurred since 2014. Under a higher emissions scenario, historically unprecedented warming is projected during this century (Frankson 2022). As shown in Figure 4-27 this warming trend is expected to be observed in the County.

The number of extreme heat days is the number of days where temperatures exceed a threshold unique to a given location, using the 98th percentile of daily maximum temperatures for a place computed using data from April through October 1961 to 1990. In Calaveras County, the extreme heat threshold is 98.3°F (Cal-Adapt 2023). The historically observed number of extreme heat days in the County varies from 0 to 15 days, with a 30-year average of 4 days per year. By the end of the century, under the RCP 8.5 scenario and using the CanESM2 simulation (an average simulation that neither skews toward a hotter/drier scenario nor a wetter/cooler scenario), the number of extreme heat days per year could range from 9 to 106 days, with an expected 30-year average of 58 days per year (Cal-Adapt 2023). These changes will pose a risk to every region and sector across natural, built, and social systems.

Figure 4-27 California Historical and Projected Temperature Increases – 1961 to 2099



Source: Cal-Adapt. Data: LOCA Downscaled CMIP5 Climate Projections (Scripps Institution of Oceanography), Gridded Observed Meteorological Data (University of Colorado Boulder), LOCA Derived Products (Geospatial Innovation Facility).

Figure 4-28 and Figure 4-29 shows the average number of extreme heat days in 2005 and the projected average number of extreme heat days in the year 2050 (mid-century) under the RCP 8.5 scenario. As shown in these two maps, the County's average number of extreme heat days is predicted to at least double throughout mid-century.

Figure 4-28 Calaveras County Average Number of Extreme Heat Days (Historical: Year 2005)

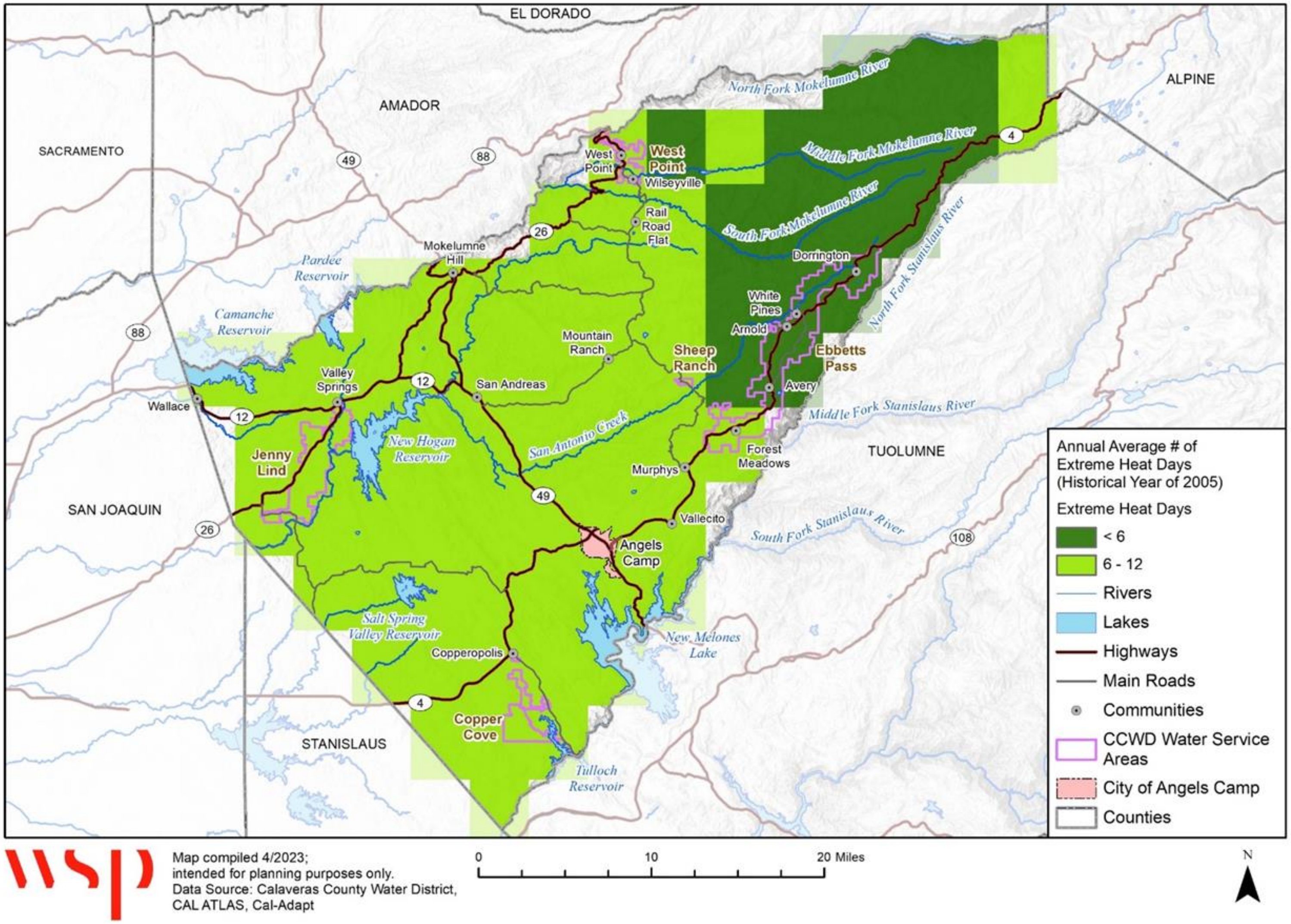
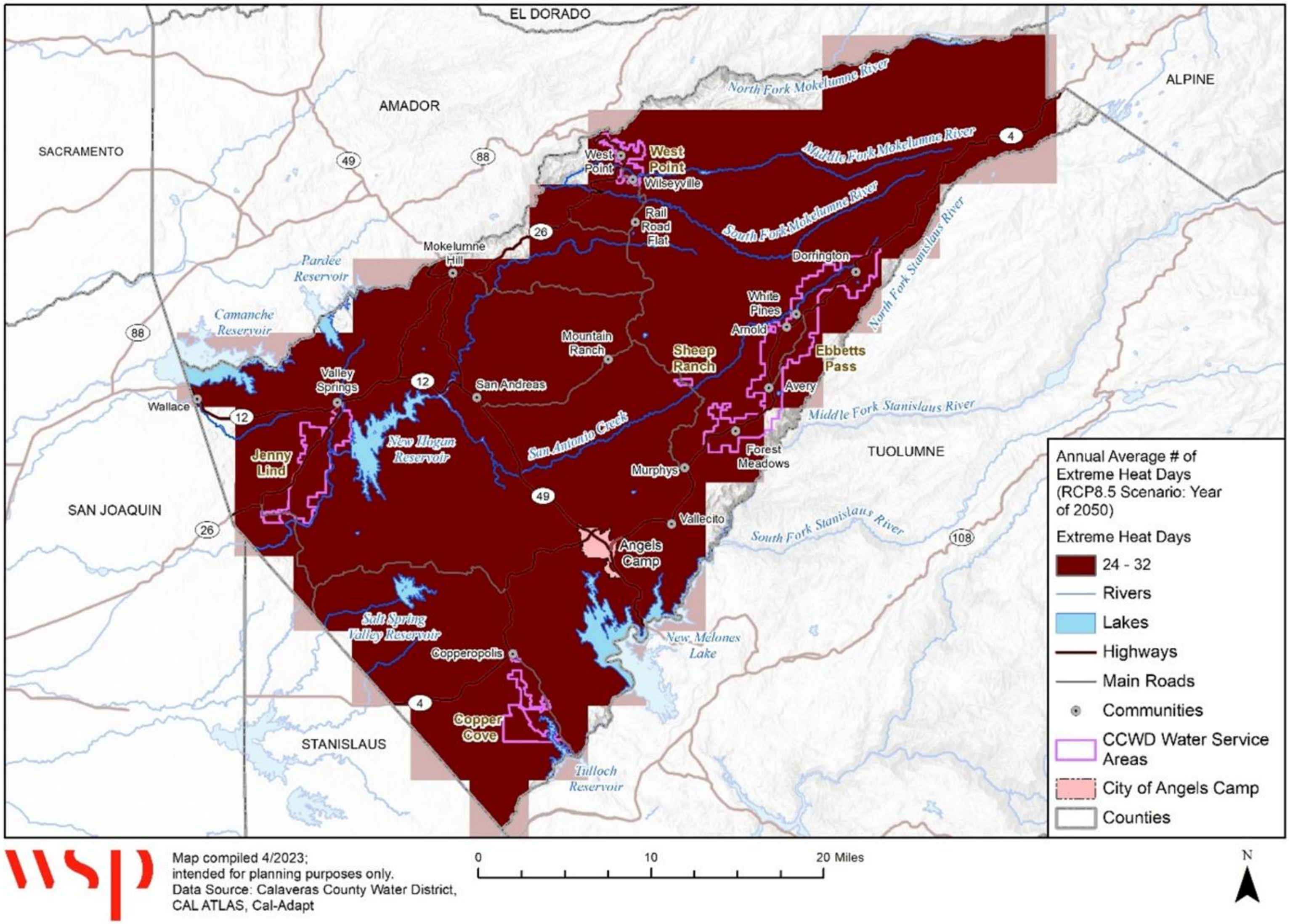


Figure 4-29 Calaveras County Average Number of Extreme Heat Days (RCP 8.5 Scenario: Year of 2050)



Furthermore, Figure 4-30 and Figure 4-31 below show the 30-year annual average maximum temperature during historical times (1961 – 1990) and predicted for mid-century under the RCP 8.5 scenario. As shown in these two maps, the County's annual average maximum temperature is predicted to rise throughout mid-century.

Figure 4-30 Calaveras County 30-year Annual Average Maximum Temperature (Historical: 1961 – 1990)

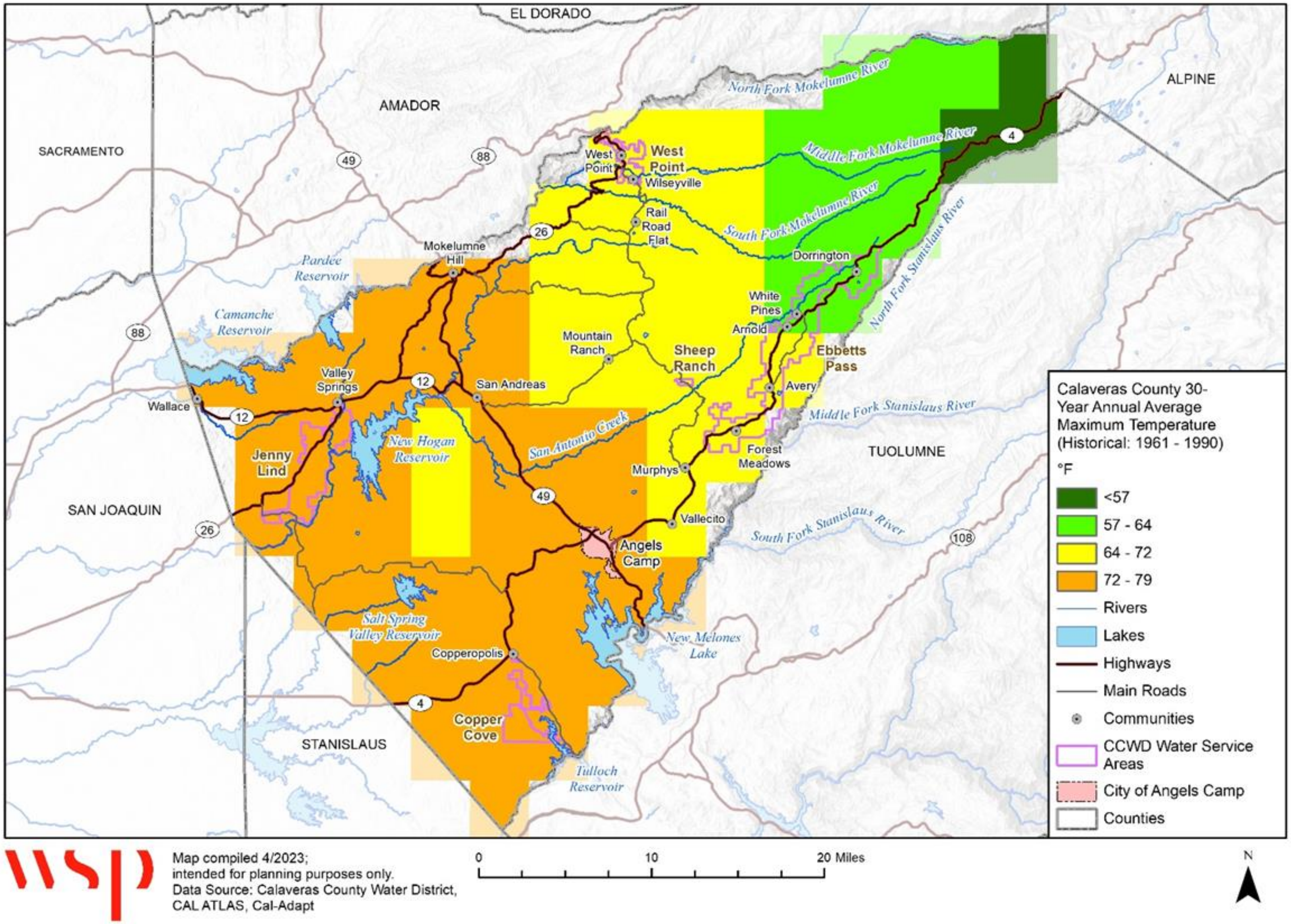
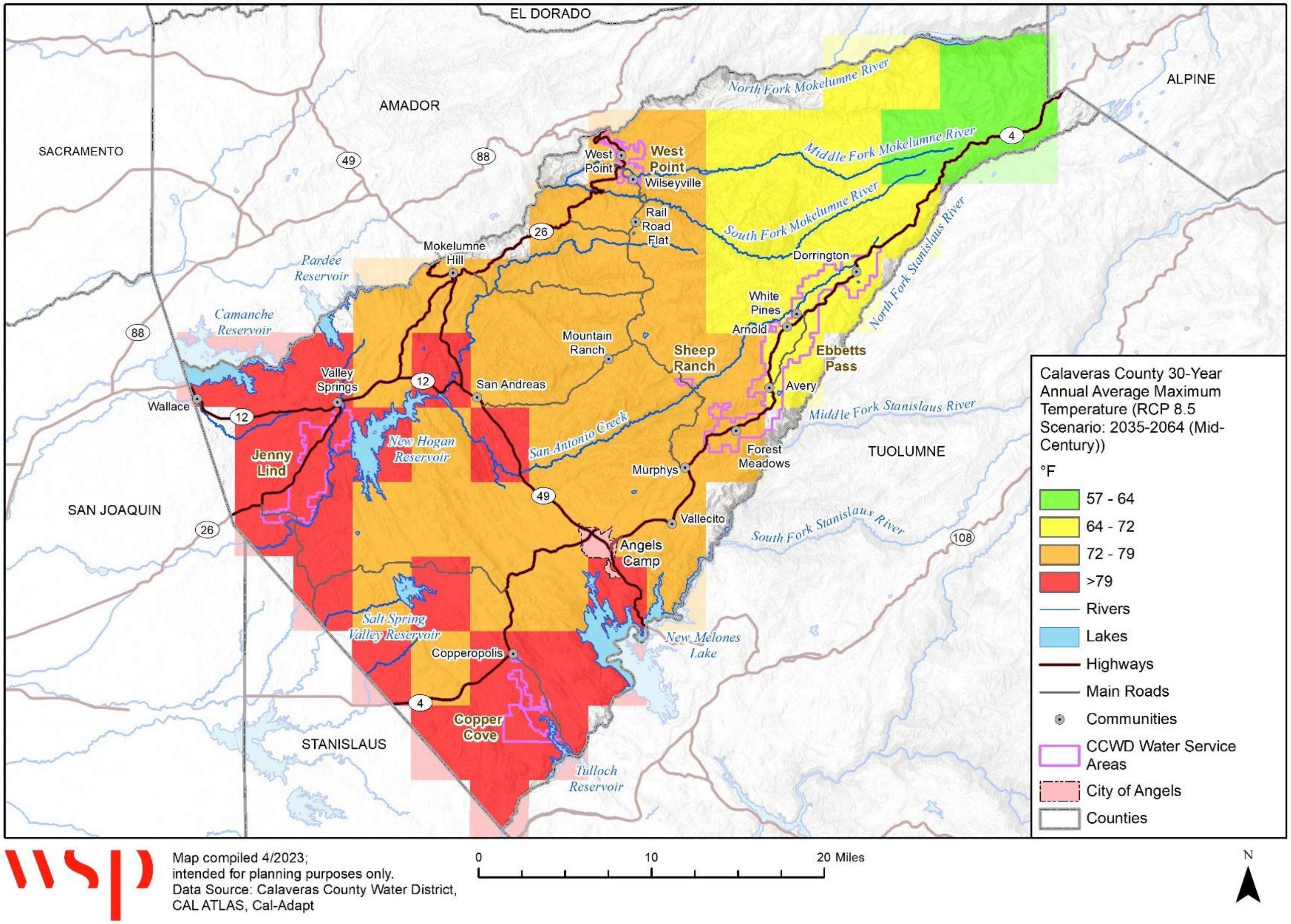


Figure 4-31 Calaveras County 30-year Annual Average Maximum Temperature (RCP 8.5 Scenario: 2035 – 2064 (Mid-Century))



4.4.6.7 Vulnerability Assessment

People

As the County heats up, the worst health impacts will be felt among lower-income households—many of whom work or even live outdoors or cannot afford air conditioning at home—and among those too elderly or frail to physically withstand the heat or get themselves to air-conditioned facilities. These may include the Copperopolis and Valley Springs communities situated at the lower elevations in the County.

The California Climate Adaptation Strategy (2022a), citing a California Energy Commission study, states that "over the past 15 years, heat waves have claimed more lives in California than all other declared disaster events combined." This study shows that California is getting warmer, leading to an increased frequency, magnitude, and duration of heat waves. These changes could lead to an increase in deaths related to extreme heat in Calaveras County, and will substantially worsen with climate change particularly along the western slope where the number of extreme heat days per year is projected to increase the greatest. Water customers may also increase water usage during extreme heat events both to cool down and to increase irrigation. This water usage would also increase with climate change.

Property

The CCWD's facilities and assets will face additional strain as temperatures rise. This will result in increased cooling costs and a reduction in the lifespan of crucial equipment such as motors, motor control centers, roofing, and parking lot pavement. The 10-degree rule, an industry standard, indicates that for every 10˚C (18˚F) increase in operating temperature, the lifespan of motor insulation decreases by a factor of one-half (WUCA 2020). Climate change is expected to substantially affect extreme heat events due to increased temperatures. As a result, decreased lifespan of certain equipment on CCWD properties will lead to higher replacement costs.

Critical Facilities and Lifelines

As temperatures rise due to climate change, the strain on energy systems is expected to increase. This strain will have dual effects, including reduced efficiency and performance, as system operators struggle to cool down facilities. It will also lead to increased electricity consumption and costs due to a surge in demand for air conditioning.

Moreover, as temperatures continue to rise, projected increases in summer demand may exceed the capacity of existing energy infrastructure, including substations and distribution line infrastructure and systems. This may result in peak demand exceeding the local utility's capacity for supply, which can lead to blackout-conditions or PSPS events. The effects of rising temperatures due to climate change on energy systems were evident during the September 2021 heat wave in California. The heat wave generated significant impacts across the state, and according to the California Independent System Operator (ISO) President and CEO, it was one of the most challenging events in the history of the ISO grid (CaISO 2021). The record demand for electricity threatened power outages that were narrowly averted through unprecedented actions. These power outages and the secondary impacts on critical water infrastructure dependent on electricity will worsen with climate change.

Economy

There may be multiple implications on the economy from the effects of extreme heat. Such impacts may include delays in completing scheduled work activities, heat-related disruptions to the power grid that impact the ability to operate (e.g., pumps go offline), short-term increases in workload as scheduled activities get moved into shorter work windows, increased costs associated with higher staffing levels to offset the need for more on-site rest periods and increases in staff sick days for existing health conditions exacerbated by heat and heat illness.

Cultural, Historic and Natural Resources

Extreme heat also threatens California's natural systems. Increasing temperatures, for example, lead to an exacerbated risk of wildfire, drought, and its effects on the health of watersheds, and the direct effects of heat on plants and animals resulting in reduced fitness, increased stress, migration, and death. In Calaveras, summer days will likely be increasingly hot and dry, increasing the potential of the drying up of surface water sources. As the climate heats up, the region is likely to have a reduced snowpack in the mountains, leading to decreases in spring runoff. Extreme heat exacerbated by climate change may also lead to higher evaporation of existing reservoirs, which will lead to less available ground and surface water. Increased energy demand from air conditioning will likely lead to increased water demand, as electricity generation is heavily water-dependent.

4.4.6.8 Development Trends

As structures and buildings are not usually directly impacted by extreme heat, continued development is less impacted by this hazard than others in the plan. However, pre-emptive measures such as the construction of green buildings that require less energy to heat and cool, the use of good insulation on pipes and electric wirings, and smart construction of structures that minimize exposure to severe temperatures may help increase the overall durability of the buildings and the community to extreme heat.

4.4.6.9 Risk Summary

- There have been 59 heat events recorded by the NOAA NCEI database between 1993 and 2023 with two recorded deaths.
- CCWD facilities vulnerable to extreme heat events include water tanks, pump stations, water treatment plants, and wastewater treatment plants near Burlson, Valley Springs, Wallace, and the area south of Copperopolis.
- Extreme heat events can have negative impacts on CCWD employee safety and CCWD electrical systems.
- Climate change is expected to increase the frequency and severity of extreme heat events.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Extensive	Highly Likely	Critical	Medium

4.4.7 Extreme Cold and Winter Storms

4.4.7.1 Hazard/Problem Description

Extreme cold often accompanies heavy snow and winter storms. It is most likely to occur in the winter months of December through February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities. Extreme cold can also affect the crops grown in Calaveras County.

In 2001, the NWS implemented an updated Wind Chill Temperature index, which is shown in Figure 4-32. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4-32 Wind Chill Temperature Chart

Temperature (ºF)

Wind (mph) / Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes / 10 minutes / 5 minutes

$$\text{Wind Chill (ºF)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (ºF) V= Wind Speed (mph)

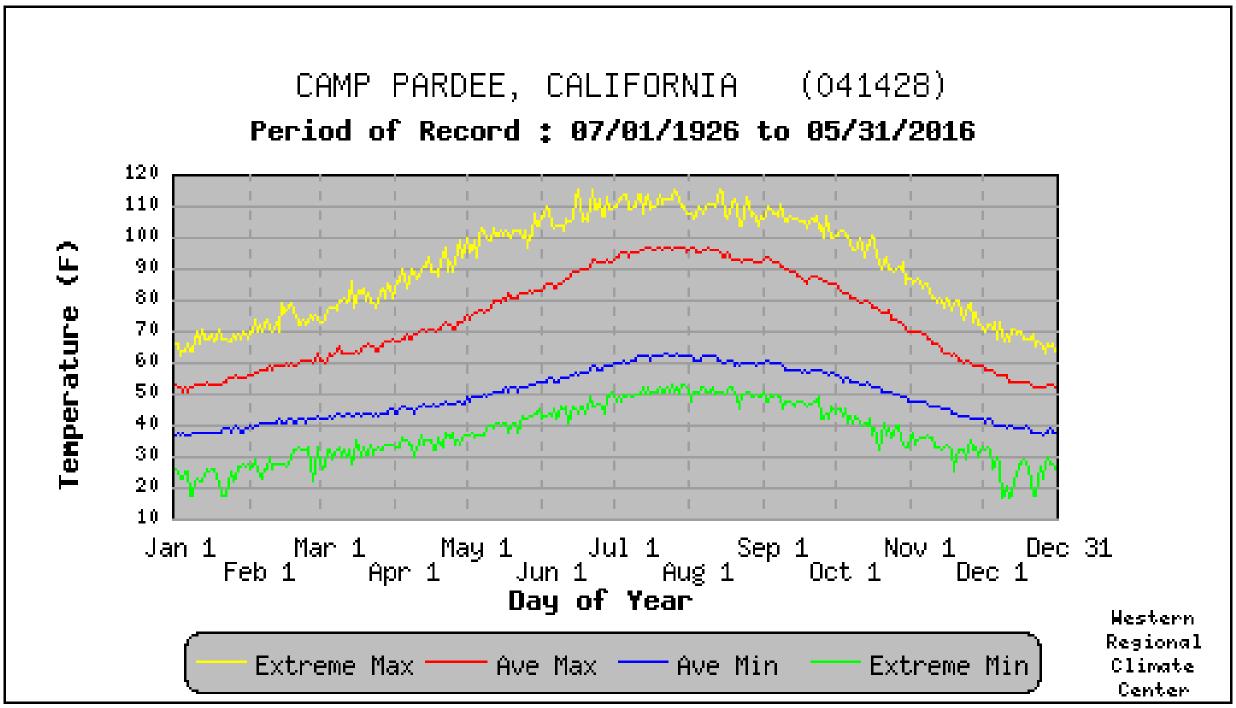
Effective 11/01/01

Source: National Weather Service

Information from the two representative weather stations introduced in Section 4.2.11 is summarized below and in Figure 4-33 and Figure 4-34.

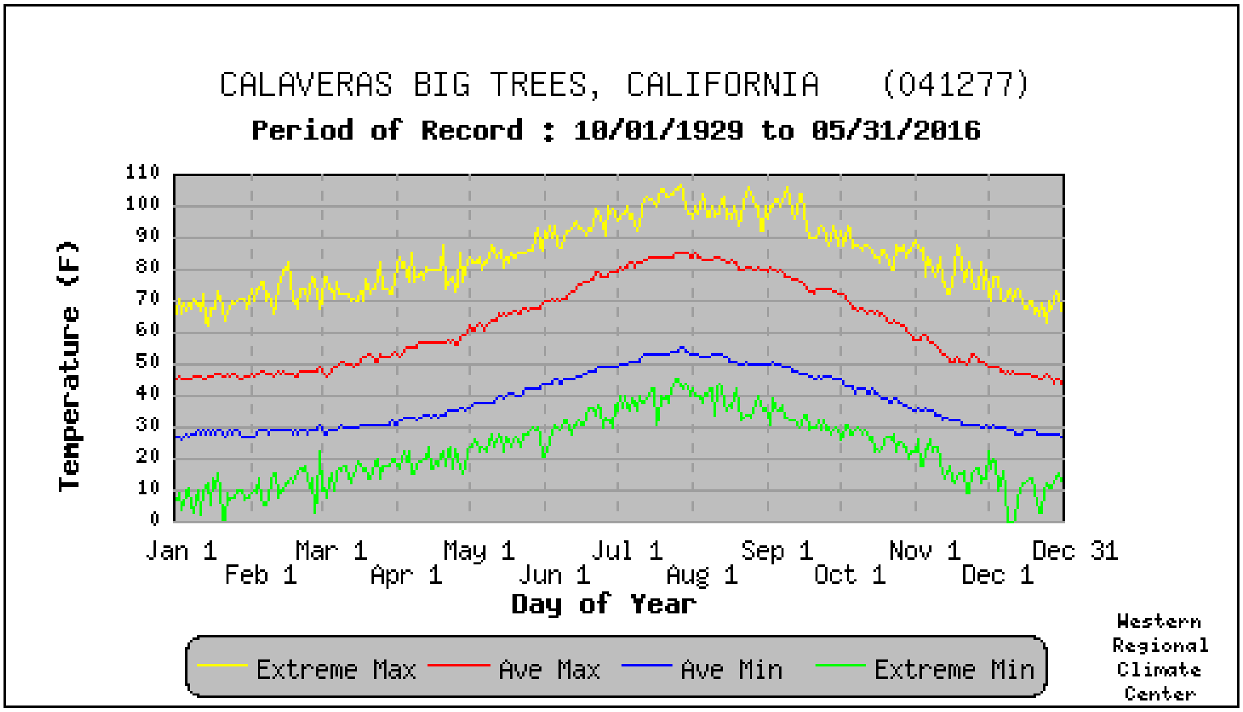
In Calaveras County, monthly average minimum temperatures from November through April range from the upper 30s to the higher 40s, and cold and freezing temperatures can occur across the County. The extent of freezing events is most likely to cover the entire County. More freezing events due to snow accumulation may occur in the eastern portion of the County, while similar cold temperature/freeze events may occur in the western portion of the County and result in crop damage. The lowest temperature on record at Camp Pardee is 17˚F recorded on December 12, 1932. On average, there were 11.3 days annually with a low temperature below 32˚F; more than half of these occurred in December and January. At Camp Pardee, temperatures of 32˚F or below are on record for every month from December through March. At the Calaveras Big Trees station, the lowest recorded temperature on record is -4˚F on February 3, 1932. On average, there are 11.7 days annually that are below 32˚F; most occurring in December and January.

Figure 4-33 Daily Temperature Averages and Extremes, Camp Pardee, 1926 – 2016



Source: Western Regional Climate Center, www.wrcc.dri.edu/CLIMATEDATA.html

Figure 4-34 Daily Temperature Averages and Extremes, Calaveras Big Trees, 1929 – 2016



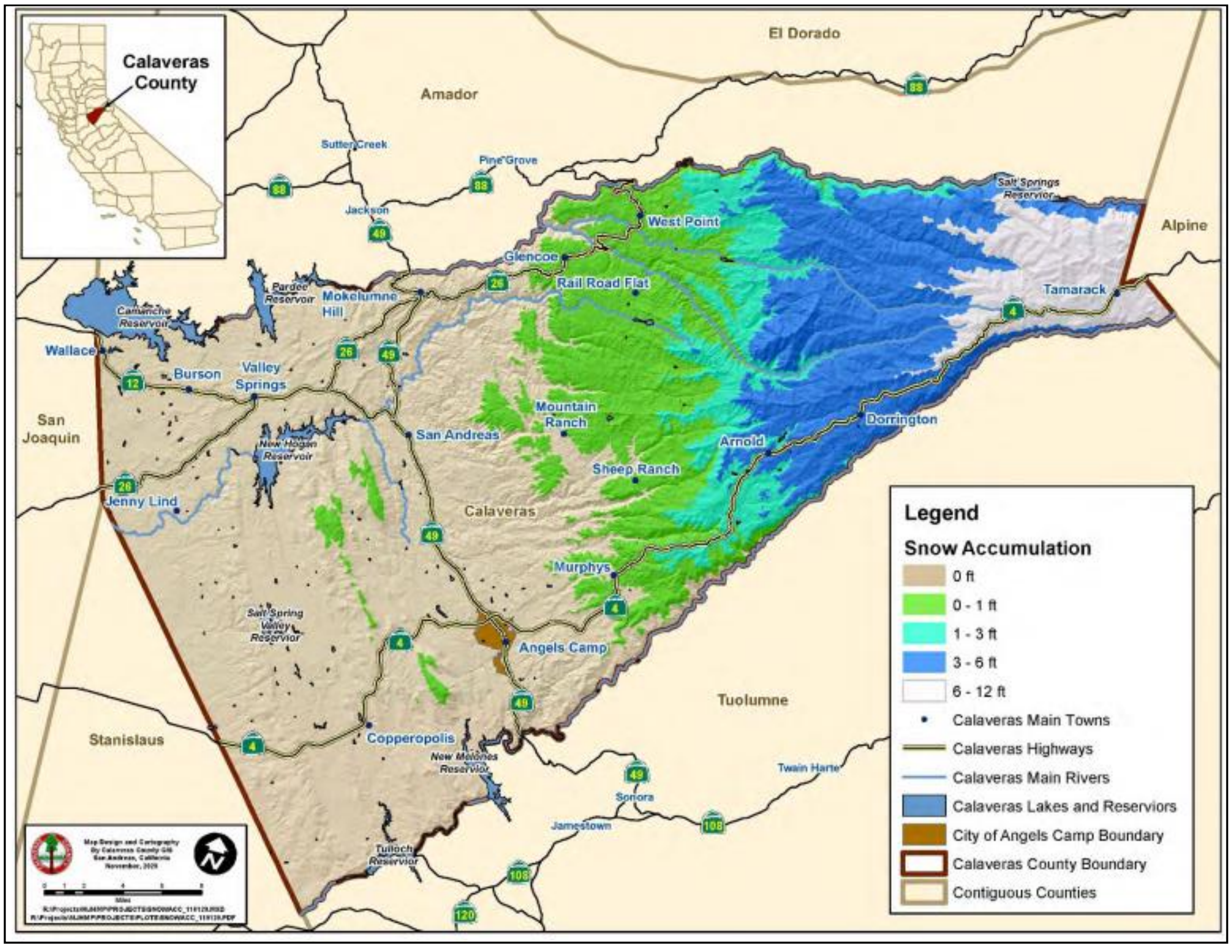
Source: Western Regional Climate Center, www.wrcc.dri.edu/CLIMATEDATA.html

Severe winter storms include events related to heavy snow, blowing snow, ice, sleet or freezing rain, and extreme cold temperatures (including wind chill). Blizzards are severe winter storms that pack a combination of blowing snow and wind resulting in very low visibilities. Sometimes strong winds pick up snow that has already fallen, creating a ground blizzard. Hazardous winter weather may also result from bitterly cold temperatures and may not involve snow. The NWS generally categorizes winter storms into the following:

- Winter Storm: indicates heavy snow or significant ice accumulations
- Blizzard: A blizzard means that the following conditions are expected to prevail for a period of three hours or longer: Sustained wind or frequent gusts to 35 miles an hour or greater; and considerable falling and/or blowing snow (i.e., reducing visibility frequently to less than ¼ mile)
- Ice Storm: An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous. Significant ice accumulations are usually accumulations of ¼" or greater.

Snow accounts for much of the precipitation in the higher elevations in the eastern part of Calaveras County. Snowfall in the Sierra Nevada Mountains increases with elevation. The lower foothills rarely receive any measurable snow. Middle elevations receive a mix of snow and rain during the winter. Above 6,000 feet, most precipitation falls as snow. It is not unusual, in some locations, to have ten feet of snow on the ground for extended periods. Figure 4-35 shows the average annual snow accumulation in the County, which was created by Calaveras County GIS in November 2020 for the 2021 Calaveras County MJHMP that covers the County, City of Angels Camp, and Murphys Sanitary District. In addition, according to WRCC's climate data, the County receives the highest amount of snowfall annually from December to March. January is when the County receives the highest amount of snow, which is an average 29.44 inches between the year 1929 and 2023.

Figure 4-35 Average Annual Snow Accumulation in Calaveras County



Source: Calaveras County GIS, November 2020, http://calaveragov.us/Portals/0/Images/snowfall.jpg

4.4.7.2 Geographic Area

Extensive – Extreme cold and winter storms have the potential to affect all corners of Calaveras County, potentially impacting the entirety of CCWD's service area. The highest degree of damage from winter events is anticipated in the downtown sectors of incorporated communities, where extensive trees, crucial infrastructure, and denser development are prevalent.

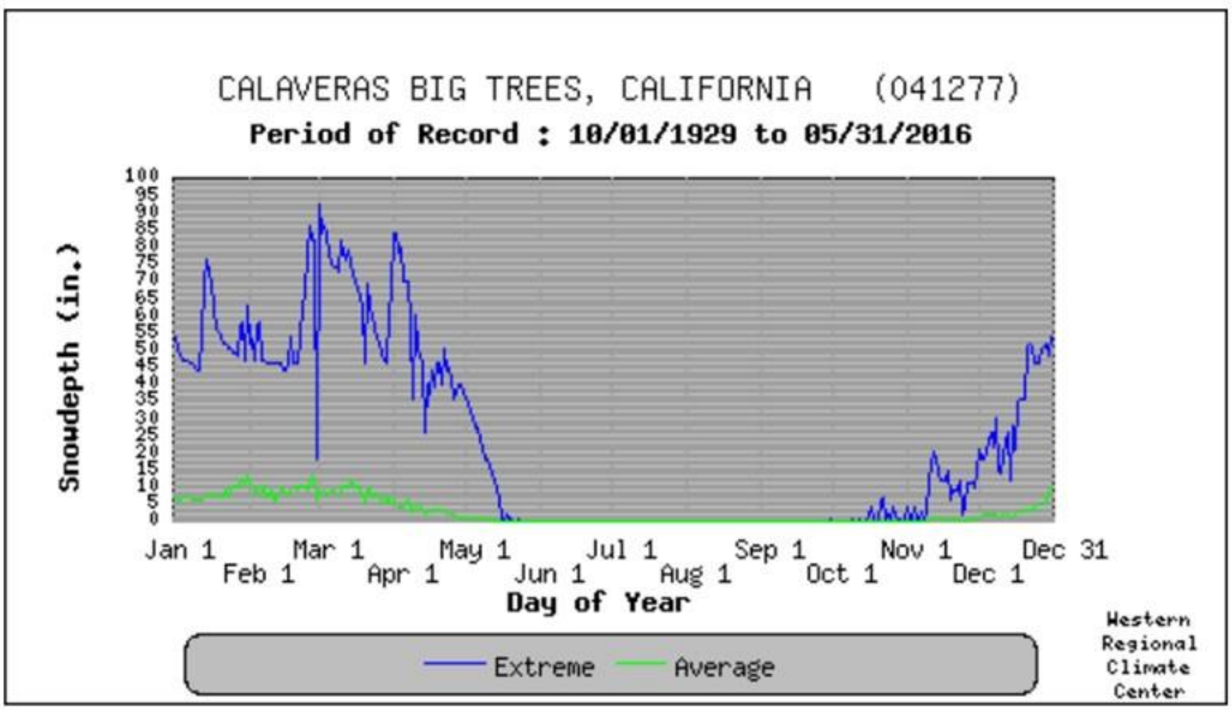
In terms of snow accumulation, larger snowstorms are more likely to occur in the northern reaches of the Planning Area, where elevations are higher. Notably, the service areas most susceptible to impact are West Point, Ebbetts Pass, and Sheep Ranch, collectively encompassing 6,572 connections and serving 12,677 residents

4.4.7.3 .Extent (Magnitude and Severity)

Critical – NCEI data recorded 20 cold/wind chill and extreme cold/wind chill incidents for Calaveras County since 1996, which resulted in four deaths yet no property or crop damage. However, there are potential secondary impacts associated with lost time, maintenance costs, and damaged building contents. Even a minor event of extreme temperatures can have a significant impact on city resources, necessitating the activation of shelters, severe weather plans, and other measures.

With regards to winter storms, according to WRCC, from 1929 to 2016, the Calaveras Big Trees weather station receives an annual average snowfall of 129.5 inches. Most of the snowfall was recorded during the months between November and April. The daily snow depth average and extreme are shown in Figure 4-36. The highest annual snowfall recorded was 287 inches from 1951 to 1952. The highest monthly snowfall recorded was 128.5 inches in January 1933. Moreover, NCEI data recorded a combination of 474 blizzard, heavy snow, winter storm and winter weather events for Calaveras County since 1996. These events resulted in $1,316,000 of property damage, three deaths and five injuries.

Figure 4-36 Daily Snowdepth Average and Extreme, Calaveras Big Trees, 1929 – 2016



Source: Western Regional Climate Center, www.wrcc.dri.edu/CLIMATEDATA.html

4.4.7.4 Past Occurrences

NCEI data recorded 20 cold/wind chill and extreme cold/wind chill incidents for Calaveras County since 1996. These events resulted in four deaths. No property or crop damage was recorded.

NCEI data recorded a combination of 474 blizzard, heavy snow, winter storm and winter weather events for Calaveras County since 1996. These events resulted in $1,316,000 of property damage, three deaths and five injuries. Table 4-23 shows these events categorized by specific event type, followed by details on these events. No ice storm event was recorded for Calaveras County.

Table 4-23 Blizzard, Heavy Snow, Winter Storm, and Winter Weather Events in Calaveras County

HAZARD TYPE	PROPERTY DAMAGES ($)	CROP DAMAGES ($)	DEATHS	INJURIES	# of EVENTS	# of DAYS with EVENTS
Blizzard	0	$0	0	0	1	1
Heavy Snow	$1,125,000	$0	1	2	109	65
Winter Storm	$191,000	$0	1	3	264	163
Winter Weather	$0	$0	1	0	100	64
Total	$1,316,000	-	3	5	474	293

Source: NCEI 2023

The heavy snow and winter storm events are summarized below.

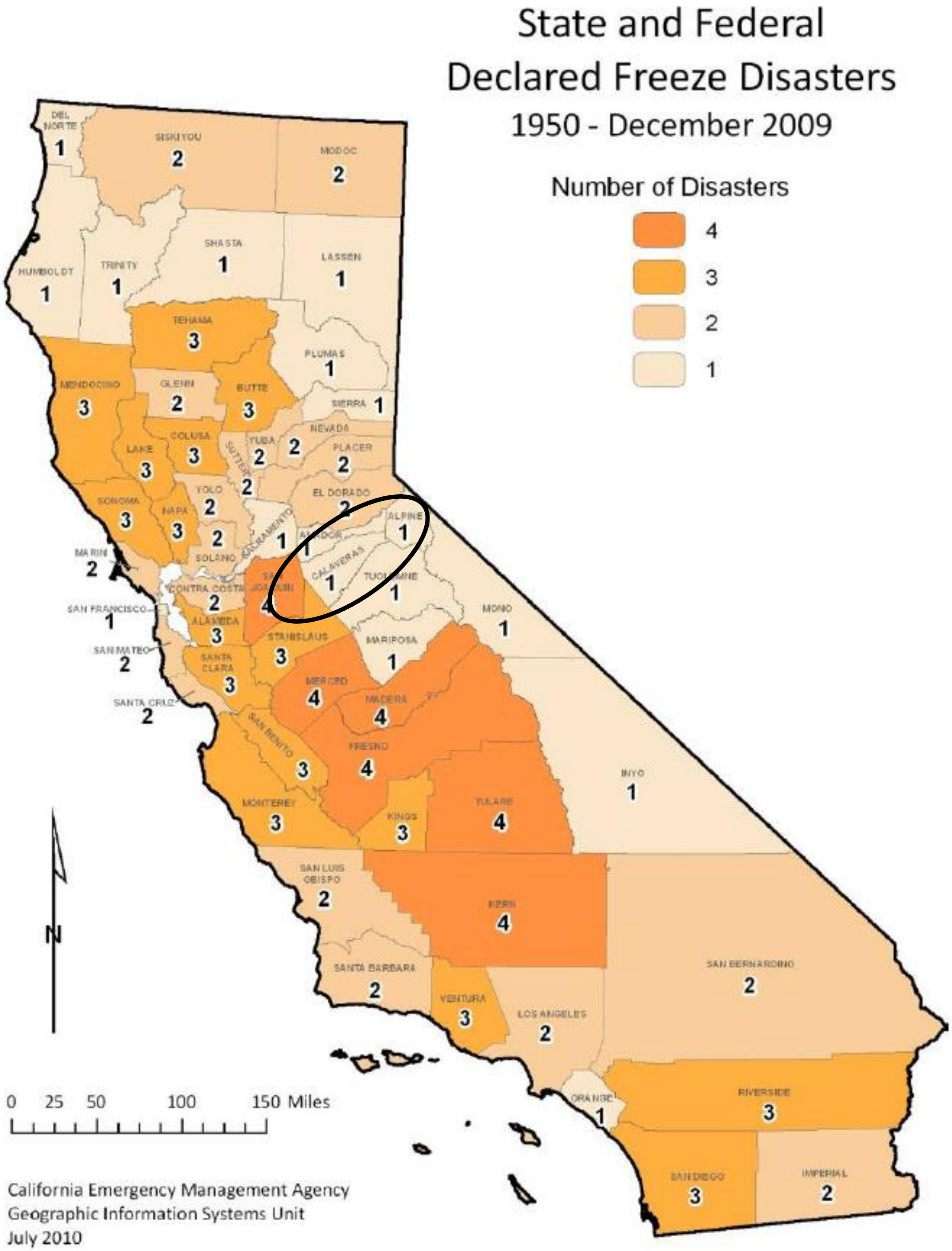
- **March 7, 2023 (Heavy Snow):** A cold winter storm brought low snow levels, with accumulating snow extending into the northern Sacramento Valley and the foothills. Accumulated heavy snow from a series of storms caused the roof of a school in Nevada City to collapse. There was 3.6 inches of snow reported 2 NNW of Nevada City on the 8th, but this was in addition to previous snow and road from earlier storms.
- **May 4, 2023 (Winter Weather):** A powerful, cold storm system with heavy snow and gusty winds sometimes brought dangerous driving with whiteout conditions. Snow amounts of 3 to 5 feet were reported in the mountains. Heavy snow fell down into the foothills impacting travel. Numerous schools were closed or had delays due to the snow. Gusty winds of 40-50 mph were recorded across the area, with gusts locally higher in the high elevations of the northern Sierra. The winds and low snow combined to cause dangerous travel conditions with an extended closure of Interstate 80.
- **February 4-5, 2019 (Heavy Snow):** Accumulating heavy, wet snow fell into the Motherlode foothills, causing major winter weather impacts. The heavy snow brought down many hundreds of trees & limbs, blocking roads at times and bringing down numerous power lines. Nearly 40,000 PG&E customers were reported without power in Tuolumne and Calaveras counties. Some power outages lasted several days before crews could reach and repair the lines. More than 40 schools closed down in Tuolumne and Calaveras counties, as well as most county offices and many businesses. Even snowplows got stuck on Highway 49 due to the heavy snow. Snow

reached down to as low as 750 feet elevation briefly. This event resulted in over $1 million in property damage.

- **March 15-17, 2018 (Winter Storm):** Heavy snow fell, impacting travel on Sierra Highways with chain controls, holds, and closures for elevations above 3000'. Numerous road closures were reported, Hwy 50 for avalanche control and collision prevention. This event resulted in $150,000 in property damage.
- **February 8-10, 2019 (Heavy Snow):** Heavy snow caused travel delays on foothill highways and some reported downed trees and local power outages. This event resulted in $100,000 in property damage.
- **December 20-22, 1996 (Heavy Snow):** The heaviest snow in many years caused a number of problems in the Shasta-Cascades region and the Sierra Nevada range. The heavy snow pulled down numerous trees, taking power lines with them. About 120,000 people in the Sierra Nevada and its foothills lost power for several days, with some getting back power late Christmas Eve, and most regaining power by the day after Christmas. The snow closed most roads and several major highways in the region. This event resulted in one death and two injuries.

Figure 4-37 shows disaster declarations due to freeze disasters in the County and California. The greatest concentrations are in the Central Valley. The disaster declaration for Calaveras County was issued in 1969.

Figure 4-37 State and Federal Declared Freeze Disasters from 1950 to 2009



4.4.7.5 Source: CalOESProbability of Future Occurrences

Highly Likely – 494 freeze, extreme cold and winter weather events occurred in Calaveras County (e.g., Northern San Joaquin Valley, Motherlode, and West Slope Northern Sierra zones) over the past 31 years (1996-2023) of record keeping which equates to 16 freeze, extreme cold or winter weather events on an annual basis. These types of events will occur annually, and they can affect most CCWD facilities. Impacts would be mostly related to limited accessibility during winter storm events, power outages, and difficulty coordinating major repairs due to storm damage. The likelihood of future occurrences for extreme cold and winter weather events in the County, including those that would impact the CCWD's facilities was ranked slightly higher than Calaveras County. Winter storms was ranked a likely future occurrence. A recent study carried out by NOAA found that the frequency of extreme cold weather may increase due to climate change.

4.4.7.6 Climate Change Considerations

Regarding extreme cold temperatures, a study funded by NOAA's Climate Program Office's Modeling, Analysis, Predictions and Projections (MAPP) program, which used machine learning techniques to link extreme cold weather in the United States to Arctic warming, suggests that extreme cold events may increase (Cohen et al 2021). Accelerated Arctic warming has been evident since the 1990s as one of the more robust signs of global warming. MAPP program's researchers concluded that Arctic warming and climate change are likely contributing to the increasing frequency of Arctic polar vortex stretching events, which deliver extreme cold from the north pole to the lower United States. One such event occurred in 2021 in Texas when a cold wave caused the collapse of the state's infrastructure and resulted in approximately $80-130 billion in direct and indirect economic losses (Cohen et al 2021).

As far as winter storms, a recent article published in the New York Times mentioned that winters have been getting warmer in the United States and elsewhere. However, cold snaps still occur. Meteorologists say it was caused by the polar vortex, a mass of cold Arctic air that moved southward into Canada and the United States. That air had become very cold sitting over the North Pole at a time of year when no sunlight reaches the region and the Arctic Ocean is frozen over. When it reached the United States, the cold air, intruding between masses of warmer air, caused temperatures and air pressure to plunge drastically. The falling temperatures triggered a deep freeze in many locations, and the pressure changes generated strong winds. The winds combined with the clash of air masses into what meteorologists call a bomb cyclone, a rotating, fierce storm that can bring heavy snow or rain. However, what causes the polar vortex to make southward excursions like this is debated. Some scientists say that the rapid warming of the Arctic, which has warmed nearly four times faster than other regions, is responsible. The research is continuing. To conclude, higher winter temperatures in the Western United States, for example, have increased the survivability of tree-destroying insects like pine beetles, contributing to large-scale die-offs in forests. Warming also means more precipitation falls as rain, rather than snow, reducing winter snowpack that in many areas is critical for water supplies. Rain-on-snow and flooding events, in general, can increase. When it is cold enough for snow rather than rain, however, more snow can fall. That is because air can hold more moisture when it is warmer.

4.4.7.7 Vulnerability Assessment

Property

Buildings are considered to be exposed to severe winter weather, but structures in poor condition may risk the most damage mostly due to snow loads. Vulnerability is influenced both by architecture and types of construction materials and should be assessed on a building-by-building basis. Those that are located under or near overhead lines or large trees may be vulnerable to falling ice or may be damaged in the event of a collapse.

Extreme cold temperatures impact structures when pipes or water mains freeze and burst, causing damage. Cold temperatures can also, in the most extreme of circumstances, make materials more fragile and breakable. Extreme cold temperatures may also lead to higher electricity and natural gas demands to maintain appropriate indoor heating levels combined with damages caused to the delivery infrastructure such as frozen lines and pipes. Research suggests that extreme cold events may increase with climate change, but also result in warmer winters where precipitation occurs as rain rather than snow, which will reduce the amount of snowpack on buildings and structures. This can effect property mostly by impacting the structures, whether the buildings or infrastructure on a parcel. For example, colder temperature periods that can increase with climate change could freeze water pipes that convey CCWD water customer’s potable water supply. However, the greatest impacts will be on remote and vulnerable populations that loose electricity and water supply at the same time and require travel in heavy snow to find resources and support.

People

Winter storms, and heavy snow, and high winds have similar impacts on people. The combination of heavy snow and strong winds can result in unintentional power outages, and therefore impact the CCWD’s customers if long-term power outages result in a temporary loss of wastewater service or water delivery (e.g. WTP closures, pump station failures). Transportation around the winter storm-prone areas can also be affected, with road closures interrupting the movement of goods.

The interruption of power also causes the loss of electricity, which affects the heating of homes and water, pumping of water, refrigeration, lighting, computing, as well as the loss of communication systems like television and the internet. Power outages can be life-threatening to those dependent on electricity for life support. Vulnerable populations, including the elderly, low-income and/or linguistically isolated populations, particularly those in West Point and Sheep Ranch at higher elevations can face worse isolation and exposure during severe winter weather events and face secondary effects of the hazards. These losses of water and wastewater service are also likely if the CCWD temporarily loses electrical service necessary to run WTPs and WWTPs during heavy winter storms. In these events the most vulnerable populations would need temporary water drinking water supplies. Because the CCWD provides water supplies during emergencies and can identify mutual water provider partners to deliver the water supplies in extreme weather conditions if certain roads are not accessible, overall impacts to their customers, including those most vulnerable to power outages during winter storms are anticipated to be moderate. Nonetheless, these impacts are expected to increase with climate change and as more severe winter storms or as cold Arctic air move south.

Severe winter storms produce snow and ice and create problems and challenges to transportation systems. Uprooted trees and fallen limbs pose possible hazards to roadways, structures, vehicles, and people. Roads can also close or may only be open to vehicles that are properly equipped with snow tires. Productivity is also lost due to the increased time it takes to go from one point to another. Typically, these secondary impacts from winter storms is temporary, but recent AR events like those that occurred in early 2023 have resulted in storms that have lasted multiple days, and these types of severe winter events are anticipated to increase with climate change. The severity of future AR events means remote and vulnerable populations within the CCWD's Planning Area (such as those along Ebbetts Pass) may go days without electricity and water supply, which will significantly increase the vulnerability of these populations.

Critical Facilities and Infrastructure

All critical facilities and infrastructure are exposed to severe winter weather, and particularly those facilities located in the eastern portion of the CCWD's Planning Area, including the communities of West Point, Ebbetts Pass, and Sheeps Ranch . The most common problems associated with this hazard are utility losses and power outages. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water, and sewer systems may then not function without electrical power. Roads may become impassable due to ice or snow. Also, snowstorms can significantly impact the transportation system and the availability of public safety services. Of particular concern are roads in the County that provide access to isolated areas and vulnerable populations near West Point, Ebbetts Pass, and Sheeps Ranch. Several of these communities were also identified as moderately to highly vulnerable to hazards (see Section 4.3.5 Social Vulnerability). Prolonged obstruction of major routes, like State Highway 26 and 120 (Ebbetts Pass) can disrupt the shipment of goods and other commerce. Moreover, structures are put at an increased risk due to increased snow loads on roofs, and the increased threat of falling trees or power lines.

Extreme cold events can also have secondary impacts on CCWD's critical facilities and infrastructure. When extreme cold is accompanied by high winds or ice storms, power lines can be downed, causing a disruption in the transmission of power, and shutting down electric furnaces, which may lead to frozen pipes. Moreover, the loss of utilities or power outages during extreme cold events can have adverse secondary impacts on sensitive populations, particularly those that live in remote areas of the CCWD's Planning Area like West Point and Sheep Ranch. Hospitals and clinics may also experience a reduction in response or care capabilities due to electrical power outages.

In addition, during the 2023 plan update, the HMPC expressed particular concern regarding winter storm and extreme cold events impacts on charging stations, grid assessments, and community-based energy grid systems. Charging stations that rely on the electrical grid may not function during winter power outages unless they have backup power sources such as generators or battery storage systems. In cold weather, the performance of electric vehicle (EV) batteries can be affected, leading to reduced charging efficiency and slower charging speeds. Community-based energy grid systems often prioritize resiliency and reliability through localized generation and distributed energy resources. However, winter storms can also pose challenges to these systems' resiliency. For example, the availability of renewable energy sources may be limited during extreme weather conditions, and the reliance on localized generation may result in insufficient supply during high demand periods. Moreover, power outages can disrupt the stability of the community-based energy grid system, affecting the supply of electricity to local homes and businesses. Grid instability can result in voltage fluctuations, frequency imbalances, or even complete blackouts, impacting the reliability of the system.

In summary, the CCWD's critical water facilities are vulnerable to extreme cold, winter storms, and heavy snow, particularly the facilities along Ebbetts Pass, where heavy snow during AR events has the potential to result in downed trees, avalanches, and power outages. These winter weather impacts are all expected to intensify with climate change with either colder temperatures and more snow over a longer period of time or warmer temperatures that result more rain or heavier snow. NCEI data shows incidents resulting in $1,316,000 of property damage, three deaths, and five injuries associated with severe winter weather. In light of these past incidents, the CCED has comprehensive measures in place to mitigate vulnerabilities and manage impacts from future extreme cold and winter storms. These encompass utility readiness, structural integrity safeguards, hardening of water and wastewater facilities and associated electrical and SCADA communication systems, mutual aid agreements with other water providers and County agencies, contingency plans for secondary impacts, and emergency considerations for vulnerable populations.

Economy

Economic impacts primarily stem from snow removal and restoration activities. Other direct costs affect primarily the financial and insurance category from property damage. Disruptions to business operations resulting in short-term regional or local impacts may occur.

As mentioned previously, extreme cold can cause damage to buildings and infrastructure, resulting in significant repair costs. This can include damage to pipes, roofs, windows, and other structures. In addition, extreme cold can cause roads and bridges to freeze and crack, resulting in repair costs for governments and taxpayers. Extreme cold hazards can also disrupt business operations, causing lost revenue and profits. Moreover, extreme cold can also cause transportation disruptions, resulting in lost productivity and increased costs for businesses. Many of these economic disruptions could also worsen with climate change.

Cultural, Historic and Natural Resources

Extreme cold and winter storm hazards' impact on cultural resources would be similar to their impact on general properties. Extreme cold can also have significant effects on environmental resources, including water, soil, plant, and wildlife resources. In water bodies such as lakes, rivers, and ponds, extreme cold can cause ice cover to form, which can limit the amount of oxygen that is available for aquatic organisms and negatively impact aquatic ecosystems and wildlife. Soil can also freeze during extreme cold temperatures, affecting its health and nutrient availability, which can impact agricultural production.

Winter storms including heavy snow can have various impacts on natural resources. For example, heavy snowfall and ice accumulation can lead to the breakage of tree branches and even the uprooting of trees. Winter storms can also pose challenges to wildlife survival.

4.4.7.8 Development Trends

New critical facilities should be built to withstand potential winter storm and extreme cold impacts if built within hazard-prone areas. Also, as CCWD's Planning Area increases in population due to new residential construction particularly in the remote and higher elevation communities around Ebbetts Pass (e.g. Arnold, Dorrington, etc.), the number of people and housing developments exposed to extreme cold and winter weather events increases. Some of these larger developments, for example, those around the community or Arnold are only accessible from State Highway 4 and steep neighborhood roads making access difficult during winter storms. Climate change, in combination of more residential units in these existing developments, will further impact people and the operation and maintenance of key water facilities. This exposure will increase with climate change and shifts in weather patterns, thereby increasing the vulnerability of these rural communities, particularly those occupied by vacation renters or second-home owners not used to the severe weather conditions. Property and vacation renter education on knowledge and awareness of winter storms and heavy snow hazards can reduce the increased vulnerability.

4.4.7.9 Risk Summary

- Historical data shows 20 cold/wind chill and extreme cold/wind chill incidents for the County since 1996, which resulted in four deaths.
- Historical data shows a combination of 474 blizzard, heavy snow, winter storm and winter weather events for the County since 1996, which resulted in $1,316,000 of property damage, three deaths and five injuries.
- Extreme cold and winter storm hazards are predicted to happen on an annual basis.
- All critical facilities and infrastructure are likely exposed to severe winter weather. The most common problems associated with this hazard are utility losses.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Extensive	Highly Likely	Critical	Medium

4.4.8 Flood: 100-/500-year and Flood: Localized Stormwater Flooding

4.4.8.1 Hazard/Problem Description

100-/500-year Flood

Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. According to California DWR, flooding is the rising and overflowing of a body of water onto normally dry land. Floods can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. Floods can be extremely dangerous, and even six inches of moving water can knock over a person given a strong current. A car will float in less than two feet of moving water and can be swept downstream into deeper waters. This is one reason floods kill more people trapped in vehicles than anywhere else. During a flood, people can also suffer heart attacks or electrocution due to electrical equipment short-outs. Floodwater can transport large objects downstream which can damage or remove stationary structures.

Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed through sediment deposition. Floodwater can also break utility lines and interrupt services. Standing water can cause damage to crops, roads, foundations, and electrical circuits. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Where flooding occurs in populated areas, warning and evacuation will be of critical importance to reduce life and safety impacts from any type of flooding.

There are three types of flood events in the County: riverine, flash, and urban stormwater. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reaches.

- **Riverine flooding** is the most common type of flood event and occurs when a watercourse exceeds its "bank-full" capacity. Riverine flooding generally occurs because of prolonged rainfall, or rainfall that is combined with already saturated soils from previous rain events. The duration of riverine floods may vary from a few hours to many days. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. The warning time associated with slow rise floods assists in life and property protection.
- **Flash flood** describes localized floods of great volume and short duration. In contrast to riverine flooding, this type of flood usually results from heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour.
- **Stormwater/Urban flood** events have increased as land has been converted from fields or woodlands to roads and parking lots and lost its ability to absorb rainfall. Urbanization increases runoff by two to six times that of natural terrain.

Other types of floods include general rain floods, thunderstorm floods, snowmelt and rain-on-snow floods, dam failure floods, and local drainage floods. The volume, onset, and duration characteristics for different types of floods are described below:

- **Snowmelt**—Flooding is characterized by moderate peak flows, large volume of runoff, moderate speed of onset, long duration, and marked daily fluctuation of flow.
- **Rain in a general storm system**—Flooding is characterized by high peak flows and moderate speed of onset and duration of flood flows.
- **Rain in a localized intense thunderstorm**—Flooding is characterized by high peak flows, relatively sudden onset, short duration of flow, and smaller volumes of runoff.

The potential for flooding can change and increase through various land use changes and changes to land surface, resulting in a change to the floodplain. Environmental changes can create localized flooding problems in and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

Health Hazards from Flooding

According to FEMA, certain health hazards are also common in flood events. While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. 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. Pastures and areas where cattle and hogs are kept, or their wastes are stored can contribute to polluted waters to the receiving streams.

Floodwaters also 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.

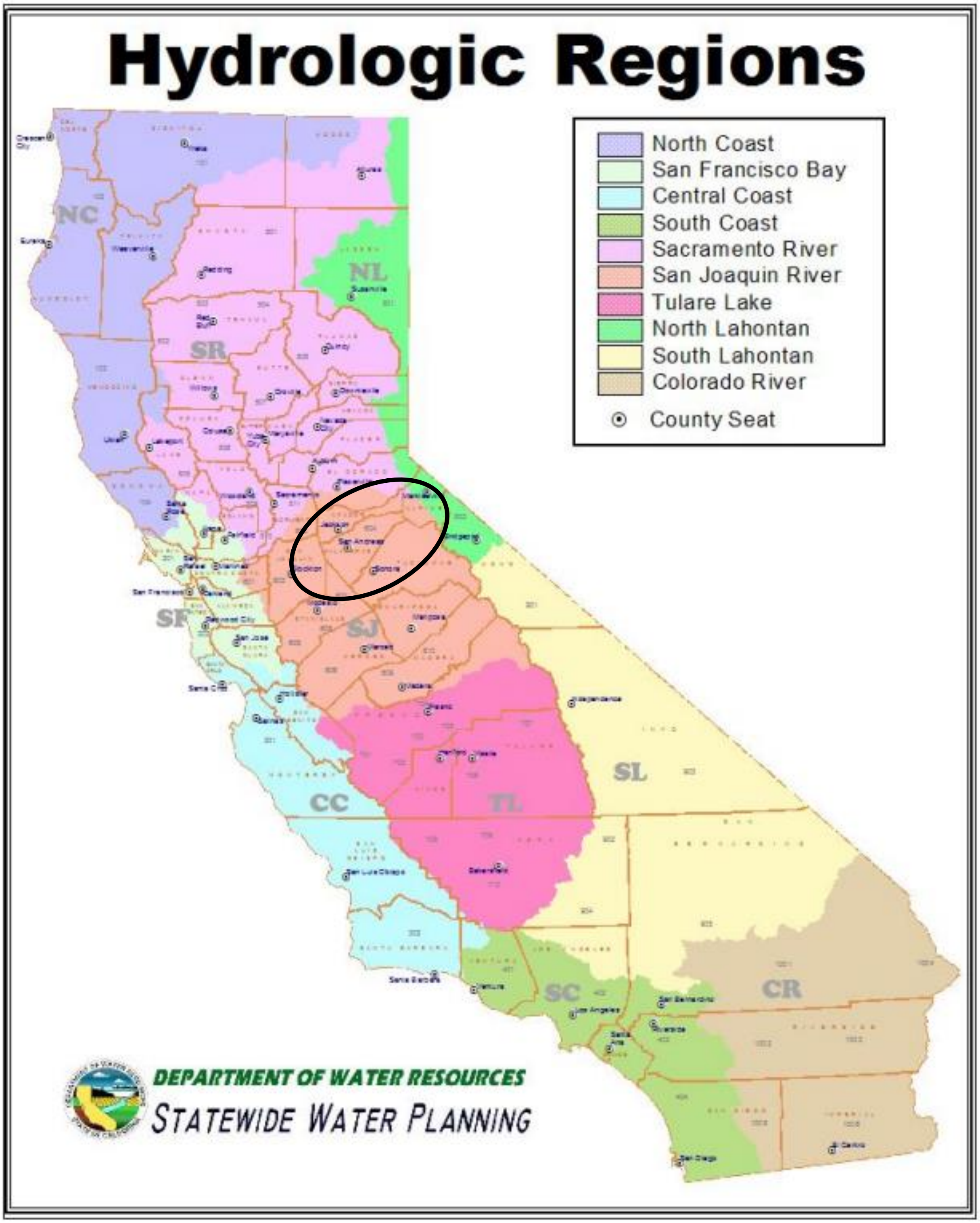
The second type of health problem arises after most of the water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet areas of a building that have not been properly cleaned breed mold and mildew. A building that is not thoroughly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced air system are not properly cleaned after inundation. When 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. If a water system loses pressure, a boil order may be issued to protect people and animals from contaminated water. Additionally, a fourth problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and irreplaceable keepsakes destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

4.4.8.2 Geographic Area

Significant – The geographical extent of flooding across Calaveras County is significant, as there are several major sources of flooding in the San Joaquin region, which encompasses the middle portion of the Central Valley bounded by the Sierra Nevada Mountains, the Coast Range, the divide between the American and Consumnes river watersheds, and the divide between the San Joaquin and Kings River watersheds. The region also includes portions of the Sacramento-San Joaquin Delta. Although predominantly agricultural, this region has experienced increased urbanization in recent years and is subject to flooding from winter storm events and snowmelt. A map of California's hydrological regions is provided below in Figure 4-38.

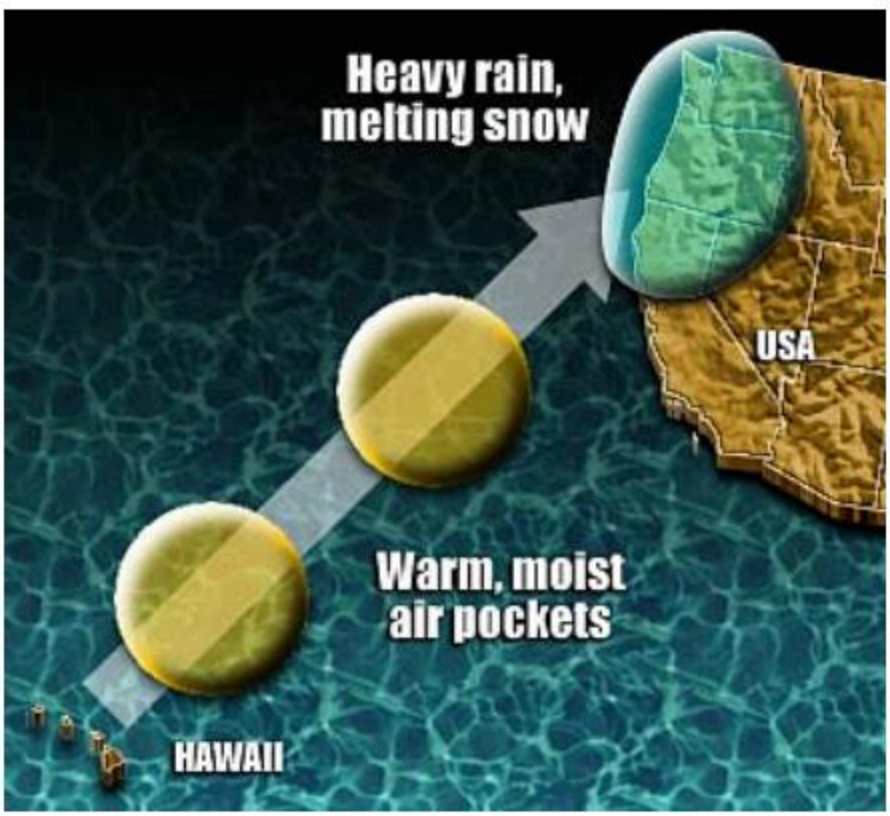
Figure 4-38 California Hydrologic Regions



The County encompasses multiple rivers, streams, creeks, and associated watersheds. The County is situated in a region that dramatically drops in elevation from the eastern portion (Sierra Nevada) to the western portion, where excess rain-on-snow can contribute to downstream flooding. Damaging floods the County occur primarily in the developed areas of the county. Flood flows generally follow defined stream channels, drainages, and watersheds.

A weather pattern called the "Pineapple Express" contributes to the flooding potential of the area. The Pineapple Express brings warm air and rain to the West (NOAA n.d.). A relatively common weather pattern, it brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. This weather pattern is shown in Figure 4-39.

Figure 4-39 Pineapple Express Weather Pattern



Source: USA TODAY research by Chad Palmer. http://www.usatoday.com/weatherwpinappl.htm

Flooding has been a major problem in Calaveras County and has an extent that is ranked by the County and the CCWD as critical, particularly where urban development intersects with flood plains. In Calaveras County, flooding may occur from heavy rainfall on saturated soils, rapid snowmelt, or a combination of these factors. Riverine flooding along the main channels of the Mokelumne and Stanislaus Rivers, mid-elevation tributaries of the Mokelumne, and the upper reaches of the Calaveras usually result from heavy snowmelt in combination with heavy rainfall. In the western portion of the county, the sources of flooding are heavy rainfall associated with repeated winter storms and a saturated soil mantle. Summer thunderstorms can also lead to flooding. Flooding sources that could affect the CCWD, and where urban development occurs within or near the floodplains are shown in Table 4-24.

Table 4-24 Major Sources of Flooding in the CCWD Service Area

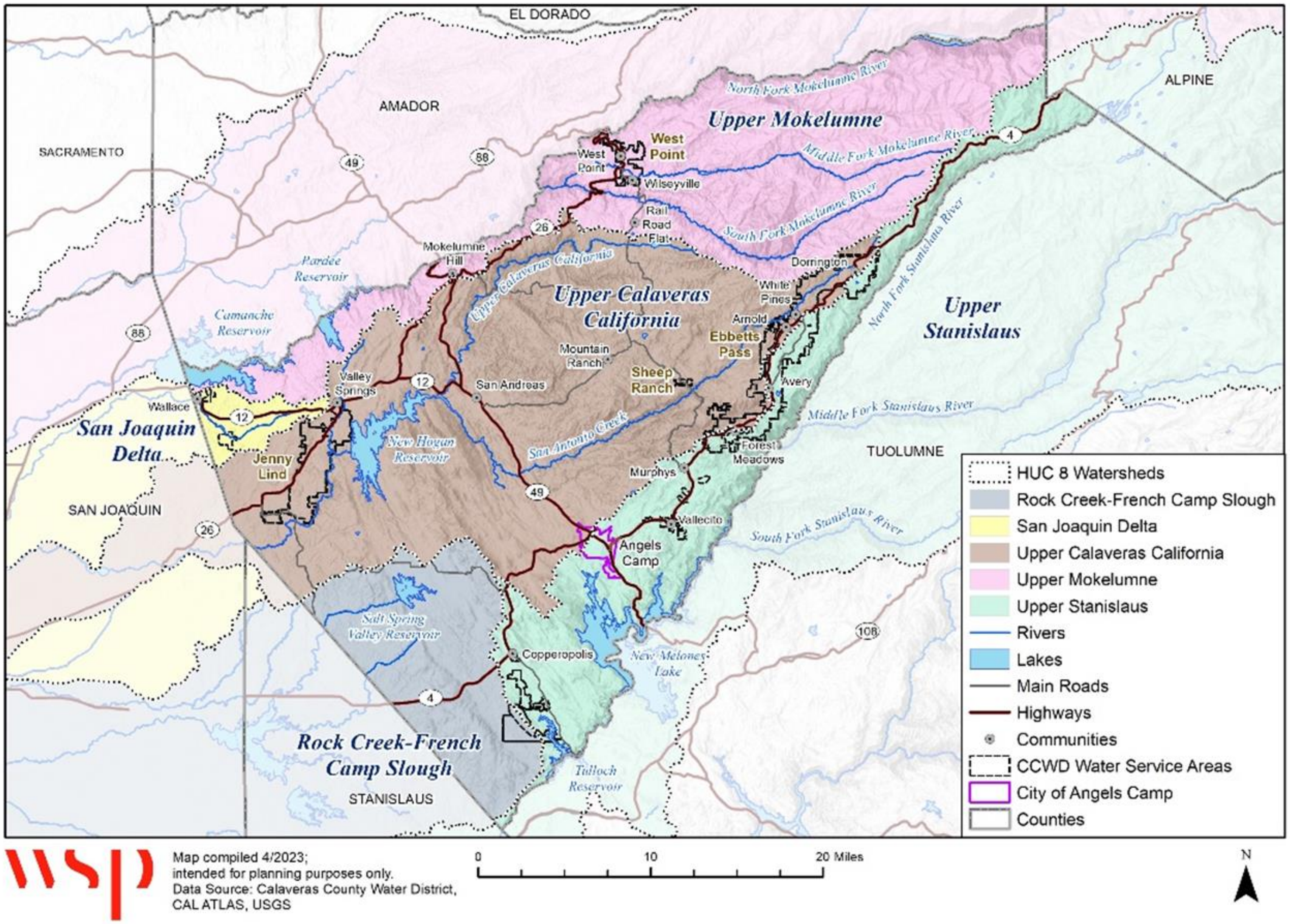
SERVICE AREA	FEMA FLOOD ZONE	FLOODING SOURCES
Copper Cove/Copperopolis	Zone A	Stanislaus River, unnamed tributaries
Ebbetts Pass	Zones A, Zone AE	Big Trees Creek, Mill Creek, Moran Creek San Antonio Creek, San Domingo Creek, unnamed tributaries
Jenny Lind	Zones A, Zone AE	Calaveras River, Cosgrove Creek, Indian Creek, Spring Valley Creek, unnamed tributaries
Sheep Ranch	Zone A	Unnamed tributaries
Wallace	Zone A; 0.2 Percent Annual Chance Flood Hazard	Comanche Reservoir, Pardee Reservoir, North Fork Mokelumne River, Unnamed tributaries
West Point	Zone A	Middle Fork Mokelumne River, unnamed tributaries

Source: FEMA

According to mapping done by the California DOC, Calaveras County intersects many watersheds. There are numerous small creeks that are tributaries to the major waterways. Waterways and watersheds in the County are shown in Figure 4-40. The five primary watersheds in the County are:

- Upper Calaveras California
- Upper Stanislaus River
- Upper Mokelumne River
- Rock Creek-French Camp Slough
- San Joaquin Delta

Figure 4-40 Waterways and Watersheds in Calaveras County



Although predominantly agricultural, the County has experienced increased urbanization in recent years and is subject to flooding from winter storm events and snowmelt. The western portion of Calaveras County contains the majority of the properties and facilities that could be impacted by flooding. The Jenny Lind facilities are located in this area, as well as CCWD facilities in Burlson, Wallace, and Valley Springs.

In Calaveras County, the Flood Insurance Study (FIS) reports that flooding may occur from heavy rainfall on saturated soils, rapid snowmelt, or a combination of these factors. Riverine flooding along the main channels of the Mokelumne and Stanislaus Rivers, mid-elevation tributaries of the Mokelumne, and the upper reach of the Calaveras usually results from heavy snowmelt in combination with heavy rainfall. In the western portion of the County, the sources of flooding are heavy rainfall associated with repeated winter storms and a saturated soil mantle.

Floodplain Mapping

FEMA established standards for floodplain mapping studies as part of the National Flood Insurance Program (NFIP). The NFIP makes flood insurance available to property owners in participating communities adopting FEMA-approved local floodplain studies, maps, and regulations. Floodplain studies that may be approved by FEMA include federally funded studies; studies developed by state, city, and regional public agencies; and technical studies generated by private interests as part of property annexation and land development efforts. Such studies may include entire stream reaches or limited stream sections depending on the nature and scope of a study. A general overview of floodplain mapping and associated products is provided in the following paragraphs.

Flood Insurance Study (FIS)

The FIS develops flood-risk data for various areas of the community that will be used to establish flood insurance rates and to assist the community in its efforts to promote sound floodplain management. The effective Calaveras County FIS is dated May 16, 2017.

Digital Flood Insurance Rate Maps (DFIRM) and National Flood Hazard Layers

As part of its Map Modernization program, FEMA is converting paper FIRMS to digital FIRMs, DFIRMS. These digital maps:

- Incorporate the latest updates Letter of Map Revision (LOMRs), which are FEMA's modification to an effective FIRM, or Flood Boundary and Floodway Map, or both and Letter of Map Amendments (LOMAs), which are official amendments, by letter, to an effective NFIP map;
- Utilize community supplied data;
- Verify the currency of the floodplains and refit them to community supplied basemaps;
- Upgrade the FIRMs to a GIS database format to set the stage for future updates and to enable support for GIS analyses and other digital applications; and
- Solicit community participation.

The National Flood Hazard Layers (NFHL) for the County with the latest LOMRs were updated on January 3, 2020. The DFIRMs data layers for Calaveras County are shown in

Figure 4-41 through Figure 4-43; which include zoomed-in versions of the eastern and western portions of the County.

Figure 4-41 Calaveras County FEMA Flood Hazards

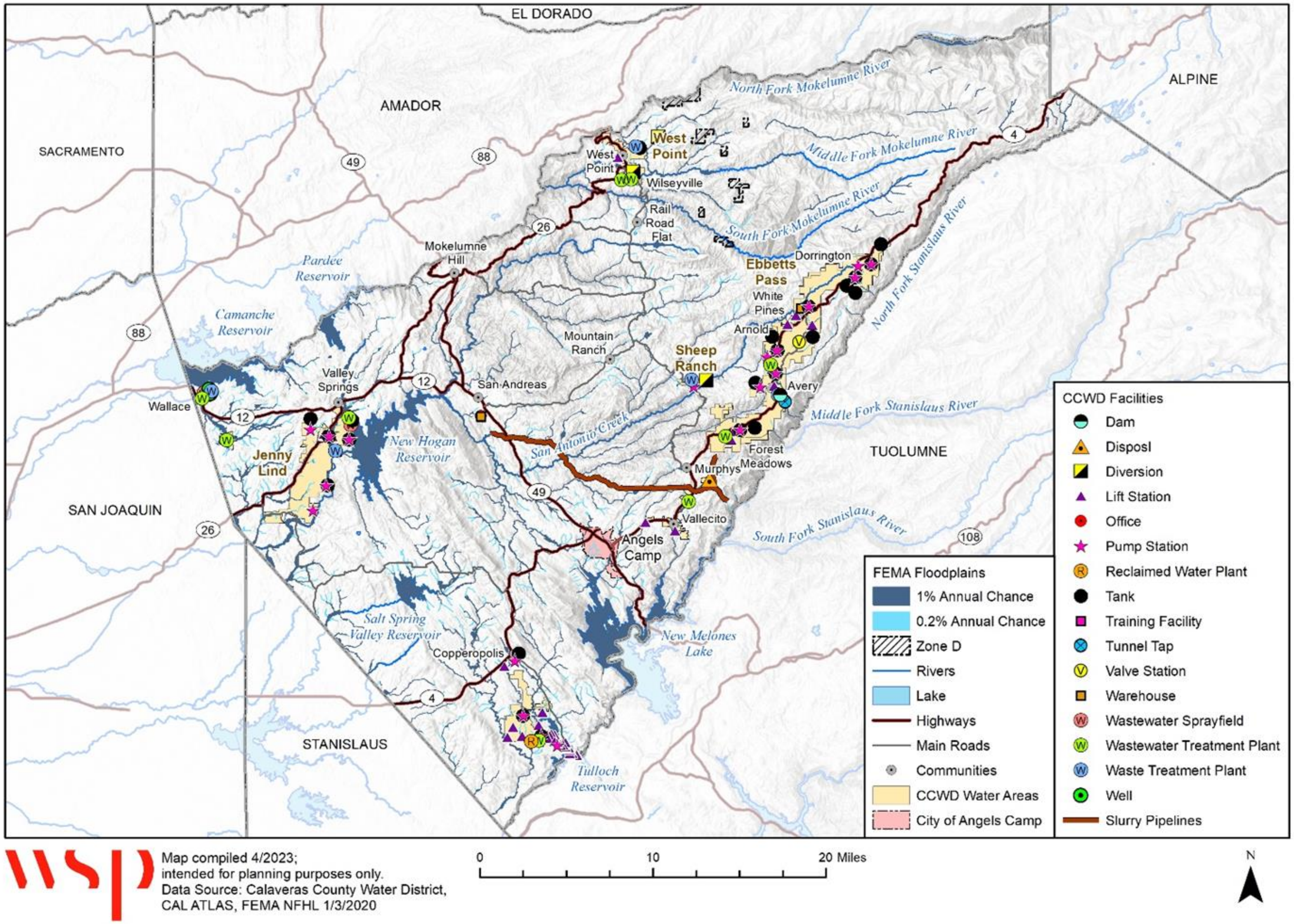


Figure 4-42 East Calaveras County FEMA Flood Hazards

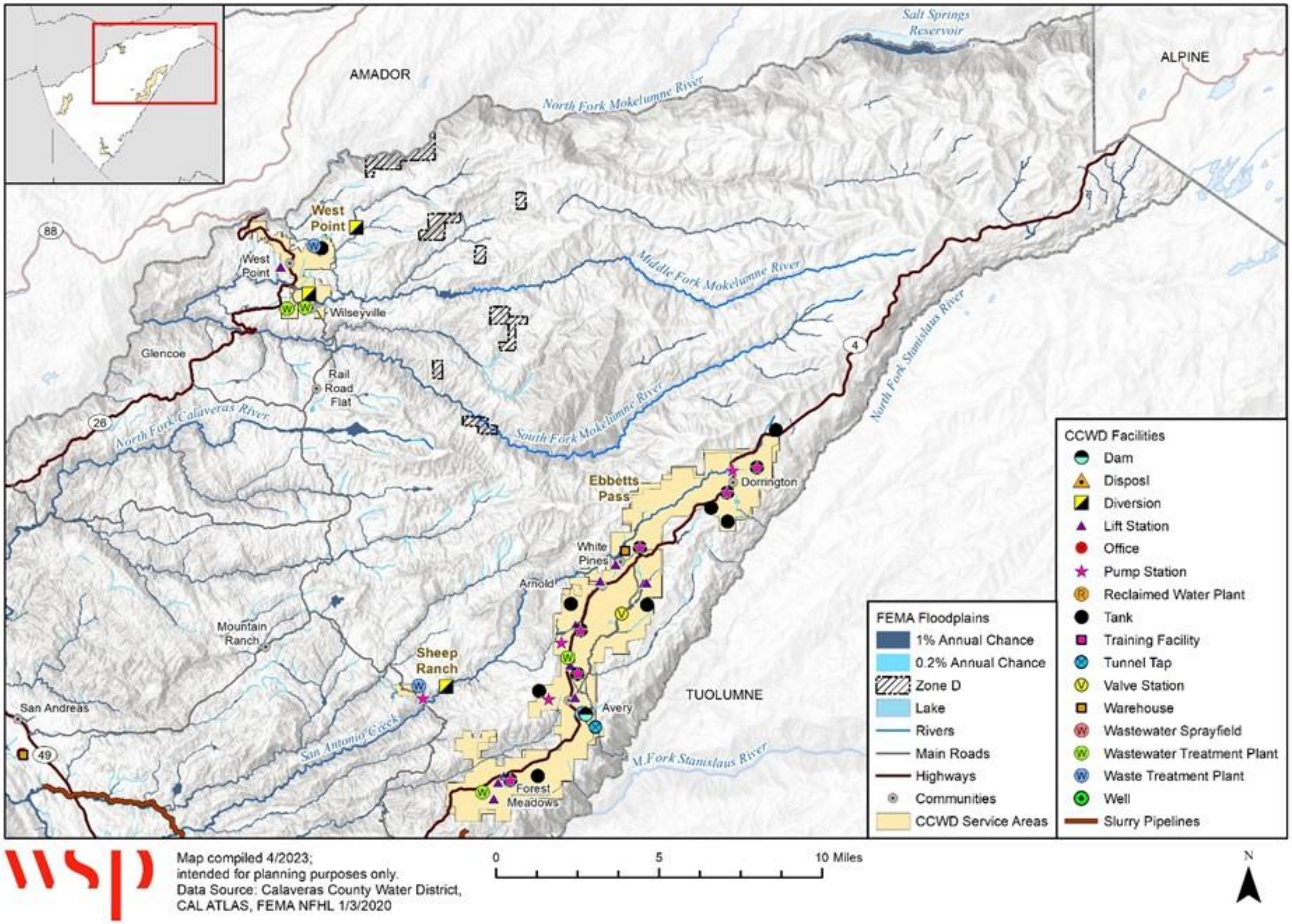
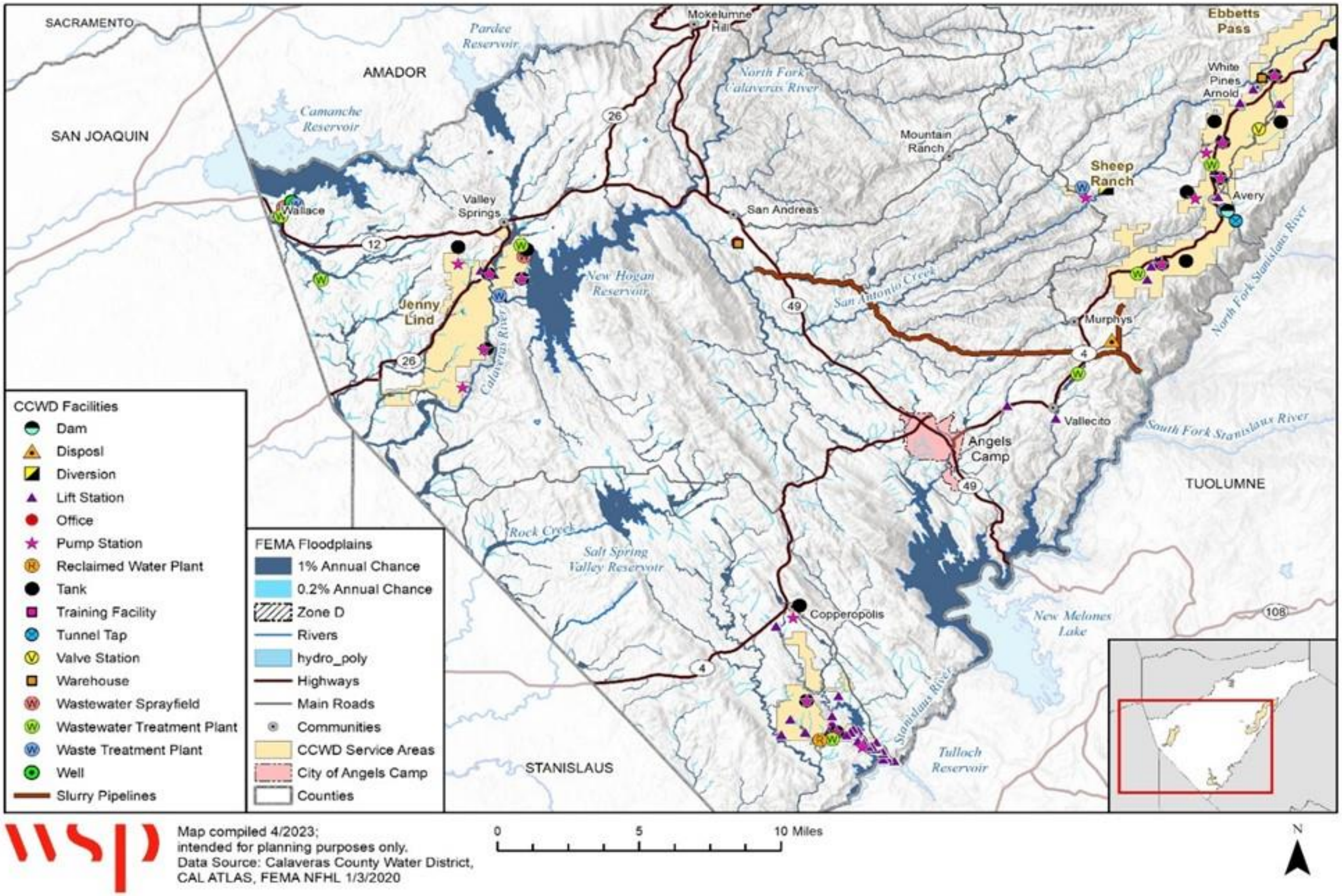


Figure 4-43 West Calaveras County FEMA Flood Hazards



Department of Water Resource (DWR) Floodplain Mapping

Various floodplain maps developed by the California DWR for various areas throughout California, including the County should also be considered when evaluating flood risk.

DWR Best Available Maps

The Best Available Maps (BAM) were developed pursuant to Senate Bill (SB) 5 which requires DWR to develop preliminary maps for the 100- and 200-year floodplains located within the Sacramento-San Joaquin Valley watershed. These maps were developed by DWR to better reflect the most accurate information about the flooding potential in a community and were designed to provide a better understanding of the true risk of flooding to public safety and property. SB 5 requires that these preliminary maps be provided as the best available information on flood protection to cities and counties in the watershed for: 1) areas protected by State-Federal project levees, and 2) areas outside the protection of project levees.

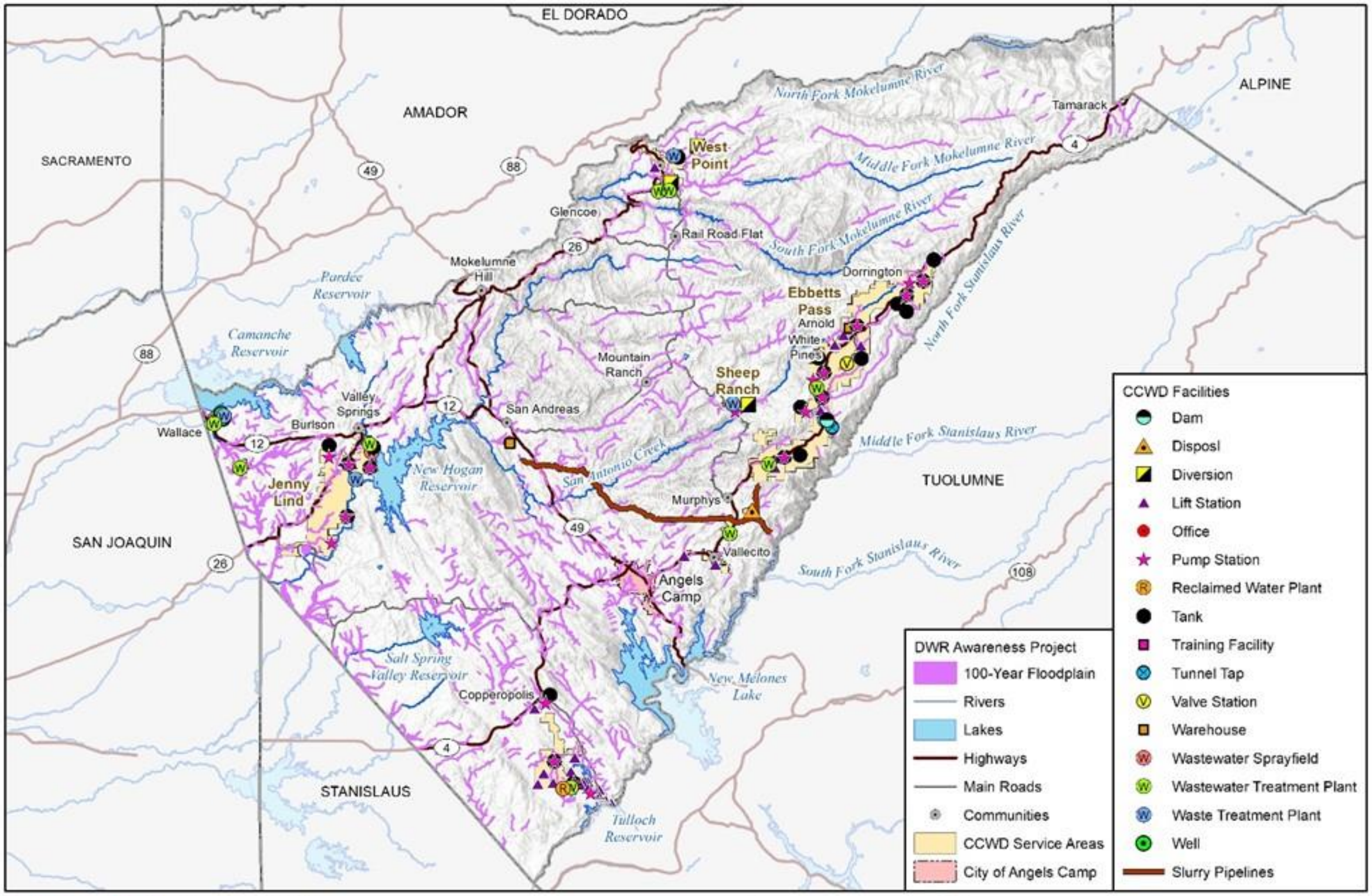
The new maps compiled using information from state, local and federal agencies, have no regulatory status for floodplain development and are for information only. They do not replace existing FEMA regulatory floodplain maps (i.e., FIRMs and DFIRMs) and therefore do not make any changes in federal flood insurance requirements for homes and businesses. However, city and county governments will be able to use the maps to identify areas that warrant further study and to help make informed floodplain management and land use decisions. The floodplains shown on these maps delineate areas with potential exposure to flooding for two different storm events: one with storm flows that have a 1 percent chance of being equaled or exceeded in any year (100-year) and one with storm flows that have a 0.5 percent chance of being equaled or exceeded in any year (200-year).

These BAM advisory maps will help communities begin early planning activities to meet SB 5 requirements calling for a minimum of 200-year protection for new development in urban and urbanizing areas. These “best available” floodplain maps can be accessed online at: http://gis.bam.water.ca.gov/bam/.

DWR Awareness Floodplain Maps

The Flood Awareness Maps, developed under the Flood Awareness Mapping Project, are designed to identify all pertinent flood hazard areas by 2015 for areas that are not mapped under the FEMA NFIP and to provide the community and residents an additional tool in understanding potential flood hazards currently not mapped as a regulated floodplain. The awareness maps identify the 100-year flood hazard areas using approximate assessment procedures. As shown in Figure 4-44, the floodplains are shown on these maps simply as flood-prone areas without specific depths and other flood hazard data.

Figure 4-44 Calaveras County DWR Awareness Project



Map compiled 4/2023;
intended for planning purposes only.
Data Source: Calaveras County Water District,
CAL ATLAS, Department of Water Resources (DWR)

Levee Flood Protection Zones Maps

Levee Flood Protection Zone (LFPZ) maps represent floodplain areas protected by Central Valley State-Federal Project Levees. Under Water Code Section 9110(b), "LFPZ" means the area, as determined by the Central Valley Flood Protection Board or DWR, that is protected by a project levee. These maps were developed based on the best available information as required by Assembly Bill (AB) 156. This Bill requires DWR to prepare LFPZ maps to identify the areas where flood levels would be more than three feet deep if a project levee were to fail. DWR delineated the LFPZs by estimating the maximum area that may be flooded if a project levee fails with flows at the maximum capacity that may reasonably be conveyed. DWR is using information from several sources, including FEMA floodplain maps, FEMA Q3 data, USACE's 2002 Sacramento and San Joaquin River Basins Comprehensive Study, and local project levee studies. Using this data, DWR is implementing a multi-year program to evaluate and delineate detailed floodplains for areas protected by project levees. This effort includes new topography, hydrology, hydraulic models, and floodplain maps. This information will be used to update the initial LFPZ maps. LPFZ maps can be accessed at: http://gis.lfpz.water.ca.gov/lfpz/. There are currently no LFPZs in the County.

Localized Stormwater Flooding

Extensive – Localized, stormwater flooding also occurs throughout the County. Urban storm drainpipes and pump stations have a finite capacity. When rainfall exceeds this capacity, or the system is clogged, water accumulates in the street until it reaches a level of overland release. This type of flooding may occur when intense storms occur over areas of development.

According to the County, numerous parcels and roads throughout the County not included in the FEMA 100- and 500-year floodplains are subject to flooding in heavy rains. In addition to flooding, damage to these areas during heavy storms includes pavement deterioration, washouts, mudslides, debris areas, and downed trees. The frequency and type of damage or flooding varies yearly, depending on the quantity of runoff. During the 2022-2023 plan update, the HMPC described the following areas of concern:

- Meadowmont Golf Course floodplain and sewer inundation.
- Cosgrove Creek buildings in the floodplain:
  - Cosgrove Creek flooded four times in 2023 while the 2022-2023 plan update was ongoing; the flooding impacted approximately 15 homes; the Middle Fork Facility, in particular, is impacted during big storms. The CCWD has replaced plastic pipes with steel pipes and plans to bury these pipes in gravel in the future.
  - CCWD is considering consolidating the 31 lift stations around Pardee Lake to reduce the number of potential impact points; this project could be eligible for funding.
- Historic Sawmill Pond at White Pines Lake is disintegrating into the San Antonio Creek.

Also, as mentioned in the 2018 plan, there are numerous other areas where CCWD facilities have been subject to flooding during heavy rain events. Flood events in 2017 washed out roads and exposed CCWD water and sewer pipelines at White Pines Reservoir near Arnold. As a result, CCWD evaluated more frequent flood intervals near this facility, and according to the UWMP, began addressing increased variability and flooding resulting from larger precipitation events and those impacts on supply reliability (CCWD 2020, CCWD 2015). The Jenny Lind Water Treatment Plant (which was pointed out in the previous LHMP of 2006 and 2012) and all Wastewater Treatment Plant Effluent Ponds are also at risk of localized flooding.

4.4.8.3 Extent (Magnitude/Severity)

100/500-year Flood & Localized Stormwater Flooding

Critical – A significant portion of the County is susceptible to various types of flooding events. According to the Calaveras County MJHMP, approximately 35,161 total acres have been determined to be in the 100-year and 500-year FEMA floodplains (Calaveras County 2021). The 100-year and 500-year floodplains combined cover 24.4% of the unincorporated County and 68.6% of the land within the City of Angels Camp (Calaveras County 2021). Therefore, a potential flood hazard would threaten a significant geographic area (10% – 50%) of the County, and if a flood event would occur the damage associated with flooding could impact between 20% to 50% of the property. Also, five out of CCWD's 123 critical facilities are located in 1% and 0.2% annual chance floodplains. In addition, 0.48 mile and 0.12 mile of CCWD's slurry pipeline is in 1%-annual-chance and 0.2%-annual-chance floodplains, respectively.

The occurrence of a flood can lead to life and property loss, damage to agricultural land, road and bridge closures and disruption of communication systems, resulting in significant disturbances to regular processes. Individuals living in low-lying trailer parks along the rivers and those experiencing homelessness are particularly vulnerable to such disasters. However, sufficient time is generally available to alert and warn those who might be affected. In the event of a catastrophic flood control structural failure, local response capabilities may be overwhelmed, necessitating mass evacuations to save lives. The impact on life safety will be determined by the warning time and the resources available to notify and evacuate the public. Loss of life is a possibility, and there may be associated health concerns, as well as negative effects on local buildings and infrastructure. Refer to the Vulnerability Assessment section below for more detailed discussion on the potential impacts of flooding events.

4.4.8.4 Past Occurrences

This section deals with past occurrences of both 100-/500-year flooding and localized flooding. The state and federal declarations for storms and flooding were in 1950, 1955, 1958, 1969, 1980, 1982, 1995, 1997, 1998, 2001, 2006, 2017, 2910, 2020, 2022 and 2023.

The NCEI database tracks flooding in Calaveras County. Entries into the NCEI database since 1993 for Calaveras County are shown in Table 4-25.

Table 4-25 NCEI Flooding Events for Calaveras County 1993 to 2023

HAZARD TYPE	DATE	INJURIES*	FATALITIES*	PROPERTY DAMAGE*	CROP DAMAGE*
Flood	1/23/1996	0	0	$1,000,000	$0
Flood	1/24/1996	0	0	$0	$0

HAZARD TYPE	DATE	INJURIES*	FATALITIES*	PROPERTY DAMAGE*	CROP DAMAGE*
Flood	1/27/1996	0	0	$0	$0
Flood	2/3/1996	2	0	$0	$0
Flood	2/18/1996	0	0	$0	$0
Flood	5/16/1996	0	0	$5,000,000	$0
Flood	12/7/1996	0	0	$7,000,000	$0
Flood	12/12/1996	0	0	$0	$0
Flood	12/22/1996	0	0	$10,000	$0
Flood	12/29/1996	0	0	$20,000	$0
Flood	12/30/1996	0	1	$0	$0
Flood	12/31/1996	0	0	$0	$0
Flood	1/1/1997	2	0	$376,300,000	$0
Flood	1/3/1997	0	1	$0	$0
Flood	9/25/1997	0	0	$0	$0
Flood	2/2/1998	0	1	$0	$0
Flood	2/3/1998	0	2	$0	$0
Flood	1/23/2000	0	0	$20,000	$0
Flood	2/11/2000	0	0	$45,000	$0
Flood	5/15/2000	0	0	$0	$0
Flood	1/10/2001	0	0	$0	$0
Flood	2/9/2017	0	0	$7,010,000	$0
Flood	2/14/2019	0	0	$500,000	$0
Flood	4/5/2020	0	0	$0	$0
Flood	12/10/2022	0	0	$0	$0
Flood	12/31/2022	0	0	$100,000	$0
Flood	1/10/2023	0	0	$0	$0
Flood	1/14/2023	0	0	$0	$0
Total		4	5	$397,005,000	$0

Source: NCEI 2022

*Injuries, fatalities, and damage figures are for the event as a whole, and not solely for Calaveras County

Details on recent floods from the NCEI are provided below:

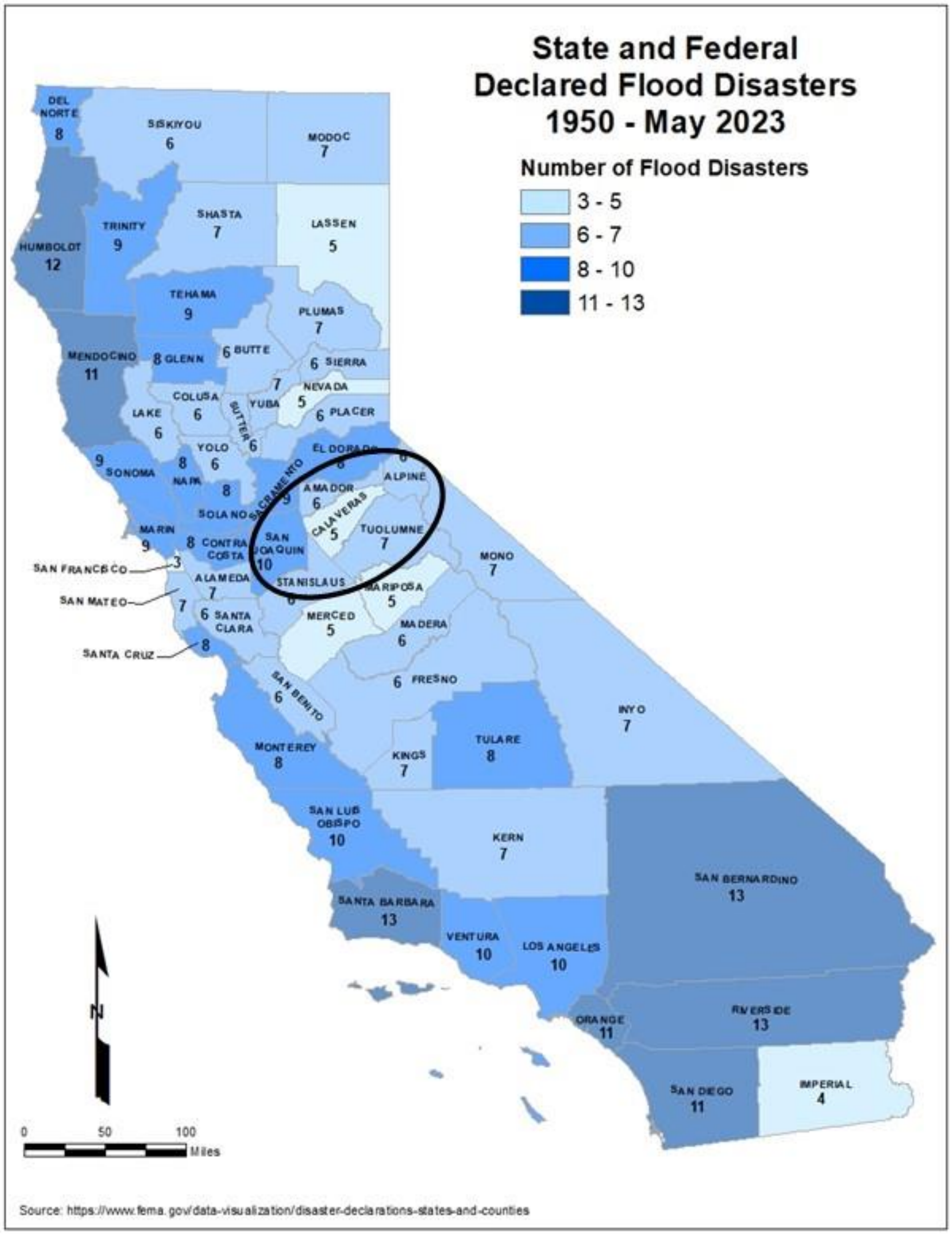
- **January 1997**: Heavy rains caused a mudslide along Highway 4 in Calaveras County and led to overtopping of Don Pedro Dam in Tuolumne County, resulting in 300 square miles of land flooded and 23,000 homes and 2,000 businesses damaged or destroyed.
- **January 12, 1998**: Heavy rains from a strong Pacific storm caused widespread but minor flooding across the Sacramento and Northern San Joaquin Valleys and nearby foothills. Hundreds of traffic accidents occurred on the highways and city streets throughout the region.
- **February 9, 1999**: A flash flood near Valley Springs in Calaveras County occurred when Cosgrove Creek left its banks and flooded four homes and a low-lying golf

course. The flood threatened sewage treatment ponds, temporarily closed Highway 26, and caused $20,000 in property damage.

- **January 10, 2001**: Automated rain gauges throughout Tuolumne and Calaveras counties commonly measured two to three inches of rain in 24 hours. The Gianelli gauge measured 3.36 inches.
- **April 2006**: In June 2006, FEMA designated 17 counties in northern California eligible for public assistance for severe storms and flooding, including Calaveras County. From April 2-6, 2006, Calaveras received 6.8 inches of rain, 168 percent of the average amount for April (Calaveras County OES 2019). Approximately 35 acres of farmland, several homes, and a mobile home park were flooded, and many people evacuated. The flood also overflowed sewage treatment plants.
- **February 2017:** In February 2017, a series of storms resulted in a range of significant weather impacts to northern California. The first storm was a wet and warm storm, followed by a second less wet, but colder storm with snow at lower elevations. Both storms involved strong and damaging winds and widespread heavy rain that resulted in flooding of small streams and rivers, and extremely wet conditions that involved flood control releases. At higher elevations, snow accumulation was significant, and there were numerous downed trees. Many roads were also shut down due to mudslides, heavy snow, flooding, and washouts near West Point. The east and west bound lanes of SR 26 were closed from Iris Way to the North Fork Mokelumne River Bridge due to flooding and slope failure.
- **February 2019:** In February 2019 severe storms brought heavy snowfall to the mountains, which extended into lower elevations. Thunderstorms brought heavy rain and small hail with widespread road flooding. Gusty winds downed several trees and caused power outages.
- **April 2020:** A series of Pacific storms brought periods of rain, scattered thunderstorms, heavy mountain snow and gusty winds. The heavy rains and thunderstorms caused travel impacts as roadways became flooded and localized mudslides occurred. Gusty winds also downed trees and power lines.
- **December 2022:** Storms delivered widespread rains, mountain snow and gusty winds to Northern California. Widespread flooding was experienced throughout the region, with significant river flooding on the Cosumnes River around Wilton, due to multiple levee breaks. The area was evacuated and area highways and roads close, including SR-99. River flooding was also reported along the Mokelumne River near Benson's Ferry and Mormon Slough at Bellota. Flooding of streams in low areas and clogged storm drains also closed many roads. High gusty winds brought down several trees, resulting in widespread power failures across the area.
- **January 2023:** A major winter storm brought strong winds with moderate to heavy rain bringing renewed flooding of already elevated waterways. There was flooding of roadways, urban areas, rivers, streams, and creeks, along with rockslides and mudslides. Downed trees throughout the region closed roads and caused numerous power outages. Thunderstorms produced the formation of a tornado on January 10, and funnel clouds on January 14.

Figure 4-45 below shows the number of state and federal declared flood disasters from 1950 till May 2023.

Figure 4-45: Calaveras County Flood Declarations from 1950 to 2023



Substantial flooding took place during the 2022/2023 winter season. The Mokelumne, Stanislaus Rivers, and the upper reaches of the Calaveras cut through Calaveras County and its geography, along with several major streams, diversion canals and tributaries and many of these waterways experienced recent flooding. Heavy precipitation in the higher elevations often lead to overbank flows in lower elevations, leaving homes and properties susceptible to flood damage during major storm events. Weeks of heavy rain and winds pushed Cosgrove Creek from its usual 25-foot-wide water body to 150 feet, leading to major flooding in nearby neighborhoods. Subsequently, severe property damage and displacement of residents had the County added to a major disaster declaration from storms that began in December 2022.

4.4.8.5 Probability of Future Occurrence

100/500-year Flood

Occasional— The term "100-year flood" is misleading. It is not the flood that will occur once every 100 years. Rather, it is the flood elevation (or depth) that has a 1 percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short time. In short, the 100-year flood is the flood that has a one percent chance in any given year of being equaled or exceeded.

Localized Stormwater Flooding

Highly Likely—With respect to the localized, stormwater 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 the increasing urbanization of the Calaveras County Planning Area, combined with older infrastructure, this type of flooding will continue to occur during heavy rains. The extent of localized flooding will continue to occur within all portions of the County but with more occurrences in urbanized areas.

4.4.8.6 Climate Change Considerations

Climate change may affect flooding in the County. While average annual rainfall may increase or decrease slightly, the intensity of the individual rainfall events is likely to increase during the 21st century. Also, as mentioned in Section 4.2.8 Dams, over the next century snowmelt and surface water runoff is expected to occur earlier in the spring, and the overall duration of snowmelt runoff, typically from April through July is expected to decline (State of California 2022a).

4.4.8.7 Vulnerability Assessment

People

Among the populations most susceptible to heightened risks to flooding are those with limited time for evacuation due to inadequate warning or close proximity to rivers and creeks. This risk particularly encompasses socially vulnerable groups such as the elderly, disabled, and young individuals. Their vulnerability and potential loss of life are directly impacted by the amount of early warning time available to both first responders and the public prior to the onset of a flood event. These vulnerable communities exposure and risk to flooding will also increase with climate change, as the timing of surface water runoff is expected to occur earlier but also with a shorter onset or warning times when precipitation events are more extreme and long term. This means that some remote population groups may have less time to prepare and stock up on food and supplies during winter storms. Vulnerable populations in the CCWD's service area may also require more assistance during winter storms, such as emergency water supplies, or evacuation assistance to a warming shelter during power outages.

These vulnerable populations may also face unique challenges during floods, including limited mobility, medical dependencies, and potential difficulties in accessing emergency services. While County efforts are made to provide timely warnings and support, catastrophic flood events can strain local response capabilities, including the response and recovery actions by the local water utilities. This may necessitate large-scale evacuations to ensure the safety of vulnerable individuals. The effectiveness of these measures depends on the availability of resources and coordinated response efforts.

Addressing the distinct needs of vulnerable populations in flood planning and response, as they relate to the CCWD's delivery of water and wastewater services, is crucial for safeguarding their well-being during such events, particularly in the context of climate change-induced impacts. This means ensuring that evacuation plans are accessible and tailored to the specific needs of these groups, and that adequate resources are allocated to support them in times of crisis. For those vulnerable populations that must shelter-in-place because of road closures due to flooding or other accessibility limitations, Calaveras County responders and CCWD must coordinate to identify ways to make sure these vulnerable populations have adequate water supply. In these situations, the CCWD and other water provider partners should be able to deliver water to these populations to minimize health and safety impacts, but overtime these impacts are anticipated to continue and worsen with climate change.

Property

The storms of 2022/2023 left dozens of people displaced as flooding left their homes uninhabitable. At least nine commercial buildings and nine townhomes were flooded during this storm event. Some of the hardest hit areas of Calaveras County (where there were road closures and detours) were around Valley Springs, Burson, and Copperopolis. In some instances, home evacuations were necessary, including the entire Castle Rock Mobile Home Park. Residents trapped in the Valley Springs area required emergency boat rescues. Creek maintenance, such as clearing of brush as well as keeping culverts clear of debris, could have created better water flow and drainage, though the unusual amount of water ultimately caused the areas to flood. These property impacts are anticipated to worsen with climate change if more remote and rural neighborhoods and individual properties are flooded and also inaccessible from repeated storm damage to roads and other infrastructure.

Critical Facilities and Lifelines

To assess if any of the CCWD facilities are located within inundation areas, CCWD's critical facilities and infrastructure assets were intersected with FEMA's most up to date NFHL for the County, which are also shown in Table 4-26. Eight CCWD facilities are in FEMA floodplains. Four facilities are in 1%-annual-chance floodplains and four are in 0.2%-annual-chance floodplains. These facilities possess a total replacement value of $17,650,000. These facilities are shown in the Table 4-26. In addition, 0.48 mile and 0.12 mile of CCWD's slurry pipeline is in 1%-annual-chance and 0.2%-annual-chance floodplains, respectively.

Table 4-26 CCWD Facilities Exposed to FEMA 1% & 0.2% Annual-Chance-Flood-Events

FEMA FLOOD ZONE	FLOOD SOURCE	NAME	CCWD JURISDICTION
1% annual chance	Cosgrove Creek	Jenny Lind Raw Water Intake	Jenny Lind

FEMA FLOOD ZONE	FLOOD SOURCE	NAME	CCWD JURISDICTION
	Middle Fork	Middle Fork Mokelumne River Diversion	West Point
	Bear Creek	Bear Creek Diversion	West Point
	Unnamed Tributary	RAW WATER SUPPLY WELL #3	Wallace
0.2% annual chance	Black Creek	LIFT STATION 10	Copper Cove
	White Pines Lake	LIFT STATION 3	Ebbetts Pass
	-	Bummerville Dam	West Point
	-	CCWTP Clearwells	Copper Cove

Source: CCWD, FEMA NFHL 1/3/2020, WSP GIS Analysis 2023

In addition to the table above, during the 2022-2023 Plan Update, the HMPC expressed concern over Jenny Lind WTPs potential exposure to 1% annual-chance-flood-events. Based on further analysis, although the WTP is not directly located in any 1%-annual-chance-floodplains, it is, however, located very close to the 1%-annual-chance floodplains associated with Cosgrove Creek. This is an example of how increased storm runoff and extreme precipitation events due to climate change could potentially inundate these facilities in the future. In other words, while these facilities are currently not within the floodplain, because they are close enough to experience flood impacts, more frequent storms and earlier runoff could potentially flood these facilities in the future.

In addition, CCWD's critical facilities and infrastructure assets were also intersected with the California DWR Awareness 100-year floodplains layer, which is shown in Figure 4-44. Ten facilities are identified to be in the DWR Awareness floodplains, which are shown in the Table 4-27. These facilities possess a total replacement value of $19,650,000. In addition, 0.53 mile of CCWD's slurry pipeline is in DWR Awareness 100-year floodplains.

Table 4-27 CCWD Facilities Exposed to DWR Awareness 100-Year Floodplains

	NAME	CCWD JURISDICTION
	Middle Fork Mokelumne River Div	West Point
	Bear Creek Diversion	West Point
	LIFT STATION 10	Copper Cove
	LIFT STATION 21	Copper Cove
	LIFT STATION 3	Ebbetts Pass
	LS SEQUOIA WOODS	Ebbetts Pass
	LIFT STATION 1	Ebbetts Pass
	White Pines Dam	Ebbetts Pass
	Bummerville Dam	West Point
	CCWTP Clearwells	Copper Cove

Source: CCWD, DWR, WSP GIS Analysis 2023

Economy

Flooding can have a major impact on the economy. Damage to infrastructure, such as roads and bridges, can create critical transportation delays and disrupt supply chains, increasing costs for businesses. Damaged buildings can also cause a loss in revenue as if a business's facility is lost or damaged due to flooding, the time to repair the damage can lead to lost sales, decreased productivity, and higher costs to get the business back up and running. Climate change may further impact the extent of flooding in the County and the CCWD's service areas, and in turn the local economy.

Cultural, Historic and Natural Resources

Floods can lead to the loss of historical monuments, devastation of historic sites, changes in the cultural landscape, and the disappearance of intangible heritage. However, natural areas within the floodplain often benefit from periodic flooding. These natural areas are important as they often reduce flood impacts by allowing the absorption and infiltration of floodwaters. They are also generally resistant to flooding except where natural landscapes and soil compositions have been altered for human development or after previous disasters, such as drought and fire.

4.4.8.8 Development Trends

With respect to the localized, stormwater flood issues, the potential for flooding may increase as storm water is channelized due to new land development. New development and water facilities should be built outside of known flood-prone areas or built high enough to escape flood waters. If development is not carefully planned with appropriately sized storm drainage systems and infrastructure or replaced with water systems with more capacity, both new development and climate change impacts could make the CCWD's water customers more vulnerable to flooding. Larger residential developments could also further alter the natural topography of the environment and impact CCWD's existing water system in place, which could impact the safe delivery of water services. However, given site plan reviews and environmental review are already in place at the County level, new development is not anticipated to affect the overall vulnerability of the CCWD's water customers, nor their water facilities and systems.

4.4.8.9 Risk Summary

- Calaveras County consists of predominantly agricultural lands; however there has been an increase in urbanization in recent years in areas subject to flooding from winter storm events and snowmelt. Winter storms in 2022/2023 caused damage to multiple properties and displacement of residents.
- The western portion of the County contains the majority of the properties and CCWD facilities that could be impacted by flooding. The Jenny Lind facilities are located in this area, as well as CCWD facilities in Burlson, Wallace, and Valley Springs.
- Though a 100-Year flood will impact the CCWD Planning Area, the more likely scenario will be localized stormwater flooding. As with the increased urbanization of the County, combined with older infrastructure, stormwater flooding will continue to occur during heavy rains.

HAZARD	GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
100-/500-year & Localized Stormwater Flooding	Significant	Occasional	Critical	Medium
	Extensive	Highly Likely	Critical	High

4.4.9 High Wind and Tornado

4.4.9.1 Hazard/Problem Description

High Winds

High winds, as defined by the NWS glossary, are sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. Straight-line winds may also exacerbate existing weather conditions by increasing the effect on temperature and decreasing visibility due to the movement of particulate matters through the air, as in dust and snowstorms. The winds may also exacerbate fire conditions by drying out the ground cover, propelling fuel around the region, and increasing the ferocity of existing fires. These winds may damage crops, push automobiles off roads, damage roofs and structures, overturn mobile homes, tear roofs off houses, topple trees, snap power lines, shatter windows, and sandblast paint from cars, and cause secondary damage due to flying debris. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and an occasional structure fire.

In the County, high winds, sometimes accompanying severe thunderstorms but often not, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Windstorms in the County are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

For this hazard, three different classifications of windstorms were analyzed: high winds, strong winds, and thunderstorm winds. The most significant distinction between high winds and thunderstorm winds in the NCEI dataset is that high winds are most frequently reported in the winter months (December, January, and February) and are recorded on a zonal scale, whereas thunderstorm winds are most reported in the summer months (June, July, and August) and recorded on a local county or city scale. Strong winds are another type of windstorm, which originates from thunderstorms and are any wind exceeding 58 mph. Despite these differences, the wind speeds and associated impacts from these winds are comparable.

Tornado

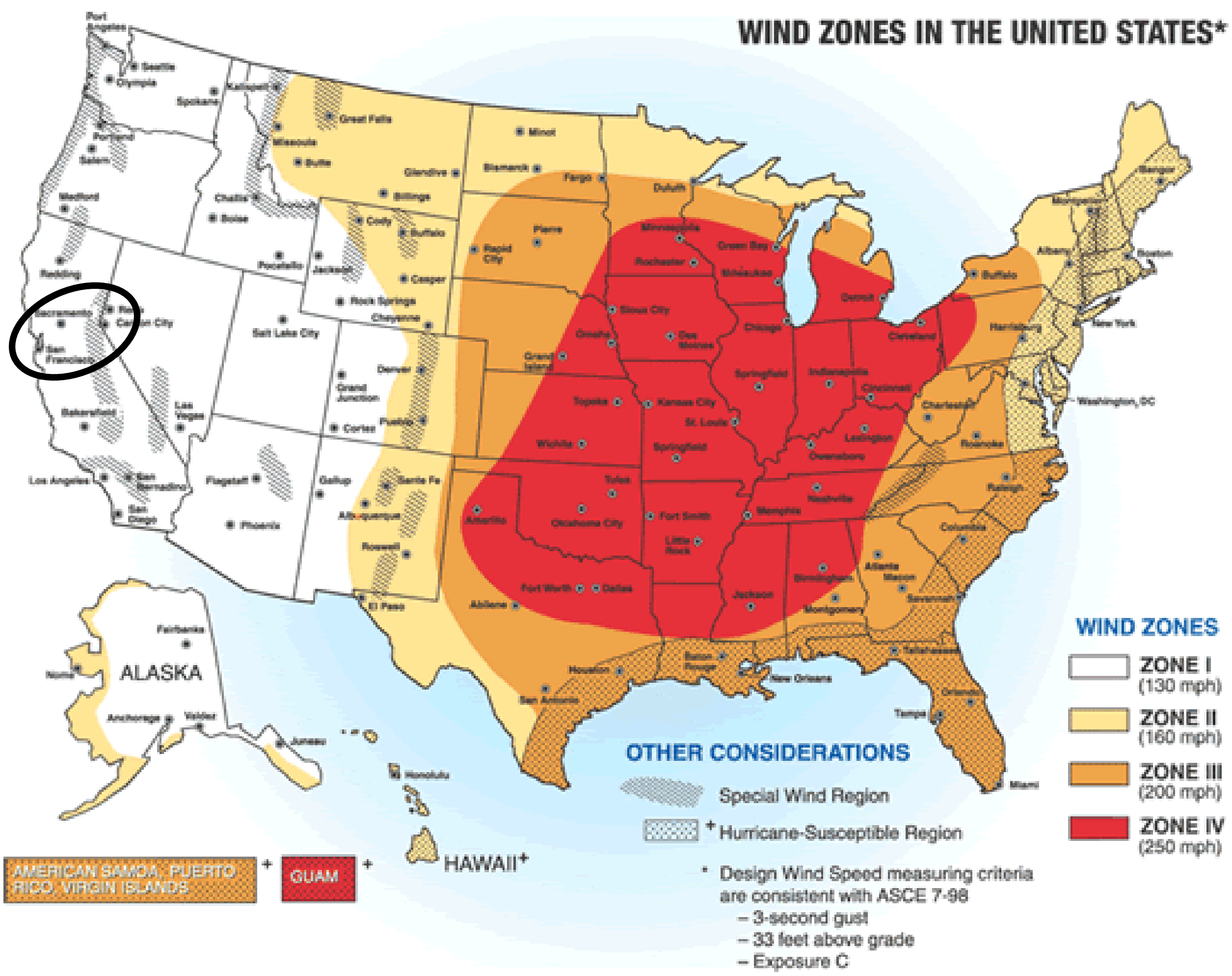
Tornadoes are a severe weather hazard that may occur in the County, primarily during the rainy season in the late fall and early spring. Tornadoes form when cool, dry air sits on top of warm, moist air. Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist. They can have the same pressure differential across a path only 300 yards wide or less as 300-mile-wide hurricanes.

4.4.9.2 Geographic Area

Extensive – High wind events have the potential to happen anywhere in Calaveras County and therefore, impact CCWD's service area. Similar to tornado hazard, the resulting damage from high wind events may be most severe in the downtown areas of incorporated communities where there are more large trees, infrastructure, and higher-density development.

Figure 4-46 depicts wind zones for the United States. The map denotes that portions of Calaveras County fall into the Special Wind Region. Special Wind Regions are known for abnormal wind speed.

Figure 4-46 Wind Zones in the United States



Source: Federal Emergency Management Agency

Tornadoes also have the potential to happen anywhere in the County and therefore, impact CCWD's service area. Similar to high wind hazards, the resulting damage from tornado events may be most severe in the downtown areas of incorporated communities where there are more large trees, infrastructure, and higher-density development.

4.4.9.3 Extent (Magnitude/Severity)

Critical – High winds and tornadoes can cause damage to property and loss of life. While most tornado damage is caused by violent winds, most injuries and deaths result from flying debris. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Crops and industries may also be damaged or destroyed. Access roads and streets may be blocked by debris, delaying the necessary emergency response.

In 2007, the NWS began rating tornadoes using the Enhanced Fujita Scale (EF-scale). The EF-scale is a set of wind estimates (not measurements) based on damage. It uses three-second gusts estimated at the point of damage based on a judgment of eight levels of damage to the 28 indicators. These estimates vary with height and exposure. Standard measurements are taken by weather stations in open exposures. Table 4-28 describes the EF-scale ratings versus the previous Fujita Scale used prior to 2007.

Table 4-28 The Fujita Scale and Enhanced Fujita Scale

FUJITA SCALE			DERIVED		OPERATIONAL EF-SCALE	
F NUMBER	FASTEST ¼ MILE (MPH)	3-SECOND GUST (MPH)	EF NUMBER	3-SECOND GUST (MPH)	EF NUMBER	3-SECOND GUSTS (MPH)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Source: NWS.

Notes: EF – Enhanced Fujita F – Fujita mph – Miles per Hour

Figure 4-47 illustrates the potential impact and damage from a tornado.

Figure 4-47 Potential Impact and Damage from a Tornado

Source: NOAA NWS, Storm Prediction Center

The damaging effects of wind speed are measured using the Beaufort Wind Scale as shown in Table 4-29 below. This scale only reflects land-based effects and does not take into consideration the effects of wind over water.

Table 4-29 Beaufort Wind Scale

WIND SPEED (MPH)	DESCRIPTION – VISIBLE CONDITION
0	Calm; smoke rises vertically
1-4	Light air; direction of wind shown by smoke but not by wind vanes
4-7	Light breeze; wind felt on face; leaves rustle; ordinary wind vane moved by wind
8-12	Gentle breeze; leaves and small twigs in constant motion; wind extends light flag
13-18	Moderate breeze; raises dust and loose paper; small branches are moved
19-24	Fresh breeze; small trees in leaf begin to sway; crested wavelets form on inland water
25-31	Strong breeze; large branches in motion; telephone wires whistle; umbrellas used with difficulty
32-38	Moderate gale whole trees in motion; inconvenience in walking against wind
39-46	Fresh gale breaks twigs off trees; generally, impedes progress
47-54	Strong gale slight structural damage occurs; chimney pots and slates removed
55-63	Whole gale trees uprooted; considerable structural damage occurs
64-72	Storm very rarely experienced; accompanied by widespread damage
73+	Hurricane devastation occurs

Source: NWS

Based on NCEI records between 1955 and 2022 there have been a combined 94 strong wind/high wind/thunderstorm winds and two tornado/funnel cloud events in Kings County, which have resulted in a total of $10.9 million in property damage and $11,000 in crop damage. The most damaging event took place on January 4, 2008. A powerful Pacific storm brought widespread winds gusting to 60 mph and in some areas to more than 80 mph across interior Northern California, causing extensive damage and numerous power outages. Rainfall and liquid equivalent amounts ranged from 2 to 3 inches in the northern Central Valley. Snowfall totals of 3 to 11 feet were reported in the northern Sierra Nevada Mountains, with winds up to and possibly exceeding 100 mph coupled with heavy snow bringing blizzard conditions. This event resulted in a total of $5,535,000 in property damages and $11,000 in crop damages. Overall, however, high wind event impacts would likely be limited, with a majority of impacts being related to property damages caused by downed trees as well as power outages.

In the past 73 years, only two tornado events took place in Calaveras County – one did not have an assigned magnitude while the other one was EF-1 magnitude. However, it should be noted that, although unlikely, larger tornadoes could occur. Should the County be hit by an EF-3 or higher tornado, it can be extrapolated that because of its relative size and the potential size and length of a tornado's path, a significant portion of the County could be impacted, resulting in property and crop damage and loss of life.

4.4.9.4 Past Occurrences

According to the NCEI, most high wind events occur between November and March. Wind events can also occur across the County. It is also these winds experienced during the winter storms that result in the most wind-related damage. Severe wind events create the most problem when trees fall on power lines, knocking out power and often making it difficult to reach CCWD facilities. Based on NCEI data, Calaveras County has experienced 55 high wind events, 28 strong wind events and 11 thunderstorm events. These events resulted in a total of three deaths, eight injuries, $10.9 million in property losses, and $11,000 in crop losses. Table 4-30 shows a few of the most severe wind events that resulted in property losses.

Table 4-30 Severe High Wind and Strong Wind Events in Calaveras County

HAZARD TYPE	DATE	LOCATION	MAGNITUDE	PROPERTY DAMAGES ($)	CROP DAMAGES ($)	DEATHS	INJURIES
High Wind	1/4/2008	Countywide	80 kts-MG	$5,535,000	$11,000	0	0
High Wind	12/30/2014	Countywide	54 kts-MG	$800,000	$0	0	0
High Wind	1/4/2008	Countywide	63 kts-MG	$726,000	$0	0	0
Strong Wind	10/27/2013	Countywide	43 kts-MG	$0	$0	2	2
High Wind	11/21/2013	Countywide	65 kts-MG	$0	$0	1	1

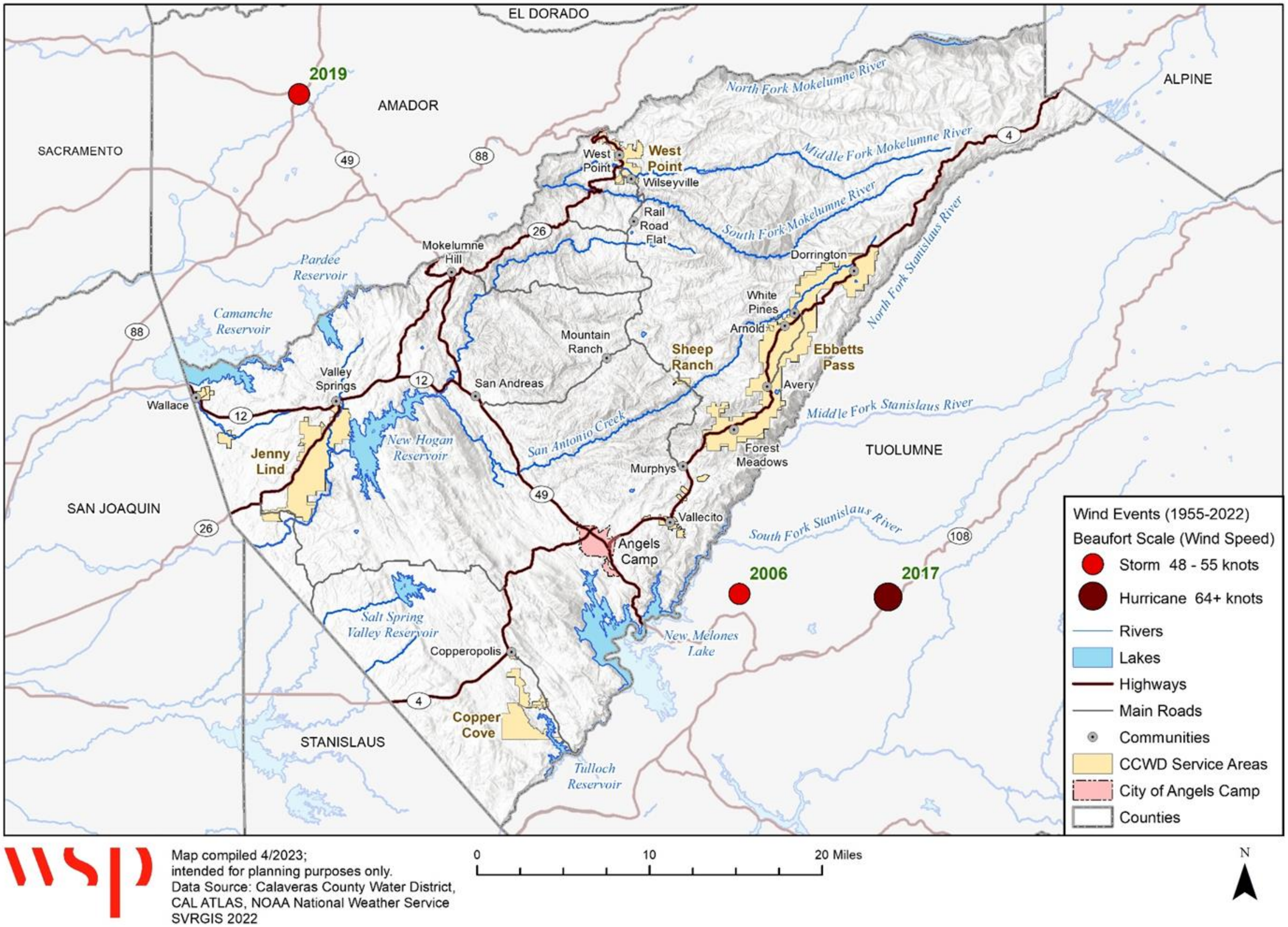
Source: NCEI 2022

The details on the severe wind events are summarized below.

- **January 4, 2008:** A powerful Pacific storm brought widespread winds gusting to 60 mph and in some areas to more than 80 mph across interior Northern California, causing extensive damage and numerous power outages. Rainfall and liquid equivalent amounts ranged from 2 to 3 inches in the northern Central Valley. Snowfall totals of 3 to 11 feet were reported in the northern Sierra Nevada Mountains, with winds up to and possibly exceeding 100 mph coupled with heavy snow bringing blizzard conditions. This event resulted in a total of $5,535,000 in property damages and $11,000 in crop damages.
- **December 30, 2014:** A strong low-pressure system brought strong winds to the Sierra Nevada, the foothills, and the Valley. Fallen trees and branches caused power outages, with 344,000 customers across northern California impacted. The storm dropped several inches of snow at higher elevations, causing traffic slowdowns and chain controls over the Sierra passes. Strong winds and cold temperatures also combined to bring wind chill temperatures well below zero for the higher Sierra, impacting outdoor recreation. This event resulted in a total of $800,000 in property damages.
- **January 4, 2008:** A powerful Pacific storm brought widespread winds gusting to 60 mph and in some areas to more than 80 mph across interior Northern California, causing extensive damage and numerous power outages. Rainfall and liquid equivalent amounts ranged from 2 to 3 inches in the northern Central Valley. Snowfall totals of 3 to 11 feet were reported in the northern Sierra Nevada Mountains, with winds up to and possibly exceeding 100 mph coupled with heavy snow bringing blizzard conditions. This event resulted in a total of $726,000 in property damages.
- **October 27, 2013:** Ahead of a low-pressure system, strong onshore winds caused travel disruption for Northern California. The system then dropped over a foot of snow for the Sierra at higher elevations as it passed through the region. This event resulted in two deaths and two injuries.
- **November 21, 2013:** A strong low-pressure system dropped heavy rain and a few inches of snow at higher levels. Behind the storm, the Sierra Nevada received significant wind damage. Strong wind gusts of 50 to 75 mph were estimated and measured. Thousands of power outages were reported. This event resulted in one death and one injury.

Figure 4-48 shows the locations of historical high wind events that happened in Calaveras County from 1955 to 2022.

Figure 4-48 Calaveras County High Wind Events (1955 – 2022)

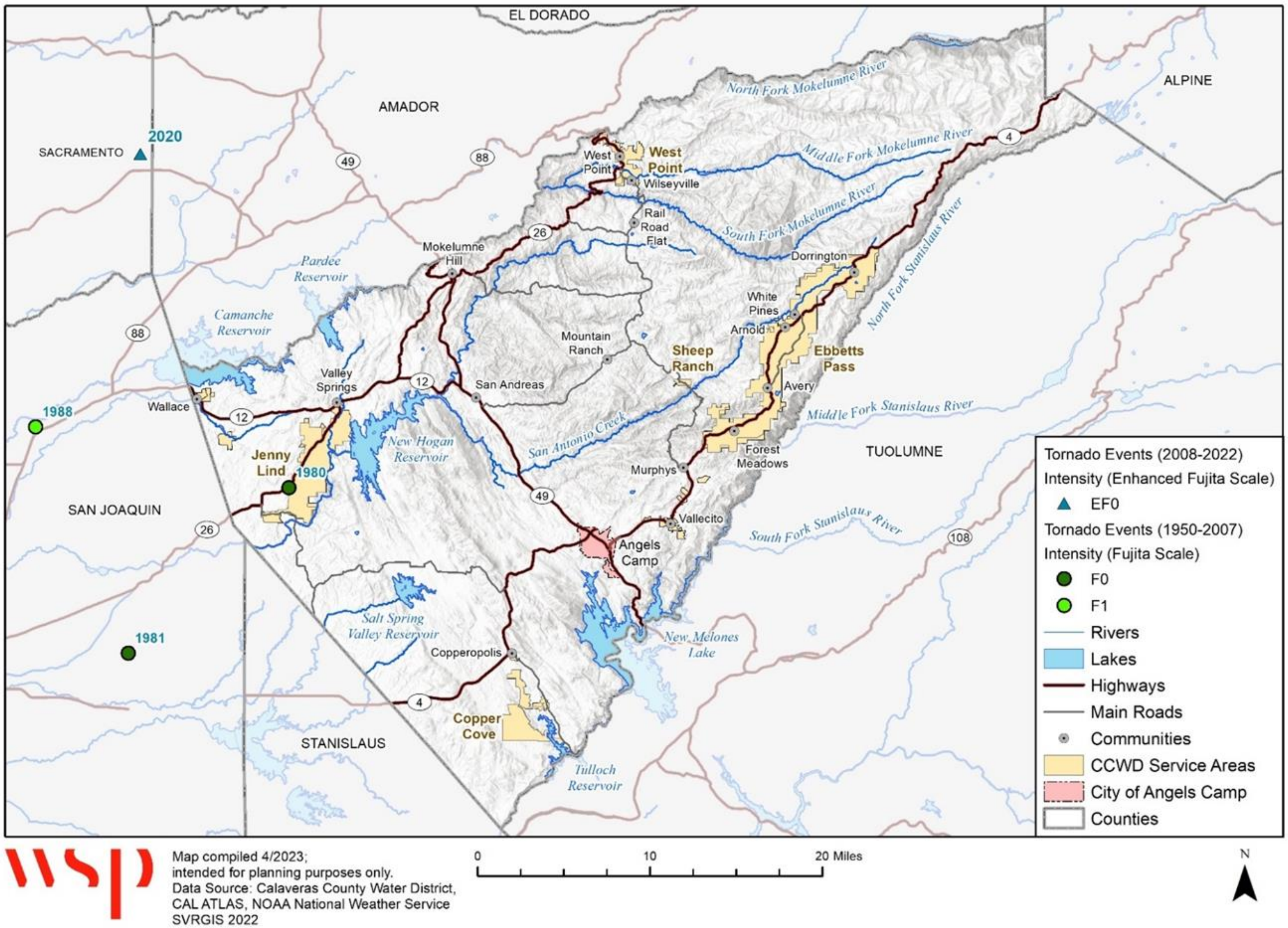


Two tornado events were recorded in Calaveras County during the period from 1950-2023. The first event happened on July 29, 1980, while no magnitude was assigned for the event. The second event happened on January 10, 2023, near Felix. According to the NCEI database, a brief EF-1 tornado touched down near a small reservoir and Hogan Dam Road and continued Northeast for approximately 0.4 miles. This event resulted in two deaths and $100,000 in property damage.

During the 2022-2023 plan update, the HMPC also mentioned that a tornado warning was issued in Calaveras and Amador Counties during a severe storm capable of producing a tornado in 2022 but was cancelled before the tornado was formed.

Figure 4-49 shows the historical tornado events that happened in Calaveras County from 1950 to 2022.

Figure 4-49 Calaveras County Tornado Events (1950 – 2022)



4.4.9.5 Probability of Future Occurrences

Highly Likely – A total of 94 high winds events have occurred in the County over 28 years of recordkeeping, which equates to almost four high wind events on an annual basis. Historical wind activity within the Planning Area indicates CCWD's service area will likely continue to experience high wind events. On the other hand, two tornado events occurred in Calaveras County over 74 years (1950-2023) of record keeping which equates to one tornado every 37 years, on average, and a 2.7 percent chance of a tornado occurring in any given year. The actual risk of high wind and tornado events to CCWD is dependent on the nature and location of any given event.

Moreover, ongoing research has resulted in different conclusions on the effect of climate change on wind regimes. Meanwhile, ongoing research stated that for extreme weather events, such as tornadoes and severe thunderstorms, more research is needed to understand how climate change will affect them. Refer to the Climate Change Considerations subsection below for more details on climate change's impact on high wind and tornado events.

4.4.9.6 Climate Change Considerations

Studies referenced in California's Fourth Climate Assessment indicated that extreme fire weather, particularly in the form of hot and dry winds, can strongly influence shrub-land fire regimes (Bedsworth et al. 2018). Strong winds have also been now associated with severe forest fires in California meaning climate change impacts on wind patterns may also affect forest health and wildfire susceptibility. However, ongoing research compiled in the recent climate assessment has resulted in different conclusions on the effect of climate change on wind regimes.

The August 2021 IPCC report argues that in most places, wind speeds will be drastically reduced because of climate change, whereas in 2019, Scientific American reported that winds across the world were speeding up. The Maine Monitor suggests that a lack of wind can increase wildfire risks and aggravate drought. Unusual wind patterns combined with other climate change issues, such as hotter water temperatures, can also cause problems. At this time, these changing factors are not well understood and are still being incorporated into state and regional research and risk analysis.

For other types of extreme weather events, such as tornadoes and severe thunderstorms, more research is needed to understand how climate change will affect them. These events occur over much smaller scales, which makes observations and modeling more challenging. Projecting the future influence of climate change on these events can also be complicated by the fact that some of the risk factors for these events may increase with climate change, while others may decrease, like the complexity of predicting future wind patterns, which is mentioned above. Even though some studies predict that climate change could provide the opportunity for more severe thunderstorms to form, this does not necessarily mean that more tornadoes will occur, given that only about 20% of supercell thunderstorms produce tornadoes. The fourth National Climate Assessment summarizes the complicated relationship between tornadoes and climate change: "…extreme weather, such as tornadoes, are also exhibiting changes which may be linked to climate change, but scientific understanding is not detailed enough to project direction and magnitude of future change" (NatGeo 2022).

4.4.9.7 Vulnerability Assessment

Property

General damages are both direct (what the wind event physically destroys) and indirect, which focuses on additional costs, damages and losses attributed to secondary hazards spawned by the event, or due to the damages caused by the wind event. Depending on the magnitude of the wind events as well as the size of the tornado and its path, a tornado is capable of damaging and eventually destroying almost anything. Construction practices and building codes can help maximize the resistance of the structures to damage.

Secondary impacts of damage caused by wind events often result from damage to infrastructure. Downed power and communications transmission lines, coupled with disruptions to transportation infrastructure, create difficulties in reporting and responding to emergencies. These indirect impacts of a wind event put tremendous strain on a community. In the immediate aftermath, the focus is on emergency services. Downed trees caused by a wind event are a common occurrence in the County. Falling trees can cause significant damage to property and put people at risk. Projecting future climate change factors into wind and extreme weather events, like tornadoes and severe thunderstorms is complex. As previously discussed, some factors may increase with climate change like the formation of hot dry winds that are associated with severe forest fires versus other factors that may decrease wind speeds. As a result, because these factors are not well understood, climate change is not expected to drastically increase or decrease wind speeds or the vulnerability of property due to a tornado.

People

Community members are the most vulnerable to high wind and tornado events. The availability of sheltered locations such as basements, buildings constructed using tornado-resistant materials and methods, and public storm shelters, all reduce the exposure of the population. However, there are also segments of the population that are especially exposed to the indirect impacts of high winds and tornadoes, particularly the loss of electrical power. These populations include the elderly or disabled, especially those with medical needs and treatments dependent on electricity. Nursing homes, community-based residential facilities, special needs housing facilities, and isolated communities are also vulnerable. Life support needs can be threatened when electrical outages are prolonged since backup power generally operates only with minimal functions for a short period of time.

Critical Facilities and Infrastructure

Both winds and tornadoes may impact exposed critical infrastructure such as power lines; depending on the impact and the function, this could cause a short-term economic disruption. The most common problems associated with tornadoes and high winds are loss of utilities. Downed power lines can cause power outages, leaving large parts of CCWD's service area isolated, and without electricity, water, and communication. Damage may also limit timely emergency response and the number of evacuation routes. Downed electrical lines following a storm can also increase the potential for lethal electrical shock. Damaging winds can also cause wildfires. And, while hot dry winds could intensify with climate change it is not fully understood whether these winds would continue to change over time and be fully associated with climate change patterns.

Most CCWD's critical facilities should be able to withstand and provide adequate protection from severe wind and tornadoes. Those facilities with backup generators should be fully equipped to handle severe wind and tornado events should the power go out.

Economy

As mentioned above, high winds can damage buildings and other infrastructure, resulting in significant repair costs. The cost of repairing or rebuilding damaged property can be quite high, especially in areas where the wind is particularly strong or frequent. High wind hazards can also disrupt business operations, causing lost revenue and profits. Moreover, high wind hazards can cause power outages, which can have a range of economic impacts. For individuals, power outages can cause lost productivity, decreased revenue, and increased costs for backup power sources. However, winds typically do not have long-term impacts on the economy.

Cultural, Historic and Natural Resources

High winds and tornadoes can cause massive damage to the natural environment, uprooting trees, and other debris. This is part of a natural process, however, and the environment will return to its original state in time.

4.4.9.8 Development Trends

As CCWD's Planning Area increases in population, the number of people and housing developments exposed to the hazard increases. Future development projects for new CCWD infrastructure should also consider severe weather hazards at the planning, engineering, and architectural design stages to reduce vulnerability. Besides, proper education on building techniques and the use of sturdy building materials, basements, attached foundations, and other structural techniques may minimize property vulnerabilities.

4.4.9.9 Risk Summary

- Between 1950 and 2023 there were a combined 94 high wind and two tornado events in the County.
- High wind events resulted in a total of $10.9 million in property damage and $11,000 in crop damage.
- High wind events are predicted to happen on an annual basis.
- Both winds and tornadoes may impact exposed critical infrastructure such as power lines; depending on the impact and the function, this could cause a short-term economic disruption.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Extensive	Highly Likely	Critical	Medium

4.4.10 Landslides and Debris Flows

4.4.10.1 Hazard/Problem Description

A landslide is a general term for a variety of mass-movement processes that generate a downslope movement of mud, soil, rock, and/or vegetation. For the purposes of this plan, the term landslide includes mudslides, debris flows, and rockfalls that tend to occur suddenly, whereas erosion is a similar process that tends to occur on smaller scales and more gradually.

Natural conditions that contribute to landslide and erosion are the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Road building, excavation, and grading
- Earthquake

In addition, many human activities tend to make the earth's materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

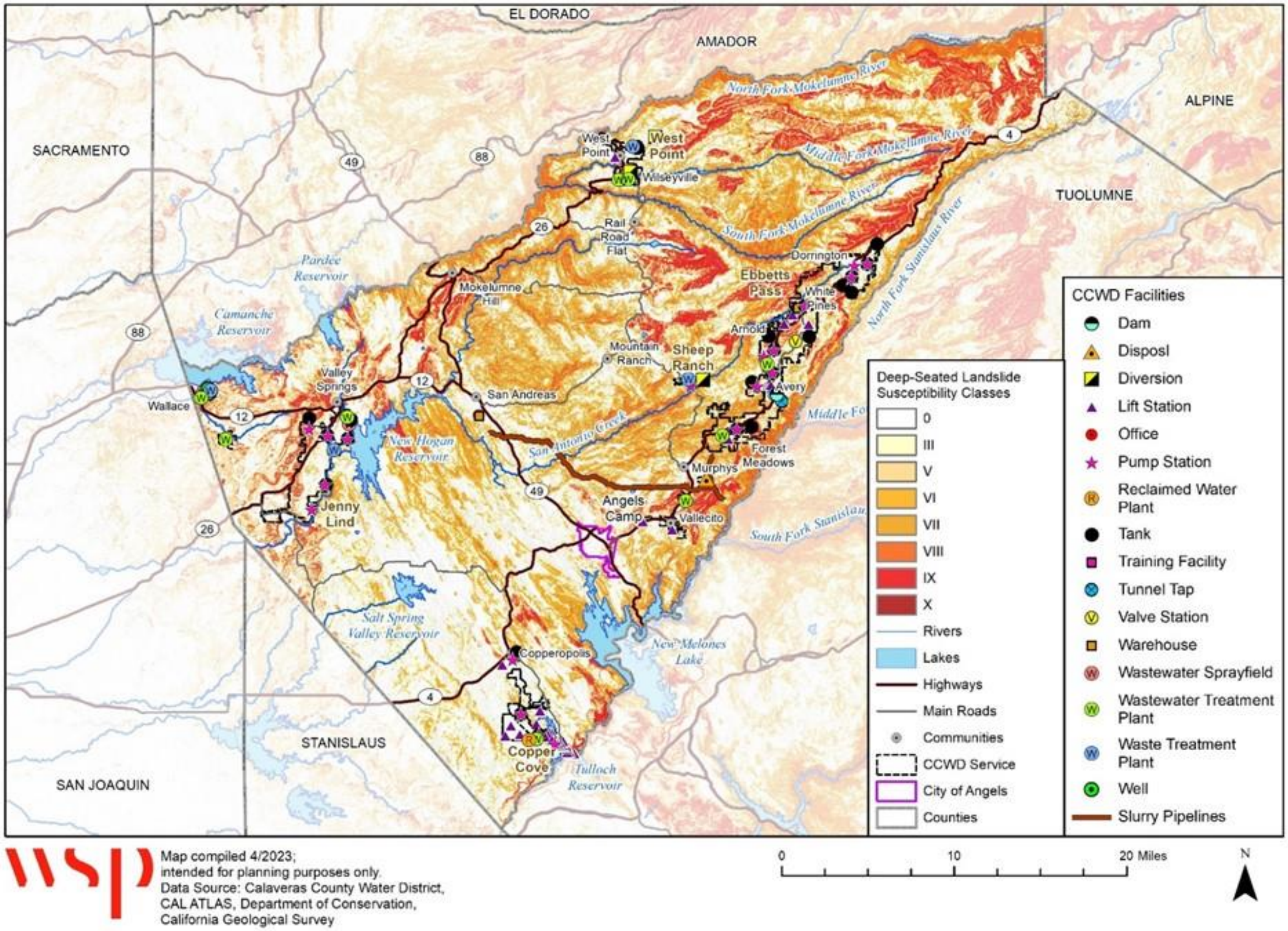
Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration. A more gradual phenomenon is erosion, which can occur over periods of years and is generally viewed as a long-term problem as differentiated from other more sudden and catastrophic natural hazards.

4.4.10.2 Geographic Area

Significant – Based on analysis of areas with both highly erosive soils and steep slopes, locations near Jenny Lind and Ebbetts Pass are at greatest risk from landslide and erosion impacts. The western edge of New Hogan Reservoir and southwest of Ebbetts Pass contain significant areas of soil classified as having severe erosion potential, which could lead to possible landslides. Another known area of elevated risk of land movement is near Murphys above McKays Reservoir.

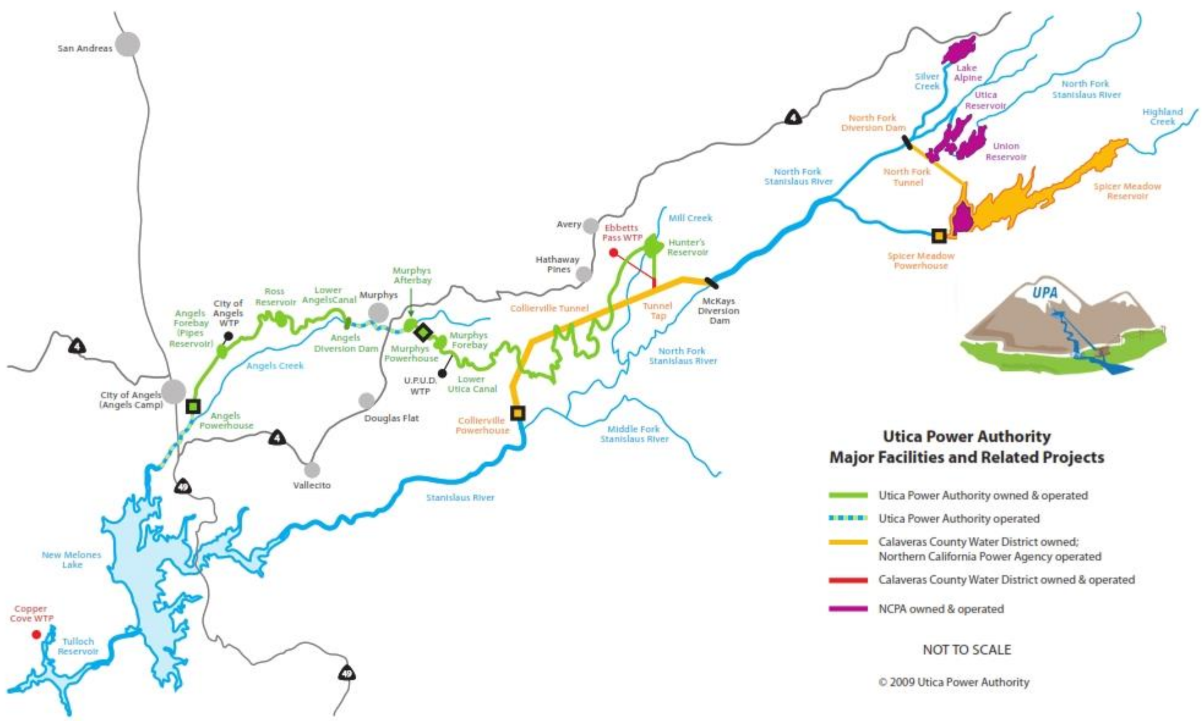
In addition, Figure 4-50 shows the overall deep-seated landslide susceptibility of Calaveras County. CCWD service areas including Jenny Lind, Sheep Ranch and Ebbetts Pass contain areas that have high landslide susceptibility.

Figure 4-50 Calaveras County Deep-Seated Landslide Susceptibility



Additionally, the HMPC identified the area above and below the Collierville Tunnel Tap between McKays Diversion Dam to the west and near Hunter's Reservoir and Ebbetts Pass WTP to the east as an area characterized by erosive soils and steep slopes that are also known to be susceptible to localized landslides and instability. The HMPC noted that as the sole source of water for the City of Angels Camp and Murphys, the Collierville Tunnel Tap was identified as a critical facility that needed to be evaluated and mitigated for hazards. For example, the Collierville Tunnel Tap is susceptible to potential landslides or slope instability based on where the flume may be damaged: if there is damage below, the Tunnel Tap loses pressure, and if it is damaged above, the Tunnel Tap does not have water, Figure 4-51 illustrates the Collierville Tunnel, and the area known as the Tunnel Tap.

Figure 4-51 Other Major Water Facilities and Related Projects in Calaveras County



Source: Utica Water and Power Authority (UWPA) 2009

The Tunnel Tap area is considered sensitive information and not shown on a detailed map due to limitations on the CCWD to disclose sensitive information on critical energy infrastructure (18 CFR 388.133 – Critical Energy/Electrical Infrastructure Information (CEII)). Also, except for the County soils map data, additional spatial data was not available for potential landslide areas, expansive soils, and other soil-related hazards.

Areas with slopes greater than 50 percent have extreme susceptibility to landslides and erosion. Areas of concern are high elevations, steep ravines, and gulches associated with river and stream channels. Generally, areas of steeper slopes and increased landslide/erosion risk are in the more mountainous eastern portion of the county. Over two percent of the total land area of Calaveras County (14,574 acres) has soil classified as highly susceptible to landslides. These areas were identified based on characteristics of low soil stability and steepness of slope. These are shown in in Section 4.4.17 Soil Erosion.

4.4.10.3 Extent (Magnitude & Severity)

Critical – As discussed in the Geographic Area section, a significant portion of the County is susceptible to landslide hazard, which also includes several CCWD service areas. Moreover, 47 of 123 CCWD facilities are at risk of landslide hazard. A total of 13.56 miles of CCWD's slurry pipeline are also located in landslide-prone areas. Refer to the Vulnerability Assessment section below for more details on the analysis.

Landslides are often triggered by other natural hazards such as earthquakes, heavy rain, flood, or wildfires. Landslide frequency is often related to the frequency of these other hazards. In Calaveras County, landslides typically occur during and after major storms so the potential for landslides largely coincides with the potential for sequential severe storms that saturate steep, vulnerable soils.

4.4.10.4 Past Occurrences

A landslide was a factor in a federal disaster declaration for Calaveras County in 2006. No details were available from the NCEI or the HMPC. Also, a large mudslide occurred in the Stanislaus National Forest near Highway 4 in January 1997. Known as the Sourgrass Slide, no damage occurred to District facilities. Other landslide incidents of varying degrees of magnitude tend to occur in places throughout the county several times in a given year, but in most cases, do not cause significant damage or public safety risk.

4.4.10.5 Probability of Future Occurrences

Likely—Landslides in the form of debris flow, or mudslides, have occurred in the past in Calaveras County. Rockfalls and landslides occur more frequently in spring months, when elevated levels of precipitation and runoff combine with saturated soils and/or repeated freezing and thawing, which leads to general slope instability. Landslides can often occur from other hazard events, such as floods, wildfires, or earthquakes.

Locations near Jenny Lind and Ebbetts Pass are at the greatest risk from landslide and erosion impacts. The western edge of New Hogan Reservoir and southwest of Ebbetts Pass contain significant areas of soil classified as having severe erosion potential, which could lead to possible landslides. Another known area of elevated risk of land movement is near Murphys above McKays Reservoir.

4.4.10.6 Climate Change Considerations

Landslides can result from intense rainfall and runoff events. Projected climate change-associated variance in rainfall events may result in more high-intensity events, which may increase landslide frequency. In addition, the increased potential of wildfire occurrence also escalates the risk of landslide and debris flows in the period following a fire, when slopes lack vegetation to stabilize soils and burned soil surfaces allow more rainfall runoff. As climate change affects the length of the wildfire season, it is possible that a higher frequency of large fires may occur into late fall, when conditions remain dry. The wildfires can be followed by intense rains early in the winter, as occurred with the Thomas Fire in December 2017 and subsequent Montecito and Carpinteria debris flows in January 2018 that occurred in Santa Barbara County (Cal OES 2018). Moreover, tree mortality resulting from drought, pests or any other threat could also pose an increase in landslides as the loss of trees would reduce the protection of steep slopes and thereby increase the probability of landslide occurrences.

4.4.10.7 Vulnerability Assessment

People

People could be at risk if they are caught in a landslide or debris flow or mudslide, potentially leading to injury or death. It is not likely that landslides will occur without warning following a severe wildfire and significant rain event, and direct impacts to people are suspected to be minimal; however, some debris flow and rockfall events can occur with very short or no warning. Climate change will also impact people's vulnerability to this hazard because landslides are projected to increase as the variance in rainfall events increases and results in higher intensity precipitation, particularly in areas previously impacted by wildfires. Information on where these events have already occurred or where there are areas susceptible to these types of events, would help when certain types of events, such as heavy prolonged rainfall may trigger soil instability.

It is crucial to recognize the potential risks posed to vulnerable populations in the CCWD's Planning Area. Vulnerable individuals caught in a landslide or debris flow may face a higher likelihood of injury or even fatality. The direct impact on the general population is expected to be minimal and mostly likely occur to motorists traveling along state highways at higher elevations. Still, certain events like debris flows and rockfalls can happen suddenly or with very little warning directly impacting the safety and mobility of vulnerable populations in the CCWD Planning Area.

The communities of West Point and Sheep Ranch in the CCWD's service areas have been identified as having relatively high social vulnerability. These two service areas encompass 616 connections and serve a combined population of 1,132 people. These two communities are situated at higher elevations and near steep ravines and relatively isolated from the western portion of the County making them potentially more vulnerable to landslides. They are also more vulnerable to the effects of climate change since increased precipitation and drier soils during drought events are expected to make these steep areas more susceptible to landslides. Any major landslide or slope instability event will require these isolated communities to evacuate or response providers and the CCWD the need to access these communities to provide back-up supplies.

However, given most of the impacts related to landslides are known to occur along travel routes, like State and County roads, direct impacts to this segment of the population is anticipated to remain low. Further, given most of the population in these communities reside outside areas prone to deep-seated landslide susceptibility, the CCWD water customers are not expected to be directly impacted by landslides, or indirectly through the temporary loss of water supply due to impacted CCWD water facilities. As shown in Table 4-31 while 44 of the CCWD's facilities are exposed to landslide risks, only a portion of these are within West Point or Sheep Ranch. There are also numerous existing capabilities and mitigations in place related to hardening these facilities against multiple hazards.

Property

Landslides directly damage structures through ground movement, which damage the structural integrity of foundations and the physical impact of debris moving downslope. A total of 47 of CCWD's facilities are located within landslide prone areas as well as a critical water source for the City of Angels Camp and Murphys, the Collierville Tunnel Tap. Climate change will increase the vulnerability of property exposed to landslides as high-intensity rainfall events in areas impacted by wildfires or tree mortality could increase the probability of occurrences.

Critical Facilities and Lifelines

To assess if any of the CCWD facilities are located within landslide-prone areas, CCWD's critical facilities and infrastructure assets were intersected with a deep-seated landslide susceptibility layer, which is also shown in Figure 4-50. A total of 44 CCWD facilities are found to be located in landslide-prone areas. Table 4-31 shows the analysis results by landslide class and facility type. Among the 44 facilities identified, 19 of them are lift stations.

Table 4-31 CCWD Facilities Exposure to Deep-seated Landslide

Landslide Class	Dam	Lift Station	Pump Station	Tank	Wastewater Sprayfield	WWTP	WTP	Well	Grand Total
Class 3	1	11	2	1	1		1		17
Class 5		2	2	8	1	1		1	15
Class 6		2		1			1		4
Class 7		3							3
Class 8		1	2			1			4
Class 9			1						1
Grand Total	1	19	7	10	2	2	2	1	44

Source: CCWD, DOC, CGS, WSP GIS Analysis 2023

In addition, a total of 13.56 miles of CCWD's slurry pipeline are located in landslide-prone areas. Table 4-32 below shows the mileage of susceptible slurry pipeline categorized by landslide class. It is also important to note that the slurry pipeline is used for non-potable irrigation customers. This means the impact on agricultural users would not be as critical as the impacts that could occur to communities if a domestic water line was damaged and the water supply was not available.

Table 4-32 CCWD Slurry Pipeline Exposure to Deep-Seated Landslide

Landslide Class	Mileage
Landslide 3	3.35
Landslide 5	1.98
Landslide 6	3.06
Landslide 7	2.7
Landslide 8	1.4
Landslide 9	1.07

Landslide Class	Mileage
Landslide 10	0
Total	13.56

Sources: CCWD, DOC, CGS, WSP GIS Analysis 2023

Climate change will alter the variability of rainfall events, which may increase landslide frequency in the future, thereby increasing the CCWD's vulnerability to landslides and the potential for direct impacts to the CCWD's critical water infrastructure systems. These impacts are anticipated to have the highest likelihood of occurrence in areas previously impacted by wildfires, areas impacted by forestry pests and disease, and other areas devoid of vegetation. Direct impacts exacerbated by climate change may involve damage to CCWD facilities related to flooding, debris contamination at intake facilities, and infiltration issues at WWTPs.

Economy

Economic impacts generally revolve around transportation routes temporarily closed by debris flow or landslide activity. These roads may be used to transport goods or provide access for commuters, visitors, and tourists. Depending upon the damage level, roads may only be closed for a short period for debris removal or require extensive reconstruction.

Cultural, Historic and Natural Resources

As primarily a natural process, landslides and debris flows can have varying impacts on the natural environment as debris flows have the potential to permanently alter the natural landscape. The impacts of landslides and debris flows on historical and cultural structures would be similar to the impacts on general property.

4.4.10.8 Development Trends

The severity of landslide problems is directly related to the extent of human activity in hazard areas. Human activities such as property development and road construction can also exacerbate the occurrence of landslides. Careful siting of future development should take place carefully to prevent landslide damage to property or people.

Since the 2018 LHMP, there has been limited significant development within the six CCWD service areas, as well as the wastewater service areas. The observed increase in population is primarily attributed to new connections into all the existing service areas, rather than one specific property development or construction project. For example, there were approximately 13,000 connections in 2018, and there are approximately 13,219 connections in 2023. The number of actual connections fluctuates as new development is constructed, but also as existing service connections are discontinued. As a result, the potential impact of landslide hazards on critical facilities and populations due to additional growth and development remains relatively stable, with any additional vulnerability being primarily associated with new connections to the existing infrastructure in the CCWD's service areas.

4.4.10.9 Risk Summary

- Landslides are often triggered by other natural hazards such as earthquakes, heavy rain, flood, or wildfires.

- Landslide frequency is often related to the frequency of these other hazards.
- In Calaveras County, over two percent of the total land area has soil classified as highly susceptible to landslides.
- As landslides typically occur in the area during and after major storms, the probability of future occurrence is likely as landslides in the form of debris flow, or mudslides, have occurred in the past when elevated precipitation levels or runoff saturated soils creating general slope instability.
- Analysis of areas with highly erosive soils and steep slopes show locations near Jenny Lind, southwest portion of Ebbetts Pass, and the western edge of New Hogan Reservoir, are at greatest risk from landslides and erosion impacts. In addition, the Collierville Tunnel Tap has areas above that are susceptible to localized landslides and instability.
- Climate change will alter the variability of rainfall events, which may increase landslide frequency in the future, thereby increasing impacts to the CCWD's critical water infrastructure systems. These impacts will have the highest likelihood of occurrence in areas previously impacted by wildfires and forestry pests and disease.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Significant	Likely	Limited	Medium

4.4.11 Severe Weather: Heavy Rain and Storms, Lightning, Hail

Severe weather is generally any destructive weather event, but usually occurs in Calaveras County and therefore CCWD's Planning Area as localized storms that bring heavy rain, hail, lightning, and sometimes strong winds. The NOAA's NCEI has been tracking severe weather since 1950. Their Storm Events Database contains data on the following: all weather events from 1996 to current; additional thunderstorm wind and hail event data from 1955 to present; additional tornado data from 1950 to present. For many of the hazard events, data is reported using zones as a scale of analysis. These zones are often expansive and cover multiple counties, which can overestimate the number of past occurrences relative to a water district's Planning Area. Table 4-33 summarizes these events.

Table 4-33 NCEI Severe Weather Reports for Calaveras County, 1950 – 2023*

	# OF EVENTS	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Avalanche	2	0	0	$0	$0
Blizzard	1	0	0	$0	$0
Cold/Wind Chill	18	4	0	$0	$0
Debris Flow	2	0	0	$15,000	$0
Dense Fog	7	1	9	$150,000	$0
Drought	111	0	0	$0	$1,500,000,000
Excessive Heat	21	0	0	$0	$0
Extreme Cold/ Wind Chill	2	0	0	$0	$0

	# OF EVENTS	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Flash Flood	3	0	0	$20,000	$0
Flood	29	3	0	$7,685,000	$0
Hail	4	0	5	$10	$300,000
Heat	38	2	0	$0	$0
Heavy Rain	37	0	0	$0	$10,250,000
Heavy Snow	109	1	2	$1,125,000	$0
High Wind	55	1	6	$8,374,000	$11,000
Lightning	1	0	0	$0	$0
Strong Wind	28	2	2	$2,473,000	$0
Thunderstorm Wind	11	1	0	$13,000	$0
Tornado	2	0	0	$0	$0
Wildfire	41	3	41	$315,000	$0
Winter Storm	264	1	3	$191,000	$0
Winter Weather	100	1	0	$0	$0
Total	886	20	68	$20,361,010	$1,510,561,000

Source: NCEI 2023

The NCEI table above summarizes severe weather events that occurred in the County. Only a few of the events resulted in state and federal disaster declarations. Also, different data sources capture different events during the same time and often display different information specific to the same events. While the HMPC recognizes these inconsistencies, they see the value this data provides in depicting the "bigger picture" of the County's hazard environment.

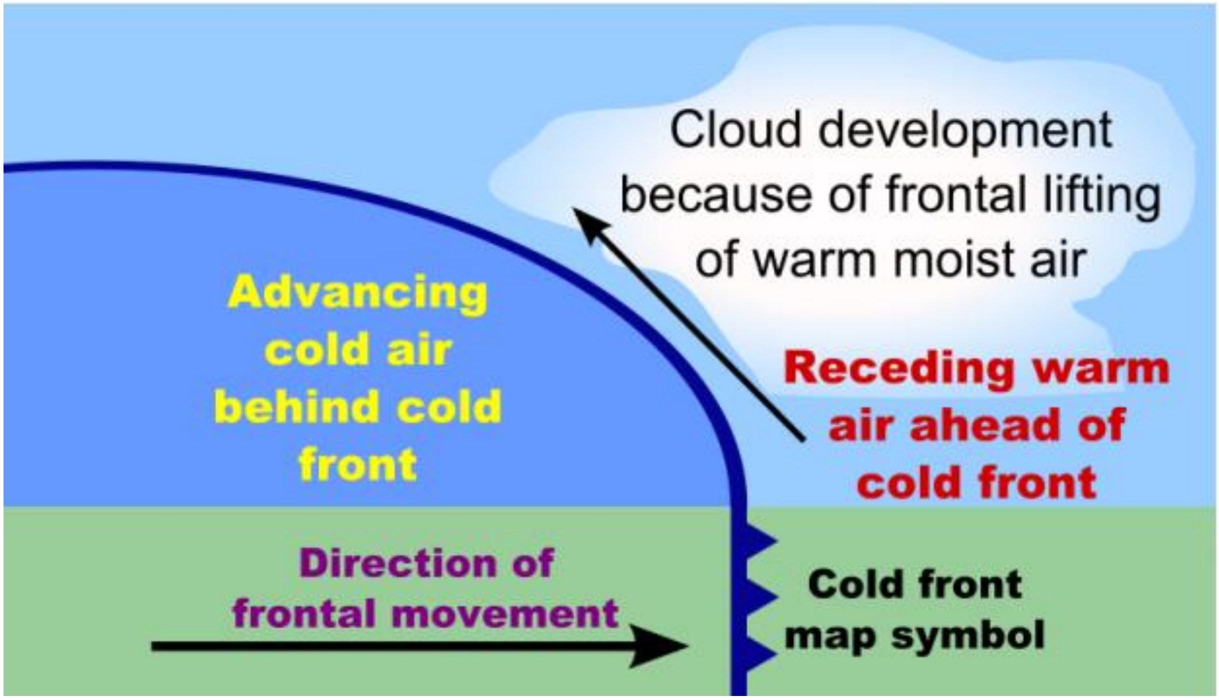
As previously mentioned, most all of the County's state and federal disaster declarations have been a result of severe weather, as well as flooding and wildfire events. For this plan, severe weather is discussed in this section. Extreme heat, high wind and tornadoes, and extreme cold and winter storms were each profiled and assessed separately.

4.4.11.1 Hazard/Problem Description

Storms in Calaveras County are generally characterized by heavy rain, often accompanied by strong winds, and sometimes lightning and hail. Approximately 10% of the thunderstorms that occur each year in the United States are classified as severe (Red Cross, 2007). A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds more than 50 knots (57.5 mph), or a tornado. Heavy precipitation in Calaveras County falls mainly in the fall, winter, and spring months.

Thunderstorms result from the rapid upward movement of warm, moist air. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that reach heights of greater than 35,000 ft. As the rising air reaches its dew point, water droplets and ice form and begin falling the long-distance 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, as shown in Figure 4-52.

Figure 4-52 Formation of a Thunderstorm



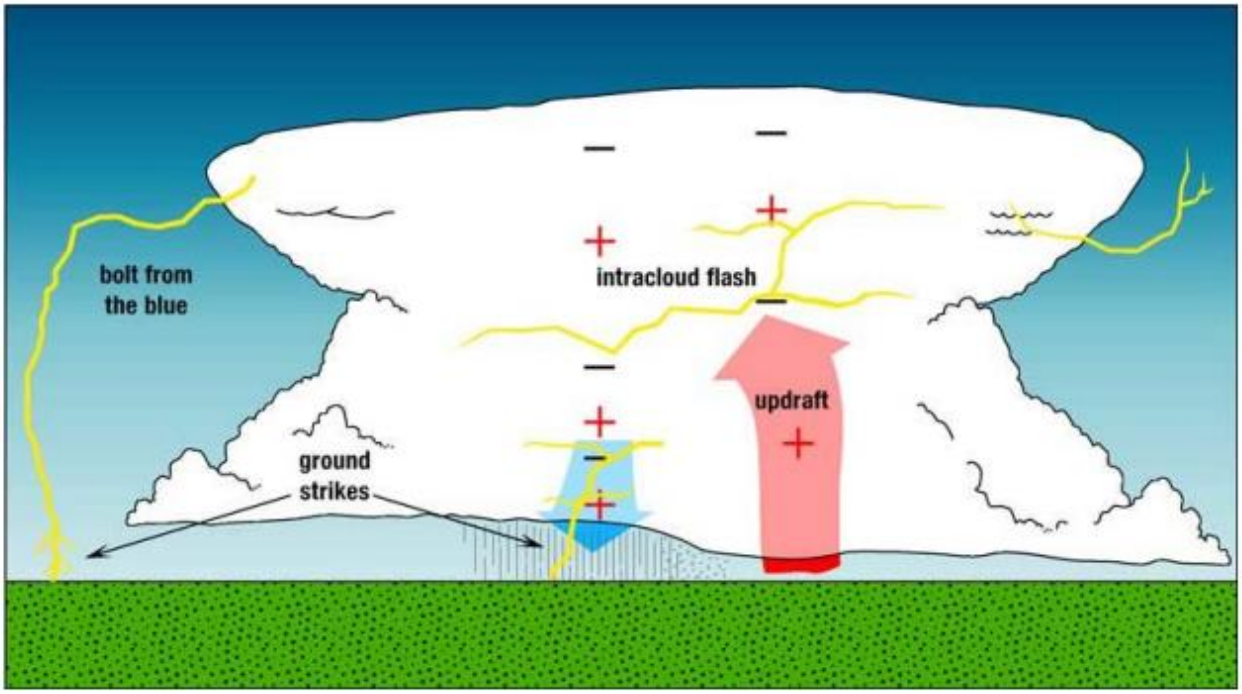
Source: NASA

Lightning is defined by the NWS as all various forms of visible electrical discharge caused by thunderstorms. Thunderstorms and lightning are usually (but not always) accompanied by rain. Cloud-to-ground lightning can kill or injure people through direct or indirect means. Objects can be struck directly, which may result in an explosion, burn, or destruction. Damage may also be indirect when the current passes through or near an object, which generally results in less damage.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually, it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel, similar to a cloud-to-ground flash, can be visible for many miles.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is less common. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes can carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead of or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm, in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited, And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage. Figure 4-53 illustrates cloud-to-ground lightning.

Figure 4-53 Cloud-to-Ground Lightning



Source: National Weather Service

Hail is formed when water droplets freeze and thaw as they are thrown high into the upper atmosphere by the violent internal forces of thunderstorms. Hail is sometimes associated with severe storms within Calaveras County and they can occur throughout the County. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 miles per hour. Severe hailstorms can be quite destructive, causing damage to roofs, buildings, automobiles, vegetation, and crops.

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Winds in Calaveras County are typically straight-line winds, or winds that are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). These winds can overturn mobile homes, tear roofs off houses, topple trees, snap power lines, shatter windows, and sandblast paint from cars. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and occasional structure fires. Tornadoes (see Section 4.2.13 High Winds and Tornado) and funnel clouds can also occur during these types of storms. Additional information on wind is described in High Winds and Tornadoes.

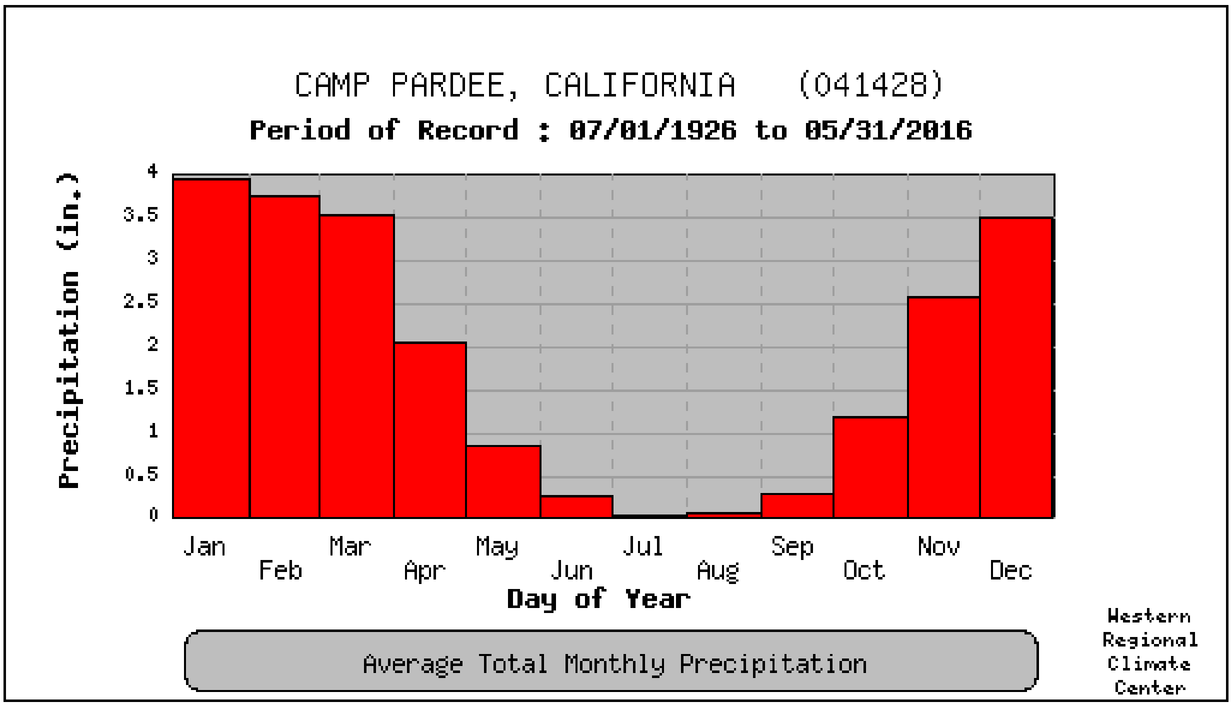
4.4.11.2 Geographic Area

Extensive – Information from the Camp Pardee and the Calaveras Big Trees weather stations in the County are summarized below in Figure 4-54 and Figure 4-56, which show average and extreme precipitation from the Camp Pardee weather station in the northwest part of the county and the Calaveras Big Trees weather station in the southeast part of the county. Based on the data from these two weather stations and past occurrences, heavy rain events can occur across the County. The extent of heavy rain events may also vary due to the season (e.g., more heavy rain in the western portion of the County during winter months versus more snow in the eastern portion of the County). Like most severe weather hazards, storms, heavy rain, lightning, and hail are not geographically isolated and are likely to affect all portions of the CCWD's Planning Area.

Camp Pardee Weather Station, Period of Record 1926 to 2011

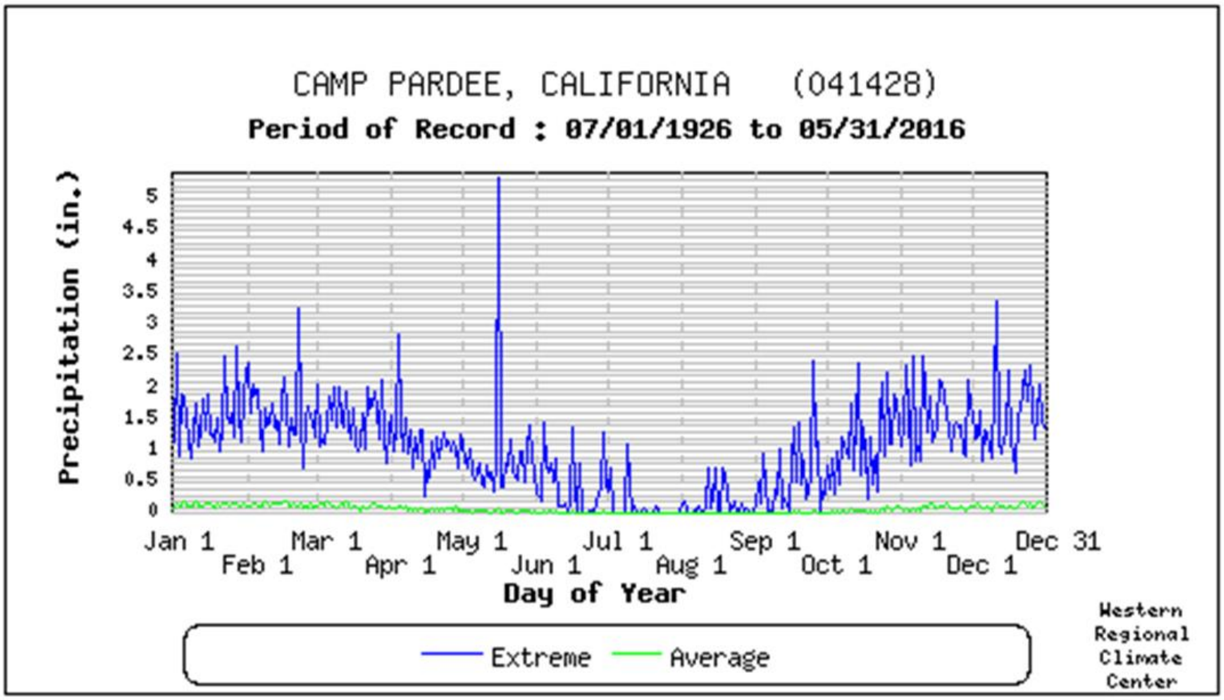
The average annual precipitation at the Camp Pardee Station is 21.5 inches per year, shown in Figure 4-54. The highest recorded annual precipitation is 44.9 inches in 1983, while the lowest recorded annual precipitation was 7.1 inches in 1976, shown in Figure 4-55.

Figure 4-54 Camp Pardee Monthly Average Total Precipitation, 1929 to 2016



Source: Western Regional Climate Center

Figure 4-55 Camp Pardee Daily Precipitation Average and Extremes, 1929 to 2016

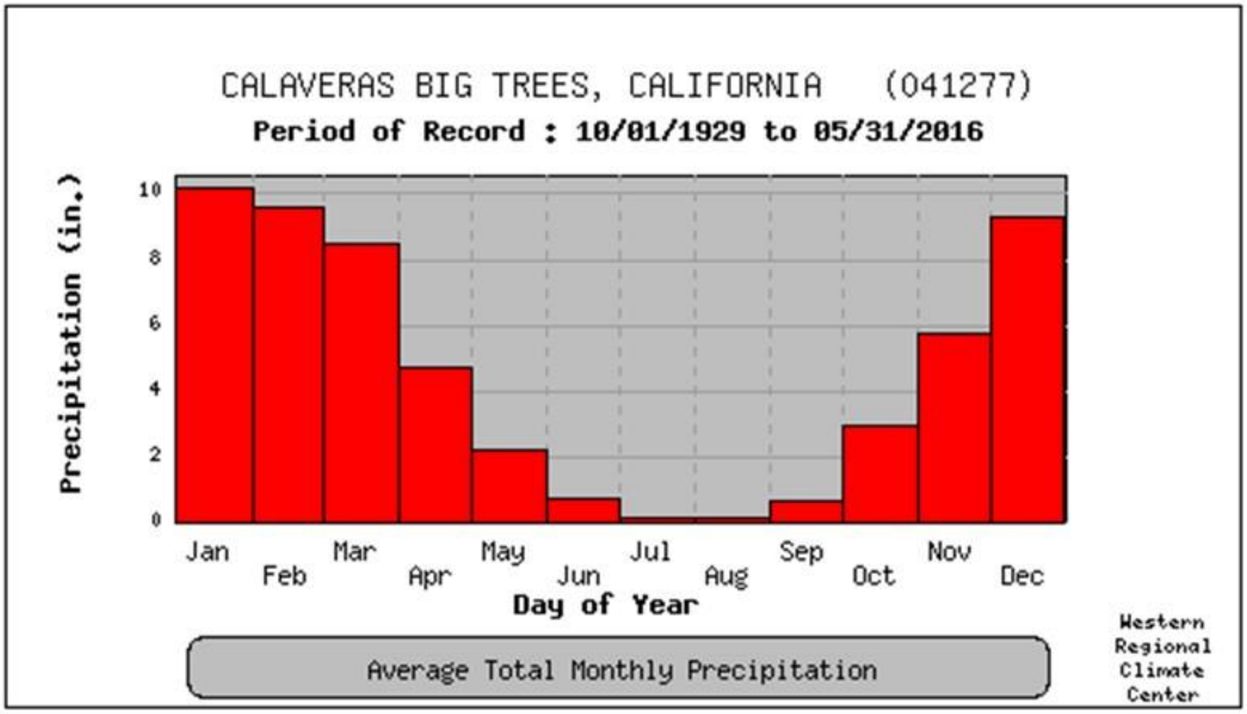


Source: Western Regional Climate Center

Calaveras Big Trees Weather Station, Period of Record 1929 to 2016

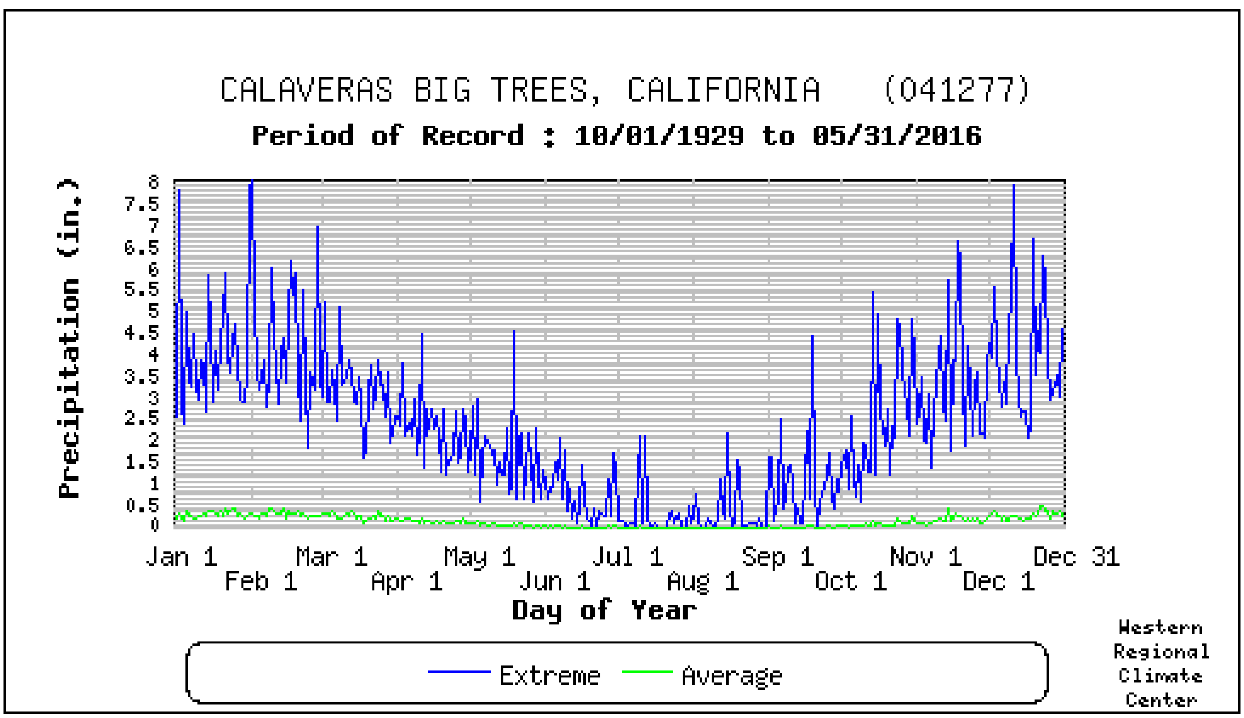
The average annual precipitation at the Calaveras Big Trees Station is 54.3 inches per year. The highest recorded annual precipitation is 109.1 inches in 1983. The lowest recorded annual precipitation was 8.1 inches in 1976. These precipitation trends are illustrated in Figure 4-56 and Figure 4-57.

Figure 4-56 Calaveras Big Trees Monthly Average Total Precipitation, 1929 – 2016



Source: Western Regional Climate Center

Figure 4-57 Calaveras Big Trees Daily Precipitation Average and Extremes, 1929 – 2016



Source: Western Regional Climate Center

4.4.11.3 Extent (Magnitude and Severity)

Critical – According to the HMPC, short-term, heavy rain storms can cause both widespread flooding as well as extensive localized drainage issues associated with surface water runoff. The heavy precipitation that is possible in the CCWD and all of California is often the result of an atmospheric river (AR). ARs are categorized by a unit of measurement known as the Integrated Water Vapor Transport (IVT), which considers the amount of water vapor in the system and the wind that moves it around. For a storm to be classified as an AR it has to reach an IVT threshold of 250 units; 1,000 IVT or more is considered to be "extreme" (Arcuni 2019).

In 2019 a system for categorizing the strength and impacts of ARs was developed by the Center for Western Weather and Water Extremes (CW3E), out of the Scripps Institution of Oceanography at the University of California San Diego. The newly developed scale ranks ARs into five categorizes from weak to exceptional. Unlike the Fujita scale for tornadoes that focuses on potential damages, the AR scale accounts for both storms that may be hazardous and storms that can provide benefits to the local water supply. A category one AR is primarily beneficial, generally lasting only 24 hours and produces modest rainfall. On the other end of the scale, a category five AR is considered "exceptional" and primarily hazardous, lasting for several days and associated with heavy rainfall and runoff that may cause significant damages. Table 4-34 describes the scale further. The Center developed the scale as a tool for officials with an operational need to assess flooding potential in their jurisdictions before the storms makes landfall.

Table 4-34 Atmospheric River Categories

Category	Potential Impacts
AR Cat 1: Weak	Primarily beneficial. For example, a Feb. 2, 2017 AR hit California, lasted 24 hours at the coast, and produced modest rainfall.
AR Cat 2: Moderate	Mostly beneficial, but also somewhat hazardous. An atmospheric river on Nov. 19-20, 2016 hit Northern California, lasted 42 hours at the coast, and produced several inches of rain that helped replenish low reservoirs after a drought.
AR Cat 3: Strong	Balance of beneficial and hazardous. An atmospheric river on Oct. 14-15, 2016 lasted 36 hours at the coast, produced 5-10 inches of rain that helped refill reservoirs after a drought, but also caused some rivers to rise to just below flood stage.
AR Cat 4: Extreme	Mostly hazardous, but also beneficial. For example, an atmospheric river on Jan. 8-9, 2017 that persisted for 36 hours produced up to 14 inches of rain in the Sierra Nevada and caused at least a dozen rivers to reach flood stage.
AR Cat 5: Exceptional	Primarily hazardous. For example, a Dec. 29, 1996 to Jan. 2, 1997 atmospheric river lasted over 100 hours at the Central California coast. The associated heavy precipitation and runoff caused more than $1 billion in damages.

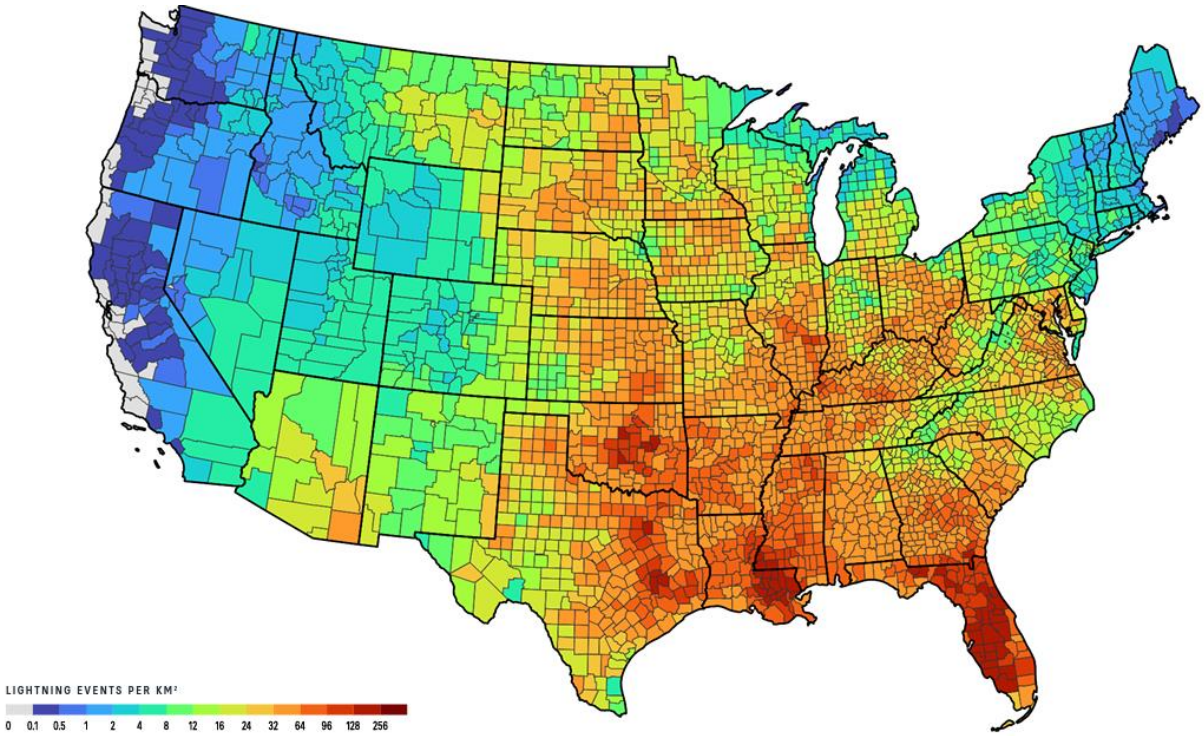
Source: Center for Western Weather and Water Extremes, Scripps Institution of Oceanography at UC San Diego. Scale was developed by F. Martin Ralph Director of CW3E in collaboration with Jonathan Rutz of NWS.

The extent of past heavy rain events in terms of County-wide property damage is also summarized in Table 4-36Table 4-36. The historical data shows that the most powerful heavy rain events typically resulted in the most property damage in the County, which resulted in up to $10 million in property damage.

Within the CCWD's Planning Area heavy rain events can have the greatest range of intensity during Atmospheric Rivers (AR) that typically form over the North Pacific Ocean and when the make landfall in California deliver moisture-laden air that results in heavy and localized precipitation. With the steady growth of some of the service areas, the lack of adequate drainage systems has become an increasingly important issue related to heavy rain. This issue became apparent after a series of ARs impacted the CCWD service area from late 2022 to early 2023, causing enough damage to deem some homes and businesses uninhabitable (De La Cruz 2023). The intensity of the recent ARs resulted in the most damage to the CCWD's water systems and infiltration infrastructure. The potential for AR events is also expected to continue to increase the intensity of future heavy rainstorms across the entire CCWD service area. This may also result in changes to flood control operations at major reservoirs, which could exacerbate flood operation impacts associated with water supply. During the 2023 plan update process, the HMPC also expressed concern over heavy rain events' various impacts, including potential damages to CCWD infiltration systems, localized flooding of CCWD facilities, contamination of water supply, and possible long-term economic impacts.

The extent of lightning can be described by the number of strikes per square mile per year, or the total number of strikes annually. According to NOAA data, on a statewide level, California averaged 1.79 lightning events per square mile in 2022, with a total of 760,046 flashes (Vaisala 2023). While the total number of flashes in Calaveras County is not available, the total number of flashes per square mile per year is estimated between 0.5 and 1, as shown in Figure 4-58.

Figure 4-58 Total Lightning Density per County in 2022



Source: Vaisala 2023

The NWS classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4-35 below indicates the hailstone measurements utilized by the NWS.

Table 4-35 Hailstone Measurements

AVERAGE DIAMETER	CORRESPONDING HOUSEHOLD OBJECT
0.25 inch	Pea
0.5 inch	Marble/Mothball
0.75 inch	Dime/Penny
0.875 inch	Nickel
1.0 inch	Quarter
1.5 inch	Ping-pong ball
1.75 inch	Golf-Ball
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup
4.00 inch	Grapefruit
4.50 inch	Softball

Source: National Weather Service

While hail events can occur across the County, the extent of these events is more frequent at lower elevations in the central and western portions of the county.

4.4.11.4 Past Occurrences

Heavy rains and severe storms occur in the Planning Area primarily during the late fall, winter, and spring (i.e., November through April). Damaging winds often accompany winter storm systems moving through the area. Although heavy rains are a frequent occurrence, thunderstorms, lightning, and hail in Calaveras County are fewer in number and usually occur in the late fall or in the spring. Twenty-two events were detailed by the NCEI database, including 17 heavy rain events (see Table 4-36. Hail events from 1955 to 2022 are illustrated in Figure 4-59.). Of the 17 heavy rain events, only two of these events have occurred since 2018. Both of these events involved a combination of heavy rain and heavy snow that fell in the eastern portion of the County and involved road flooding and power outages.

Figure 4-59 Calaveras County Hail Events: 1955 – 2022

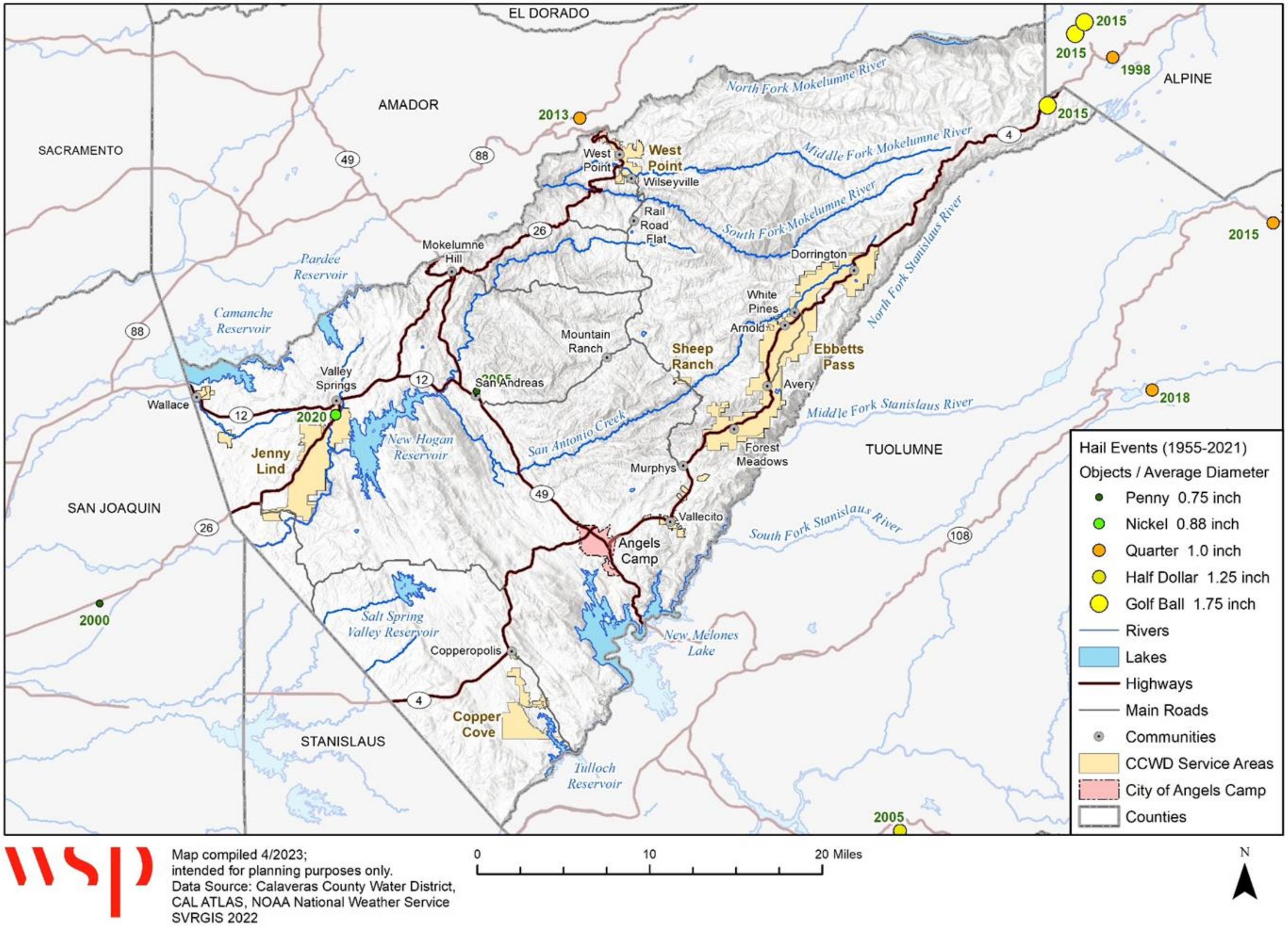


Table 4-36 NCEI Incidences of Hail, Heavy Rain, and Lightning in Calaveras County from 1993 – 2023

EVENT TYPE	COUNT OF EVENT TYPE	NUMBER OF INJURIES	SUM OF PROPERTY DAMAGE
Hail	4	5	$300,000
Heavy Rain	17	0	$10,250,000
Lightning	1	0	$0
Grand Total	22	5	$10,550,000

Source: NCEI 2023

There were no reported deaths associated with any of the events listed in Table 4-36. Reported hail stone sizes were 0.1 inches, 0.88 inches, and 1.75 inches (golf ball-sized). The most common months for events of these types was September, with a total of six events, followed by July, January, and February, with 3 events each.

4.4.11.5 Probability of Future Occurrences

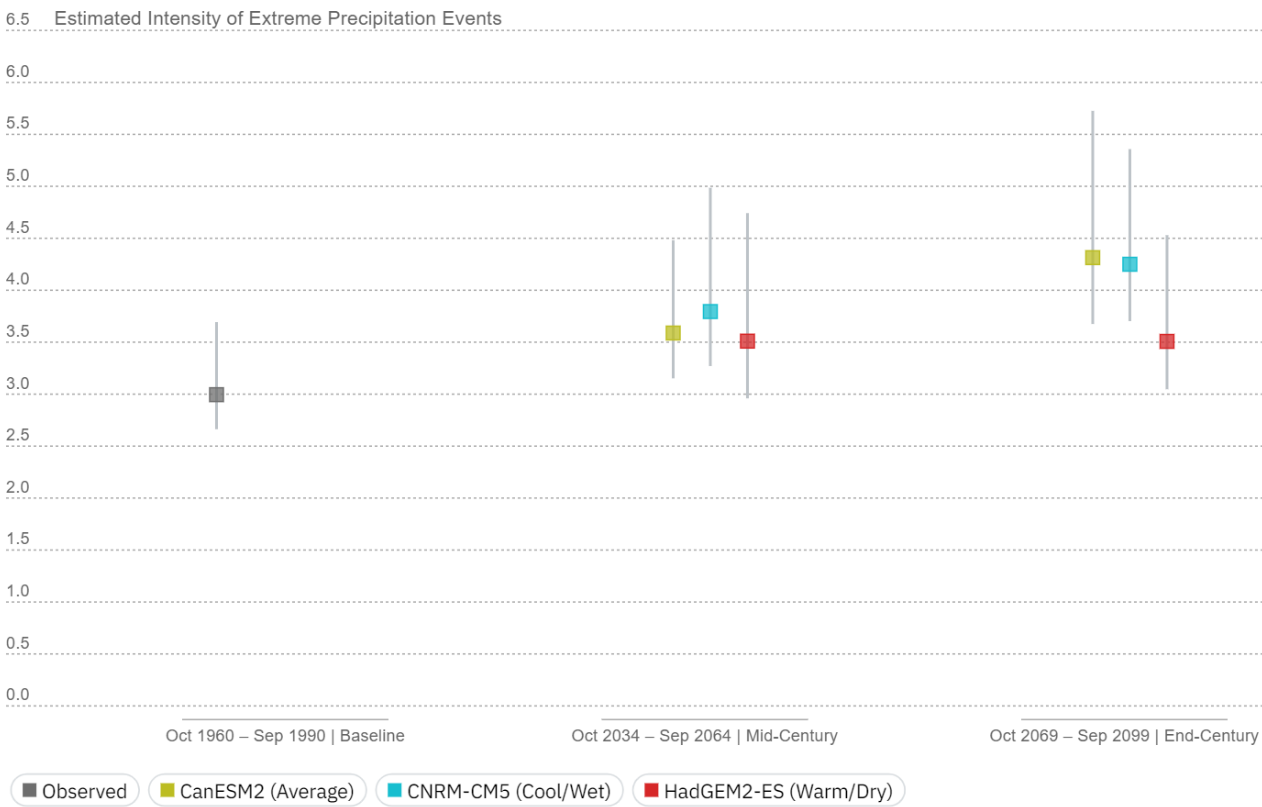
Highly Likely – Although not well-documented in the NCEI database, severe weather, including heavy rain, thunderstorms, hail, lightning, and wind is a well-documented occurrence that will continue to occur in Calaveras County.

4.4.11.6 Climate Change Consideration

According to the California Climate Adaptation Strategy, while average annual rainfall may increase or decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century. Data from the Cal-Adapt tool supports this conclusion. Using the RCP 8.5 scenario, Cal-Adapt determined the estimated intensity of extreme precipitation events which are exceeded on average once every 20 years. Extreme precipitation is geographically defined, and for Calaveras County occurs when the one-day rainfall total exceeds 0.95 inches, the historical lowest annual maximum one-day precipitation. The estimated intensity of extreme precipitation events is the amount of precipitation that is expected to be exceeded once every 20 years.

As shown in Figure 4-60 the intensity of extreme precipitation events is expected to increase using three different GCMs (a warmer/drier simulation, an average simulation, and a cooler/wetter simulation).

Figure 4-60 Projected Changes in Estimated Intensity of Extreme Precipitation Events



Source: Cal-Adapt. Data: LOCA Downscaled CMIP5 Climate Projections (Scripps Institution of Oceanography), Gridded Observed Meteorological Data (University of Colorado Boulder), LOCA Derived Products (Geospatial Innovation Facility).

Moreover, Figure 4-61 and Figure 4-62 below show Calaveras County's 30-year maximum annual average precipitation during historical times, as well as predicted precipitation for the years 2035 – 2064 under the RCP 8.5 scenario. As shown by the two maps, the County's maximum annual average precipitation is predicted to increase throughout mid-century. Areas that used to receive less precipitation are predicted to receive more precipitation throughout the mid-century.

Figure 4-61 Calaveras County 30-Year Maximum Annual Average Precipitation (Historical: 1961 – 1990)

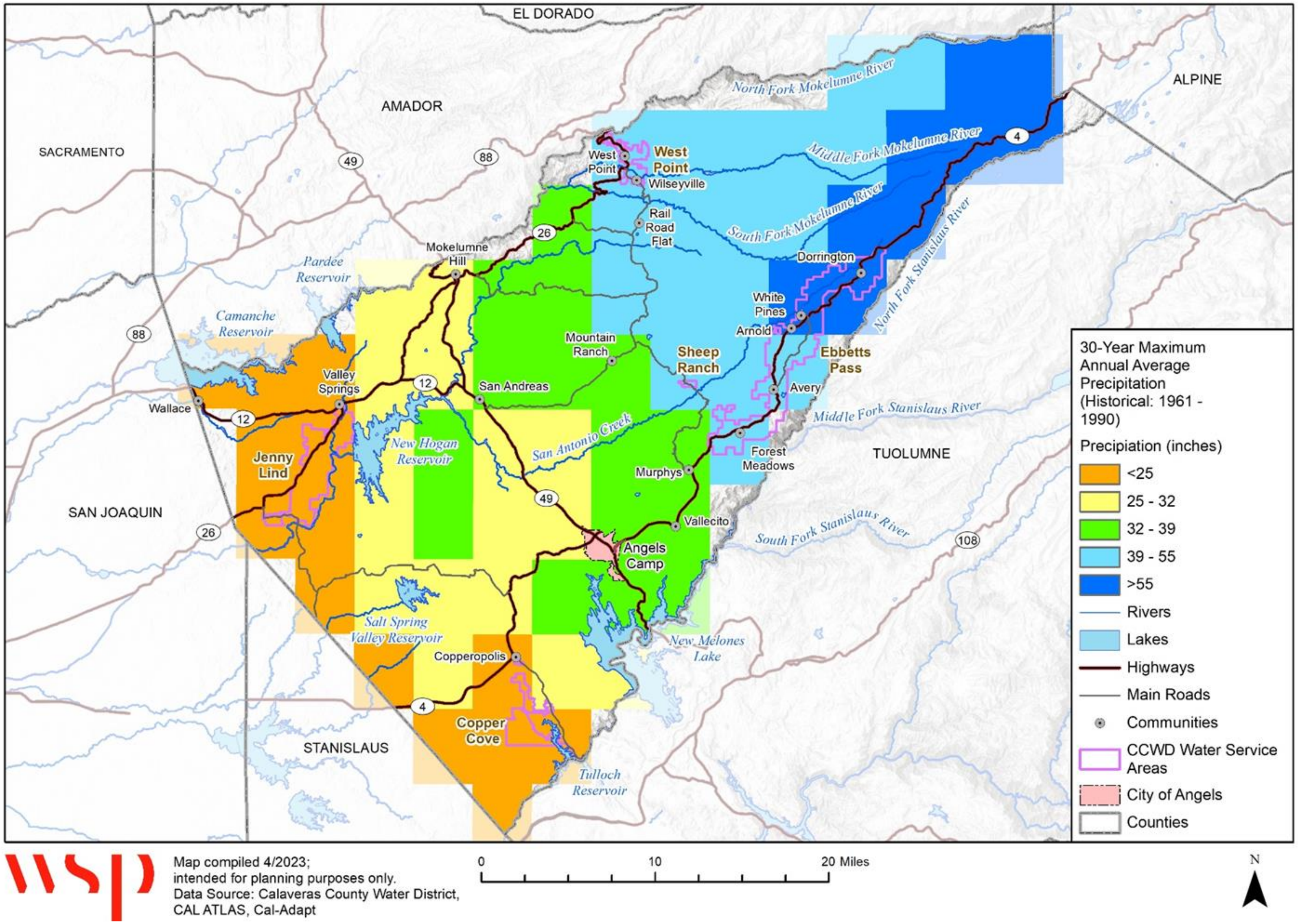
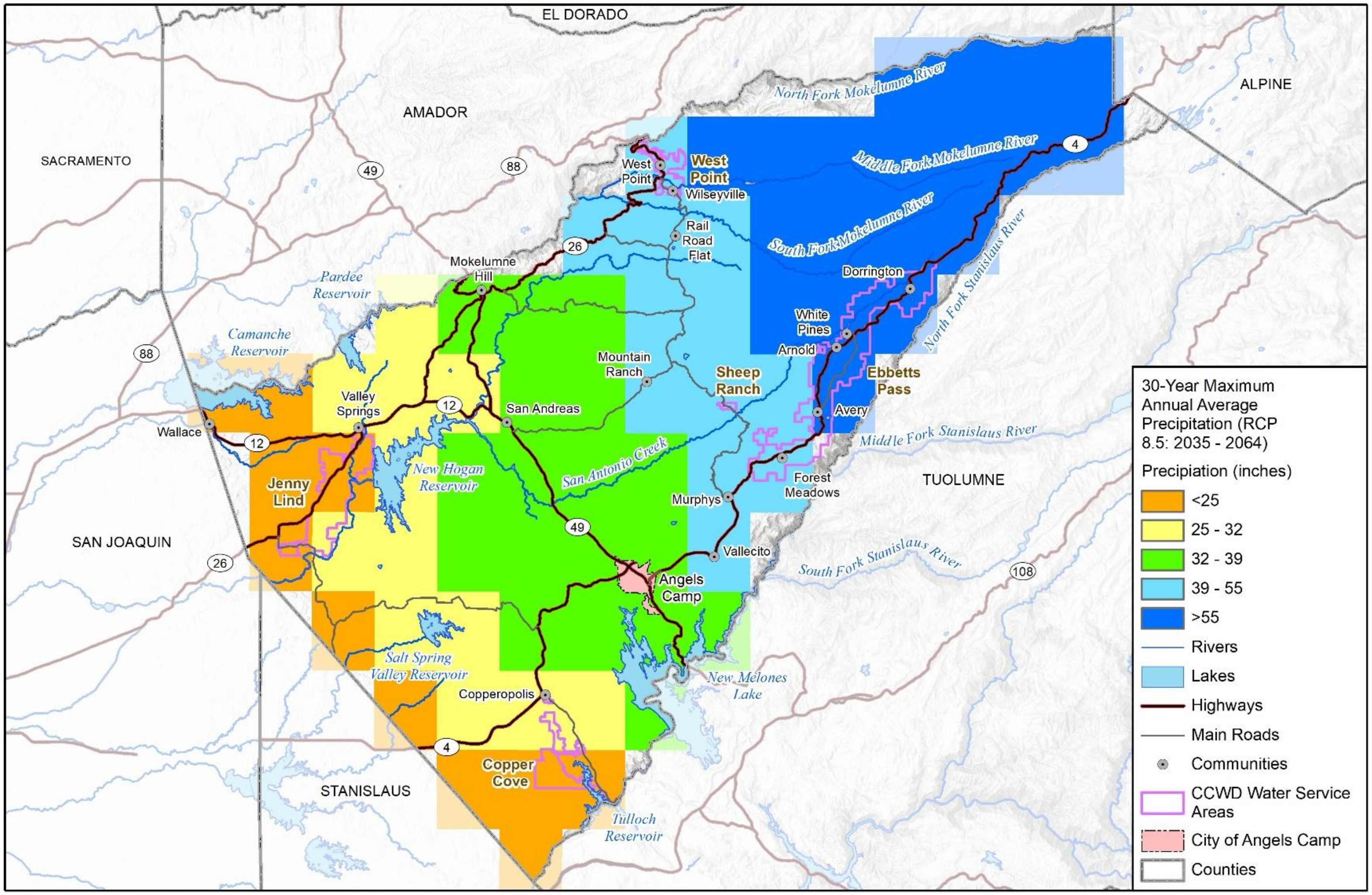


Figure 4-62 Calaveras County 30-Year Maximum Annual Average Precipitation (RCP 8.5: 2035 – 2064)



Map compiled 4/2023;
intended for planning purposes only.
Data Source: Calaveras County Water District, CAL ATLAS, Cal-Adapt)

Table 4-37further breaks down the data using 95% confidence intervals. Historic extreme precipitation events in Calaveras County were determined using a thirty-year average of data from 1960-1990. Under the warm/dry simulation, the expected intensity is projected to increase by an average of 0.52 inches. Under the cool/wet model expected intensity is projected to increase by an estimated average of 1.26 inches.

Table 4-37 Projected Changes in Estimated Intensity of Extreme Precipitation Events by Mid-Century

SIMULATION	TIME FRAME	RETURN LEVEL	95% CONFIDENCE INTERVAL
Observed	1960-1990	2.99 inches	2.66-3.69 inches
Average	2034-2064	3.59 inches	3.15-4.48 inches
Cool/Wet	2034-2064	4.25 inches	3.7-5.36 inches
Warm/Dry	2034-2064	3.51 inches	3.05-4.53 inches

Source: Cal-Adapt 2023

It is unlikely that hail will become more common in the County. The amount of lightning is not projected to change. Overall, there will be a continued risk from intense rainfall events that can generate more frequent and more extensive rainfall, and in turn more runoff and flooding (State of California 2022a).

4.4.11.7 Vulnerability Assessment

People

During heavy rain, outdoor workers may be required to work in hazardous conditions, such as flooded or muddy work sites, which can increase the risk of slips, trips, and falls. Thunder and lightning storms can also pose a risk to those who are outdoors, particularly those who work on elevated structures or who are in close proximity to electrical equipment. Lightning strikes can cause injury or death, and people may need to be evacuated until the storm has subsided. In the case of hail, people may also be at risk of injury from falling hailstones and may need to take shelter.

If critical water infrastructure is damaged by heavy rain, hail or lightning, public water may become contaminated and pose a public health risk. Climate change is projected to increase the intensity of rainfall events in the future and the County's maximum annual average precipitation is predicted to also increase throughout mid-century. Heavy rain, storms, and hail events could therefore increase with climate change, and further effect the vulnerability of people in the future, particularly vulnerable populations like outdoor workers and beneficiaries that rely on medical equipment and devices that require electricity.

Property

In addition to the flooding that often occurs during these storms, strong winds, when combined with saturated ground conditions, can down very mature trees. Based on this information, most CCWD facilities may be impacted; however, facilities that may result in the greatest indirect effects of localized flooding as a result of heavy rain include the area near White Pines Reservoir and Jenny Lind Water Treatment Plant.

Given hail can occur throughout the County, it can also impact all CCWD facilities, but may have the greatest impact on older structures and buildings with roofs, windows, and siding (e.g., older water treatment plants).

Critical Facilities and Lifelines

Water infrastructure is at risk from heavy storms. Heavy rain can overwhelm water treatment plants, leading to reduced water quality and possible system failures. Climate change will worsen the impact to the CCWD's critical water facilities and infrastructure; this vulnerability will be the greatest on the CCWD's older facilities and those that may be indirectly impacted by localized flooding.

Economy

Severe storms impact the economy when they disrupt transportation and commercial operations. Lightning strikes and other storm-related events can cause power outages, which can disrupt the delivery of water, business operations, and cause inconvenience for households. This can result in lost productivity and revenue for businesses. Generally, long-term economic impacts center more around hazards that cascade from a heavy rain event such as flooding.

Cultural, Historic and Natural Resources

As a natural process, the impacts of most heavy rain events by themselves are part of the overall natural cycle and do not cause long-term consequential damage. However, infrastructure maybe at risk if downed trees come in contact with it. Prolonged rains can saturate soils and lead to slope failure, potentially impacting infrastructure located on slopped terrain.

4.4.11.8 Development Trends

New facilities and infrastructure should be built to withstand heavy rain damage. Future development projects should consider adverse weather hazards at the planning, engineering, and architectural design stage to reduce vulnerability. Stormwater master planning and site review should account for buildings and new development to withstand heavy rain events. Thus, new land use development in the Planning Area is not expected to increase overall vulnerability of the CCWD's customers and critical facilities to heavy rain, storms, or hail events but all development will be affected by adverse weather and storm events.

4.4.11.9 Risk Summary

- Based on two weather station datasets, rain events can occur across the County, vary due to the season, are not geographically isolated, and are likely to affect all portions of the CCWD's Planning Area.
- The lack of adequate drainage systems is an increasingly important issue that became apparent after a series of ARs impacted Calaveras County during the 2022-2023 winter season and caused substantial damage to homes and businesses.
- Heavy rain during the 2022-2023 damaged CCWD infiltration systems and flooded various facilities, which has resulted in water supply contamination concerns.
- Twenty-two hail, lightning, and heavy rain events occurred in the CCWD's Planning Area from 1950 to 2023 that resulted in five injuries and over $10 million in damages.

- The maximum annual average precipitation in the CCWD's Planning Area is predicted to increase throughout mid-century and areas that used to receive less precipitation are predicted to receive more precipitation.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Extensive	Highly Likely	Critical	Medium

4.4.12 Soil Erosion

4.4.12.1 Hazard/Problem Description

Soil erosion is the process whereby soil materials are worn away and transported to another area either by wind or water. Rates of erosion can vary depending on the soil material and structure, placement, and the general level of human activity. Soil containing excessive amounts of sand and silt can be easily eroded while clay soils are less susceptible. Calaveras County contains a wide range of soils that have varying levels of susceptibility to erosion, ranging from slight to extremely high.

4.4.12.2 Geographic Area

Table 4-38identifies the soil groups with moderate to high erosion hazard. The erosion potential shown in Figure 4-63 identifies the areas with soils and slope characteristics that have high and moderate erosion potential. As shown in the map, soils susceptible to erosion are scattered throughout the County, with a larger concentration near New Hogan Reservoir. Because the geographic area for soil erosion ranges across the County, the geographic area is limited.

Table 4-38 Soils Groups with Moderate to High Erosion Potential

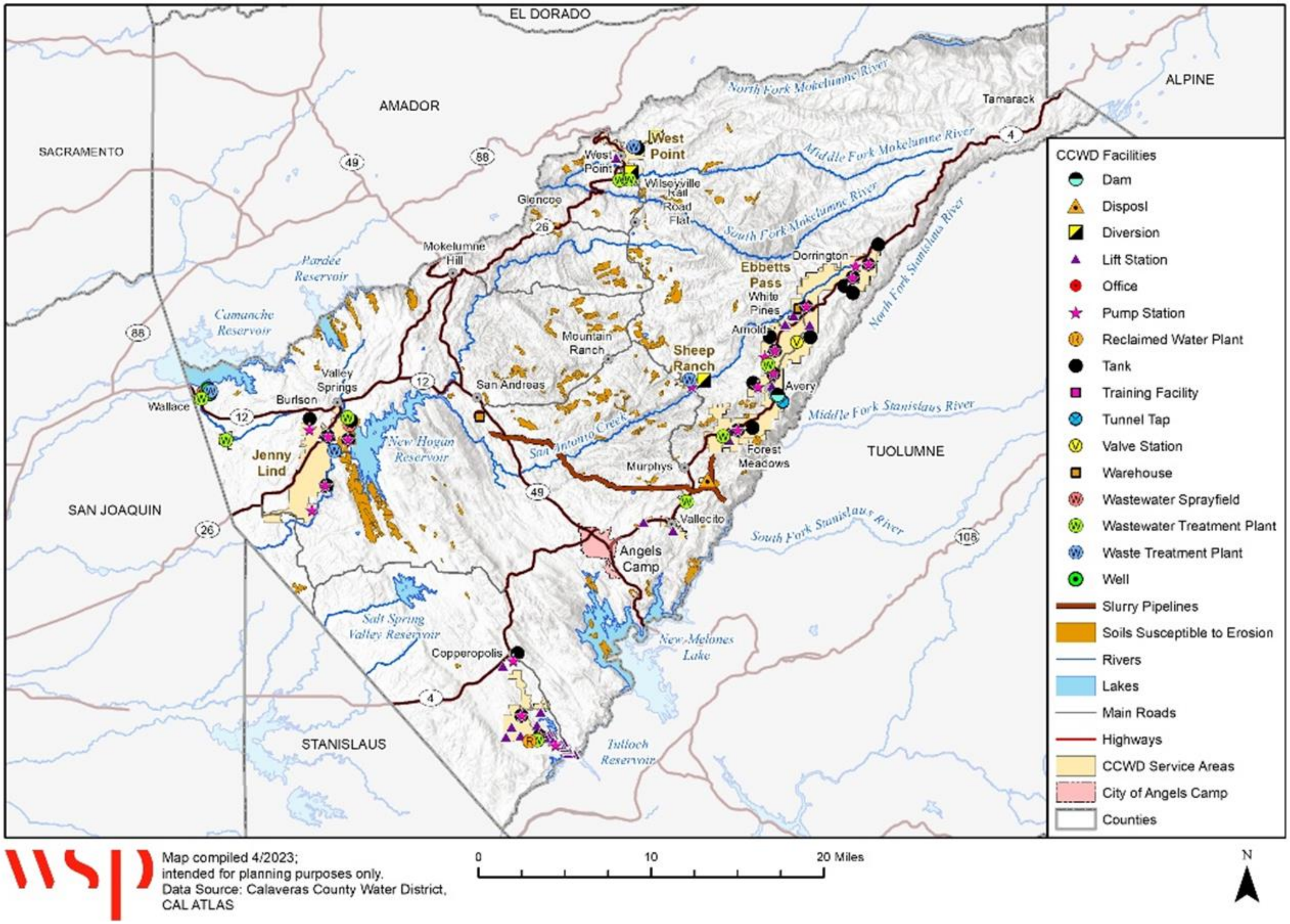
SOILS GROUP	DESCRIPTION
Group 6	Acid, rocky, or stony soil over slate rock. Erosion hazard is moderate to severe.
Group 7	Moderately course, acid soils over weathered granite. Natural drainage is good. Erosion hazard is moderate to high.
Group 8	Moderately deep, well-drained, acid soils. Natural drainage is good, but erosion hazard is moderate to high.
Group 9	Rocky outcroppings, where the soil mantle is less than 2 inches thick. Erosion hazard is very high.

Source: Calaveras County General Plan 2019

4.4.12.3 Extent (Magnitude & Severity)

Negligible – The potential magnitude of an erosion soil event and subsequent damage is estimated to be negligible, Though erosion can create localized damage to individual structures and supply lines, such as roads, railways, bridges and power lines, According to further vulnerability assessment, which will be discussed below, none of CCWD's facilities are in areas that are prone to erosion hazard; however, 0.54 mile of CCWD's slurry pipeline is in erosion-prone areas.

Figure 4-63 Erosion Potential in Calaveras County



4.4.12.4 Past Occurrences

Erosion is an ongoing problem that continually happens in Calaveras County. Much of the total land area of Calaveras County has soil classified as highly susceptible to erosion. These areas were identified based on characteristics of low soil stability and steepness of slope. During heavy storms, erosion leads to turbidity and can silt up raw water diversions for the CCWD's water treatment plants.

4.4.12.5 Probability of Future Occurrences

Highly Likely – Given the large area of the County at risk of erosion, and the constant wind and water erosion throughout the County, the likelihood of future occurrences is highly likely. Currently, the only effects are water quality due to erosion into the reservoirs and silting up the raw water intake.

4.4.12.6 Climate Change Considerations

Climate change may result in higher erosion potential due to faster and more frequent storm events, although these effects may vary across the County and in areas where CCWD facilities are located given the range of soil types.

4.4.12.7 Vulnerability Assessment

People

Erosion increases the amount of dust carried by the wind, which can act as an abrasive, but also carry infectious disease organisms. Ingested soil can also lead to exposure to heavy and organic metals. Some chronic health disorders are linked to inhalation of dust and dirt, such as acute inflammation of bronchial passages, chronic bronchitis, and emphysema to name a few. Climate change may also result in higher erosion potential due to faster and more frequent storm events, but these impacts are not expected to increase the vulnerability of the CCWD's water customers.

Property

Soil erosion can cause significant damage to the foundations of private and commercial properties. Loss of the protective topsoil around these structures will affect their structural integrity. Soil erosion may increase in the future due to climate change but not enough to result in significant impact to CCWD property.

Critical Facilities and Lifelines

To assess if any of the CCWD facilities are located within erosion-prone areas, CCWD's critical facilities and infrastructure assets were intersected with an erosion susceptibility layer, which is shown in Figure 4-63. According to the analysis, none of CCWD's facilities are in areas that are prone to erosion hazard. However, 0.54 mile of CCWD's slurry pipeline is in erosion-prone areas. Because only a portion of CCWD's linear facilities are in areas prone to soil erosion, climate change is not expected alter the CCWD's vulnerability to this hazard in the future.

Economy

Several industries are affected by the loss of soil quality due to the degradation of crops. For example, Calaveras County has an active livestock element whose food source can be affected by the degradation of soil. Poor quality feed can affect meat quality. Also, reservoirs could accumulate some costs if it is necessary to clean silt from water diversions or dredge eroded soil.

Cultural, Historic and Natural Resources

The effects of soil erosion go beyond the loss of fertile land. It has led to increased pollution and sedimentation in streams and rivers, clogging these waterways and causing declines in fish and other species. Also, degraded lands are often less able to hold onto water, which can worsen flooding.

4.4.12.8 Development Trends

The severity of erosion is often directly related to the extent of human activity in hazard areas. Human activities such as property development and construction can exacerbate areas with erosional tendencies; therefore, careful study of soil types and previous erosional activities should take place prior to construction.

4.4.12.9 Risk Summary

- Soil erosion is an ongoing problem with future occurrences highly probably as much of the total land area of Calaveras County has soil classified as highly susceptible to erosion.
- Erosion-prone areas are scattered throughout the County, with a larger concentration near New Hogan Reservoir.
- None of CCWD's facilities are in areas that are prone to erosion hazard except 0.54 mile of CCWD's slurry pipeline.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Limited	Highly Likely	Negligible	Medium

4.4.13 Subsidence

4.4.13.1 Hazard/Problem Description

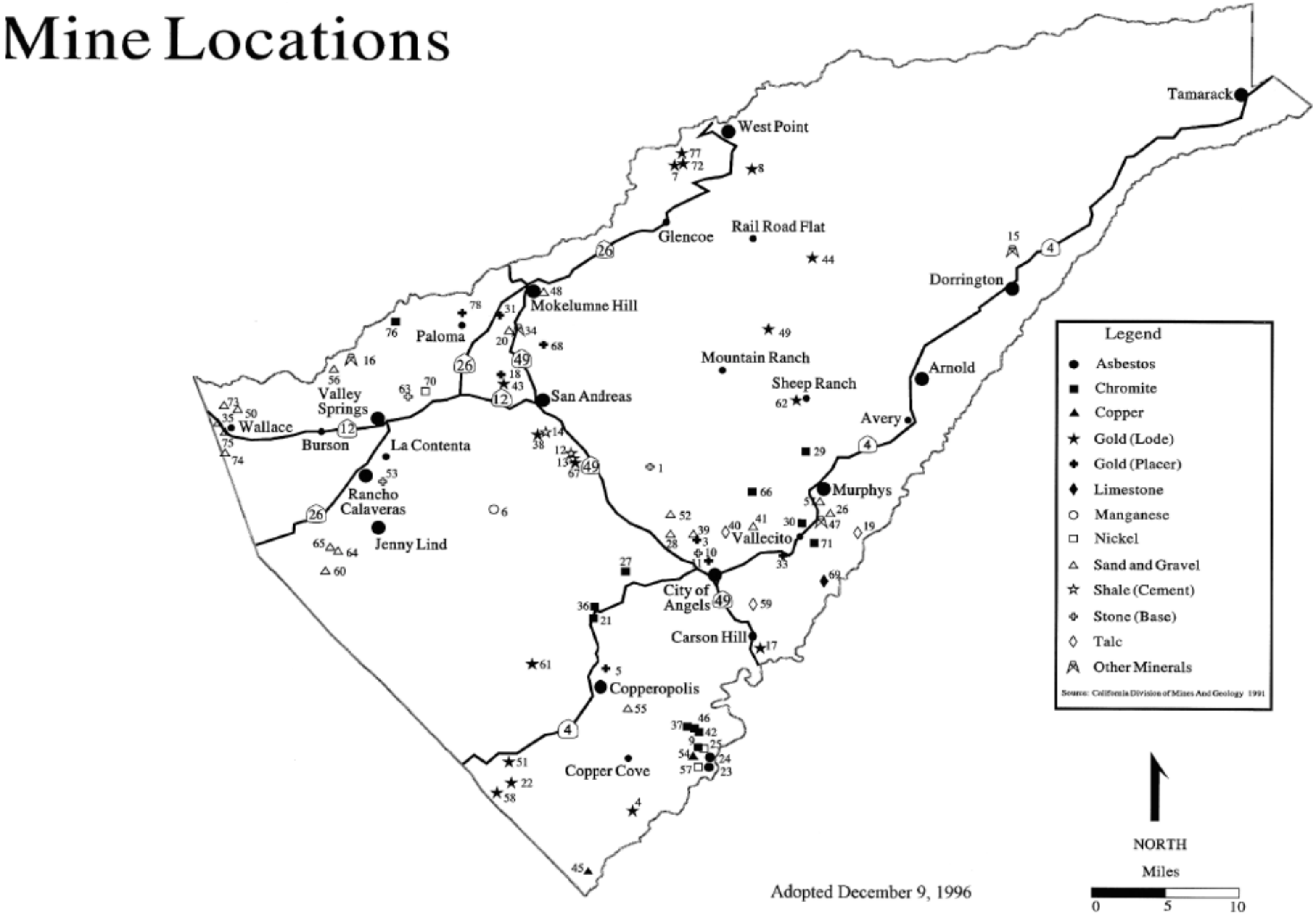
Subsidence is the sinking of the land over manmade or natural underground voids. Subsidence can result in serious structural damage to buildings, roads, irrigation ditches, underground utilities, and pipelines. It can disrupt and alter the flow of surface or underground water. Weight, including surface developments such as roads, reservoirs, and buildings and manmade vibrations from such activities as blasting or heavy truck or train traffic can accelerate the natural processes of subsidence. Fluctuations in the level of underground water caused by pumping or by injecting fluids into the earth can initiate sinking to fill the empty space previously occupied by water or soluble minerals. The consequences of improper use of land subject to ground subsidence can be excessive economic losses, including the high costs of repair and maintenance for buildings, irrigation works, highways, utilities, and other structures. This results in direct economic losses to citizens and indirect economic losses through increased taxes and decreased property values.

4.4.13.2 Geographic Area

Limited – In the County, land subsidence can occur in areas where development takes place above or near abandoned mines. Calaveras County has a long mining history and was a major player in the California Gold Rush. Lode Mining was the process by which gold was extracted directly from the lode. Miners worked together to extract gold deposits from tunnels or massive open pits in the ground. These mine locations are shown in Figure 4-64However, many mines developed during the era were quickly abandoned after insufficient minerals were found. Many of these mines are undocumented. Towns such as San Andreas have abandoned shafts and tunnels that don't appear on maps. The Stockton Record reported a mine being located under a softball field after a hole appeared. Excavation of the hole revealed an undocumented mine that had been plugged and covered over.

Abandoned mines can cause land subsidence in various ways. Mining operations typically involve extracting minerals or resources from underground deposits. Over time, as the extracted material is removed, empty spaces or voids can be created underground. If these voids are not properly filled or supported, they can eventually collapse or settle, leading to subsidence at the surface. In other cases, abandoned mine shafts and tunnels may deteriorate over time due to lack of maintenance or natural processes. If these structures collapse, they can cause the overlying ground to sink or cave in, resulting in subsidence.

Figure 4-64 Mine Locations in the County



4.4.13.3 Extent (Magnitude/Severity)

Negligible – Given that the CCWD's Planning Area is outside of areas impacted by subsidence, the potential magnitude is estimated to be negligible.

4.4.13.4 Past Occurrences

Records of previous subsidence occurrences are difficult to track, as there are no coordinating or monitoring agencies for this hazard. During the 2022-2023 plan update, the HMPC mentioned that subsidence is currently occurring in the City of Angels Camp on private properties.

4.4.13.5 Probability of Future Occurrence

Occasional—Calculating the probability of future occurrence of subsidence is difficult given the limited information regarding past events. The County does have several abandoned mines; however, it is difficult to accurately predict the exact location or time of any future subsidence from this because of the many variables. Given this, the probability of future occurrence is occasional.

4.4.13.6 Climate Change Considerations

Given soil subsidence may occur in areas where there may be fluctuations in the level of groundwater caused by pumping, climate change may exacerbate potential soil subsidence near the far western edge of Calaveras County within the San Joaquin Valley Groundwater Basin where recent groundwater overdraft has been a concern.

4.4.13.7 Vulnerability Assessment

People

As subsidence issues in the area are generally associated with abandoned mines and not groundwater overdraft due to drought conditions, the population risk seems low. Climate change will intensify soil subsidence along the western portion of the County; however, this is not anticipated to impact the CCWD's water customers because the CCWD currently projects adequate surface water supplies are available, which could offset any impacts associated with short-term groundwater overdraft.

Property

The effects of subsidence can include damage to buildings and infrastructure. However, the CCWD Planning Area is not near areas impacted by subsidence.

Critical Facilities and Lifelines

The CCWD's Planning Area is not near areas impacted by subsidence; however there are areas around the City of Angels Camp that reported subsidence issues. As previously mentioned, while climate change may intensify soil subsidence, it is not anticipated to impact the CCWD's water customers nor their water facilities, as most of their facilities are sited outside areas prone to subsidence.

Economy

Economic costs may be realized if subsidence issues along the western edge of Calaveras County become problematic to infrastructure. Land subsidence can cause damage to and reduce capacity of water conveyance infrastructure, reducing groundwater storage extent for future use and cause damage to other critical infrastructure. The costs of locating new domestic wells may also be a consideration.

Cultural, Historic and Natural Resources

Land subsidence on the western edge of the County can cause damage to and reduce the capacity of conveyance infrastructure. Water aquifers may collapse under the strain of constant groundwater pumping and not be able to fully recover.

4.4.13.8 Development Trends

As subsidence is a manmade issue and areas of subsidence of documented, careful consideration should be given to the placement of future construction and equipment.

4.4.13.9 Risk Summary

- The probability of future subsidence occurrences is difficult to predict; however, several mines are located within the County, which are susceptible to subsidence events.
- The overuse of groundwater pumping has created land subsidence issues in the western portion of the County. Therefore, future subsidence events are certainly possible but not anticipated to be intensified enough by climate change to impact the CCWD's water supply, water customers, or critical facilities.

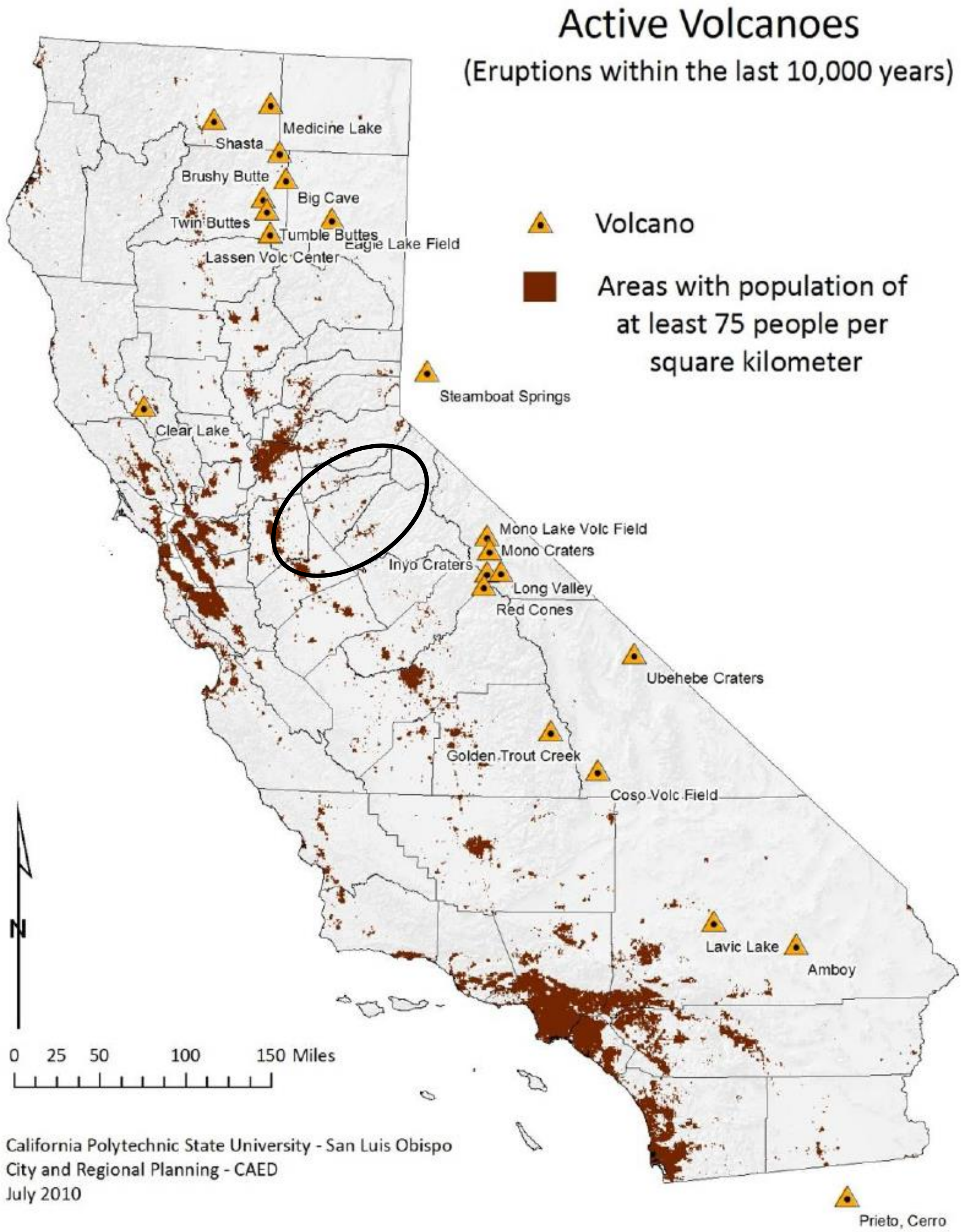
GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Limited	Occasional	Negligible	Medium

4.4.14 Volcanoes

4.4.14.1 Hazard/Problem Description

The California SHMP identifies volcanoes as one of the hazards that can adversely impact the State. However, there have been few losses in California from volcanic eruptions. Of the approximately 20 volcanoes in the State, only a few are active and pose a threat. Of these, Long Valley Caldera and Lassen Peak are the closest to Calaveras County. The Long Valley area is considered to be an active volcanic region of California and includes features such as the Mono-Inyo Craters, Long Valley Caldera, and numerous active and potential faults. Figure 4-65 shows volcanoes in or near California and the location of the Lassen Peak and the Long Valley area relative to Calaveras County. As shown in this figure, there are no active volcanoes in Calaveras County.

Figure 4-65 Active Volcanoes in California and the Calaveras County Area



Source: 2010 State of California Hazard Mitigation Plan

4.4.14.2 Geographic Area

Limited – Steam blasts commonly produce large pits or craters. Explosive eruptions, which may create fiery flows of hot ash (pyroclastic flows), are usually followed by the pushing up of a lava dome. Some less violent eruptions only produce lava flows.

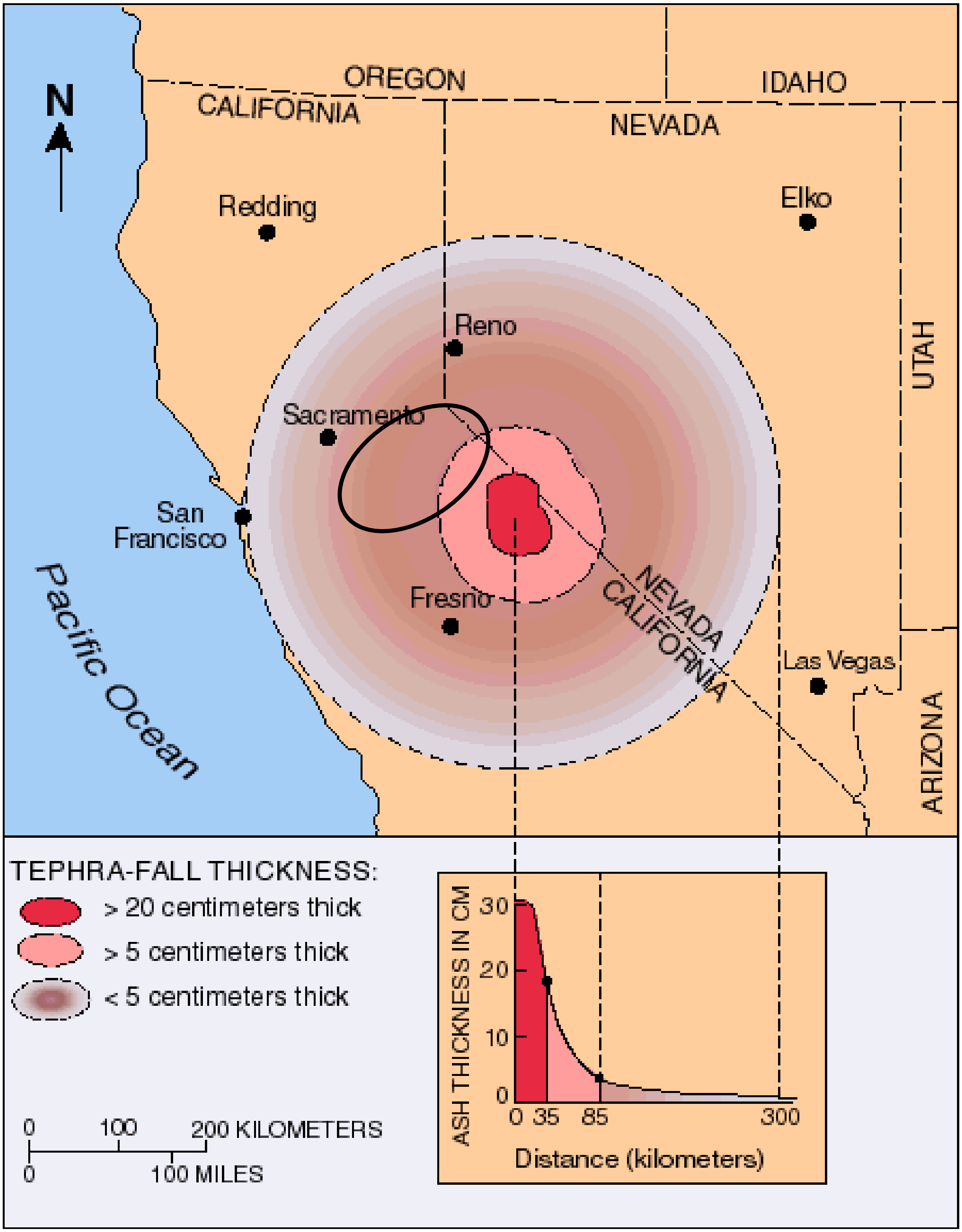
Populations living near volcanoes are most vulnerable to volcanic eruptions and lava flows, although volcanic ash can travel and affect populations many miles away and cause problems for aviation. The USGS notes specific characteristics of volcanic ash. Volcanic ash is composed of small, jagged pieces of rocks, minerals, and volcanic glass the size of sand and silt, as shown in Figure 4-66. Very small ash particles can be less than 0.001 millimeters across. Volcanic ash is not the product of combustion, like the soft fluffy material created by burning wood, leaves, or paper. Volcanic ash is hard, does not dissolve in water, is extremely abrasive and mildly corrosive, and conducts electricity when wet.

Figure 4-66 Ash Particle from 1980 Mt. St Helens Eruption Magnified 200 Times

Source: US Geological Survey: Volcanic Ash: Effect & Mitigation Strategies. http://volcanoes.usgs.gov/ash/properties.html.

Volcanic ash is formed during explosive volcanic eruptions. Explosive eruptions occur when gases dissolved in molten rock (magma) expand and escape violently into the air, and when water is heated by magma and abruptly flashes into steam. The force of the escaping gas violently shatters solid rocks. Expanding gas also shreds magma and blasts it into the air, where it solidifies into fragments of volcanic rock and glass. Once in the air, wind can blow the tiny ash particles tens to thousands of miles away from the volcano. Figure 4-67 is a volcanic hazard's ash dispersion map for the Long Valley Caldera, which could possibly affect the County.

Figure 4-67 Volcanic Hazards Ash Dispersion Map for the Long Valley Caldera



Source: US Geological Survey

As shown in the inset on the lower right side of Figure 4-67 the average grain size of rock fragments and volcanic ash erupted from an exploding volcanic vent varies greatly among different eruptions and during a single explosive eruption that lasts hours to days. Heavier, large-sized rock fragments typically fall back to the ground on or close to the volcano and progressively smaller and lighter fragments are blown farther from the volcano by wind. Volcanic ash, the smallest particles (2 mm in diameter or smaller), can travel hundreds to thousands of kilometers downwind from a volcano depending on wind speed, the volume of ash erupted, and the height of the eruption column.

The size of ash particles that fall to the ground decreases exponentially with increasing distance from a volcano. Also, the range in grain size of volcanic ash typically diminishes downwind from a volcano (becoming progressively smaller). At specific locations, however, the distribution of ash particle sizes can vary widely. Based on Figure 4-67, the US Geological Survey estimated that ash of up to 2" or more could fall in areas of Calaveras County.

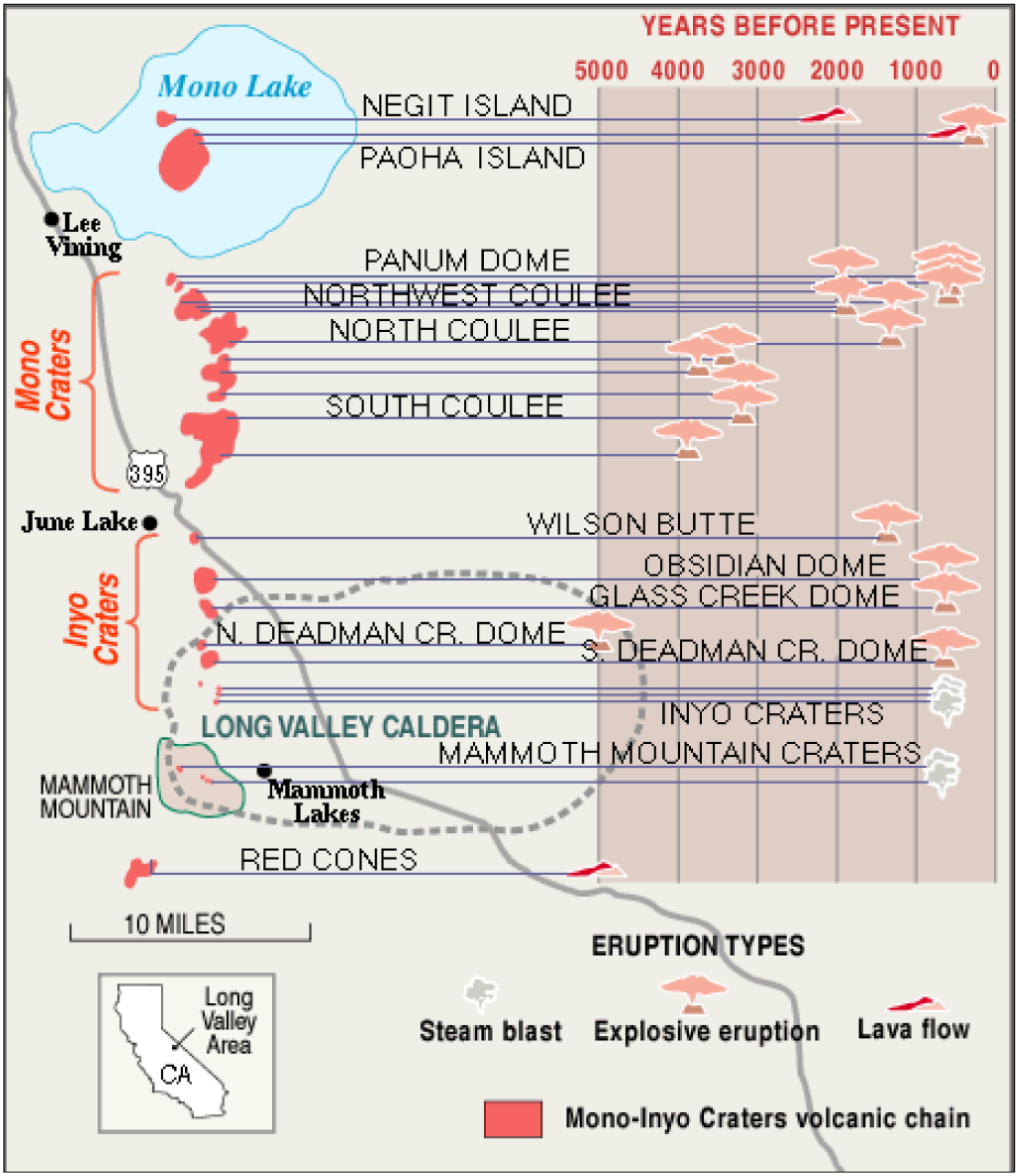
4.4.14.3 Extent (Magnitude/Severity)

The likelihood of future occurrences is considered negligible, as the probability of an eruption occurring in the Long Valley area is less than 1 percent. Also, the proximity of the Planning Area relative to active volcanoes with the consideration that future eruptions will follow the size and scale of past eruptions, Calaveras County is not considered to be vulnerable to volcanic eruption and/or the effects of lava flows or falling ash.

4.4.14.4 Past Occurrences

During the past 1,000 years, there have been at least 12 volcanic eruptions in the Long Valley area, with the most recent activity occurring about 300 years ago in Mono Lake. This activity is likely to continue long into the future as the Long Valley Caldera and Mono-Inyo Craters volcanic chain has a long history of geologic activity that includes both earthquakes and volcanic eruptions. Volcanoes in the Mono-Inyo Craters volcanic chain have erupted often over the past 40,000 years. However, no federal disasters were declared as previously addressed in Section 4.2.11 and Table 4-3. Figure 4-68 shows volcanic activity within the past 5,000 years, with small to moderate eruptions occurring at various sites along the Mono-Inyo Craters volcanic chain at intervals ranging from 250 to 700 years.

Figure 4-68 Volcanic Activity in the Mono-Inyo Craters Volcano Chain in the Past 5,000 Years



Source: US Geological Survey, http://pubs.usgs.gov/fs/fs073-97/eruptions.html

As recently as 1980, four large earthquakes (greater than magnitude 6 on the Richter Scale) and numerous relatively shallow earthquakes occurred in the area. Since then, earthquakes and associated uplift and deformation in the Mammoth Lakes Caldera have continued. Because such activities are common precursors of volcanic eruptions, the US Geological Survey closely monitors the unrest in the region. There are also no records of past impacts from volcanic eruptions on the CCWD's Planning Area according to FEMA's Disaster Declaration database, as noted in Section 4.2.11..

4.4.14.5 Probability of Future Occurrences

Unlikely—According to the US Geological Survey, the pattern of volcanic activity over the past 5,000 years suggests that the next eruption in the Long Valley area will most likely happen somewhere along the Mono-Inyo volcanic chain (Hill et al 1998). However, the probability of such an eruption occurring in any given year is less than 1 percent. The next eruption will most likely be small and similar to previous eruptions along the Mono-Inyo volcanic chain during the past 5,000 years.

According to the California MHMP, the Long Valley Caldera area could have a slight volcanic hazard potential for Calaveras County. There is a small probability that future volcanic eruptions in the Mono-Inyo volcanic chain could extend toward Calaveras County. If these volcanoes did erupt, volcanic activity would result in ash fall of less than 5 centimeters thick in most areas and 5 to 20 centimeters in the eastern portion of the County. This ash could affect CCWD facilities; water treatment facilities may be particularly susceptible to dust and airborne debris. Yet, according to the State Multi-Hazard Mitigation Plan, only Medicine Lake, Mount Shasta, Lassen Peak, and the Long Valley Caldera are considered active and pose a threat to future activity. Therefore, due to the location of the Planning Area relative to the active volcanoes, the State Plan does not consider Calaveras County to be vulnerable to eruption and/or ash from these volcanoes.

4.4.14.6 Climate Change Considerations

Climate change is unlikely to affect volcanic eruptions. However, volcanoes have the potential to impact climate, as they release large amounts of greenhouse gases, such as water vapor and carbon dioxide.

4.4.14.7 Vulnerability Assessment

People

While the likelihood of a volcanic eruption impacting Calaveras County is low, in the event there is an eruption the potential impact to residents can be severe primarily because some of the County and CCWD's population resides in rural and isolated areas in the County. Vulnerable populations, including those with limited mobility, those residing in isolated areas, or those residing nearer to active volcanic zones to the east, may face heightened risks in during an event, such as exposure to air pollution and potential evacuation difficulties. Despite a low impact to these vulnerable populations, comprehensive emergency preparedness and communication plans are in place at the County level to ensure the safety and well-being of all residents.

Additionally, the proximity to a volcano can influence the vulnerability of a population. In the unlikely event of an eruption, there may be risks associated with harmful effects, including air pollution exposure, and the potential for individuals unable to avoid the area to be at the greatest risk. Again, these may be vulnerable populations in Ebbetts Pass, Sheep Ranch, or West Point that must travel further out of the mountains to reach community shelters and other facilities around San Andreas to find resources. However, the existing distance from active volcanoes within the Mono-Inyo volcanic chain plays a significant role in decreasing overall vulnerability. As noted, climate change is not likely to affect volcanic eruptions.

Property

Property damage from volcanic eruptions is difficult to estimate at best. Erupting volcanoes spew hot, dangerous gases, ash, lava, and rock, and can cause additional threats such as floods, mudslides, power outages, contaminated drinking water, and wildfires. However, at a 1% percent chance of a volcanic eruption, the risk to property appears to be low.

Critical Facilities and Lifelines

Volcanic activity in the Mono-Inyo volcanic chain could extend towards Calaveras County, resulting in ashfall of less than 5 centimeters thick in most areas and 5 to 20 centimeters in the eastern portion. This ash could affect CCWD facilities; Water treatment facilities may be particularly susceptible to dust and airborne debris, such as ash. However, due to the location of the CCWD's Planning Area relative to the active volcanoes, Calaveras County does not appear to be vulnerable to eruption and/or ash from these volcanoes, and this volcanic activity is not anticipated to be influenced by climate change.

Economy

As with most natural disasters, a volcanic eruption will have direct and indirect costs. The initial cost is the loss of life and injury. The direct costs are property damage to homes, cars, and infrastructure. The less tangible costs include lost productivity as people evacuate, or loss of tourist revenues.

Cultural, Historic and Natural Resources

As primarily a natural process, volcanic eruptions can have varying impacts on the natural environment. Ashfalls of only a few millimeters can generate large volumes of ash for collection and disposal, and lava flows have the potential to permanently alter the natural landscape.

4.4.14.8 Development Trends

Due to the distance of active volcanoes and the small probability that future volcanic eruptions in the Mono-Inyo volcanic chain could extend towards Calaveras County, the State Plan does not consider Calaveras County to be vulnerable to eruption and/or ash from these volcanoes.

4.4.14.9 Risk Summary

- The County has no active volcanoes; the Long Valley Caldera and Lassen Peak are the volcanoes located closest to the County with the most activity occurring in the Mono-Inyo volcanic chain.
- The USGS has noted episodes of unrest in the Long Valley Caldera in the last few decades.
- Historic volcanic activity suggests that the next eruption in the Long Valley area will most likely happen somewhere along the Mono-Inyo volcanic chain. However, the

probability of such an eruption occurring in any given year is less than one percent and will most likely be small.

- The overall risk to volcanic activity hazards is low given the proximity of Calaveras County to volcanic chains.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Limited	Unlikely	Critical	Low

4.4.15 Wildfires

4.4.15.1 Hazard/Problem Description

A wildfire is an uncontrolled fire spreading through vegetative fuels, such as grasslands, brush, or woodlands and conifer forests and posing danger and destruction to property and watersheds. Wildfires can occur in areas essentially void of development, or in areas where development intermingles with the natural area known as the wildland-urban interface (WUI), a general term that applies to development adjacent to landscapes that support wildfire. Many wildfires occur in locations that consist of surface fuels like grasslands and brush. Heavier fuels with high temperatures, low humidity, low rainfall, and high winds all work to increase wildfire risk.

While wildfires are often the direct result of lightning strikes, they can be caused by downed powerlines or mechanical equipment or are the result of human activities like landscape debris burns, carelessness, or arson. Wildfires often start in undeveloped areas and public land areas, such as state and federal lands, but can spread to urban areas where structures and other human development are more concentrated. The predominant dangers from wildfires are:

- Injury or loss of life to people in the affected area; and
- The destruction of vegetation, property, wildlife.

Communities throughout California are increasingly concerned about wildfire safety as increased development in the foothills and mountain areas and subsequent fire control practices have affected the natural cycle of the ecosystem. Wildfire risk is predominantly associated with WUI areas in Calaveras County. However, significant wildfires can also occur in heavily populated areas, although urbanized and developed areas that are not contiguous with vast areas of wildlands are typically considered safer from wildfires. WUI fires are the most damaging. WUI fires occur where natural and urban development intersect. Even relatively small acreage fires may result in disastrous damages. WUI fires occur where the natural forested landscape and urban-built environment meet or intermix. The damages are primarily reported as damage to infrastructure, built environment, loss of socio-economic values and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historically forested areas that have wildfire as part of the natural ecosystem. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern now burns developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Fire conditions arise from a combination of hot weather, an accumulation of vegetation, and low moisture content in the air. These conditions, when combined with high winds and years of drought increase the potential for a wildfire to occur. Generally, three major factors sustain wildfires and allow for predictions of a given area's potential to burn. These factors include fuel, topography, and weather:

- **Fuel**—Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles and leaves, twigs, and branches to dead-standing trees, live trees, brush, and cured grasses. Manmade structures are also considered a fuel source, including homes and associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and catalyze fire spread. In addition, "ladder fuels" can spread a ground fire up through brush and into trees, leading to a devastating crown fire that burns in the upper canopy and cannot be controlled. The volume of available fuel is described in terms of fuel loading.
- **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.
- **Weather**—Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out the fuels that feed the wildfire creating a situation where fuel will more readily ignite and burn more intensely. Wind is the most treacherous weather factor. The greater the 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, which are often terrain that is difficult for firefighters to reach. Drought conditions contribute to concerns about wildfire vulnerability. During periods of drought, the threat of wildfire increases.

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 wildfires can create favorable conditions for other hazards such as flooding, landslides, and erosion during the rainy season.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century-old policies of fire exclusion and aggressive suppression have given way to a better understanding of the importance fire plays in the natural cycle of certain forest types.

4.4.15.2 Geographic Extent

Extensive – Wildfire risk is highest across a broad section of the central and eastern sections of the CCWD's Planning Area. Wildfire threat can be defined as the result of an analysis of potential fire behavior and the likelihood of fire to occur relative to the assets (or communities) at risk. The California Department of Forestry and Fire Protection (CAL FIRE) is required by law (Government Code Section 51181) to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors and to describe the potential for wildfires to occur in a given area. These zones, referred to as Fire Hazard Severity Zones (FHSZ), influence how people construct buildings and protect property to reduce risk associated with wildland fires. The FHSZs were adopted in November 2007 for the State Responsibility Areas (SRA) and adopted in September 2007 for the Local Responsibility Area (LRA).

According to the Unit Strategic Fire Plan for Tuolumne – Calaveras Counties, Battalions 1 through 4, all of which are located in Calaveras County each have a history of fire spread (CAL FIRE 2017). Figure 4-69 shows the federal, state, and local responsibility areas in the County, together with moderate to very high FHSZs shown across much of the central and eastern portion of the County. Figure 4-70 and Figure 4-71 show the FHSZs in the eastern and western portions of the County.

Generally, fire season in Calaveras County extends from early spring to late fall (May to October) of each year, but wildfires can now occur at any time of the year during the warmer and dryer months. Onset can happen suddenly due to lightning or human-caused factors and wildfires can last from a few hours to a few months, but the likelihood of a large and damaging fire lasting for months in Calaveras County is not likely. Secondary effects from wildfire include increased erosion, destabilized slopes, degraded air and water quality, and economic impacts from burned landscapes. Urban fires primarily involve the uncontrolled burning of residential, commercial and/or industrial structures generally caused by human activities.

Figure 4-69 Federal, State, and Local Responsibility Areas (FRA, LRA & SRA) in Calaveras County

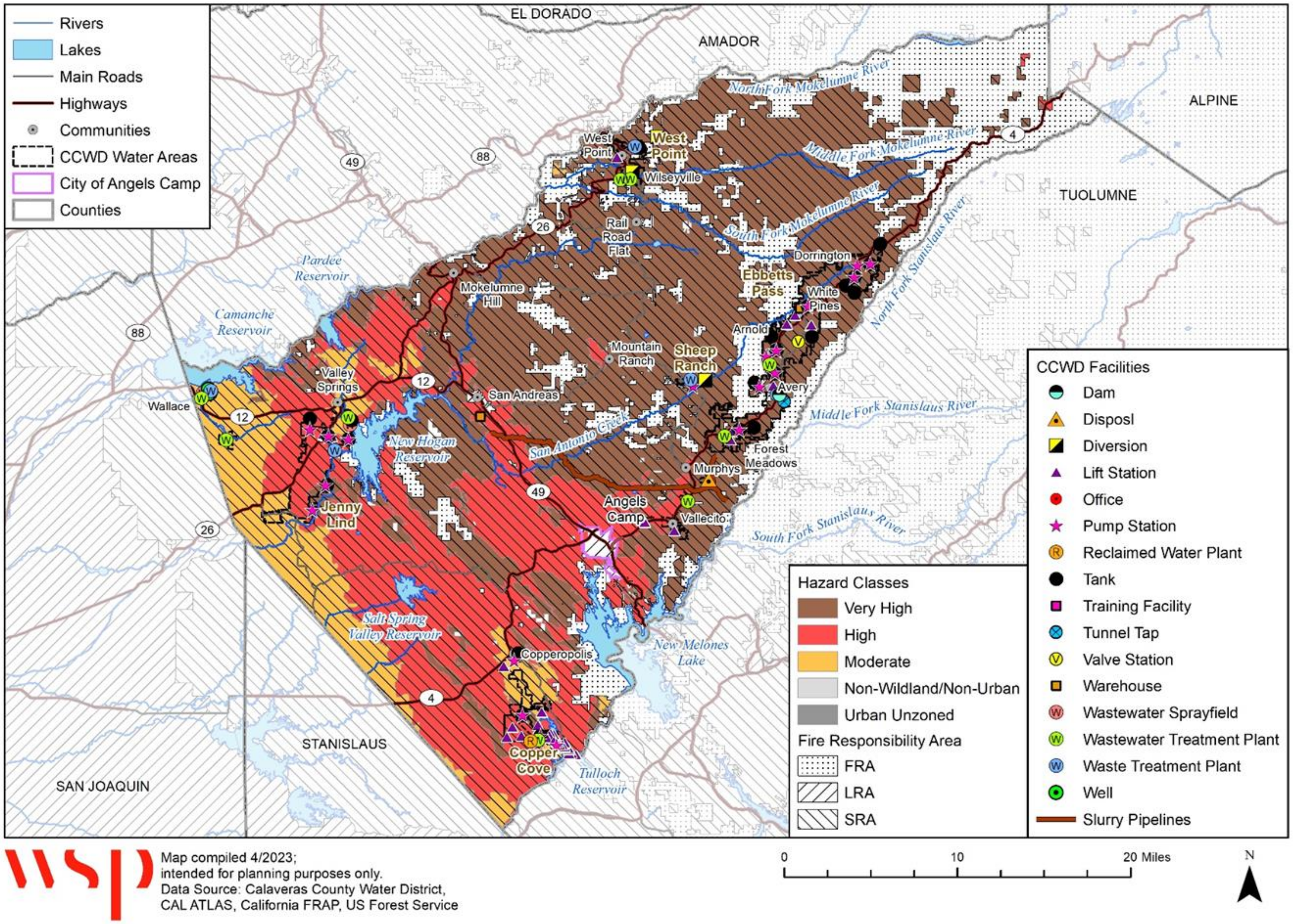


Figure 4-70 Eastern Calaveras County Wildfire Severity

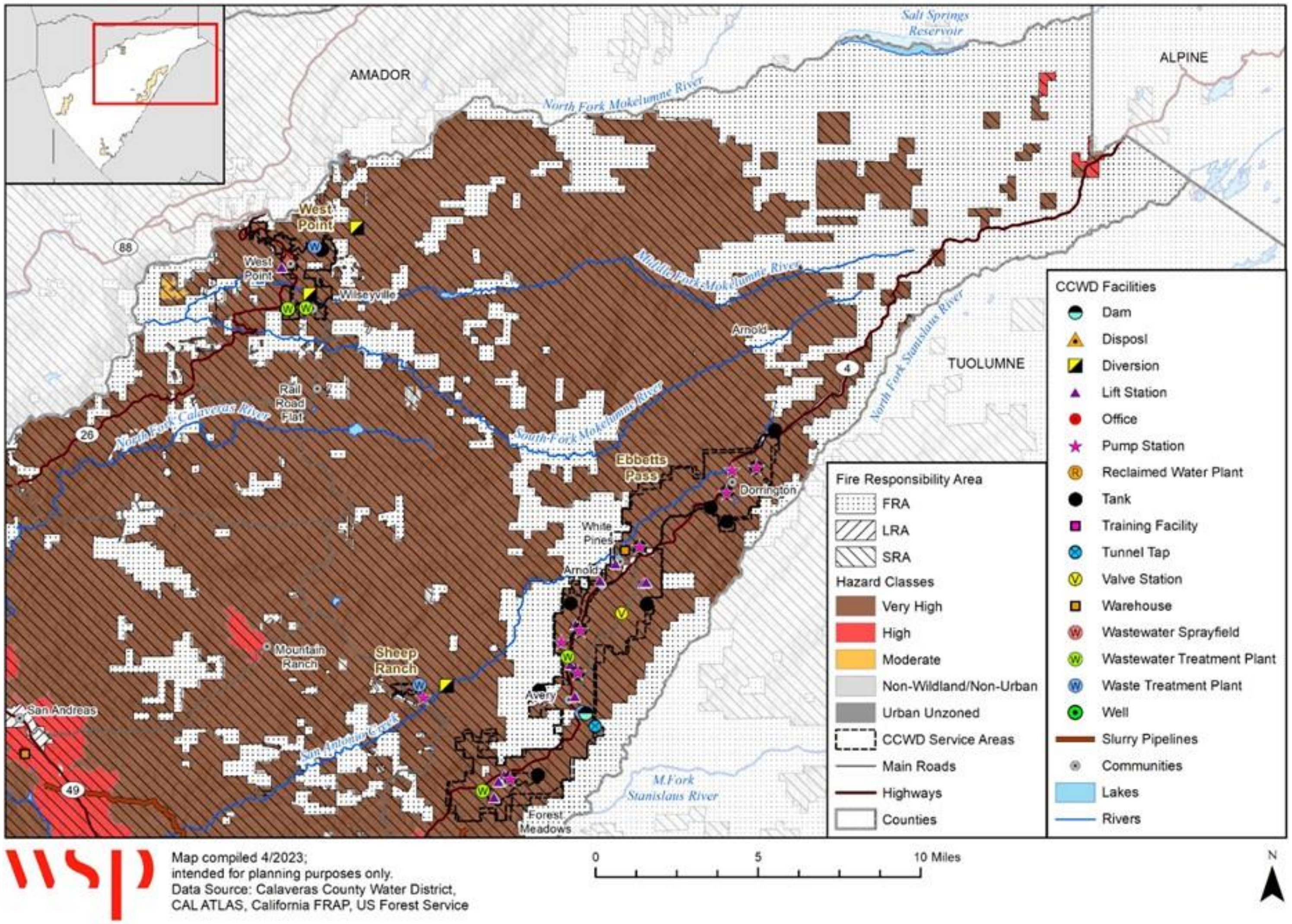
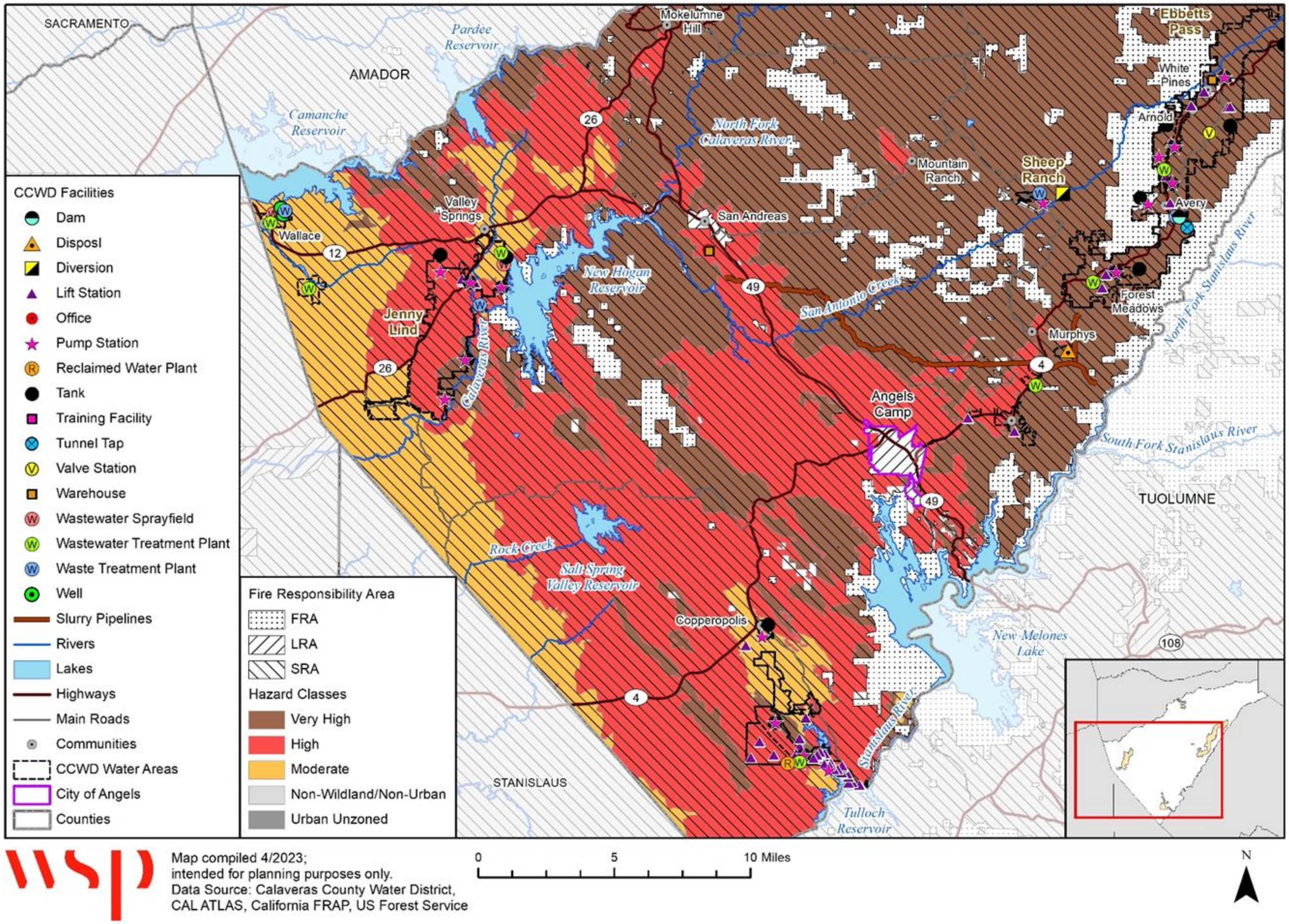


Figure 4-71 Western Calaveras County Wildfire Severity



CALFIRE's FRAP assesses the amount and extent of California's forests and rangelands, analyzes their conditions, and identifies alternative management and policy guidelines. CAL FIRE identifies areas that are at high risk of damage from wildfire based primarily on three factors:

- **Ranking Fuel Hazards** – ranking vegetation types by their potential fire behavior during a wildfire.
- **Assessing the Probability of Fire** – annual likelihood that a large damaging wildfire would occur in a particular vegetation type.
- **Defining Areas of Suitable Housing Density that would Create WUI Fire Protection Strategy Situations** – areas of intermingled wildland fuels and urban environments that are in the vicinity of fire threats.

Population density and the presence of structures are not currently used to determine the FHSZ for a particular region, although they do have a significant impact on fire behavior. Based on the above criteria, CAL FIRE maps FHSZs for each County as "Very High," "High," or "Moderate". As shown in Figure 4-69 through Figure 4-71 the areas ranked "High" and "Very High" are primarily located in the central and eastern portion of the County. These areas exhibit the combination of vegetative fuel and topography that contribute to an increased fire hazard potential. Also, an area with a "moderate" hazard designation does not mean it cannot experience a damaging fire. It only means that the probability is reduced, generally because the number of days a year that the area has "fire weather" is less.

The FHSZ spatial dataset was explicitly developed for adopting new ignition-resistant building code standards mandated by the California Building Standards Commission in 2007 (California Code of Regulations [CCR], Title 24, Part 2, known as the California Building Code [CBC] Chapter 7A). The dataset is used to implement WUI building standards for new construction, defensible space requirements, and property development standards such as road width, water supply, and signage. For example, beginning on July 1, 2021 Ab 38 required all homes sales in "High" or "Very High" FHSZs to be compliant following a Defensible Space Inspection. The FHSZ spatial datasets were also developed to describe the nature and probability of fire exposure to structures, including those lands that are highly urbanized, but in close proximity to open wildlands. It is broken into Federal Responsibility Areas (FRA), SRA, and LRA.

Table 4-39 shows the location and fire hazard rating of fuel models in Calaveras County.

Table 4-39 Location and Hazard Ranking of Fuel Models in Calaveras County

FUEL MODEL	FIRE HAZARD RANKING	LOCATION IN CALAVERAS COUNTY
Grass	Moderate to High	West of Highway 49 in the lower foothills. Moderate to high fuel hazard ranking depends on slope.
Woodland	High to Very High	Scattered between 800 to 4,000 feet in elevation; fuel hazard ranking depends on slope.
Brush	Very High	Larger blocks in the 800 to 4,000-foot elevation in less inhabited areas of the county. Areas near New Hogan, Bear Mountain, and New Melones have large concentrations of brush as well as areas north of San Andreas.

FUEL MODEL	FIRE HAZARD RANKING	LOCATION IN CALAVERAS COUNTY
Brush/Hardwood	High	Areas with a mixture of live oak, black oak, manzanita, and chamise between 1,000 to 4,000 feet in elevation. Large blocks occur east of Highway 49.
Heavy Timber	Very High	Consists of larger, denser dead fuels on the ground. Primarily found above 3,500 feet and in scattered blocks between Arnold and West Point.

Source: California Department of Forestry; Tuolumne-Calaveras Unit Pre-Fire Management Plan, 2011

The grasslands of the rolling western plains routinely experience extreme summer heat, and significant wind events during the spring and fall months. In these areas, motorized fire equipment can be fully utilized to great success. The brush fields common throughout the County's central portions lay over broad expanses of steep hillsides and atop narrow ridgelines between the deepening river canyons. Routine summer temperatures can be extreme, while the topography makes access increasingly difficult for motorized firefighting equipment. The brush transitions into the mixed oak and conifer zones as the elevation increases and the canyon depth and width increase significantly.

Over 38 percent of the CAL FIRE-protected lands are covered with these high hazard brush and timber fuels. This mid-elevation area also experiences high summer temperatures and is most affected by the normal diurnal winds associated with the canyon-dominated topography. The higher elevation zone features dense stands of conifer timber – much of which exhibits large accumulations of ground and ladder fuels. While temperatures are routinely moderated due to the elevation, wind events in the fall contribute to potentially challenging fire conditions. Historically, severe fire weather occurred throughout the Unit on 35 percent of days during the fire season; this percentage has now increased over the past decade. The convergence of significant fire weather conditions, a wide variety of topography and a broad spectrum of fuels has resulted in a long history of large damaging fires within the County. Fire weather is sampled daily during the wildfire season at stations throughout California to create critical fire weather frequency, which is classified in three categories. Calaveras County is rated in the highest frequency class.

According to the Tuolumne-Calaveras Unit (TCU) 2020 Strategic Fire Plan, the environment in the County is conducive to large, damaging fires (CAL FIRE 2020). All fuel types in the County are ranked as moderate to very high fire hazard. Cal FIRE has also designated the following County communities located within or adjacent to the TCU, as being at increased risk from wildfires, and officially designated as "Communities at Risk within the National Fire Plan". This list includes 35 communities in Calaveras County. (https://osfm.fire.ca.gov/divisions/wildfire-planning-engineering/fire-plan/communities-at-risk/)

- Altaville
- Angels Camp
- Arnold
- Avery
- Big Meadows
- Big Trees
- Burson
- Calaveritas
- Camp Connell
- Camp Seco
- Copperopolis
- Cottage Springs
- Dorrington
- Douglas Flat
- Forest Meadows
- Ganns
- Glencoe
- Hathaway Pines
- Jenny Lind
- Milton
- Mokelumne Hill
- Mountain Ranch
- Murphys
- Paloma
- Railroad Flat
- San Andreas
- Sandy Gulch
- Sheep Ranch
- Sky High
- Tamarack
- Vallecito
- Valley Springs
- Wallace
- West Point
- Wilseyville

Some unincorporated communities located within the far western portion of the County are not confronted with a high wildfire risk, due primarily to the dominant type of vegetation in those areas. The low-growing native grasses and shrubs found in these communities present a minimal vegetative fuel source and a corresponding low wildfire risk. In addition, the topography of those areas is mainly level and well developed in both residential and agricultural land uses.

Given the wildfire risk across the County, warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are needed in a timely manner. While in most cases wildfires are contained within a week or two of the outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

4.4.15.3 Extent (Magnitude & Severity)

Critical – Vegetation (or fuel) plays a major role in fire behavior and shaping fire hazard potential. Vegetation distribution throughout the County varies by location and topography, with dramatic differences observed between the western and eastern portions of the County. For instance, fire behavior in brush fuel types, such as chapparal produces higher flame lengths than that in grassland, although spread rates are typically slower. Fire behavior in forested eastern portion of the County is variable, depending on surface fuel conditions and the presence of ladder fuels.

Fuel loading in developed areas susceptible to wildfire becomes even more complex. The introduction of some ornamental plantings as landscaping and groundcover can dramatically increase the fire loading of a neighborhood. Gazebos, fencing, patios, decks and even the structures themselves add even more fuel. Once structures become involved in fire, the problem compounds as embers cast out thousands of feet onto combustible roofs well removed from the wildland area.

Steep terrain and drainages present throughout the County also plays a key role in the rate at which wildfires spread, as fires will normally burn much faster uphill. Generally, when the gradient of a slope doubles, the rate of spread of a fire will also double. Steep topography also channels air flow, thereby creating erratic wind patterns. Fire suppression in steep areas is also complicated by limited accessibility, and the effectiveness of firefighters and equipment are hampered by lack of access roads. Another factor that can increase the severity of wildfires in the County is areas with high percentages of dead trees due to park pine beetle.

The Fire Rating System defined in describes the characteristics and potential intensity of fires, including the effect on the ability to manage and suppress fires. Fire conditions up through Class 5 are possible in the CCWD's Planning Area, primarily in the unincorporated areas in the far east and west of the County, whereas fire threat is generally moderate to low or none within urban areas. Table 4-40shows the Fire Rating System.

Table 4-40 Fire Danger Rating System

RATING	BASIC DESCRIPTION	DETAILED DESCRIPTION
CLASS 1: Low Danger (L) COLOR CODE: Green	fires not easily started	Fuels do not ignite readily from small firebrands. Fires in open or cured grassland may burn freely a few hours after rain, but wood fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.
CLASS 2: Moderate Danger (M) COLOR CODE: Blue	fires start easily and spread at a moderate rate	Fires can start from most accidental causes. Fires in open cured grassland will burn briskly and spread rapidly on windy days. Woods fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel – especially draped fuel -- may burn hot. Short-distance spotting may occur but is not persistent. Fires are not likely to become serious and control is relatively easy.
CLASS 3: High Danger (H) COLOR CODE: Yellow	fires start easily and spread at a rapid rate	All fine dead fuels ignite readily, and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly, and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuel. Fires may become serious and their control difficult, unless they are hit hard and fast while small.
CLASS 4: Very High Danger (VH) COLOR CODE: Orange	fires start very easily and spread at a very fast rate	Fires start easily from all causes and immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics – such as long-distance spotting – and fire whirlwinds when they burn into heavier fuels. Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.

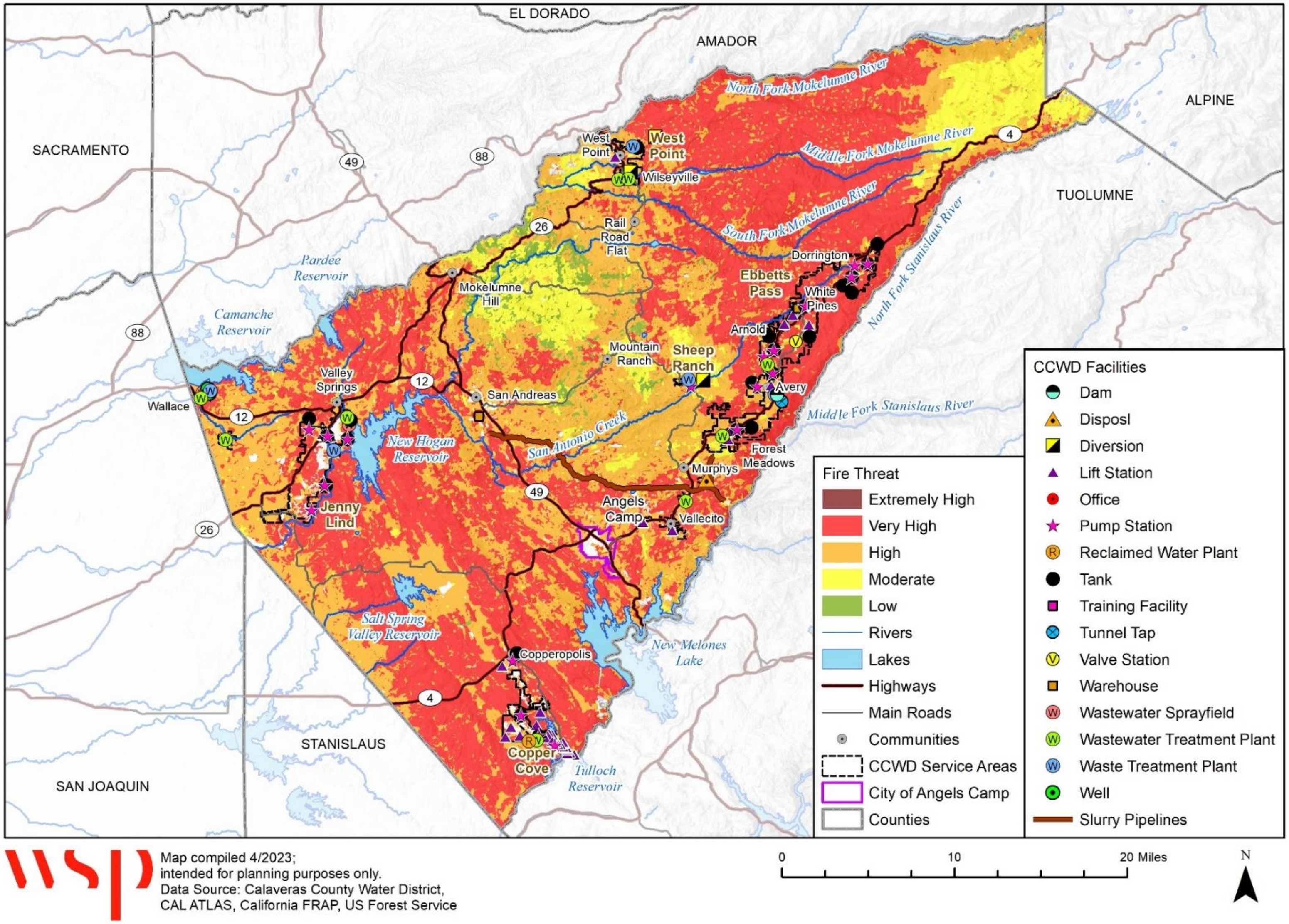
RATING	BASIC DESCRIPTION	DETAILED DESCRIPTION
CLASS 5: Extreme (E) COLOR CODE: Red	fire situation is explosive and can result in extensive property damage	Fires under extreme conditions start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur from smaller fires than in the Very High Danger Class (4). Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks, until the weather changes or the fuel supply lessens.

Source: http://www.wfas.net

Major wildland fires can completely destroy ground cover. If heavy rains follow a major fire, flash floods, heavy erosion, land subsidence, mudflows, and debris flows can occur. After a wildland fire passes through an area, the land is laid bare of its protective vegetation cover and is susceptible to excessive runoff and erosion from winter storms. The intense heat from the fire can also cause a chemical reaction in the soil that makes it less porous, and the fire can destroy the root systems of shrubs and grasses that aid in stabilizing slope material. These cascading effects can have ruinous impacts on people, structures, infrastructure, and agriculture.

Fire threat provides a measure of fuel conditions and fire potential in the ecosystem, representing the relative likelihood of “damaging” or difficult to control wildfire occurring for a given area. Fire Threat is not a risk assessment by itself but can be used to assess the potential for impacts on various assets and values susceptible to fire. Impacts are more likely to occur and/or be of increased severity for the higher threat classes. Fire threat is a combination of two factors: 1) fire probability, or the likelihood of a given area burning, and 2) potential fire behavior (hazard). These two factors are combined to create five threat classes ranging from low to extreme. Figure 4-72 shows the wildfire threat areas throughout Calaveras County.

Figure 4-72 Calaveras County Wildfire Threat Areas



4.4.15.4 Past Occurrences

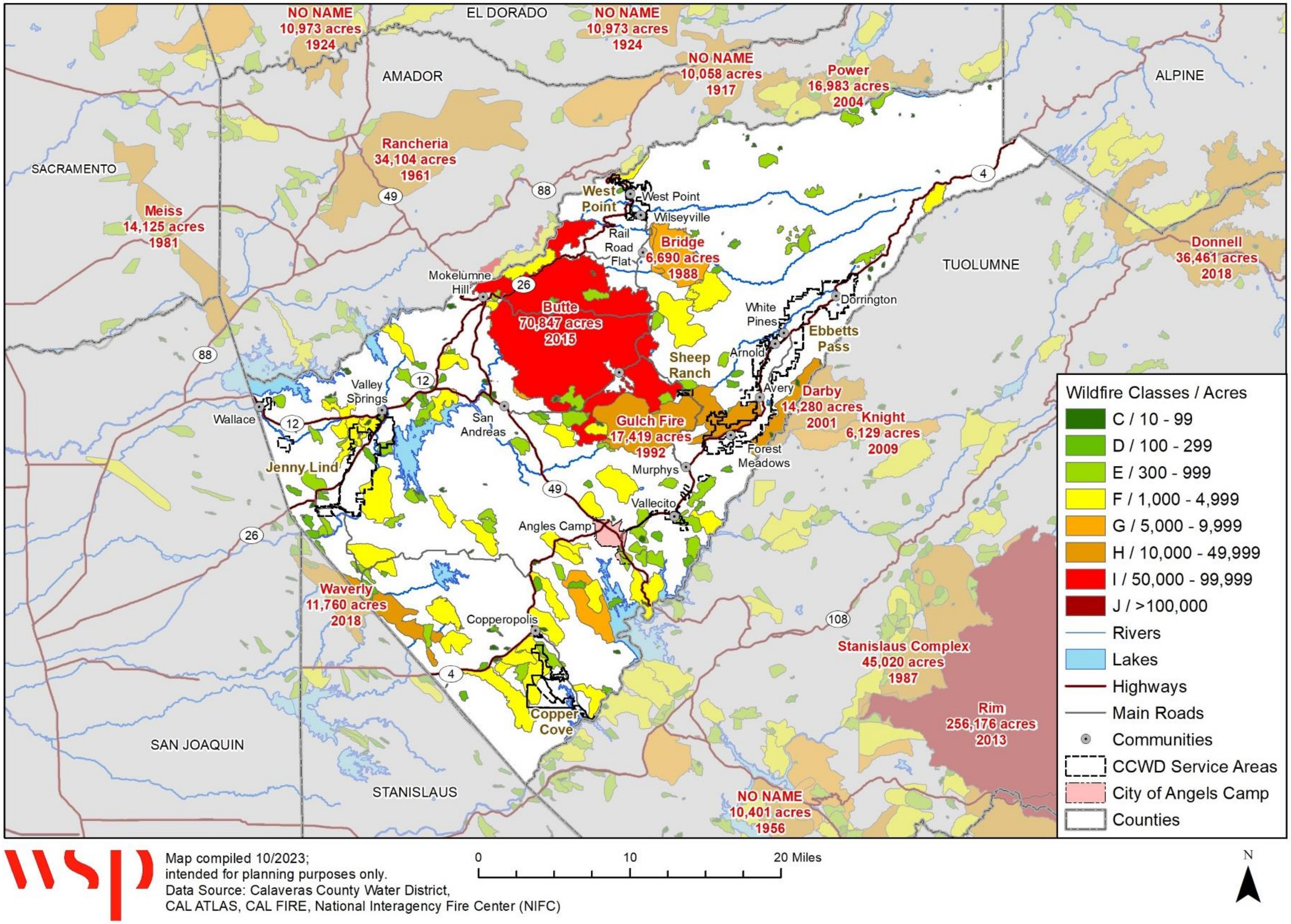
Wildfires of varying scales occur on an annual basis in the County. The County has received state disaster declarations for wildfires in 1988, 1992, 2001, and 2015. The County also received a federal declaration (DR-958) in 1992, two in 2004 (FM 2540 and FM 2553), and two in 2015 (FM-5111 and DR-4240). A map of wildfire history is shown in Figure 4-73. A summary table of fires in Calaveras County since 1908 is shown in Table 4-41.

Table 4-41 Wildfire History (1908 – 2021) in Calaveras County by Cause and Size

CAUSE	50 TO 100 ACRES	100-500 ACRES	>500 ACRES	TOTAL
Arson	-	1	2	3
Campfire	-	-	-	0
Debris	1	1	-	2
Electrical Power	-	3	-	3
Equipment Use	3	7	6	16
Lightning	19	14	3	36
Miscellaneous	1	-	-	1
Playing with Fire	2	8	8	18
Power Line	-	-	-	0
Railroad	2	5	1	8
Smoking	-	-	-	0
Prescribed	9	30	13	52
Unknown/Unidentified	6	53	53	112
Vehicle	1	3	-	4
Total	44	125	86	255

Source: Cal FIRE FRAP dataset

Figure 4-73 Calaveras County Wildfire History, 1908 – 2021

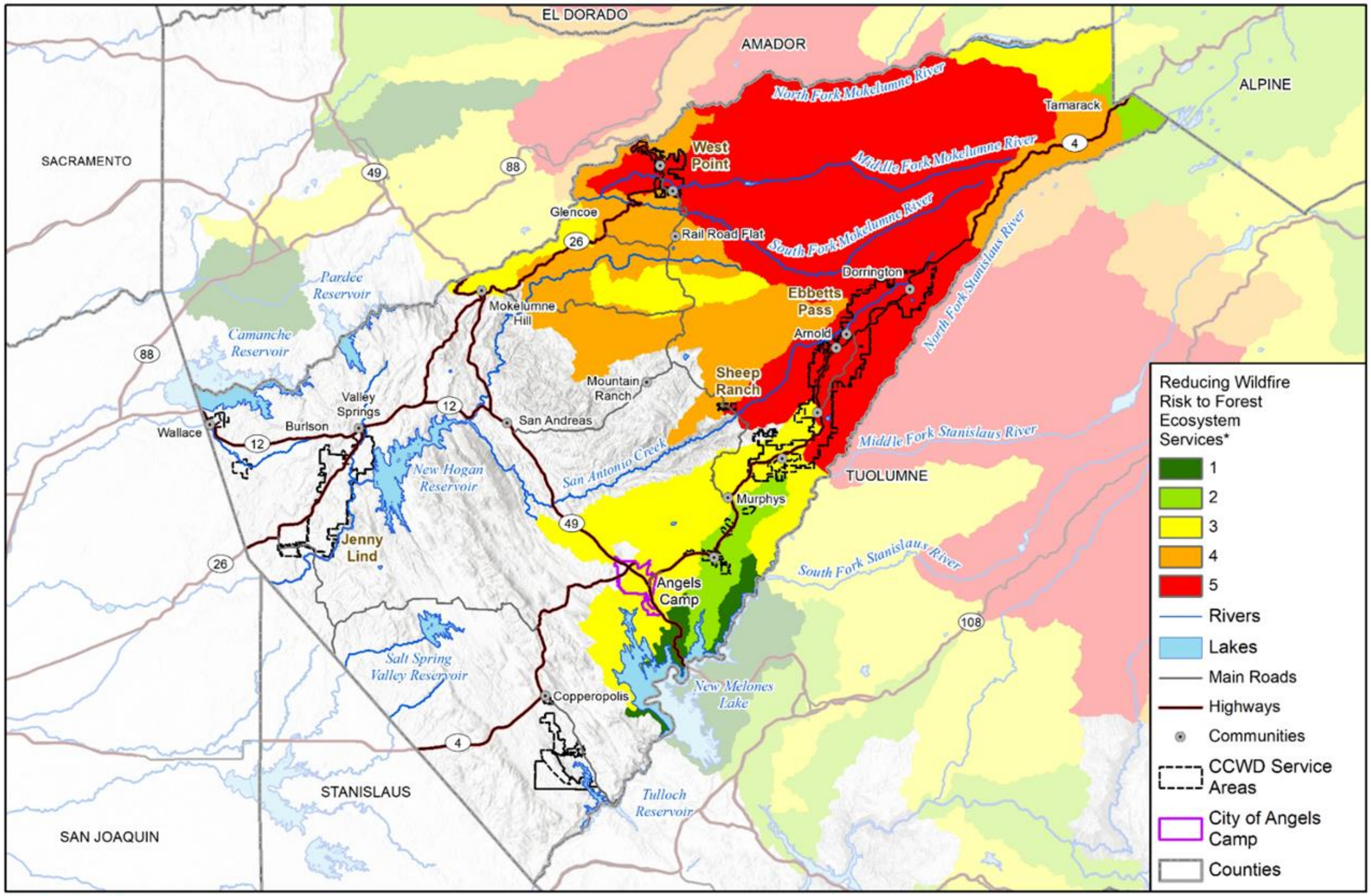


Major wildfires in Calaveras County since 1979 are summarized below:

- **June 6, 1979 Fowler Peak** – This fire burned 5,237 acres Calaveras County. The fire's cause was unknown. Damage estimates, injuries, and deaths were unavailable.
- **August 1992 Old Gulch fire/Shasta fires (DR-958**)—Damage was estimated at $54 million across Calaveras and Shasta Counties. Eight people were injured.
- **August 1996 Keystone fire**—7,000 acres burned within the California Department of Forestry Tuolumne-Calaveras Unit (TCU). 20 homes were destroyed and 7 damaged by this lightning-caused fire.
- **July 19, 1988 Bridge Fire** – This fire burned almost 7,000 acres Calaveras County. The fire was attributed to arson and was finally extinguished on July 26, 1988. Damage estimates, injuries, and deaths were unavailable.
- **September 1999 Winton Incident fire**—120 acres burned near West Point. Two homes, two outbuildings, and two vehicles were destroyed. Total costs, including firefighting, totaled $740,000.
- **2001 Darby Fire**—30,137 acres burned in the TCU. State fire disaster declaration.
- **2002 Sourgrass Fire**—884 acres burned in the TCU.
- **2003 fire season**—884 acres burned in the Tuolumne-Calaveras Unit (TCU).
- **2004 Armstrong Fires**—7,796 acres burned in 380 separate fires, totaling over $10 million in damage. 26 homes were destroyed. The majority of acreage burned and property damage were due to three fires, the Copperopolis fire (3,844 acres burned, 1 home destroyed), the Armstrong Complex (963 acres burned, 3 homes destroyed), and the Pattison fire (2,676 acres burned, 17 homes destroyed). These occurrences were mostly human-caused, including fires started by vehicle/equipment misuse and arson.
- **September 2015 Butte Fire** – burned 70,868 acres, making it the largest fire (in terms of acreage) in Calaveras County since 1908. Caused by a lightning strike, the fire resulted in a federal declaration (FM-5111) and $3.1 million dollars was made available in Public Assistance Grants, in addition to $273,418 in Emergency Work funds.
- **June 2020 Walker Fire** – Burned 1,455 acres, destroying 4 structures. Initially reported as a 10-acre fire, high winds and dry conditions expanded the blaze to 1,000 acres within an hour. About 50 properties, mostly rural ranches, were evacuated to Red Cross shelters in Copperopolis. 950 personnel, 4 helicopters, and 41 fire engines were required to stop the fire.

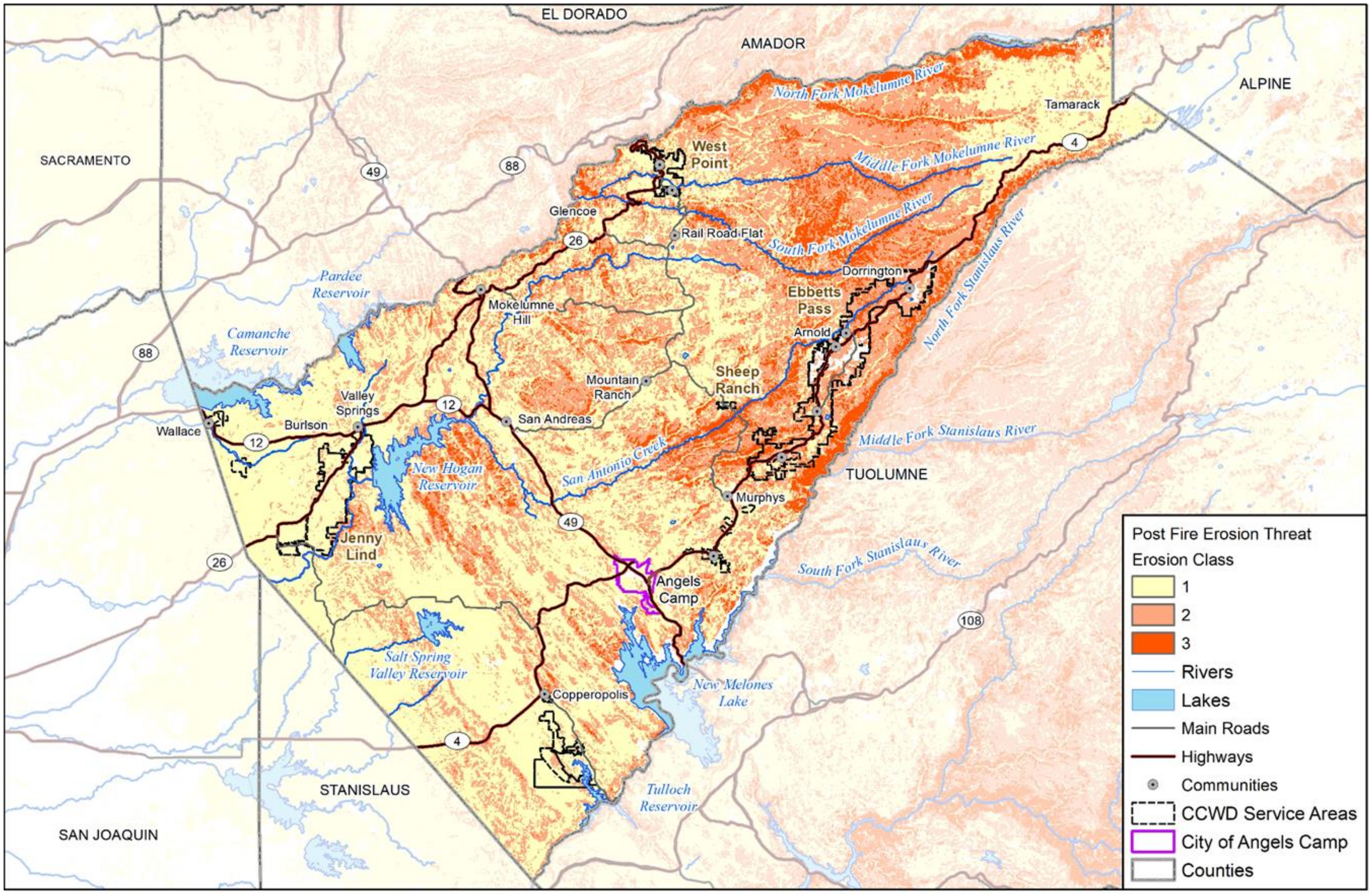
Figure 4-74 and Figure 4-75 show the effects of wildfire at a landscape level on ecosystem health and post-fire erosion. These maps are the result of the 2010 California Forest and Range Assessment. The assessment conducted a simple risk analysis on various input assets that could be impacted by wildfire threat (CAL FIRE 2010).

Figure 4-74 Fire Priority Landscape – Ecosystem Health



Map compiled 4/2023;
intended for planning purposes only.
Data Source: Calaveras County Water District,
CAL ATLAS, California FRAP, US Forest Service
*This Priority Landscape prioritizes watersheds for potential treatment to reduce wildfire risk based on threats and assets to forested lands. The ranking varies from 1 (least risk) to 5 (greatest risk).

Figure 4-75 Fire Priority Landscape – Post-Fire Erosion



Map compiled 4/2023;
intended for planning purposes only.
Data Source: Calaveras County Water District, CAL ATLAS, California FRAP, US Forest Service

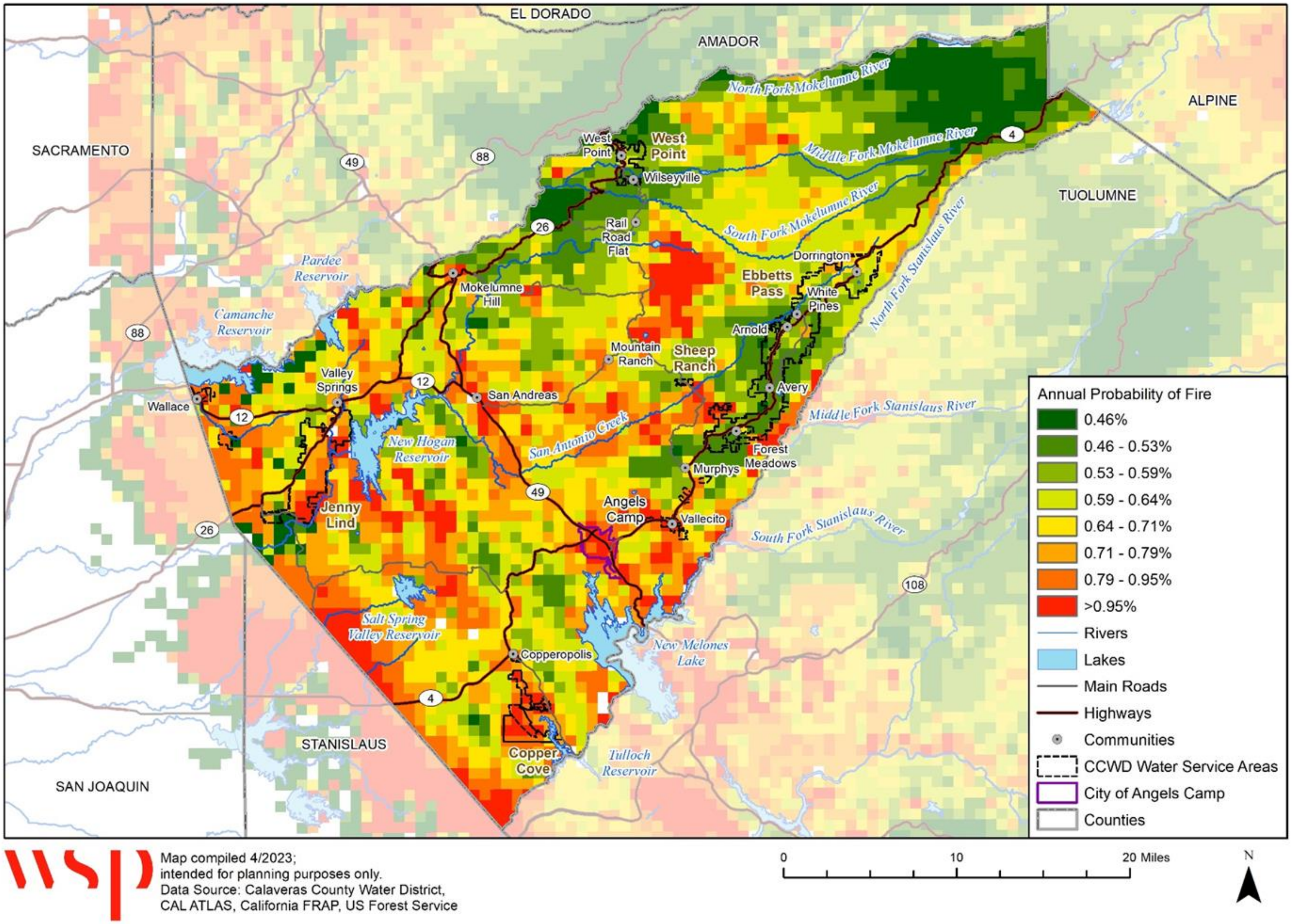
4.4.15.5 Probability of Future Occurrence

Highly Likely— Fire starts are highly likely during each fire season and commonly result in wildfires in the County. Based on climate and weather in the County and the fuels, topography, and a past fire history (approximately 255 fires over 113 years) which indicates an average of 2.2 wildfires per year, it is likely that fires will continue to occur in the future.

The wildfire season generally runs from early spring to late fall (April to October), but this historical wildfire season can now start earlier in the spring and last longer into the fall months. This is due to hot, dry conditions during this time of year and an increase in population throughout the County in the summer months as vacation homes are visited and seasonal workers converge on the area. The 4th of July and Labor Day holiday weekends are specific times when the wildfire probability is higher than average.

The 2020 TCU Strategic Fire Plan indicated the TCU featured a wide range of challenging topography, fuels, and weather that greatly influence wildland fires. It also has a long history of large damaging fires (CAL FIRE 2020). In the event of a wildfire, numerous CCWD facilities may experience direct impacts associated with limited accessibility and water availability, power outages, water shortages. Wildfire events would affect both CCWD operations and customers if water treatment becomes problematic and if water supplies are not provided. Figure 4-76 shows the predicted annual probability of fire for the years 2023 through 2050. As shown in the map, the southwestern edge of the County has a relatively higher annual probability of fire. A few areas of relatively higher annual probability of fire are also scattered over the central and other parts of the County.

Figure 4-76 Calaveras County Annual Probability of Fire, 2023 – 2050



4.4.15.6 Climate Change Considerations

According to California's Climate Adaptation Strategy, warmer temperatures can exacerbate drought conditions. Drought conditions often kill trees and shrubs within the understory of a forest, which can serve as fuel for wildfires. Warmer temperatures could increase the number of wildfires and pest outbreaks, such as the western pine beetle infestation.

Current scientific models expect all of California will be affected by increased numbers of forest fires with added intensity due to longer warmer seasons, reduced distribution of biodiversity, lack of moisture, changes in ecosystems, drought impacts (e.g., pest diseases and continued spread of invasive species), and other impacts in coming years (Cal-Adapt 2023). The extending of the wildfire season into winter months, coinciding with seasonal high wind patterns, has contributed to severe fires in recent years.

The KBDI is a measure of the amount of precipitation required to return the soil to full moisture capacity. A KBDI of zero indicates a total lack of moisture deficiency, while 800 represents drought conditions deep within soil layers. KBDI is cumulative, meaning values will increase on dry and warm days and decrease during rainy periods. It is a simplified proxy for the favorability of occurrence and spread of wildfire but is not itself a predictor of fire.

Figure 4-77 shows the historic number of days when KDBI is greater than or equal to 600, based on data from 2005, and Figure 4-78 shows the projected number of mid-century (2050) when KDBI will be greater or equal to 600 based on the RCP 8.5 scenario. As shown by the two figures, more areas of the County are projected to have more days when KBDI >= 600. An area is considered to experience severe drought if the KBDI value is higher than 600, meaning the area possesses extreme wildfire risk and has increased wildfire occurrence.

Figure 4-77 Calaveras County Annual Average Number of Days When KBDI >= 600 (Historical: Year of 2005)

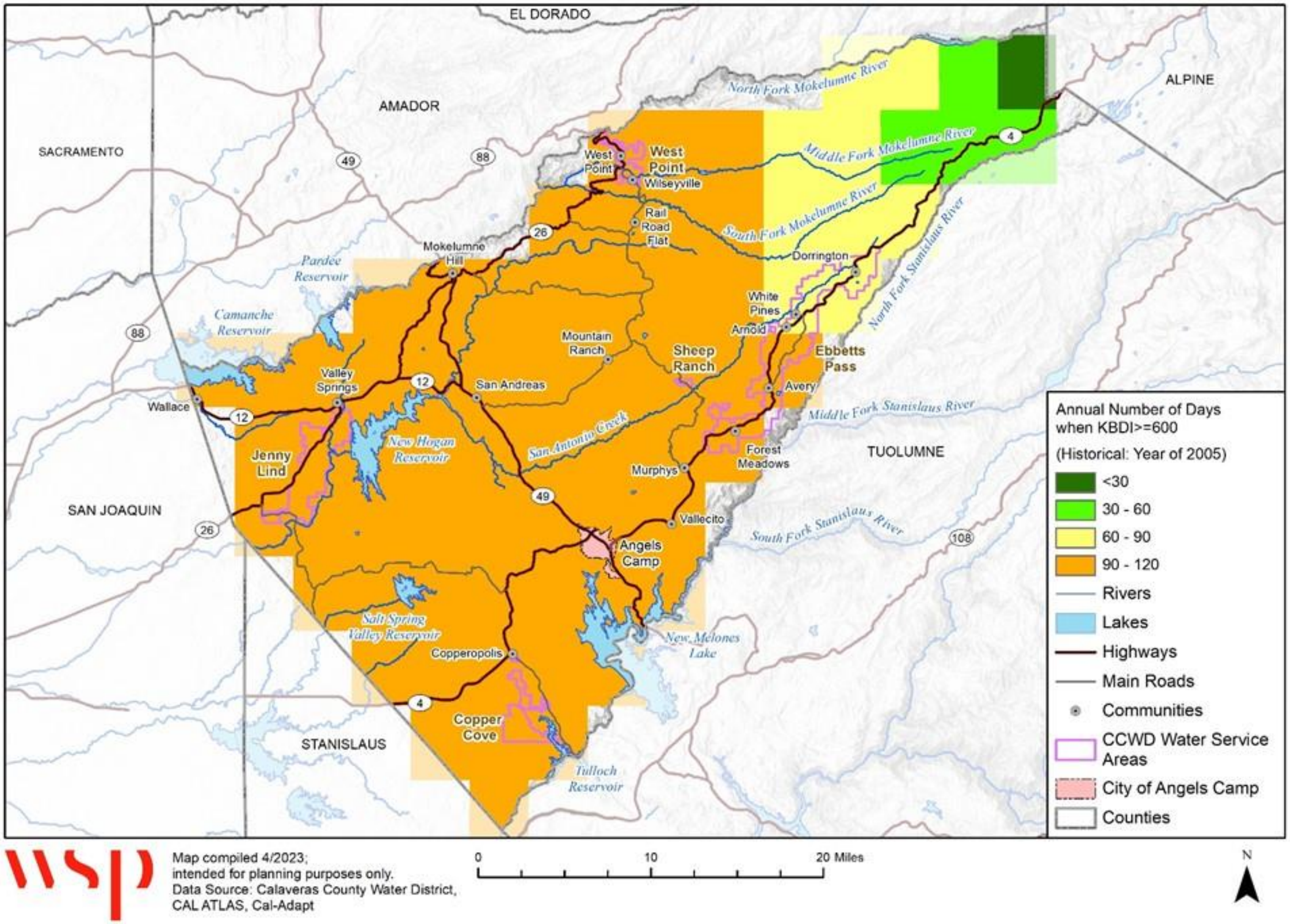
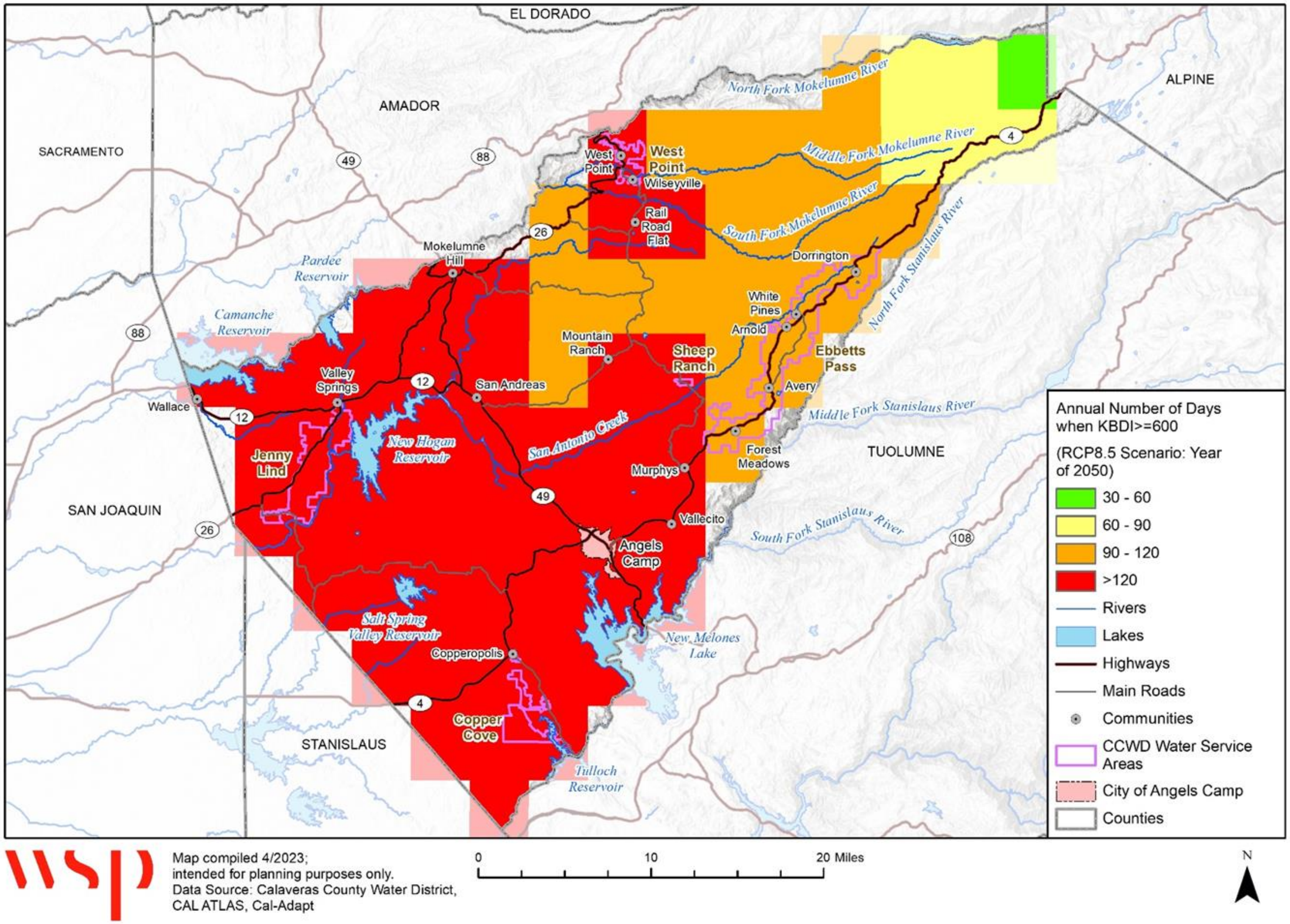


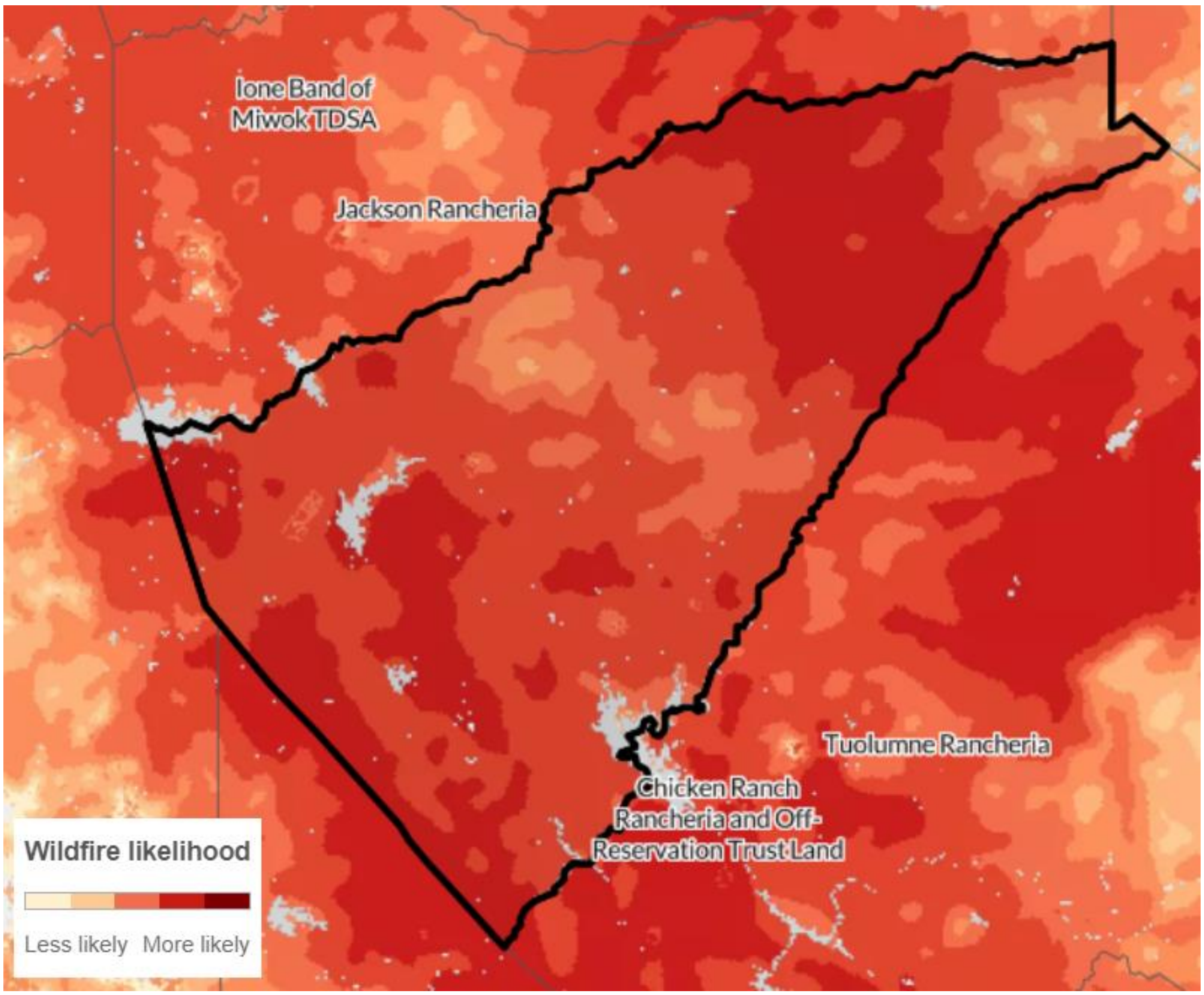
Figure 4-78 Calaveras County Annual Average Number of Days When KBDI >= 600 (RCP8.5 Scenario: Year of 2050)



4.4.15.7 Vulnerability Assessment

According to *Wildfire Risk to Communities*, a nationwide risk study from the United States Forest Service that was designed to help communities understand, explore and reduce wildfire risk, Calaveras County has a higher risk of wildfire than 98% of counties in the US and 76% of counties in California (USFS 2021); this increased wildfire likelihood is illustrated in Figure 4-79. This, combined with the devastating effects wildfire can have on water infrastructure, supply, and quality, makes wildfire a high-significance hazard for the CCWD.

Figure 4-79 Calaveras County Wildfire Likelihood



Source: US Forest Service

People

Wildfire threatens the water quality and supply within the waterways and reservoirs that supply water to CCWD and its customers. For example, the New Hogan Reservoir, which supplies water for the Jenny Lind system, is in a very high fire hazard threat area. A wildfire in that area could impact the water quality for the approximately 11,250 customers dependent on that system. The Lake Tulloch Reservoir, the source for the District's Copper Cove system, is in a similarly high-threat area. In addition to the water quality hazards, wildfires can also damage water infrastructure, like aboveground water tanks and pump stations, which could impact water delivery to customers until the damage can be remedied.

Vulnerable populations, such as the elderly, disabled, and those with limited mobility, may face additional challenges during wildfire events. These challenges can include difficulties in evacuation, respiratory issues due to smoke exposure, and potential impacts associated with access to medical care. The wildfire threat extends throughout the CCWD's Planning Area with the highest level of socially vulnerable populations encompassing the West Point and Sheep Ranch service areas with approximately 616 connections and 1,132 residents. The populations in these service areas are also the most remote compared to the rest of the CCWD's Planning Area, and may experience more challenges with evacuation due to limited accessibility, or fewer transportation options like public transit. Wildfire situations in these areas also test the capacity of local emergency response resources, including the ability of the CCWD to provide timely back-up water supply in the event that water lines are impacted. These types of events can easily overwhelm communities lacking the resources to prepare and respond.

In addition to the risk to the CCWD customer's water supply and water quality, potential impacts to communication lines and electrical power utilities, like power outages may also hinder the CCWD's ability to use pumping facilities that require electricity to operate, which could lead to the disruption in water and wastewater services to customers. Climate change specifically warmer temperatures and increased drought conditions are expected to intensify the likelihood of wildfires. As previously noted, scientific models suggest that wildfires will intensify due to longer warmer seasons, lack of moisture, and drought conditions. The extension of the wildfire season has also contributed to severe fires in the past decade in Calaveras County. As a result, climate change will impact the vulnerability of the CCWD's water customers in the future with the greatest impacts on the more remote and vulnerable populations residing in areas with very high wildfire threat and few options for evacuation and limited access to back-up water supplies.

Property

Structures, above-ground infrastructure, and critical facilities on CCWD property are all vulnerable to wildfire. An analysis of the threat of wildlife to the CCWD's critical facilities, which includes the CCWD's property is detailed below. Climate change impacts on wildfire risk are associated with large increases in the area burned by a wildfire and the frequency of large wildfires (over 24,700 acres). These larger fire events will alter the CCWD's vulnerability because they could lead to conditions where forest recovery is delayed or shifts to different landscapes, which could affect the biodiversity and health of the CCWD's watershed lands and overall quality of their surface water supply.

Critical Facilities and Lifelines

To assess if any of the CCWD facilities are located within wildfire-prone areas, CCWD's critical facilities and infrastructure assets were intersected with a wildfire threat layer. A total of 69 CCWD facilities are found to be located in at least moderate wildfire threat areas. Table 4-42 below shows the analysis results by wildfire threat class and facility type.

Table 4-42 CCWD Facilities Exposure to Wildfire Threat

	MODERATE	HIGH	VERY HIGH	GRAND TOTAL
Dam	2		1	3
Disposal		1		1
Diversion		2	1	3
Lift Station	2	8	9	19
Office			1	1
Pump Station	1	4	7	12
Tank	1	1	13	15
Tunnel Tap		1		1
Warehouse			2	2
Wastewater Sprayfield		1	1	2
WWTP	1	2		4
Water Intake		1		1
WTP		2	2	3
Well		2		2
Grand Total	7	25	37	69

Source: CCWD, California FRAP, WSP GIS Analysis 2023

In addition, a total of 13.56 miles of CCWD's slurry pipeline are located in at least moderate wildfire threat areas. Table 4-43 below shows the mileage of susceptible slurry pipeline categorized by wildfire threat class.

Table 4-43 CCWD Slurry Pipeline Exposure to Wildfire Threat Areas

WILDFIRE THREAT CLASS	MILEAGE
Fire Threat Medium	0.61
Fire Threat High	9.17
Fire Threat Very High	8.63
Fire Threat Extreme	0
Total	18.41

Source: CCWD, California FRAP, WSP GIS Analysis 2023

Among the 69 facilities identified, 37 of them are located in very high fire threat areas. Moreover, 19 out of the 66 identified facilities are lift stations. None of CCWD's facilities are located in extreme wildfire threat areas. The combined effects of drought, declines in forest health (due to pests and disease), and wildfire will all be exacerbated by climate change. These climate change effects will further threaten the communities in Calaveras County, and particularly the vulnerability of the CCWD's critical water facilities and public water supply. These effects would be especially prevalent in the WUI throughout the CCWD's Planning Area. Future development pressure (described in more detail below) will also be an increasing concern as the smaller residential communities served by the CCWD (Dorrington, White Pines, Arnold) typically have limited capacity for incident response, which can not only strain local agency resources and budgets, but also the CCWD's ability to maintain water systems during wildfire events. As a result, multiple wildfire hardening projects have been proposed over the years by the CCWD to alleviate and mitigate these potential impacts.

Economy

Wildfire can affect the economy both directly and indirectly. Directly, wildfire can damage structures and infrastructure, resulting in a loss of business. Indirectly, wildfire can introduce sediment and pollution to water sources, leading to further infrastructure damage. Additionally, power outages resulting from wildfires can disrupt water district operations reliant on electricity, while emergency response and preparedness efforts incur additional costs.

Cultural, Historic and Natural Resources

Wildfire can have significant impacts on natural resources. Wildfires can cause severe damage to watersheds, which are crucial for regulating water flow and maintaining water quality. The intense heat from wildfires can destroy vegetation and organic matter that act as natural sponges, reducing the ability of the soil to absorb and retain water. This can lead to increased erosion, sediment runoff, and decreased water infiltration into the ground. As a result, water availability and quality in streams, rivers, and reservoirs can be significantly impacted. The long-term effects of wildfires on watershed health can be significant and these impacts on natural resources are expected to worsen with climate change. The loss of vegetation can impede the recovery and regeneration of ecosystems, prolonging the impacts on water resources. The altered hydrological conditions can disrupt the natural functions of watersheds, affecting water availability, erosion control, and overall ecological resilience.

4.4.15.8 Development Trends

The CCWD and its customers are likely to continue to be impacted by wildfire events in the County in the future. The CCWD's ability to be able to continue to supply drinking water during a wildfire event or power outages due to wildfire risk should be taken into consideration by developers and the County, particularly around areas with prominent second-home residences (e.g., Dorrington, Arnold, etc.) and under development pressure, as several of the existing residential developments in the County are located in areas with high to very high wildfire threat. Future expansions of existing developments in these areas, or the construction of new residences within these developments will put more pressure on the CCWD's ability to provide water supplies and maintain those supplies during wildfire events. This is often because many of these residential developments spread across steep and rolling terrain with limited accessibility (e.g. one point of ingress/egress). The CCWD should also take fire threat and vulnerability into consideration in their design and placement of future water storage tanks and other water infrastructure in certain developments with environmental constraints that that have fewer response capabilities due to accessibility. As a result, future land use development, in combination with the effects of climate change, will impact the CCWD's water customers and facilities overall vulnerability to wildfire.

4.4.15.9 Risk Summary

- Wildfire risk is highest across a broad section of the central and eastern sections of the CCWD's Planning Area.
- Calaveras County has a higher risk of wildfire than 98% of counties in the US and 76% of counties in California.
- Cal FIRE designated 35 communities in the County as "Communities at Risk" within the National Fire Plan.
- State disaster declarations for wildfires occurred in 1988, 1992, 2001, and 2015 and federal declaration (DR-958) were made in 1992, two in 2004 (FM 2540 and FM 2553), and two in 2015 (FM-5111 and DR-4240).
- The County has recorded over 255 wildfires over a 113-year period translating to an average of one wildfire every 2.2 years. As impacts of climate change such as increased temperatures and prolonged drought conditions continue in coming years, this frequency of occurrence and intensity may increase.
- Wildfires can disrupt access to or destroy CCWD's critical facilities and infrastructure; seven critical facilities are in the "Moderate" Wildfire Threat Zone, 25 critical facilities are in the "High" Wildfire Threat Zone and 37 are in the "Very High" Wildfire Threat Zone.
- Wildfires impacts can include loss of property, direct agricultural sector job loss, secondary economic losses to businesses, and loss of public access to recreational resources.
- Future land use development, in combination with the effects of climate change, will impact the CCWD's overall vulnerability to wildfire, specifically the impacts to the condition of the CCWD's watershed lands and overall surface water supply and the CCWD's capacity for incident response and ability to maintain water systems during wildfire events.

GEOGRAPHIC AREA	PROBABILITY OF FUTURE OCCURRENCE	MAGNITUDE/ SEVERITY	OVERALL SIGNIFICANCE
Extensive	Highly Likely	Critical	High

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5 MITIGATION STRATEGY

Requirement §201.6(c)(3):

[The plan shall include the following:] A mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.

This section describes the mitigation strategy process and mitigation action plan for the District's LHMP. It describes how the District met the requirements for the following from the 10-step planning process:

- **Planning Step 6:** Set Goals
- **Planning Step 7**: Review Possible Activities
- **Planning Step 8**: Draft an Action Plan

The mitigation strategy reflects the results of the collaborative work of the HMPC. Subsection 5.3 Mitigation Action Plan is based on the updated planning process, risk assessment, capability assessment, consequence analysis, goal setting, and the identification of mitigation actions. Taking all of these into consideration, the HMPC developed the following overall mitigation strategy, which builds upon the 2018 LHMP strategy:

- **Communicate** the hazard information collected and analyzed through this planning process as well as HMPC success stories so that the community better understands what can happen where and what they themselves can do to be better prepared.
- **Implement** the action plan recommendations of this plan to reduce the District's vulnerability to hazards.
- **Use** existing rules, regulations, policies, and procedures already in existence. Given the flood hazard in the planning area, an emphasis should be placed on continued compliance with the NFIP.
- **Lessen** the impact of disasters and the speed of the response and recovery process.
- **Build** awareness to help the community become more sustainable and reliant to disasters.
- **Monitor** multi-objective management opportunities so that funding opportunities may be shared and packaged, and broader constituent support may be garnered.

5.1 MITIGATION GOALS AND OBJECTIVES

§201.6(c)(3)(i)

[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

Up to this point in the planning process, the HMPC has organized resources, assessed hazards and risks, and documented mitigation capabilities. The resulting goals and mitigation actions were developed based on these tasks. The HMPC held a series of meetings and exercises designed to achieve a collaborative mitigation strategy as described further throughout this section.

During the initial goal-setting meeting, the HMPC reviewed the results of the hazard identification, vulnerability assessment, and capability assessment. This analysis of the risk assessment identified areas where improvements could be made and provided the framework for the HMPC to formulate planning goals and objectives and the ultimate mitigation strategy for the District Planning Area.

5.1.1 Goals Development Process

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

- Represent basic desires of the District;
- 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; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation cost, schedule, and means. Goals are defined before considering how to accomplish them so that they are not dependent on the means or cost of achievement. The goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

During the planning process, HMPC members were provided a list of the four existing goals from the 2018 LHMP and a list of sample goals to consider from the draft 2023 California State Hazard Mitigation Plan (SHMP). They were told that they could build upon the existing goals, combine, or revise the existing statements or develop new ones, keeping the risk assessment in mind. The HMPC participated in a hybrid meeting and were asked to write or revise a goal statement. The goal statements from the HMPC were then reviewed during the second HMPC meeting until the team came to consensus. Based on the goal setting process, the HMPC identified the following five revised goals, which building upon the existing goal statements and provide direction for reducing future hazard-related losses within the District Planning Area:

- **Goal 1:** Protect water supply, transmission, and storage facilities and reduce exposure to hazard-related property and water assets losses from wildfire, extreme heat, flooding, and the effects of climate change.
- **Goal 2:** Increase resiliency of water supply to drought and climate change effects.
- **Goal 3:** Focus on watershed health improvements to reduce vulnerability and risk to critical infrastructure from natural hazards.
- **Goal 4:** Improve collaboration between partner water agencies, first responders, emergency management planners, and the public to maintain water system reliability.
- **Goal 5:** Increase water system redundancy and improve service levels.

5.1.2 Objectives Development Process

Next, the HMPC was asked whether they wanted to revise the existing objectives that summarized strategies to achieve each goal. In the existing 2018 LHMP these objectives were linked to the hazards they mitigate. HMPC participants revised the objective statements during the third HMPC meeting based on initial input provided by CCWD and WSP staff.

Based on the risk assessment review and goal-setting process, the HMPC carried forward seven objective statements from the existing HMP and added three new objectives that focus on specific and measurable steps related to climate change hazards and drought resiliency. The 19 revised objectives organized by goal statement are listed below.

- **Objective 1.1** Maintain adequate flows in water system for fire protection.
- **Objective 1.2** Improve capacity of critical sewer infrastructure to accommodate peak events.
- **Objective 1.3** Continue emergency water supply planning during periods of drought and water shortage
- **Objective 3.1** Protect critical lifeline utilities from hazard impacts.
- **Objective 3.2** Enhance and improve interconnections with regional water suppliers to prevent loss of service during drought and other emergencies.
- **Objective 3.3** Improve and protect water supply storage capacity.
- **Objective 3.4** Improve redundancy at critical facilities.
- **Objective 3.5** Increase backup capacities post-disaster to service the community until complete services are restored.
- **Objective 4.1** Educate public on responsible water use and conservation measures.
- **Objective 4.2** Foster partnerships with other water and sewer providers locally and regionally.
- **Objective 4.3** Improve emergency planning relative to vulnerable special populations.
- **Objective 4.4** Improve coordination with other County departments (such as planning and public health) related to natural hazard planning.
- **Objective 4.5** Maintain and enhance participation in multi-agency groups, such as the Multi-Agency Coordinating Group, related to natural hazards and emergencies.
- **Objective 4.6** Coordinate with other agencies for disaster training exercises.
- **Objective 4.7** Increase use of shared resources.
- **Objective 4.8** Make better use of communication and GIS technology to better understand water infrastructure vulnerabilities.
- **Objective 5.1** Encourage the efficient use of surface and groundwater supplies.
- **Objective 5.2** Monitor and assess the status and trends of water supply throughout the watershed to improve resiliency.
- **Objective 5.3** Review existing literature and conduct studies to improve scientific understanding about new and emerging issues pertaining to drought, water conservation, reuse, and climate change effects on water supply.

5.2 IDENTIFICATION AND ANALYSIS OF MITIGATION ACTIONS

§201.6(c)(3)(ii):

[The hazard mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

In order to identify and select mitigation actions to support the mitigation goals, each hazard identified in Section 4.4 Hazard Profiles. Only those hazards that were determined to be a priority hazard were considered further in the development of hazard-specific mitigation actions.

The priority hazards in alphabetical order are:

- Dam Failure
- Drought and Water Shortage
- Expansive Soils
- Extreme Heat
- Extreme Cold and Winter Storms
- Flood 100/500 Year and Localized Stormwater Flooding
- High Wind and Tornado
- Landslide and Debris Flows
- Severe Weather: Heavy Rains and Storms (includes hail and lightning hazards)
- Soil Erosion
- Wildfire

The HMPC eliminated the hazards identified below from further consideration in the development of mitigation actions because the risk of a hazard event in CCWD's service area is unlikely or nonexistent, the vulnerability of CCWD is low, or capabilities are already in place to mitigate negative impacts.

The eliminated hazards are:

- **Avalanche** – (although avalanche hazards exist within the West Point community, these hazards are limited to undeveloped areas and the roadways managed by the California Department of Transportation [Caltrans])
- **Cyber Threats** –(capabilities covered in the CCWD's AWIA RRA)
- Earthquake (geologic and seismic risk was generally low throughout Calaveras County)
- **Public Health Hazards** – (capabilities are covered in CCWD's Strategic Plan and other Operations Department materials, as well as public health and safety standards related to potable water supply and delivery)
- **Volcanoes** – (the closest volcanic risk to the CCWD's planning area are the Long Valley Caldera and Lassen Peak volcanic ranges located to the southeast in Mono County; the likelihood of a future occurrence is also unlikely)

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

- **Prevention**: Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property protection**: Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.

- **Structural**: Actions that involve the construction of structures to reduce the impact of a hazard.
- **Natural resource protection**: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Emergency services**: Actions that protect people and property during and immediately after a disaster or hazard event.
- **Public information/education and awareness**: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

At the mitigation strategy meeting the HMPC was also provided with a matrix showing examples of potential mitigation action alternatives for each of the above categories, for each of the identified hazards. The HMPC was provided a handout that explains the categories and provided further examples. Another reference document titled "Mitigation Ideas" developed by FEMA in 2013, and FEMA's 2020 "Mitigation Action Portfolio" were distributed to the HMPC via an online link; hard copies were also distributed during the in-person meeting. These documents list common mitigation activities by hazard and actions funded by FEMA. The HMPC was also instructed to consider both future and existing buildings in considering possible mitigation actions. This reference provides four categories of mitigation actions that were discussed at the HMPC meeting in addition to the NFIP/CRS categories. These include:

- Plans and Regulations
- Structure and Infrastructure Projects
- Education and Awareness
- Natural systems protection

Other alternatives discussed in the meeting include the four 'A's' of mitigation:

- **Alter** the physical nature of the hazard.
  - Such as wildfire defensible space and fuels treatments, snow fences etc.
- **Avert** the hazard away from people, buildings, and infrastructure.
  - Can include engineered solutions, drainage, and channel improvements, floodproofing, fuel breaks.
- **Adapt** to the hazard.
  - Through land use planning, building codes and design standards, warning systems etc.
- **Avoid** the hazard.
  - Natural systems protection, open space, acquisition, or relocation of properties out of hazardous areas.

As part of the review of mitigation options, long-term climate change adaptation strategies were discussed. HMPC members were encouraged to incorporate climate change adaptation measures into the mitigation strategy of their respective agencies or organizations utilizing resources and guidance available on the Cal-Adapt website. These materials are included in Appendix B. HMPC members were encouraged to develop mitigation alternatives that would protect future, as well as existing, development from hazards per the DMA 2000 regulations. A facilitated discussion then took place to examine the existing actions in the 2018 LHMP and analyze the other possible mitigation alternatives. With an understanding of the alternatives, a brainstorming session was conducted to generate a list of preferred mitigation actions. The result was new and updated project ideas with the intent of meeting the identified goals and mitigating identified hazards.

Subsequent meetings with CCWD staff focused on refining and prioritizing new mitigation activities. During subsequent meetings, WSP reviewed the Draft LHMP update and remaining information or mitigation gaps that needed to be addressed. The CCWD and WSP staff also discussed opportunities for plan integration and reviewed the plan implementation and maintenance procedures.

Prioritization Process

Once the mitigation actions were identified, the HMPC was provided with several decision-making tools, including FEMA's recommended prioritization criteria, STAPLEE, to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE stands for the following:

- **Social**: Does the measure treat people fairly? (e.g., social equity, different groups, different generations)
- **Technical**: Is the action technically feasible? Does it solve the problem?
- **Administrative**: Are there adequate staffing, funding, and other capabilities to implement the project?
- **Political**: Who are the stakeholders? Will there be political and public support for the project?
- **Legal**: Does the jurisdiction have the legal authority to implement the action? Is it legal?
- **Economic**: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- **Environmental**: Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

In accordance with the DMA requirements (44 CFR, Section 201.6(c)(3)), an emphasis was placed on the importance of a benefit-cost analysis in determining action priority. As part of this evaluation, the benefits of proposed actions were weighed against estimated costs as part of the prioritization process. Other criteria used to assist in evaluating the benefit-cost of a mitigation action included:

- Does the action address priority hazards or areas with the highest risk?
- Does the action protect lives?
- Does the action protect infrastructure, community assets or critical facilities?
- Does the action meet multiple objectives?
- What will the action cost?
- What is the timing of available funding?

The mitigation categories, multi-hazard actions, and criteria are included in Appendix C: Mitigation Categories, Alternatives, and Selection Criteria.

During the mitigation strategy meeting, once mitigation actions were compiled, the HMPC used STAPLEE to determine which of the identified actions were most likely to be implemented and effective. This process was completed as part of a group activity called "Connect the Dots" where each HMPC participant is given three red sticky dots, three blue sticky dots, and three green sticky dots and asked to place the sticky dots on the mitigation actions, using the different colors to indicate the chosen priority. The red dots are for high priority projects. The blue dots are for medium priority projects. The green dots are for low priority projects. Given the small HMPC group, each participant was only provided one colored sticky dot to prioritize a total of six new mitigation actions. With these criteria in mind, team members prioritized the mitigation actions, essentially voting on the projects. In summary, the projects with the reddest points became the higher priority projects, followed by the projects with the bluest points became the medium priority projects, and the projects with the greenest dots became the low priority projects. This process provided both consensus and priority for the recommendations.

The process of identification and analysis of mitigation alternatives allowed the HMPC to come to consensus and to collectively prioritize recommended mitigation actions. During the "Connect the Dots" exercise, emphasis was placed on the importance of a benefit-cost review in determining project priority; however, this was not a quantitative analysis. Benefit-cost was considered in greater detail in the development of the Mitigation Action Plan detailed below in Section 5.2. For example, parameters were established for assigning subjective ratings (high, medium, low) to the benefits and costs of each mitigation action. Specifically, each action developed for this plan contains a description of the problem and proposed project, the entity with primary responsibility for implementation, any other alternatives considered, a cost estimate, expected project benefits, potential funding sources, and a schedule for implementation. Development of these project details for each action led to the determination of an overall high, medium, or low priority for each action.

Recognizing the limitations in prioritizing actions from multiple departments and the regulatory requirement to prioritize by benefit-cost to ensure cost-effectiveness, the HMPC decided to pursue mitigation action strategy development and implementation according to the nature and extent of damages, the level of protection and benefits each action provides, political support, project cost, available funding, and jurisdiction and department priority. This process guided the development of a prioritized action plan for the CCWD. Cost-effectiveness will be considered in greater detail through a formal benefit-cost analysis when seeking FEMA mitigation grant eligibility and funding (e.g., HMGP, BRIC grant program) for eligible actions associated with this plan.

5.2.1 Progress on 2018 Local Hazard Mitigation Plan

The Calaveras County Water District has been implementing actions identified in the LHMP developed by the District in 2018 and working steadily towards meeting the plan goals, objectives, and mitigation actions based on funding and staff availability. During the 2022-2023 LHMP update process the District reported on the status of all 22 of the

2018 LHMP actions. The District provided input on whether the action had been completed, was deferred (not yet implemented, but still relevant for the updated plan), was in progress, or should be deleted. Table 5-1 summarizes the mitigation actions included in the 2018 LHMP.

Table 5-1 Mitigation Action Progress Summary

PROGRESS CATEGORY	# OF MITIGATION ACTIONS
Completed	2
Deleted	1
Continue In Progress	14
Continue-Not Started	5
Total Continuing Actions	19
New Actions in 2021	19
Grand Total Continuing and New	**38**

Table 5-2 indicates the details for each of the 2018 mitigation action items that have been completed or deleted based on input from the HMPC.

Table 5-2 Completed and Deleted Mitigation Actions

ID	HAZARD(S) ADDRESSED	MITIGATION ACTION	GOALS	ACTION STATUS NOTES
7	Multi-hazard	Work with Calaveras County on County General Plan update to integrate natural hazards mitigation measures in new development planning.	Goal 1 Goal 2 Goal 3 Goal 4	**Completed.** The Calaveras County General Plan and 2021 MJHMP cross references the 2018 LHMP and was adopted in 2021.
17	Drought	Review and update a tiered rate structure to encourage responsible water use.	Goal 1 Goal 2 Goal 3 Goal 4	**Deleted.** CCWD selected to implement a different rate structure for water use
19	Flood	Update the National Pollutant Discharge Elimination System (NPDES) permits for wastewater facilities as required.	Goal 1 Goal 3	**Completed.** This action is also ongoing as updates are required.

As shown in Table 5-2, two mitigation actions from the 2018 LHMP were completed, and one mitigation action was deleted. These include Action 7, integration natural hazards mitigation in new development planning for the Calaveras County General Plan, and Action 19 updating NPDES permits for District wastewater facilities.

The remaining actions from the 2018 LHMP will carry forward into the 2022-2023 LHMP given they involve annual implementation and continuing actions. For this 2023 LHMP update, new flood, drought, energy shortage, public health, and wildfire mitigation actions were developed. Details on the progress of the existing actions carried forward into this LHMP update since the 2018 LHMP planning process can be found in Section 5.3 and Table 5-3 below.

5.3 MITIGATION ACTION PLAN

REQUIREMENT §201.6(C)(3)(III)
[The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

This action plan presents the recommendations developed by the HMPC outlining how the District can reduce the risk and vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. The 38 mitigation actions developed by the HMPC are summarized in Table 5-3 and listed in detail in the mitigation action worksheets that follow. Table 5-3 is a summary table for quick reference. It identifies the mitigation action title, lead agency/department, hazards mitigated, and priority. The 'Related Goal' column notes which of the four goals in Section 5.2 that the action helps achieve. The action worksheets that follow provide more background information, ideas for implementation, lead agency, partners, potential funding sources, cost estimates, benefits, and timeline for each identified action.

The HMPC realizes that new needs, priorities, and adaptation strategies may arise as a result of a disaster or other circumstances and reserves the right to support new actions and strategies, as necessary, as long as they conform to the overall goals of this plan.

The actions included in this mitigation strategy are subject to further review and refinement; alternatives analyses; and reprioritization due to funding availability and/or other criteria. The District is not obligated by this document to implement any or all of these projects. Rather this mitigation strategy represents the desires of the District, the HMPC, and the community to mitigate the risks and vulnerabilities from identified hazards. Many of the action items included in this plan are also a collaborative effort among District staff, Conservancy, TRPA, STPUD, LVFPD, Tahoe Prosperity Center, El Dorado County, and other state, regional, and local agencies, and stakeholders in the District's Planning Area.

Table 5-3 CCWD Mitigation Actions

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
1	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Wildfire	Implement and Expand Fuel Breaks to Reduce Wildfire Hazards at CCWD Properties	CCWD Engineering Department	Moderate	Sierra Nevada Conservancy Forestry Management implementation grants, US Forest Service Non-Federal Lands Hazard-Fuel Reduction Funding, CAL FIRE Fuel Reduction Activity Funding, California Disaster Assistance Act, FEMA HMA HMGP	Safety and Security	High	Ongoing	Annual Implementation
2	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Avalanche, Wildfire, Severe Weather: Winter Storms and Extreme Cold, Severe Weather: Heavy Rain and Storms Severe Weather: Wind, Volcano	Hardening of Water and Wastewater Facilities (and Associated Electrical and SCADA Communication Systems) Against Wildfire and Other Severe Weather Hazards	CCWD Engineering Department	Very High	FEMA HMA HMGP	Water Systems; Energy	High	Ongoing	Annual Implementation
3	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Implement Other Facility Flood Mitigation Projects	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	High	Ongoing	Annual Implementation
4	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Wildfire	Replace Remaining Redwood Water Storage Tanks	CCWD Engineering Department	High	FEMA HMA HMGP	Food, Hydration, Shelter; Water Systems	High	Short-Term	In Progress
5	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Improve grading and drainage of Wastewater Effluent Storage Ponds	CCWD Engineering Department	Very High	FEMA HMA HMGP	Hazardous Materials; Water Systems	High	Medium Term	Annual Implementation

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
6	Goal 1, Goal 3, Goal 4, Goal 5	Wildfire	Enhance On-Site Coordination with Cal-Fire during Fire Events	CCWD Engineering Department	Moderate	CAL FIRE Wildfire Prevention Grants Program	Safety and Security; Water Systems	High	Short-Term	Annual Implementation
7	Goal 1, Goal 3, Goal 4, Goal 5	Flood	Implement recommendations in service area master plans related to critical sewer facilities	CCWD Engineering Department	Very High	FEMA HMP HMGP, US EPA, USDA Rural Utility Service, California State Water Resources Control Board Small Community Wastewater Grant, State revolving fund grants and/or loans	Hazardous Materials; Water Systems	High	Long-Term	Annual Implementation
8	Goal 1, Goal 3, Goal 4, Goal 5	Wildfire	Implement pipeline improvements identified in water master plans to provide adequate fire flows	CCWD Engineering Department	High	District revenue from rates, fees, property taxes, interest on investments, FEMA HMGP, Department of Housing and Urban Development Community Development Block Grant Program, USDA Rural Utility Service, State revolving fund grants and/or loans	Safety and Security; Water Systems	High	Long-Term	Annual Implementation
9	Goal 1, Goal 3, Goal 4, Goal 5	Wildfire	Strategic Wildfire Protection Improvements in Sheep Ranch and West Point Water Systems	CCWD Engineering Department	Very High	FEMA HMA HMGP, CCWD General Fund/Revenue for Match	Water Systems	High	Short-Term	In Progress
10	Goal 1, Goal 3, Goal 4, Goal 5	Avalanche, Multi-hazard, Flood, Wildfire, Volcano	Evaluate the need for improved redundancy at critical facilities	CCWD Engineering Department	Moderate	CCWD General Fund/Revenue from rates, fees, property taxes, interest on investments	Water Systems	High	Medium Term	Not Started
11	Goal 1, Goal 3, Goal 4, Goal 5	Wildfire, Severe Weather: Heavy Rain and Storms, Severe Weather: Wind	Create and maintain wildfire defensible spaces around facilities identified as in high fire hazard areas	CCWD Engineering Department	Little to No Cost	Staff Time – CCWD revenue from rates, fees, property taxes, interest on investments, FEMA HMP HMGP, US Forest Service Wildland-Urban Interface grants, CAL FIRE Wildfire Prevention	Safety and Security; Water Systems	Medium	Ongoing	Annual Implementation

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
						Grants Program, California State Fire Safe Council or local Fire Safe Council, State revolving fund grants and/or loans				
12	Goal 1, Goal 3, Goal 4, Goal 5	Drought and Water Supply, Flooding	White Pines Lake Storage Restoration Project	CCWD Engineering Department	Very High	FEMA HMA HMGP, DWR Urban Community Drought Relief Grant Program	Food, Hydration, Shelter; Water Systems	Medium	Long-Term	Not Started
13	Goal 1, Goal 3, Goal 4, Goal 5	Multi- Hazard	Participate in the Calaveras County Multi-Jurisdictional Hazard Mitigation Plan by the next 2025 Update Cycle	CCWD, Calaveras County	Moderate	FEMA HMA HMGP	Safety and Security; Food, Hydration, Shelter; Water Systems	Medium	Long-Term	Modified Action in 2023.
14	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought and Water Supply	Highway 4 Community Emergency Water Supply Feasibility Planning Study	CCWD Water Resources Department	High	DWR Urban Community Drought Relief Grant Program	Water Systems	Medium	Long-Term	Not Started
15	Goal 1, Goal 3, Goal 4, Goal 5	Avalanche, Wildfire, Severe Weather: Heavy Rain and Storms, Volcano	Construct Fire Resistant Electrical Control Panels	CCWD Engineering Department	Moderate	CAL FIRE Wildfire Prevention Grants Program,	Energy; Water Systems	Medium	Medium Term	Annual Implementation
16	Goal 1, Goal 3, Goal 4, Goal 5	Flood	Retrofit Manhole Covers	CCWD Engineering Department	Moderate	FEMA HMA HMGP	Water Systems	Medium	Long-Term	Annual Implementation
17	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought	Identify and incorporate strategies for increasing water storage capacity to mitigate impacts of drought and other emergencies in an updated CCWD County Water Master Plan	CCWD Water Resources Department	Moderate	CCWD General Fund/Revenue	Food, Hydration, Shelter; Water Systems	Low	Short-Term	Annual Implementation
18	Goal 1, Goal 3, Goal 4, Goal 5	Dam Failure	Dam Failure Emergency Planning –	CCWD Operations Department, Utica Water and Power	Low	FEMA HHPD Program	Food, Hydration, Shelter:	Low	Medium Term	Annual Implementation

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
			Regularly coordinate with dam owners and operations on dam evaluations, inspections, rehabilitation activities, and Emergency Action Plan updates				Energy; Water Systems			
19	Goal 1, Goal 3, Goal 4, Goal 5	Avalanche, Multi-hazard, Volcano	Develop mutual aid agreements with other water providers and county agencies for support during emergencies	CCWD, Utica Water and Power, Calaveras Public Utility District, City of Angels, Union Public Utility District	Little to No Cost	Staff Time, CCWD General Fund/Revenue	Water Systems	Low	Ongoing	Annual Implementation
20	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Multi-hazard, Wildfire	Electrical Grid and Electrical Vehicle Charging Station Implementation Project	CCWD Engineering Department, Calaveras County, Calaveras Council of Governments	High	FEMA HMA HGMP, BRIC, APGP	Water Systems	High	Long-Term	New Action in 2023
21	Goal 1, Goal 4, Goal 5	Flood	Penn Gulch Culvert	CCWD Engineering Department, Calaveras County Public Works Department	High	FEMA HMA HMGP	Water Systems	Medium	Short-Term	New Action in 2023
22	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought	Implementing Disinfection Byproducts (DBPs) Mitigation	CCWD Engineering Department, Water Resources Department	High	DWSRF	Water Systems	High	Medium Term	New Action in 2023
23	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Stormwater Management Regulations	Calaveras County Public Works Department	Moderate	General Fund, DWR Funds	Water Systems	High	Short-Term	New Action in 2023
24	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Critical Facility Consolidation Project	CCWD Engineering Department	High	FEMA HMA HMGP, USDA, DWSRF	Water Systems	High	Medium Term	New Action in 2023
25	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Flood	Evaluate Plan and Designs for Huckleberry Lift Station Flood Protection Project and Need for	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	High	Medium Term	New Action in 2023

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
			Elevation Equipment or Dry Floodproofing Measures to Address Flood and Dam Inundation Risk and Infiltration and Inflow (I&I) Issues Plan and Design							
26	Goal 2, Goal 3, Goal 5	Flood, Wildfire	Copper Cover Collections System Lift Station Consolidation Project	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	High	Medium Term	New Action in 2023
27	Goal 1, Goal 4, Goal 5	Flood, Wildfire	Cross Lake Pipeline Mitigation Project	CCWD Engineering Department	Moderate	FEMA HMA HMGP, General Funds	Water Systems	Medium	Long Term	New Action in 2023
28	Goal 1, Goal 3, Goal 4, Goal 5	Drought, Flood	Middle Fork of the Mokelumne River Infiltration Gallery and Pump Station Replacement Project	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	Medium	Long Term	New Action in 2023
29	Goal 2, Goal 4	Flood	Middle Fork Mokelumne River Transmission Pipeline Replacement	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems, Safety and Security	High	Long Term	New Action in 2023
30	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought, Flood, Severe Weather, Wildfire	Sheep Ranch Water System Replacement	CCWD Engineering Department	High	FEMA HMA HMGP, DWRSRF	Water Systems, Safety and Security	High	Long Term	New Action in 2023
31	Goal 1, Goal 2	Drought, Flooding (Localized Stormwater), Soil Hazards, Severe Weather	Jenny Lind WTP Infiltration Gallery Replacement Project	CCWD Engineering Department	Moderate	FEMA HMA HMGP, USDA DWSRF	Water Systems, Safety and Security	Medium	Medium Term	New Action in 2023
32	Goal 3, Goal 5	Drought, Flood, Severe Weather, Soil Hazards	White Pines Reservoir Cleaning and Capacity Plan	CCWD Engineering Department	Moderate	FEMA HMA HMGP	Water Systems	Medium	Long Term	New Action in 2023
33	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought	Storage Tank Rehabilitation	CCWD Engineering Department	High	FEMA HMA HMGP	Water Systems	Medium	Medium Term	New Action in 2023

ID	LINKS TO GOALS	HAZARD(S) MITIGATED	DESCRIPTION AND BACKGROUND/ BENEFITS	LEAD AGENCY AND PARTNERS	COST ESTIMATE	POTENTIAL FUNDING	FEMA LIFELINE	PRIORITY	TIMELINE	IMPLEMENTATION STATUS
34	Goal 1, Goal 4, Goal 5	Drought, Severe Weather, Wildfire	Wastewater Lift Station Hardening Projects	CCWD Engineering Department	High	FEMA HMA HMGP, BRIC	Water Systems	Medium	Medium Term	New Action in 2023
35	Goal 3, Goal 5	Drought, Flood, Severe Weather, Wildfire	Hunters Pump Station Improvement Project	CCWD Engineering Department	Moderate	FEMA HMA HMGP	Water Systems	High	Short Term	New Action in 2023
36	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought, Flood, Severe Weather, Wildfire	West Point Bummerville Reservoir Capacity Improvement Project	CCWD Engineering Department	Moderate	FEMA HMA HMGP, USDA DWSRF	Water Systems	High	Long Term	New Action in 2023
37	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5	Drought	West County Burson Area Groundwater Recharge Project	CCWD Engineering Department, San Joaquin Subbasin GSA	High	FEMA HMA HMGP, USDA DWSRF, DWR Urban Community Drought Relief Grant Program	Water Systems	High	Long Term	New Action in 2023
38	Goal 1, Goal 2, Goal 4, Goal 5	Avalanche, Multi Hazard, Severe Weather, Wildfire, Volcano	CCWD Intertie Projects	CCWD Engineering Department, Utica Water and Power, Calaveras Public Utility District, City of Angels, Union Public Utility District	High	FEMA HMA HMGP, General Funds	Water Systems, Safety and Security	High	Long Term	New Action in 2023

KEY:

Cost Estimate

- Little to no cost
- Low: Less than $10,000
- Moderate: $10,000 – $100,000
- High: $100,000 – $1,000,000
- Very High: More than $1,000,000

*Specific cost estimate information is provided, if available.

Potential Funding

- FEMA HMA HMGP – Hazard Mitigation Assistance Hazard Mitigation Grant Program.
- BRIC – Building Resilient Infrastructure and Communities Grant.
- HHPD – High Hazard Potential Dam Grant.
- US Forest Service Wildland-Urban Interface (WUI) Grants – Funds to mitigate risk from wildland fire within the Wildland Urban Interface (WUI) that are awarded annually.
- USDA DWSRF – Program that help water systems finance infrastructure improvements to ensure compliance with drinking water standards and public health objectives.
- CAL FIRE Fuel Reduction Activity Funding – Funds projects in and near fire threatened communities to improve public health and safety while reducing GHG emissions.
- DWR Urban Community Drought Relief Grant Program – Grant program designed to strengthen drought resilience and better prepare communities for dry conditions.

- APGP – California funding to local, regional, and tribal communities in integrated climate adaptation planning; supports climate-resilient projects in California.

<u>FEMA Community Lifelines</u>

- Safety and Security
- Food, Hydration, and Shelter
- Health and Medical
- Energy
- Communications
- Transportation
- Hazardous Materials
- Water Systems

<u>Timeline</u>

- Short-Term: 1-2 years
- Medium Term: 3-5 years
- Long-Term: 5+ years
- Ongoing: Action is implemented every year

1 Implement and Expand Fuel Breaks

Mitigation Project Title	Implement and expand fuel breaks to reduce wildfire hazards at CCWD properties.
Project Description, Issue/Background	Throughout Calaveras County, the District's facilities and properties are located within areas of substantial risk of wildfire. This includes areas adjacent to state and federally managed lands. Because the District is a large landowner in the county and is responsible for multiple facilities associated with the protection of human health and safety, it is prudent to implement fuel breaks on District property where feasible. Also, the District would ensure all facilities maintain the recommended 100-foot defensible space to reduce potential for losses during a fire. CDF fire crews or California Conservation Corps crews may be available to complete work. Further, as CCWD facilities are often adjacent to state and federal manage lands the District should coordinate with state and federal agencies responsible for wildfire prevention activities including fuel breaks and defensible space maintenance. Allowing for these agencies to coordinate and access strategically located CCWD properties to establish fuel breaks is vital to the protection of critical infrastructure and assets. This 2018 mitigation action was carried forward to the current plan. Fuel breaks should be strategic in terms of level of risk and vulnerability of key facilities to potential wildfire. While progress is being made, the area around White Pines Barn is a hazard
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Wildfire/ Safety and Security
Goals(s) Addressed	Goal 1, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Operations
Partners	US Forest Service Calaveras County
Potential Funding	Sierra Nevada Conservancy Forestry Management implementation grants, US Forest Service Non-Federal Lands Hazard-Fuel Reduction Funding, CalFIRE Fuel

	Reduction Activity Funding, California Disaster Assistance Act, FEMA HMA HMGP
Cost Estimate	Unknown
Benefits (Avoided Losses)	Reduce loss of water and sewer services for major population centers in Calaveras County and maintain lower risk of future damages to critical infrastructure of the CCWD.
Timeline	Ongoing

2 Hardening of Water and Wastewater Facilities

Mitigation Project Title	Hardening of water and wastewater facilities (and associated electrical and SCADA communication systems) against wildfire and other severe weather hazards.
Project Description, Issue/Background	The CCWD has many pump stations, treatment plants, and other water and sewer facilities critical to maintaining water and sewer service. The subject facilities serve communities at risk to wildfire that are located near the wildland urban interface. In many cases facilities are not constructed of fire-resistant materials, lack necessary retrofits and upgrades, have limited defensible space, and are surrounded by vegetation fuels. Damage to these facilities can result in a loss of potable water or sewer service for an extended period. Often electrical, SCADA, radio and communication systems are located outdoors in unprotected electrical panels/enclosures that are highly vulnerable to wildfire. Some facilities also lack recent upgrades to roofs, windows, siding materials, and other building infrastructure, as well as adequate insulation. The mitigation action would involve hardening the facilities against the threat of wildfire and severe weather events related to wind by adding concrete, masonry, steel or other ignition resistant materials. It would involve adding construction materials related to bracing to strengthen external infrastructure and improve insulation (pipe wrapping) to ensure generators operate during winter storms and during power outages. This mitigation action would also involve retrofitting the facilities (specifically buildings) with new construction materials to minimize damage from severe weather, winter storms, hail, and lightning. Specific retrofits may include installing structural bracing, shutters, laminated windowpanes, and hail-resistant roof coverings and siding. The facilities identified are: a) Big Trees #1 Water Pump Station, b) Big Trees 4&5 Water Pump Station, c) Dorrington Water Pump Station, d) Forest Meadows Larkspur Water Pump Station, e) Forest Meadows Sewer Treatment Plant (wood frame buildings), f) Forest Meadows and Hwy 4, Sewer Lift Stations, g) Arnold Sewer Lift Stations #1 and #2 (wood frame buildings), and others. The Timber Trails Tank is also vulnerable.
Hazards Mitigated/ Lifelines Addressed	Avalanche, Wildfire, Severe Weather: Winter Storms and Extreme Cold, Severe Weather: Heavy Rain and Storms Severe Weather: Wind, Volcanoes/ Water Systems; Energy

(include all that apply)	
Goals(s) Addressed	Goal 1, Goal 2, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering and Field Operations Staff
Partners	None
Potential Funding	FEMA HMA HMGP
Cost Estimate	$4,000,000
Benefits (Avoided Losses)	The benefits are based primarily upon the losses avoided in terms of potable water and sewer service and replacement costs for the damaged facilities.
Timeline	Ongoing

3 Implement Facility Flood Mitigation Projects

Mitigation Project Title	Implement other facility flood mitigation projects.
Project Description, Issue/Background	Prepare an alternatives report and select preferred alternatives for each location. Prepare planning documents and implement as required. Identify other facility flood mitigation projects throughout the District and implement as needed. CCWD input also indicated that Huckleberry has infiltration and inflow (I&I) improvement issues that need to be addressed. Lift stations in Copper and Ebbetts Pass also need to be improved for flood mitigation. Other projects that may be considered under this action include the Hunter's Reservoir Raw Water Supply Mitigation Project. This project is related to possible inundation of the McKay's reservoir on the North Fork Stanislaus River that has been impacted by landslides in its watershed, which is the primary raw water source for Arnold, Murphys and Angels Camp. The backup water source for Ebbetts Pass is Hunter's Reservoir. The existing raw water pump station is located near the toe of the dam, adjacent to the spillway. As part of this flood mitigation project, the electrical systems will be relocated and elevated to a building on the north side of the dam.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood/ Water Systems
Goals(s) Addressed	Goal 1, Goal 3, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering and Operations
Partners	Other Water Agency Partners
Potential Funding	FEMA HMA HMGP
Cost Estimate	Unknown
Benefits (Avoided Losses)	Increased life safety and property protection and safeguard the potable water supply.
Timeline	Ongoing

4 Replace Redwood Storage Tanks

Mitigation Project Title	Replace remaining redwood water storage tanks.
Project Description, Issue/Background	Replace remaining redwood water storage tanks with fire resistant steel tanks in high fire hazard zones where redwood tanks and potable water supply are at significant risk to wildfire and no alternate potable water source is readily available. The following list of existing redwood tanks are identified for mitigation projects: • Big Trees Tanks 4, 5 and 8, Dorrington, CA (a.k.a. Big Trees North Zone) • Bummerville Tank, West Point, CA • Copper Cove Tank 'B', Copperopolis, CA • Heather Drive Tank, Forest Meadows, CA • Meadowmont #13, Arnold, CA • Timber Trails, Avery, CA The remaining redwood tank that is vulnerable to wildfire is Timber Trails in Avery, CA in the Ebbetts Pass Water System. The rest of the storage tanks have been completed.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Wildfire/ Food, Hydration, Shelter; Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	TBD
Cost Estimate	$300,000 for Timber Trails
Benefits (Avoided Losses)	FEMA HMA HMGP, DWR Proposition 84
Timeline	Ongoing

5 Improve Grading and Drainage of Wastewater Effluent Storage Ponds

Mitigation Project Title	Improve grading and drainage of wastewater effluent storage ponds.
Project Description, Issue/Background	CCWD owns and operates 12 sewer facilities that treat wastewater for 50 to 4,000 people depending on the system. Peak wet weather flows can cause inflow and infiltration problems as well as flooding of the effluent ponds, especially during wet winters when excessive winter storage at the wastewater treatment plant(s) can cause dam failures of the treatment ponds. These projects reduce runoff and improve storage and WWTP operations. The mitigation action also related to other projects. Atmospheric river (AR) storms and high intensity drainage and concentrated runoff cause localized flooding in drainages and steams and causing high levels of I&I into the sewer collection systems and wastewater treatment and effluent storage facilities. Additional surface drainage and runoff inundate culverts, drainages, and washout access roads in our facilities. Without mitigation, these high intensity flows can overwhelm facilities. This includes all CCWD sewer service areas: a) Copper Cove, b) La Contenta, c) Arnold, d) Vallecito/Douglas Flat, e) Six-Mile Village, f) West Point, g) Wallace, h) Southworth, and i) other areas. Potential mitigation measures may include: 1) improving road drainages and culverts, 2) re-grading surface sheds immediately adjacent to facilities to re-direct localized drainage, 3) subsurface waterproofing of facilities to prevent underground infiltration into ponds, manholes, wet wells and other structures, 4) waterproofing manholes and raising the levels of manholes grade rings to elevate them above localized flooding levels, 5) increasing the capacity of emergency overflow tanks at sewer lift station or equivalent mitigation of pumping systems to handle high levels of infiltration and inflow.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood/ Hazardous Materials; Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering and Operations

Partners	None
Potential Funding	TBD
Cost Estimate	$5,000,000
Benefits (Avoided Losses)	Reduced risk of infiltration of flood waters to the wastewater ponds, which could cause an effluent spill.
Timeline	Master Plans have been updated and CCWD staff will identify critical recommendations regarding these facilities. Ongoing since previous plan.

6 Enhance On-Site Coordination with CAL FIRE during Fire Events

Mitigation Project Title	Enhance on-site coordination with CAL FIRE during fire events.
Project Description, Issue/Background	Contact information through the Multiple Agency Coordination Committee, (aka MAC Group). There may be times during fire emergencies when CCWD's resources are overwhelmed in terms of staff and support. Quick response to emergencies and restoration of services is vital to protect public health and assist with community disaster recovery. This action seeks to establish contact procedures and information through the Multiple Agency Coordination Committee and related public safety organizations. Calaveras County OES has taken the lead on this mitigation action and make great progress and the CCWD takes an active role when an Emergency Operations Center (EOC) is propped up and often acts as the subject matter expert in the EOC for water and wastewater.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Wildfire/ Safety and Security; Water Systems
Goals(s) Addressed	Goal 1, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering, Calaveras County OES
Partners	CAL FIRE
Potential Funding	TBD
Cost Estimate	Unknown
Benefits (Avoided Losses)	Enhanced protection of CCWD facilities from wildfire.
Timeline	Short-Term

7 Implement Critical Sewer Facilities Recommendations in Service Area Master Plans related to Critical Sewer Facilities

Mitigation Project Title	Implement recommendations in service area master plans related to critical sewer facilities.
Project Description, Issue/Background	CCWD owns and operates 45 sewer lift stations in their 12 wastewater systems. Many lift stations are located near water bodies used for recreational activities including full-body contact. One example is Lake Tulloch, where CCWD has 30 lift stations within a few feet from the lake. These stations can convey up to 100,000 gallons of raw sewage each day. Heavy rainfall and flooding create I&I in the collection system exacerbating the quantity of sewage these stations must pump. It is imperative that the public be protected from overflows from these lift stations. A recent state regulation requires collection system operators to reduce overflows and spills from their systems or face mandatory monetary penalties. Six of the largest sewer systems master plans have been completed. Computer modeling of collection systems was conducted to determine adequacy for current and future flows. Many were found to be deficient, and recommendations were made for the improvements needed to bring them up to capacity.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood/ Hazardous Materials; Water Systems
Goals(s) Addressed	Goal 1, Goal 3, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMP HMGP, US EPA, USDA Rural Utility Service, California State Water Resources Control Board Small Community Wastewater Grant, State revolving fund grants and/or loans
Cost Estimate	$7,900,000
Benefits (Avoided Losses)	Benefits include protecting public safety and the environment and access to recreational activities in rivers and lakes, avoiding mandatory fines due to overflows and

	spills, and reducing revenue losses due to closures of recreational areas (not CCWD revenue).
Timeline	Long-Term

8 Implement Pipeline Improvements

Mitigation Project Title	Implement pipeline improvements identified in water master plans to provide adequate fire flows.
Project Description, Issue/Background	CCWD owns and operates six potable water systems in the county. Recently, master plans have been prepared for the four largest systems: Copper Cove, Ebbetts Pass, Jenny Lind, and West Point. In each system, the computer models identified zones of inadequate fire flow in the distribution systems. Most of the systems were installed when 500 gallons per minute (gpm) was considered adequate flow. By today's standards that flow is inadequate; today's fire experts recommend at least 1,000 gpm fire flow. Particularly in the West Point system, but also to smaller degrees in the other three systems, it was found that the system does not even deliver CCWD's own standard of 500 gpm. This lack of fire flow is a threat to the safety of the West Point residents and is also curbing the development of the business section of downtown West Point. County planners will not approve the construction of buildings, residential or commercial, in areas of inadequate fire flows.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Wildfire/ Safety and Security; Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	District revenue from rates, fees, property taxes, interest on investments, FEMA HMGP, Department of Housing and Urban Development Community Development Block Grant Program, USDA Rural Utility Service, State revolving fund grants and/or loans
Cost Estimate	$2,600,000
Benefits (Avoided Losses)	Benefits include ensuring adequate fire flow for the protection of lives and property from fire, providing for community development, and protecting public health and safety.
Timeline	Long-Term

9 Strategic Wildfire Protection Improvements for Sheep Ranch and West Point Water Systems

Mitigation Project Title	Strategic wildfire protection improvements in Sheep Ranch and West Point water systems.
Project Description, Issue/Background	The isolated water systems in the communities of West Point and Sheep Ranch, two CCWD service areas located in the northern and southern boundaries of the heart of Calaveras County, are strategically positioned to provide public water supplies to combat catastrophic wildfires. However, existing infrastructure is inadequate to store and deliver the quantities of water necessary to support firefighting efforts in large-scale wildfire. As evidence during the recent Butte Fire, these limitations seriously hamper the ability of first responders to fight the fire's progression and protect the community because the water tenders are not able to extract the necessary water from the limited capacity of these systems. Without functioning fire hydrants or available water storage in Sheep Ranch, for example, fire tenders were forced to travel winding, mountain roads to fill their tanks with water from the nearest public water supply miles away. With improvements to CCWD's existing infrastructure at Sheep Ranch, however, ample supplies would be immediately available to fire personnel without the delay and danger experienced today. Likewise, existing infrastructure at West Point cannot deliver sufficient water supplies to meet the needs of first responders battling a ravaging fire. Unfortunately, the limited financial resources of these extremely disadvantaged communities are insufficient to realize these improvements. Specific improvements include: • West Point Water System: Replacement of approximately 6,000 linear-feet (lf) of 4 inch and 2,000 lf of 3 inch of raw water transmission pipeline from the Middle Fork Mokelumne River to CCWD's Regulating Reservoir that supplies the West Point water system and increased pumping capacity at the associated intake by installation of a larger pump (700 gallons per minute). • Sheep Ranch Water System: Improvements to raw water storage, transmission facilities, potable water storage, and distribution facilities, including: • Replacement of antiquated, leaky pipeline from White Pines Lake to Sheep Ranch diversion. • Construction of new pump station at diversion point with fire flow pump and backup generator. • Installation of new 250,000-gallon storage tank.

	• Replacement of existing water distribution system including installation of functioning fire hydrants. (Existing water system, with non-functioning hydrants, cannot meet fire code standards.) In summary, the entire water system needs replacement and more reliable raw storage, a new WTP, and new distribution system and tanks of adequate size for fire protection. Replacement and upgrading at Sheep Ranch Diversion and the pipeline from diversion to the Water Treatment Plant must also occur to protect against natural disasters. The CCWD also needs to increase the pipe size for fire protection volume and expand on the fire tank system and providing more hydrants. The CCWD is currently working with R.O.P. to expand their system and increase protection on Fricot City Road given the number of wildfires in this area.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Wildfire/ Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP, CCWD General Fund for Match
Cost Estimate	$6,500,000- The West Point Project would be estimated at approximately $2,500,000 according to CCWD's 2018 Draft West Point Water Supply Master Plan. Improvements to the Sheep Ranch Facilities could exceed $4,000,000.
Benefits (Avoided Losses)	The benefits are based primarily upon the losses avoided in terms of potential widespread damage to communities and homes in these service areas.
Timeline	Short-Term

10 Improved Redundancy Evaluation at Critical Facilities

Mitigation Project Title	Evaluate the need for improved redundancy at critical facilities.
Project Description, Issue/Background	CCWD owns and operates 6 water and 12 sewer facilities that deliver drinking water and provide fire flow to 100 to 13,000 people and treat wastewater of 50 to 4,000 people, depending on the system. Redundancy of critical processes at these facilities can avoid outages and loss of services during emergencies. The extent of redundancy and need for improvements are currently unknown. This mitigation action applies to a couple of locations: 1) the potable water system intertie between the West Point and Wilseyville System only occurs at one location, (i.e., a water main embedded into the diversion dam at the Middle Fork Pump Station site). This intertie will be lost in the event that the dam becomes washed out by a significant flood event. It is proposed to complete a second water distribution loop crossing the Hwy 26 bridge and extending a water main on Railroad Flat Road to connect to the existing system on June Avenue 2) In Copperopolis, CA the east side of Lake Tulloch (Poker Flats, Conners Estates, etc.) is served by a single submerged potable water line crossing Lake Tulloch. The integrity of this pipeline is at risk in the event of any natural disasters (wildfire, flooding, erosion, debris flows, etc.). The operation and repair of the submerged pipeline is very complicated and requires unusual construction methods and equipment and costly labor for divers, which are not conducive to emergency repairs. CCWD has proposed construction of a redundant pipeline on O'Byrnes Ferry Road to mitigate the risk.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Avalanche, Severe Weather Heavy Rain, Storms, Lighting, Hail, Tornado, and Wind, Earthquake, Flood, Volcano/Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Operations Department
Partners	None
Potential Funding	District revenue from rates, fees, property taxes, interest on investments
Cost Estimate	$10,000

Benefits (Avoided Losses)	This action results in improved reliability of water delivery and sewer conveyance facilities and the protection of public health and safety.
Timeline	Medium Term

11 Maintain Wildfire Defensible Spaces around Facilities in High Fire Hazard Areas

Mitigation Project Title	Create and maintain wildfire defensible spaces around facilities identified as in high fire hazard areas
Project Description, Issue/Background	The risk assessment indicates that much of Calaveras County is at high to very high wildfire risk due to vegetative fuels, topography, and weather. Damaging fires are likely to occur each year. The risk assessment also showed many of CCWD's facilities to be in high fire hazard areas; the operations of these facilities are critical lifeline utilities for the public and critical for fire protection. Maintaining the recommended 100-foot defensible space around facilities will reduce potential for losses during a fire. This defensible space would also limit the spread of wildfires that ignite from lightning strikes and remove trees that could fall and damage structures during windstorms. CDF fire crews or California Conservation Corps crews may be available to complete work. Occurs – but need to reaffirm what the consideration of an adequate defensible space is – may not be feasible in areas where the District only has an easement – or may require extensive coordination with the neighbors
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Wildfire, Severe Weather: Heavy Rain and Storms, Severe Weather: Wind/ Safety and Security; Water Systems
Goals(s) Addressed	Goal 1, Goal 3, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Operations Department, CCWD Administration Department
Partners	US Forest Service, California Fire Safety Councils, CAL FIRE
Potential Funding	Staff Time – District revenue from rates, fees, property taxes, interest on investments, FEMA HMP HMGP, US Forest Service Wildland-Urban Interface grants, California State Fire Safe Council or local Fire Safe Council, State revolving fund grants and/or loans
Cost Estimate	Staff Time
Benefits (Avoided Losses)	This mitigation will reduce risk of damage or destruction to facilities due to wildfire and reduce risk of loss of services to customers and for fire protection.
Timeline	Ongoing

12 San Antonio Creek/White Pines Lake Flood Restoration Project

Mitigation Project Title	White Pines Lake Storage restoration project
Project Description, Issue/Background	In 2017, CCWD completed a bathymetric survey of the White Pines Lake water storage reservoir located in Arnold. White Pines Lake is the sole source of water supply for the community of Sheep Ranch. The bathymetric survey determined that the reservoir had lost 40% of capacity since it was constructed in 1965. Several known events in high flow water years including 1996/97 and 2016/17 have deposited eroded upstream sediments in the reservoir. In 2016/17, an entire road upstream of the reservoir overwhelmed a historical bridge culvert and washed tons of sediment downstream into the District's water supply storage reservoir. The diminished capacity of the reservoir has created water supply issues in prolonged drought, and water was required to be trucked into the community of Sheep Ranch during the droughts in the 2000s. Additionally, the diminished capacity increases the risk of localized flooding near the reservoir during high flow events. This is an expensive project, but key to a long-term reliable supply of SA Creek water to Sheep Ranch. The CCWD is still waiting on the Sheep Ranch Water System assessment completed by Lumos Associates. This mitigation action also needs to be more specific as to the risk. This project was previously referred to as the White Pines Lake Storage Project and renamed the San Antonio Creek / White Pines Lake Flood Mitigation Project. This would include repair/rehabilitation of upstream spillway (between Mill Pond and White Pines Lake) and other measures to mitigate hydraulics due to atmospheric river storms. The project is also pending potential water right issues. Grant funding for water storage rehabilitation may also be available.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought and Water Supply, Flooding/ Food, Hydration, Shelter; Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Engineering Department

Partners	None
Potential Funding	None
Cost Estimate	$4,000,000
Benefits (Avoided Losses)	Limit water supply interruptions for Sheep Ranch, provide a more robust emergency surface water supply for fire suppression supply in an area prone to wildfires, and reduce risk of flooding for homes and District facilities near the lake.
Timeline	Long-Term

13 Participate in the Calaveras County Multi-Jurisdictional Hazard Mitigation Plan by next 2025 Update Cycle

Mitigation Project Title	Participate in the Calaveras County Multi-Jurisdictional Hazard Mitigation Plan by the next 2025 Update Cycle.
Project Description, Issue/Background	Many other water and wastewater utilities within Calaveras County do not currently have Local Hazard Mitigation Plans in place. Several agencies have participated on the District's Hazard Mitigation Planning Committee (HMPC) and the District feels adjacent facilities operated by other agencies may be better served by a multi-jurisdictional planning effort. Currently, the County has a broad Local Hazard Mitigation Plan used for specific needs. The HMPC identified a multi-jurisdictional plan as a desired effort to be established in the future. The CCWD plans to participate in the Calaveras County MJHMP by the next plan update anticipated in 2024 or 2025
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Dam failure, Drought, and Water Shortage, Earthquake, Extreme Heat, Flood, Landslides and Debris Flows, Subsidence, Tornado and Wind, Wildfires, Winter Storms and Extreme Cold/ Safety and Security; Food, Hydration, Shelter; Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Water Resource Department, Calaveras County OES
Partners	Calaveras County OES
Potential Funding	FEMA HMA HMGP
Cost Estimate	$50,000
Benefits (Avoided Losses)	A multi-jurisdictional coordinated plan could better integrate all the critical facilities in the County and prevent loss of life, provide protection of public, health, and safety facilities, and enhance emergency planning.
Timeline	Medium Term

14 Highway 4 Community Emergency Water Supply Study

Mitigation Project Title	Feasibility planning study for Highway 4 community emergency water supply.
Project Description, Issue/Background	The majority of the Stanislaus River water supplies for the communities of Murphys, City of Angels and surrounding vicinities are supplied from a single point of delivery via an underground rock bored tunnel that is part of the North Fork Hydroelectric Project. In the case of an emergency interruption or failure, these communities could be in serious danger due to water shortages for unknown periods of time without an alternative point of delivery. An emergency alternative water supply feasibility planning study for the Highway 4 community would outline alternative sources of water supply for these communities. There is some thought to implement this action through potential agreements with the North California Power Agency (NCPA) and neighboring agencies. For example: Second Tunnel tap. Inter-tie with BLS. The CCWD needs to get water to Mill Creek. Utica is currently funding a planning effort on this front and could be another planning partner.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Avalanche, Drought and Water Supply, Volcano/ Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Engineering Department, Water Resources Department
Partners	Other Local Agencies, NCPA, Utica Water and Power
Potential Funding	TBD
Cost Estimate	$300,000
Benefits (Avoided Losses)	Feasibility will determine construction projects that may mitigate serious interruptions in water supply for large population centers in the County and protect public health and safety. This could be a multi-jurisdictional project.
Timeline	Long-Term

15 Fire Resistant Electrical Control Panels

Mitigation Project Title	Construct fire resistant electrical control panels.
Project Description, Issue/Background	The District has several facilities (water treatment plants, pump stations, wastewater facilities and lift stations) that require 24-hour service. Some of these facilities are in high fire severity zones. It is the District's responsibility to keep service operating during all types of weather and hazards. By protection the electrical control panels with fire resistant control panels and lightning protection devices and methods, among other grounding infrastructure, the District can keep services going to our customers. This project was carried over from the 2018 LHMP and not yet complete. This project is also similar to the hardening of critical facilities, as noted in Mitigation Action #2.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Wildfire, Severe Weather: Heavy Rain and Storms, Volcano/ Energy; Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP
Cost Estimate	Unknown
Benefits (Avoided Losses)	The primary benefits are safeguarding the potable water supply and reducing or eliminating wastewater spills or overflows. Protects public health, safety, and the environment.
Timeline	Medium Term

16 Retrofit Manhole Covers

Mitigation Project Title	Retrofit manhole covers.
Project Description, Issue/Background	Reduce the amount of peak wet weather flow entering the District's wastewater conveyance system. I/I flows contribute to sewer system overflows into local homes and region's waterways, negatively impacting public health and the environment. Retrofitting manhole covers would control infiltration and inflow into the manholes, which end up at the wastewater treatment plant(s) where it must be treated like sewage, resulting in high treatment costs. Also, I/I creates overflows of the manholes, where it can get into waterways and homes. The peak wet weather flows also cause problems with winter storage at the wastewater treatment plant(s), which can create dam failures of the treatment ponds. Some of the manhole covers have been completed since the 2018 LHMP; this is also similar to Mitigation Action #5.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood – 100/500-year Flood, Localized Stormwater Flooding
Goals(s) Addressed	Goal 2, Goal 3, Goal 5
Priority (High, Medium, Low)	Low
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	TBD
Cost Estimate	$25,000
Benefits (Avoided Losses)	Reduced risk to localized flooding to property, as well as increased traffic safety.
Timeline	Medium Term

17 Increase Water Storage Capacity to Mitigate Drought Impacts and Other Emergencies in Water Master Plan Update

Mitigation Project Title	Identify and incorporate strategies for increasing water storage capacity to mitigate impacts of drought and other emergencies in an updated CCWD County Water Master Plan.
Project Description, Issue/Background	CCWD's County Water Master Plan is 20 years old. There are many strategies recommended in this plan. Some are related to communications between local agencies, whereas others focus on policy issues and feasibility studies. An updated comprehensive analysis is needed to address changing conditions and ensure a high reliability water supply for the future. The updated plan will review the status of accomplished feasibility studies, assess new priorities, include measures to maintain and enhance interagency communications, and incorporate strategies to increase the district's and community's disaster resistance. Related projects include the Bummerville Regulating Reservoir Capacity increase and Burson Area Recharge Project. Other project may include: 1) In extreme droughts, the community of West Point experiences raw water supply issues. Options were presented in a supply study prepared by consultants (KASL and ECORP). As one option I have an active application with Cal OES and under review by FEMA to increase the capacity of the Bummerville Regulating Reservoir from 50-AF to 150-AF, which would allow CCWD to capture increased diversions from Bear Creek. As a second option, CCWD has previously looked at increasing the size of the raw water pipeline from the Middle Fork to the Water Treatment Plant which is intertied with the Regulating Reservoir. This would fix a bottleneck in the amount of water that can be diverted from the Middle Fork that is currently limited to about 200-gpm. In the hottest summer months, the community water demands exceed available raw water supply. 2) The West County area is served by primarily groundwater wells including many private wells. CCWD has two active wells in this area serving the community of Wallace. This is in the Eastern San Joaquin Groundwater Basin that is in a state of critical overdraft. Increasing frequency, severity and duration of droughts limits natural groundwater recharge of the aquifer. CCWD is tasked with implementing a mitigation effort to correct declining groundwater supplies through recharge projects or other mitigation efforts. CCWD has

	submitted an application with Cal OES for further analysis and development of a preferred solution. Alternatives are to dredge Mill Pond and White Pines Lake.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought/ Food, Hydration, Shelter; Water Systems
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	Low
Responsible Office/ Agency	CCWD Administrative Department
Partners	None
Potential Funding	CCWD General Fund
Cost Estimate	$50,000 to $100,000
Benefits (Avoided Losses)	Reduces vulnerability to drought and ensures future water supply needs.
Timeline	Short-Term

18 Dam Failure Emergency Planning – Regularly coordinate with dam owners and operations on dam evaluations, inspections, rehabilitation activities, and Emergency Action Plan updates

Mitigation Project Title	Dam Failure Emergency Planning – Regularly coordinate with dam owners and operations on dam evaluations, inspections, rehabilitation activities, and Emergency Action Plan updates
Project Description, Issue/Background	The State of California Division of Safety of Dams recommends that an EAP be developed for dams, which in the event of failure, or uncontrolled release, could endanger downstream life or property. Once developed, the EAP should be regularly updated and exercised. The CCWD needs to review High-Hazard Dam EAPs and work to develop an internal emergency document built off the HH EAPs. Wilson Dam/Lake is located on Winton Road in West Point, California. This is a small in stream earthen dam on Bear Creek. The recurrence of AR storms and high stream flows will continue to deteriorate the dam. A dam failure is likely to inundate downstream areas. The dam will be unable to safely sustain repeated high intensity runoff and hydraulic flows. CCWD is proposing to conduct a dam failure analysis and develop preferred mitigation action, either removal or reconstruction.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Dam Failure/ Food, Hydration, Shelter: Energy; Water Systems
Goals(s) Addressed	Goal 1, Goal 2
Priority (High, Medium, Low)	Low
Responsible Office/ Agency	CCWD Operations Department
Partners	Dam Owners and Operators
Potential Funding	TBD
Cost Estimate	$75,000
Benefits (Avoided Losses)	Dam safety
Timeline	Medium Term

19 Develop Mutual Aid Agreements

Mitigation Project Title	Develop mutual aid agreements with other water providers and County agencies for support during emergencies
Project Description, Issue/Background	There may be times during an emergency or disaster when CCWD resources are overwhelmed-in terms of staff and equipment. While CCWD is an active participant in the countywide Multi-Agency Coordinating Committee (MAC) and receives support from them, no formal mutual aid agreements exist with other county or regional water/sewer service providers. Quick response to emergencies and restoration of services is vital to protect public health and allow for community disaster recovery. This action seeks to develop mutual aid agreements with the Tuolumne Utilities District and Amador Water Agency, neighboring countywide agencies, and with WARN, the statewide emergency response network. These mutual aid agreements are ongoing for the vast majority. CCWD is also providing mutual aid mostly due to the smaller size and limited resources of the other entities.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Avalanche, Heavy Rain and Storms, Lightning, Hail, Dam Failure, Drought and Water Storage, Flood, Levee Failure, Earthquake, Wildfire, Volcano/ Water Systems
Goals(s) Addressed	Goal 1, Goal 4, Goal 5
Priority (High, Medium, Low)	Low
Responsible Office/ Agency	CCWD Field Operations
Partners	None (additional water agency partners need to be identified)
Potential Funding	Staff Time, CCWD General Fund
Cost Estimate	Little to No Cost
Benefits (Avoided Losses)	These agreements improve timeliness of restoring services following emergencies, which will allow communities and businesses to recover more quickly and protect public health and safety.
Timeline	Ongoing

20 Electric Grid & Electric Vehicle Charging Station Implementation Project

Mitigation Project Title	Electrical Grid and Electrical Vehicle Charging Station Implementation Project
Project Description, Issue/Background	An electrical grid and electrical vehicle (EV) charging station will improve the electrical grid reliability and installations of EV charging stations will improve emergency response during natural disasters exacerbated by climate change.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Climate Change, Dam Failure, Drought, Severe Weather: Heavy Rain and Storms, Lightning, Hail, Flood, Levee Failure, Earthquake, Wildfire
Goals(s) Addressed	Goal 1, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Field Operations
Partners	Calaveras County, Calaveras Council of Governments
Potential Funding	FEMA HMA BRIC, Adaptation Planning Grant Program (APGP)
Cost Estimate	$5,000,000
Benefits (Avoided Losses)	An Electric Grid & EV Charging station will enhance climate resiliency in the County and within CCWD Operations during emergencies and promote climate-resilient infrastructure.
Timeline	Ongoing

21 Penn Gulch Culvert

Mitigation Project Title	Penn Gulch Culvert
Project Description, Issue/Background	The CCWD will upsize the culvert at the intersection of Penn Gulch and Indian Rock Vineyards. The existing culvert is 24 x 30 feet.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood
Goals(s) Addressed	Goal 1, Goal 4, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Field Operations
Partners	Calaveras County Public Works Department
Potential Funding	General Fund
Cost Estimate	$200,000
Benefits (Avoided Losses)	Provides access to Indian Rock Vineyards WWTP and improves health outcomes.
Timeline	Short-Term

22 Implementing Disinfection Byproducts (DBPs) Mitigation

Mitigation Project Title	Implementing Disinfection Byproducts (DBPs) Mitigation
Project Description, Issue/Background	Drinking water must be disinfected to treat microbial pathogens like bacteria, viruses, and parasites. Disinfection byproducts (DBPs) are formed when disinfectants like chlorine interact with natural organic materials in water, such as chlorinated drinking water. Byproducts, if consumed in excess of the US EPA's maximum contaminant level over many years, may increase health risks. The US EPA has therefore developed Disinfection Byproduct Rules (DBPR) to limit exposure to these DBPs.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Climate Change, Flood, Drought, Severe Weather, Extreme Heat (specific natural hazard cause is still being investigated)
Goals(s) Addressed	Goal 1, Goal 4, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Field Operations
Partners	US EPA
Potential Funding	Drinking Water Stake Revolving Fund (DWSRF)
Cost Estimate	Unknown
Benefits (Avoided Losses)	Improves water quality and ensures health risks are minimized if DBPs are monitored and when underlying natural causes are better understood in local water systems.
Timeline	Medium Term

23 Stormwater Management Regulations

Mitigation Project Title	Stormwater Management Regulations
Project Description, Issue/Background	Streambeds are overtopping during large storms. This management plan would mitigate forms of stream detention, flooding out of residential areas along the floodplain, and prevent future issues.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	County Public Works Department
Partners	None
Potential Funding	DWR Funds
Cost Estimate	$200,000
Benefits (Avoided Losses)	Improves water quality and ensures health risks are minimized.
Timeline	Short-Term

24 Critical Facility Consolidation Project

Mitigation Project Title	Critical Facility Consolidation Project
Project Description, Issue/Background	This project would consolidate a number of wastewater lift stations and aboveground tanks in moderate to high FHSZs to mitigate the systems exposure to risk and failure.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Climate Change, Drought, Flood, Landslides, Soil Hazards Wildfire
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP, BRIC, USDA, DWSRF
Cost Estimate	$10 Million
Benefits (Avoided Losses)	Avoids impacts to critical facilities associated with flooding and fire hazards given there will be fewer facilities through consolidation.
Timeline	Medium Term

25 Evaluate Plans and Designs for Huckleberry Lift Station Flood Protection Project and Need for Equipment Elevation or Dry Floodproofing Measures to Address Flood and Dam Inundation Risk and Infiltration and Inflow (I&I) Issues

Mitigation Project Title	Huckleberry Flood Protection Project
Project Description, Issue/Background	The Huckleberry Lift Station Flood Protection project is designed to mitigate flood risk from dam inundation; the Huckleberry Lift Station is also located near the floodplain. The CCWD indicated that the Huckleberry Lift Station has infiltration and inflow (I&I) improvement issues that need to be addressed (see Mitigation Action 3). This action would involve evaluating the need for design and engineering plans for the lift station to reduce flood inundation risk and I&I issues. Two techniques for reducing flood damage to this essential water facility may be elevating equipment and dry floodproofing the facility. Lift station equipment may be elevated above the highest anticipated flood elevation (based on dam inundation studies, if available), or to the elevation of the 0.2% annual chance flood, whichever is higher. Dry floodproofing may involve constructing flood barriers around individual pieces of equipment or areas that contain essential equipment to prevent floodwaters from reaching critical equipment.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP
Cost Estimate	High
Benefits (Avoided Losses)	Avoids impacts to critical facilities associated with flooding.
Timeline	Medium Term

26 Copper Cove Collections System Lift Station Consolidation Project

Mitigation Project Title	Copper Cover Collections Systems Lift Station Consolidation Project
Project Description, Issue/Background	The work will involve improvements to the current pumping regime to reduce lift stations and thereby the CCWD's exposure to I&I and risk of failure.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood, Wildfire
Goals(s) Addressed	Goal 2, Goal 3, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP
Cost Estimate	High
Benefits (Avoided Losses)	Consolidates lift stations to avoids impacts to critical facilities associated with flooding and wildfire.
Timeline	Medium Term

27 Cross Lake Pipeline Mitigation Project

Mitigation Project Title	Cross Lake Pipeline Mitigation Project
Project Description, Issue/Background	Install a loop to the Poker Flat area to loop the water system and provide water supply redundancy. Also involves adding a tank for additional fire protection/pressure management. Mitigates flood and wildfire risk.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood, Wildfire
Goals(s) Addressed	Goal 1, Goal 4, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP
Cost Estimate	Moderate
Benefits (Avoided Losses)	Mitigates flood and wildfire risk.
Timeline	Long Term

28 Middle Fork of the Mokelumne River Infiltration Gallery and Pump Station Replacement Project

Mitigation Project Title	Middle Fork of the Mokelumne River Infiltration Gallery and Pump Station Replacement Project
Project Description, Issue/Background	This project is in development and the design as of 2018 was at approximately 30%. The CCWD plans to continue the project based on the 30% design and move into construction. The project mitigates flood and water supply loss. It also improves supply through reliability and redundancy.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought, Flood
Goals(s) Addressed	Goal 1, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP
Cost Estimate	High
Benefits (Avoided Losses)	Mitigates flood and loss of water supply through improved reliability and redundancy of pump stations.
Timeline	Long Term

29 Middle Fork Mokelumne River Transmission Pipeline Replacement

Mitigation Project Title	Middle Fork Mokelumne River Transmission Pipeline Replacement
Project Description, Issue/Background	This project eliminates the Acorn Pump Station and mitigates risk associated with flooding. The CCWD needs to finish the design and construction and improve the volume that can be conveyed from the MFMR to the Bummerville Reservoir and Water Treatment Plant and thereby the community.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Flood
Goals(s) Addressed	Goal 2, Goal 4
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP
Cost Estimate	High
Benefits (Avoided Losses)	Mitigates flood through a pump station replacement.
Timeline	Long Term

30 Sheep Ranch Water System Replacement

Mitigation Project Title	Sheep Ranch Water System Replacement
Project Description, Issue/Background	The Sheep Ranch water system replacement is a wholesale replacement necessary to mitigate several hazards, such as wildfire, drought, severe weather (atmospheric rivers and storms), and flooding that all impact the intake system. This project also likely benefits a DAC.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought, Flood, Severe Weather, Wildfire
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP, USDA DWSRF
Cost Estimate	High
Benefits (Avoided Losses)	Mitigates wildfire, drought, severe weather (atmospheric rivers and storms), and flooding risk on an intake system.
Timeline	Long Term

31 Jenny Lind WTP Infiltration Gallery Replacement Project

Mitigation Project Title	Jenny Lind WTP Infiltration Gallery Replacement Project
Project Description, Issue/Background	The design and construction of this project will mitigate the loss of water supply due to stormwater and debris inundation related to floods, drought, and atmospheric river storms. It also mitigates Harmful Algae Blooms (HABs) which are an increasing concern to regulatory bodies. There are benthic mats of HABs that exist at the current intake and environmental mitigation measures are in place that would improve water quality. The CCWD notes that HABs are often the result of water extremes from flood or drought events.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought, Flood (Localized Stormwater), Soil Hazards, Severe Weather
Goals(s) Addressed	Goal 1, Goal 2
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP, USDA DWSRF
Cost Estimate	Moderate
Benefits (Avoided Losses)	Mitigates the loss of water supply due to stormwater and debris inundation related to floods, drought, and atmospheric river storms.
Timeline	Medium Term

32 White Pines Reservoir Cleaning and Capacity Plan

Mitigation Project Title	White Pines Reservoir Cleaning and Capacity Plan
Project Description, Issue/Background	This project involves cleaning and removing sediment from White Pines Reservoir. This would improve the capacity and reliability of the water quality for the community. It also benefits a DAC.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought, Flood, Soil Hazards, Severe Weather
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP, USDA DWSRF
Cost Estimate	Moderate
Benefits (Avoided Losses)	This project benefits a socially vulnerable community by improving the quality of the community's water supply.
Timeline	Long Term

33 Storage Tank Rehabilitation

Mitigation Project Title	Storage Tank Rehabilitation
Project Description, Issue/Background	There are water storage tanks within various disadvantaged communities that need to be rehabilitated to improve system reliability. Rehabilitation also bolsters the CCWD's ability to deal with all forms of hazards, which mitigates their risks when it comes to drinking water storage.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	Medium
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP
Cost Estimate	High
Benefits (Avoided Losses)	This project benefits a socially vulnerable community and improves water system conveyance and delivery reliability.
Timeline	Medium Term

34 Wastewater Lift Station Hardening Projects

Mitigation Project Title	Wastewater Lift Station Hardening Projects
Project Description, Issue/Background	The CCWD plans to design, implement, and construct hardening projects at all wastewater lift stations, namely those on Ebbetts Pass that are in high wildfire risk areas. These lift stations often have infrastructure exposed to the elements and are at risk to loss due to wildfire. Reconstructing these lift stations with fire resistant enclosures will improve the systems reliability and mitigate the risk.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Avalanche, Drought, Severe Weather, Wildfire, Volcano
Goals(s) Addressed	Goal 1, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP, BRIC
Cost Estimate	Medium
Benefits (Avoided Losses)	Reduces the risk to loss due to wildfire.
Timeline	Medium Term

35 Hunters Pump Station Improvement Project

Mitigation Project Title	Hunters Pump Station Improvement Project
Project Description, Issue/Background	The CCWD needs to construct the Hunters Pump Station Improvements Project to mitigate multiple hazards linked to drought, flooding, wildfires, and atmospheric river storms.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought, Flood, Severe Weather, Wildfire
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP
Cost Estimate	Moderate
Benefits (Avoided Losses)	Avoids losses associated with flood, wildfires, and drought that may occur at Hunters Pump Station.
Timeline	Short Term

36 West Point Bummerville Reservoir Capacity Improvement Project

Mitigation Project Title	West Point Bummerville Reservoir Capacity Improvement Project
Project Description, Issue/Background	The project would more than double the capacity of the Bummerville Reservoir and mitigate water supply issues associated with drought and an unreliable primary source of supply at Bear Creek. This project also benefits a disadvantaged community.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought, Flood, Severe Weather, Wildfire
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP, USDA DWSRF
Cost Estimate	Moderate
Benefits (Avoided Losses)	Maintains water storage capacity at the reservoir and therefore mitigates drought and water supply shortages.
Timeline	Long Term

37 West County Burson Area Groundwater Recharge Project

Mitigation Project Title	West County Burson Area Groundwater Recharge Project
Project Description, Issue/Background	The project would bolster the reliability of the groundwater supply in the Burson Area by pumping surface water into the ground during periods of abundance to re-establish and improve the supply reliability to the residents in the western portion of Calaveras County. This project mitigates drought and also improves supply reliability for a DAC.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Drought, Flood, Severe Weather, Wildfire
Goals(s) Addressed	Goal 1, Goal 2, Goal 3, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	None
Potential Funding	FEMA HMA HMGP, USDA DWSRF, DWR Urban Community Drought Relief Grant Program
Cost Estimate	High
Benefits (Avoided Losses)	Bolsters the reliability of groundwater supply in a disadvantaged community and avoids water shortage risks.
Timeline	Long Term

38 CCWD Intertie Projects

Mitigation Project Title	CCWD Intertie Projects
Project Description, Issue/Background	Various interties are needed with other County water purveyors to bolster water supply reliability during emergencies. This project mitigates multiple hazards.
Hazards Mitigated/ Lifelines Addressed (include all that apply)	Multi Hazard
Goals(s) Addressed	Goal 1, Goal 2, Goal 4, Goal 5
Priority (High, Medium, Low)	High
Responsible Office/ Agency	CCWD Engineering Department
Partners	Utica Water and Power, Calaveras Public Utility District, City of Angels, Union Public Utility District
Potential Funding	FEMA HMA HMGP, General Funds
Cost Estimate	High
Benefits (Avoided Losses)	Benefits include improved water supply reliability through interties and collaboration with other Calaveras County water purveyors
Timeline	Long Term

6 PLAN ADOPTION, IMPLEMENTATION, AND MAINTENANCE

6.1 PURPOSE OF PLAN ADOPTION AND IMPLEMENTATION

DMA Requirements §201.6(c)(3):

[The local hazard mitigation plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).

The purpose of formally adopting this plan is to secure buy-in from CCWD, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan. The governing board for CCWD has adopted this LHMP by passing a resolution.

Implementation and maintenance of the plan are critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This section provides an overview of the overall strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, updating, and evaluating the plan. The section also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

6.2 ADOPTION

Adoption by the local governing body demonstrates the community's commitment to implementing the mitigation strategy and authorizes responsible agencies to execute their actions. The final plan is not approved until CCWD adopts the plan and FEMA receives documentation of formal adoption by the governing body of CCWD requesting approval.

CCWD plans to submit this plan to the CCWD Board of Directors upon successful completion of State and federal review and following the issuance of an Approved Pending Adoption (APA) designation from FEMA. This provides an efficient approval process if FEMA determines the LHMP requires revisions because CCWD can make these revisions prior to initiating the local plan adoption process. Once FEMA issues APA notification, adoption by CCWD must take place within one year for CCWD to become or remain eligible for FEMA HMA program funding.

Once CCWD records and submits the adoption documentation to Cal OES and FEMA, FEMA will issue an official approval letter stating CCWD has adopted and is approved and eligible for FEMA HMA program funding. The approval letter will include an expiration date five years from the date of the letter and attached to the approval letter will be a final FEMA Local Mitigation Plan Review Tool that provides feedback on the strengths of the plan, recommendations for plan improvements during future plan updates, and suggestions for implementing the mitigation strategy.

6.3 IMPLEMENTATION

Once adopted, the plan faces the truest test of its worth: implementation. While this plan contains many worthwhile actions, CCWD will need to decide which action(s) to undertake first. Two factors will help with making that decision: the priority assigned to the actions in the planning process and funding availability. Low or no-cost actions most easily demonstrate progress toward successful plan implementation.

Implementation will be accomplished by adhering to the schedules identified for each action (see Section 5 for mitigation actions), and through constant, pervasive, and energetic efforts to network and highlight the multi-objective, win-win benefits of each project to CCWD's service areas, customers, and its stakeholders. These efforts include the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. The three main components of implementation are:

- Implement the action plan recommendations of this plan.
- Utilize existing rules, regulations, policies, and procedures already in existence; and
- Communicate the hazard information collected and analyzed through this planning process so that the community better understands what can happen where, and what they can do themselves to be better prepared. Also, publicize the "success stories" that are achieved through the HMPC's ongoing efforts.

During the implementation of these efforts, it is important to maintain constant monitoring of funding opportunities that can be leveraged to implement some of the more costly recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements, should grants be pursued. When funding becomes available, the participating jurisdictions will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, special district budgeted funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective applications.

For this update, CCWD's implementation program will emphasize mitigation projects and setting priorities based on loss reduction consistent with DMA requirements.

6.3.1 Role of the HMPC in Implementation and Maintenance

With the adoption of this plan, CCWD will be tasked with plan implementation and maintenance. The HMPC members agree to:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Keep the concept of mitigation at the forefront of CCWD decision-making by identifying plan recommendations when other CCWD goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Maintain vigilant monitoring of multi-objective cost-share opportunities to help CCWD implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in the implementation and update of this plan;
- Report on plan progress and recommended changes to the CCWD Board of Directors; and
- Inform and solicit input from the public.

The committee is an advisory body and will not have any powers over CCWD or its staff. The primary goal and duty of CCWD and the HMPC are to see the plan successfully carried out and to report to the governing board and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the CCWD website (and others as appropriate).

6.4 MAINTENANCE AND MONITORING

Requirement §201.6(c)(2)(i):

[The risk assessment shall include a] description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as required or as progress, roadblocks, or changing circumstances are recognized. This section describes how public participation will be integrated throughout the plan maintenance and implementation process. It also explains how the mitigation strategies outlined in this plan will be incorporated into existing planning mechanisms and programs. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

6.4.1 Maintenance Schedule

In order to track progress and update the mitigation strategies identified in the action plan, the HMPC will revisit this plan at the following times or occurrences:

- Annually, to assess if mitigation actions/projects have been completed;
- Following a significant hazard event;
- Following a disaster declaration; or
- Any other time the HMPC sees it is prudent or necessary.

Annual Reviews: The HMPC will meet annually to assess progress on plan implementation. CCWD's Water Resource Manager will lead and facilitate these annual reviews and be responsible for scheduling and leading an associated annual review meeting. The annual reviews will also support an efficient plan update process because mitigation actions/project will be tracked by the CCWD's Water Resource Manager, and new significant hazard events will also be discussed and documented. The timing of the annual meeting is recommended for the first or second quarter of each year to identify potential mitigation grants, some of which have a submittal period in the fourth quarter. The CCWD's Water Resource Manager will schedule these annual meetings and the completion of an Annual Review and Progress Report. A template for the annual meeting and a summary report is provided in Appendix E. Another tool developed during the 2023 update process to facilitate regular review and implementation and make the plan more of a "living document" is the LHMP website, where the updated 2023-2028 LHMP and HMPs from previous years are available for public access. Various links to additional disaster and emergency preparation, hazard mitigation, as well as other related local, state, and federal-level information are also included on the LHMP website. This website is accessible from CCWD's homepage.

CCWD can use the LHMP website to post updates on the plan implementation process, such as grants submitted, grants pending review, and grant awards.

Critical Facility Database Maintenance: Moving forward CCWD will maintain the critical facility database that was prepared during the 2023 update. CCWD's Water Resource Manager will work with CCWD's GIS Manager to lead periodic reviews of the database and assess the need for updates.

Five-Year Update: This plan will be updated, approved, and adopted within a five-year cycle as per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000. Efforts to begin the update should be initiated by the CCWD's Water Resource Manager no later than October 2027 in order to provide at least 9 to 12 months to facilitate the planning process, update the plan, and provide adequate time for public review. CCWD's Water Resource Manager will monitor planning grant opportunities from the Cal OES and FEMA for funds to assist with the update approximately one year prior to the desired kick-off date for the formal Five-Year update. This may include submitting an HMGP planning grant, or a BRIC grant application. This grant should be submitted in 2024, as there is a three-year performance period to expend the funds, and there is no guarantee that the grant will be awarded when initially submitted. This allows time to resubmit the grant in subsequent years if needed. It also allows time for the CCWD to allocated General Funds for the Five-Year Update, if necessary. Further, if the CCWD selects to participate in the Calaveras County's multi-jurisdictional planning process anticipated to start in 2025, this preparation window allows time for the CCWD to decide the best approach for the 2027 update, whether it is an update to the existing LHMP or the integration of the LHMP as an Annex to the Calaveras County MJHMP. Updates to this plan will follow the most current FEMA and Cal OES planning guidance. It is likely the CCWD will release a Request for Proposals (RFP) from qualified consultants to complete the LHMP update. Once a consultant is selected this means the next Five-Year Update will be initiated by reconvening a HMPC or planning committee during an internal kick-off meeting, followed by a development of the plan. The development of the LHMP update will be based on direction provided by the CCWD and the HMPC during a series of at least three planning work sessions or meetings (e.g., HMPC Meeting #1). This process is anticipated to take six months to one year to complete; each planning phase would involve ongoing input and direction from the CCWD Water Resource Manager, HMPC, outside stakeholders, and the CCWD's water customers and the general public. The next plan update should be completed and reapproved by Cal OES and FEMA Region VIII by October 2028.

6.4.2 Maintenance and Evaluation Process

The HMPC will continually observe the incorporation process, evaluation method, updating method, continued public participation, and completion of the action/projects to assure that the HMPC and the plan itself are performing as anticipated. By monitoring these processes, the HMPC will then be able to evaluate them at the time of the formal Five-Year plan update, determining if any changes are needed.

The Five-Year plan update provides an opportunity to determine whether there have been any significant changes in CCWD that may, in turn, necessitate changes in the types of mitigation actions proposed. New development in identified hazard areas, increased exposure to hazards, increase or decrease in capability to address hazards, and changes to federal or state legislation are examples of factors that may affect the necessary content of how the LHMP is updated.

The plan review provides CCWD officials with an opportunity to evaluate those actions that have been successful and to explore the possibility of documenting potential losses that were avoided due to the implementation of specific mitigation measures. The process for setting new priorities based on loss reduction is also emphasized in this LHMP update process. The plan review also provides the opportunity to document how mitigation actions were addressed that may not have been successfully implemented as assigned.

During the Five-Year plan update process, the following questions will be considered as criteria for assessing the effectiveness and appropriateness of the LHMP:

1. Do the goals address current and expected conditions?
2. Are the goals and objectives consistent with changes in state and federal policy?
3. Complete status updates on all mitigation projects. What strategies should be revised?
4. Has the nature or magnitude of risks changed (current and expected conditions)?
5. Are the current resources appropriate for implementing the LHMP?
6. Are there implementation problems, such as technical, political, legal or coordination issues with other agencies?
7. Have the outcomes occurred as expected?
8. Did CCWD and other partners participate in the plan implementation process as assigned?

These questions will also support how the CCWD and HMPC update the plan. The CCWD's Water Resource Manager will track and coordinate the development of the LHMP update throughout the planning process, and in coordination with a consultant, if necessary. Further, the CCWD is committed to involving the public in the continual reshaping and updating of the LHMP, as discussed in Subsection 6.3.4.

6.4.3 Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is the incorporation of the HMP recommendations and their underlying principles into other related plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. This plan should also be cross-referenced when related planning mechanisms are updated. As previously stated above, mitigation is most successful when it is incorporated into the day-to-day functions and priorities of CCWD's operation, management, and development. As described in this plan's capability assessment, CCWD already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms.

These existing mechanisms include (but are not limited to) the following:

- Strategic Plan (2021 – 2026)
- County Water Master Plan (1996)
- Water System Master Plans
    - Copper Cove Water and Wastewater System Master Plan (2018)
    - Jenny Lind Water System Master Plan (2018)
    - Supplemental West Point Water System Master Plan (2018)
    - Ebbetts Pass Water Master Plan (2005)
    - La Contenta Wastewater System Master Plan
    - Supplemental West Point Water System Master Plan
    - Arnold Sewer System Master Plan (2005)
    - Wastewater Facilities Master Plan (2005)
    - West Point Water System Master Plan (2005)
    - Forest Meadows Wastewater Facility Plan (2004)
- Urban Water Management Plan (2020)
- Integrated Regional Water Management Plan(s)
- CCWD AWIA RRA (The 2021 RRA incorporated the 2018 CCWD LHMP)
- Calaveras County General Plan Safety Element
- Calaveras County Multi-Jurisdictional Hazard Mitigation Plan
- Local Fire Safe Plans and Community Wildfire Protection Plans
- Other plans, regulations, and practices with a mitigation focus
- Other capital improvement and community plans within the county

HMPC members involved in the updates to the planning mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, programs, etc., as appropriate. As an action step to ensure integration with other planning mechanisms, CCWD's Water Resources Manager will discuss this topic at the annual meeting of the HMPC described above in Subsection 6.3.1. The HMPC will discuss where there are opportunities to incorporate the plan into other planning mechanisms and who would be responsible for leveraging those opportunities. Efforts to integrate the HMP into local plans, programs, and policies will be reported at the annual HMPC plan review meeting, and a record of successful integration efforts will be kept.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan. Incorporation into existing planning mechanisms could be done through the routine actions of:

- Monitoring other planning/program agendas;
- Attending other planning/program meetings;
- Participating in other planning processes; and
- Monitoring CCWD and community budget meetings for other program opportunities.

6.4.4 Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan's implementation. Efforts will be made to involve the public in the plan maintenance, evaluation, and review process. This includes maintaining a digital version of the plan on CCWD's homepage for public review. CCWD's homepage should continue to function as a repository of the current and past HMPs. In addition, information on who to contact within CCWD will be posted with the plan. CCWD will maintain a file of comments received for reference during the next five-year update. Any revisions to the plan that may occur as a result of a disaster will also be made public and posted on the CCWD website.

The next five-year update process also provides an opportunity to solicit participation from new and existing stakeholders and publicize success stories from the plan implementation and seek additional public comment. A public hearing(s) or survey to receive public comment on the plan will be held during the plan update period. When the HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process, including those who joined the HMPC after the initial effort, to update and revise the plan. Public notice will be posted, and public participation will be invited, at a minimum, through available website postings and press releases to the local media outlets as well as email and social media announcements.

Public involvement strategies that were used during the 2023 planning process are captured in the Outreach Strategy in Appendix F. The appendix can serve as a reference for continued public involvement over the next several years and lays the foundation for outreach associated with the next formal five-year update. The HMPC should incorporate the following engagement concepts from the Outreach Strategy:

- Collaborate with other utility providers and agencies in the area (i.e., Calaveras Public Utility District, Utica Power Authority, etc.)
- Create stories and mitigation success announcements to use for publishing at media outlets.
- Distribute emails and postcards and newsletters to the public about hazard mitigation.
- Participate in existing community events to share information about hazard mitigation (e.g., community farmer's markets, library events, senior centers).
- Continue to use CCWD's website as a distribution point or repository for HMP information.

7 REFERENCES

Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja. (2018). *Statewide summary report. California's fourth climate change assessment.* California Governor's Office of Planning and Research, Scripps Institution of Oceanography, California Energy Commission, California Public Utilities Commission. https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf

Cal-Adapt. (2018). Cal-Adapt. University of California at Berkeley's Geospatial Innovation Facility under contract with the California Energy Commission. Retrieved 2022, from https://cal-adapt.org/

Calaveras County Office of Emergency Services (OES). (September 2019). *Calaveras County Emergency Operations Plan (EOP).* http://oes.calaverasgov.us

Calaveras County Water District. (2018). *Local Hazard Mitigation Plan*. https://www.dropbox.com/s/5gmvhljr0iyavu5/CCWD2018LHMP.pdf?raw=1

Calaveras County Water District. (2021). *2020 Urban Water Management Plan (UWMP).* https://www.dropbox.com/s/8eewsd0oqubnn70/CCWD2020UWMP_FinalwErrata.pdf?raw=1

Calaveras County Water District. (2021). *2020 Water Shortage Contingency Plan (WSCP).* https://www.dropbox.com/s/6353owd8t83dp8i/CCWD2020WSCP_FinalwErrata.pdf?raw=1

Calaveras County Water District. (2021). *2021-2026+ Strategic Plan*. https://calaverascountywd-my.sharepoint.com/:b:/g/personal/jessicas_ccwd_org/EQrpKiUrP8BOjBh3HVh9_t8BaC4j6vTyAs9vTQMJULwa_g?e=AkNVoD

Calaveras County Water District. (2021). *America's Water Infrastructure Act of 2018 (AWIA) Risk and Resiliency Assessment.* https://ccwd.org/wp-content/uploads/2021/08/CCWD_AWIAEmergencyRespPlanPublicVers.pdf

Calaveras County. (2019). *General Plan*. (Amended October 13, 2020) https://planning.calaverasgov.us/General-Plan

California Department of Finance (DOF). (2023). Population Estimates for Cities, Counties, and the State – January 1, 2021 and 2022. May 2022. The State of California. Retrieved March 2023, from https://dof.ca.gov/forecasting/demographics/estimates-e1/

California DOF. (2021). Population Estimates for Cities, Counties, and the State, 2011-2020 with 2010 Census Benchmark. May 2021. Retrieved October 2023, from https://dof.ca.gov/Forecasting/Demographics/Estimates/e-4-population-estimates-for-cities-counties-and-the-state-2011-2020-with-2010-census-benchmark-new/California Department of Forestry and Fire Protection (CAL FIRE). (2001). *Communities at risk*. https://osfm.fire.ca.gov/divisions/wildfire-planning-engineering/fire-plan/communities-at-risk/

California Department of Forestry and Fire Protection (CAL FIRE). (2020). Strategic fire plan: Tuolumne-Calaveras Unit. https://osfm.fire.ca.gov/media/bdppiaqj/2020-tcu-fire-plan.pdf

California Department of Forestry and Fire Protection (CAL FIRE). (May 2, 2023). https://www.fire.ca.gov/

California Department of Forestry and Fire Protection's Fire and Resource Assessment Program (FRAP) (May 2, 2023). https://www.fire.ca.gov/what-we-do/fire-resource-assessment-program

California Department of Water Resources (DWR) Awareness Program (May 2023). https://gis.bam.water.ca.gov/bam/

California Department of Water Resources (DWR). (2021). *California Jurisdictional Dams*. Department of Water Resources, Division of Safety of Dams (DSOD). https://gis.water.ca.gov/arcgis/rest/services/Structure/i17_California_Jurisdictional_Dams/FeatureServer

California Department of Water Resources (DWR). (2023). Division of Safety of Dams (DSOD), Dam Breach Inundation Map Web Publisher. https://fmds.water.ca.gov/webgis/?appid=dam_prototype_v2

California Department of Water Resources. (2015). California's Most Significant Droughts: Comparing Historical and Recent Conditions. February 2015. Accessed on March 13, 2018. Available at: https://cawaterlibrary.net/wp-content/uploads/2017/05/CalSignficantDroughts_v10_int.pdf

California Employment Department (EED). (2023). Labor market profiles. Retrieved 2023, from https://edd.ca.gov/en/jobs/

California Geological Survey, (May 2023) https://www.conservation.ca.gov/cgs/maps-data

California Independent System Operator (CaISO). (2022, November 2). *California ISO posts analysis of September heat wave*. https://www.caiso.com/Documents/california-iso-posts-analysis-of-september-heat-wave.pdf

California Office of Emergency Services (Cal OES). (2023). *Draft California State Hazard Mitigation Plan.* Governor's office of emergency services. https://www.caloes.ca.gov/office-of-the-director/operations/recovery-directorate/hazard-mitigation/state-hazard-mitigation-planning/

California Office of Environmental Health Hazard Assessment (OEHHA). (2021). CalEnviroScreen 4.0. California Environmental Protection Agency. Retrieved 2022, https://oehha.ca.gov/calenviroscreen

California Office of Historic Preservation. (n.d.) *California historical landmarks by county*. California State Parks. Retrieved January 2023, from https://ohp.parks.ca.gov/?page_id=21387

California Office of Historic Preservation. (n.d.) *California Points of Historical Interest*. California State Parks. Retrieved January 2023, from https://ohp.parks.ca.gov/?page_id=21750

California Office of Historic Preservation. (n.d.) *California Register of Historical Resources*. California State Parks. Retrieved January 2023, from https://ohp.parks.ca.gov/?page_id=21238

Center for Western Weather and Water Extremes (2019). *Atmospheric Rivers scale.* http://cw3e.ucsd.edu/CW3E-Releases-New-Scale-to-Characterize-Strength-and-Impacts-of-Atmospheric-Rivers/

Centers for Disease Control and Prevention (CDC) Agency for Toxic Substances and Disease Registry (ATSDR) Geospatial Research, Analysis, and Services Program. (2020). CDC/ASTDR social vulnerability index (SVI). U.S. Department of Health and Human Services. Retrieved 2022, from https://www.atsdr.cdc.gov/placeandhealth/svi/

Cohen, J., Agel, L., Barlow, M., Garfinkel, C. I., & White, I. (2021). Linking Arctic variability and change with extreme winter weather in the United States. *Science*, 373(6559), 1116-1121. https://doi.org/10.1126/science.abi9167

De La Cruz, M. (2023, January 17). More than a dozen homes uninhabitable after major flooding in Calaveras County. KCRA. https://www.kcra.com/article/calaveras-county-valley-springs-homes-damaged-storms/42527336

Federal Emergency Management Agency (FEMA), CRS Coordinators Manual. https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_coordinators-manual_2017.pdf

Federal Emergency Management Agency (FEMA), Local Mitigation Plan Review Guide, 2011. https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf

Federal Emergency Management Agency (FEMA). (2023) *Disaster declarations for states and counties.* https://www.fema.gov/about/reports-and-data/openfema

Federal Emergency Management Agency (FEMA). (2023). Local Mitigation Planning Handbook. May 2023. Available at: https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-handbook_052023.pdf

Federal Emergency Management Agency (FEMA). (January 3, 2020). National Flood Hazard Layer (NFHL). Available at: https://msc.fema.gov/portal/home

Federal Emergency Management Agency (FEMA). (March 18, 2022). National Flood Insurance Program (NFIP), Community Status Book, Available at: https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book

Federal Emergency Management Agency (FEMA). (May 16, 2017) Flood Insurance Study (FIS) Calaveras County. https://msc.fema.gov/portal/home

Frankson, R., L.E. Stevens, K.E. Kunkel, S.M. Champion, D.R. Easterling, W. Sweet, and M. Anderson. (2022). California State Climate Summary 2022. NOAA Technical Report NESDIS 150-CA. NOAA/NESDIS, Silver Spring, MD, 6 pp. https://statesummaries.ncics.org/chapter/ca/

Hardebeck, J. L., Boatwright, J., Dreger, D., Goel, R., Graizer, V., Hudnut, K., & Tinsley, J. C. (2004). Preliminary report on the 22 December 2003, m 6.5 San Simeon, California earthquake. *Seismological Research Letters*, 75(2), 155-172.

Hill David P., Roy A. Bailey, C. Dan Miller, James W. Hendley II, and Peter H. Stauffer. (1998). *Future Eruptions in California's Long Valley Area—What's Likely*? US Geologic Survey. https://pubs.usgs.gov/dds/dds-81/Intro/facts-sheet/fs073-97.pdf

Multi-hazard Mitigation Council (2017) Natural Hazard Mitigation Saves 2017 Interim Report: An Independent Study – Summary of Findings. Principal Investigator Porter, K.; co-Principal Investigators Scawthorn, C.; Dash, N.; Santos, J.; P. Schneider, Director, MMC. https://www.fema.gov/sites/default/files/2020-07/fema_ms2_interim_report_2017.pdf

National Centers for Environmental Information (NCEI). (2023). Storm events database. National Oceanic and Atmospheric Administration (NOAA). http://www.ncdc.noaa.gov/stormevents/

National Drought Mitigation Center (NDMC), the U.S. Department of Agriculture (USDA) and the National Oceanic and Atmospheric Administration (NOAA). (2023). *US Drought Monitor (USDM).* University of Nebraska-Lincoln. https://droughtmonitor.unl.edu/

National Geographic (NatGeo). (n.d.). Tornadoes and climate change. Education. https://education.nationalgeographic.org/resource/tornadoes-and-climate-change/

National Inventory of Dams (NID). (2020). US Army Corps of Engineers. https://nid.sec.usace.army.mil/#/

National Oceanic and Atmospheric Administration (NOAA). (n.d.) What is the Pineapple Express? National Ocean Service https://oceanservice.noaa.gov/facts/pineapple-express.html

National Interagency Fire Center (NIFC) (2023). https://data-nifc.opendata.arcgis.com/

National Register of Historic Places (NHRP). 202318. https://www.nps.gov/subjects/nationalregister/index.htmwww.nationalregister.gov

National Risk Index. (n.d.) Social vulnerability (SoVI). Department of Homeland Security. Retrieved 2022, from https://hazards.fema.gov/nri/social-vulnerability

National Weather Service. (n.d.). Heat and Drought. Retrieved 2022, from https://www.weather.gov/otx/Heat_and_Drought

National Weather Service (NOAA) Storm Prediction Center Server Weather GIS (SVRGIS), (May 2023). http://www.spc.noaa.gov/gis/svrgis/

NOAA National Centers for Environmental information, Climate at a Glance: County Time Series, published September 2023, retrieved on September 22, 2023 from https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series

Red Cross. (2007, March). Tornadoes – V2 – NC. Risk Management Portal. https://rmp.nc.gov/LCF/Publications/AL_Resources/Tornado/Red%20Cross%20-%20Tornadoes.pdf

Rheinheimer, D. E., and J. H. Viers. 2014. "Combined Effects of Reservoir Operations and Climate Warming on the Flow Regime of Hydropower Bypass Reaches of California's Sierra Nevada". River Research and Applications 31 (3): 269-279. https://doi.org/10.1002/rra.2749

Smith, Hayley. (October 3, 2022). *California Suffering through Driest Three Years Ever Recorded, with No Relief in Sight*. Los Angeles Times, https://www.latimes.com/california/story/2022-10-03/california-experiences-driest-three-years-ever-recorded

State of California (2022) WSIHIST, California Data Exchange Center. (Accessed: 2023). Available at: https://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST

State of California. (2022a). California Climate Adaptation Strategy. https://climateresilience.ca.gov/

Strapazzon, G., Schweizer, J., Chiambretti, I., Brodmann Maeder, M., Brugger, H., & Zafren, K. (2021). Effects of climate change on avalanche accidents and survival. Frontiers in physiology, 12, 639433. https://doi.org/10.3389/fphys.2021.639433

U.S. Census Bureau (2020). Decennial census. Retrieved 2022, from https://data.census.gov/table

U.S. Census Bureau. (2021). 2017-2021 American community survey 5-year estimates. https://data.census.gov/table

U.S. Environmental Protection Service EPA. (2021, April). Climate change indicators: Cold-related deaths | US EPA. Climate Change Indicators: Cold-Related Deaths.

https://www.epa.gov/climate-indicators/climate-change-indicators-cold-related-deaths

U.S. Fish and Wildlife Service, Information for Planning and Consultation. IPaC Tool. Threatened and Endangered Species and Critical Habitat in Calaveras County. Available at: https://ecos.fws.gov/ipac/

U.S. Department of Agriculture Farm Service Agency (2022). Disaster Declarations USDA. Farm Service Agency, Department of Agriculture. https://data.nal.usda.gov/dataset/disaster-declarations-usda. Accessed 2023-02-02

Vaisala. (2023). Total Lightning Statistics 2022 – The Annual Lightning Report. XWeather. https://www.xweather.com/annual-lightning-report

Water Utility Climate Alliance (WUCA). (2020). It's Hot and Getting Hotter: Implications of Extreme Heat on Water Utility Staff and Infrastructure, and Ideas for Adapting. https://www.wucaonline.org/assets/pdf/pubs-implications-of-extreme-heat.pdf

Western Regional Climate Center, 2023: Cooperative Climatological Data Summaries. Accessed August 2023. Available online at https://wrcc.dri.edu/Climate/west_coop_summaries.php

Zuzak, C., E. Goodenough, C. Stanton, M. Mowrer, A. Sheehan, B. Roberts, P. McGuire, and J. Rozelle. (2023). *National Risk Index Technical Documentation*. Federal Emergency Management Agency, Washington, DC. https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf

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