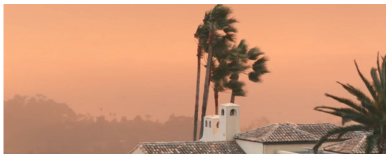
Ventura County

Multi-Jurisdictional Hazard Mitigation Plan

Update 2022

Volume 1—Area-wide Information



Public Review Draft, February 2022

TETRA TECH

COUNTY of VENTURA

VENTURA COUNTY SHERIFF
Emergency Services

Ventura County
Multi-Jurisdictional Hazard Mitigation Plan

Update 2022

February 2022

PREPARED FOR

County of Ventura

800 South Victoria Avenue
Ventura, CA 93009

PREPARED BY

Tetra Tech

1999 Harrison Street
Suite 500
Oakland, CA 94612

Phone: 510.302.6300
Fax: 510.433.0830
tetratech.com

Tetra Tech Project #103s7429

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DEFINITION OF TERMS

0.2 percent-annual-chance flood—the flood that has a 0.2 percent chance of being equaled or exceeded in any given year; often referred to as the 500-year flood

1 percent-annual-chance flood—the flood that has a 1 percent chance of being equaled or exceeded in any given year; often referred to as the 100-year flood

AB—Assembly Bill

ADA—Americans with Disabilities Act

asset—any man-made or natural feature that has value, including people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

base flood—the flood having a 1% chance of being equaled or exceeded in any given year, also known as the "100-year" or "1 percent annual chance" flood. The base flood is a statistical concept used to ensure that all properties subject to the National Flood Insurance Program (NFIP) are protected to the same degree against flooding.

basin—the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds."

benefit/cost analysis—a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

benefit—a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit/cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

BLM—Bureau of Land Management

CAL FIRE—California Department of Forestry and Fire Protection

Cal OES—California Governor's Office of Emergency Services

capability assessment—an analysis of a community's capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out.

CCR—California Code of Regulations

CDBG-DR—Community Development Block Grant Disaster Recovery grants

CEQA—California Environmental Quality Act

CFR—Code of Federal Regulations

climate action plan—a detailed and strategic framework for measuring, planning, and reducing greenhouse gas emissions and related climatic impacts. Climate action plans, at a minimum, include an inventory of existing emissions, reduction goals or targets, and analyzed and prioritized reduction actions.

climate change—a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

Community Rating System (CRS)—a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

critical facilities—facilities and infrastructure that are critical to the health and welfare of the population. These become especially important after any hazard event occurs.

CWA—Clean Water Act

dam failure—an uncontrolled release of impounded water due to a partial or complete breach in a dam (or levee) that impacts its integrity.

dam—any artificial barrier or controlling mechanism that can or does impound or divert water.

DART—Disaster Assistance Response Team

debris flow—dense mixtures of water-saturated debris that move down-valley, looking and behaving much like flowing concrete. They form when loose masses of unconsolidated material are saturated, become unstable, and move down slope. The source of water varies but includes rainfall, melting snow or ice, and glacial outburst floods.

DFIRM—Digital Flood Insurance Rate Map

Disaster Mitigation Act (DMA; Public Law 106-390)— the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving certain federal financial assistance.

drought—the cumulative impacts of long periods of dry weather. These can include deficiencies in surface and subsurface water supplies and general impacts on health, well-being, and quality of life.

DWR—Department of Water Resources

EAP—emergency action plan

earthquake—the shaking of the ground caused by an abrupt shift of rock along a fracture in the earth or a contact zone between tectonic plates.

ecosystem services—an ecosystem service is any positive benefit that wildlife or ecosystems provide to people. The benefits can be direct or indirect—small or large.

epidemic—the spread of an infectious disease beyond a local population, reaching people in a wider geographical area. Several factors determine whether an outbreak will become an epidemic: the ease with which the disease spreads from vectors, such as animals, to people, and the ease with which it spreads from person to person.

equity—the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, racially, or geographically.

ESA—Endangered Species Act

exposure—the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

extent—the size or location of an area affected by a hazard. For hazards that do not have a clearly defined extent, this definition expands to the strength or magnitude (severity) of the hazard. For hazards in this plan that do not have mapping, extent is addressed by the severity discussion of the hazard profile.

extreme cold—temperatures from winter storms associated with freezing rain, sleet, snow and strong winds that may cause hypothermia or frostbite.

extreme heat—temperatures that hover 10 ºF or more above the average high temperature for a region and last for several days.

federal disaster declaration—declarations for events that cause more damage than state and local governments and resources can handle without federal government assistance. A federal disaster declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, to help disaster victims, businesses, and public entities.

FEMA—Federal Emergency Management Agency

FERC—Federal Energy Regulatory Commission

FHSZ—Fire Hazard Severity Zone

flash flood—a flood that occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM)—the official map on which the Federal Emergency Management Agency delineates the special flood hazard area.

Flood Insurance Study—a report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's Flood Insurance rate Map. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

floodplain—the land area along the sides of a river that becomes inundated with water during a flood.

flood—the inundation of normally dry land resulting from the rising and overflowing of a body of water.

FRA—federal responsibility area

freeboard—the margin of safety added to the base flood elevation.

frequency—how often a hazard of specific magnitude, duration, and/or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1 percent chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Fujita tornado damage scale—scale for rating tornado wind speeds, estimated on the basis of damage sustained. The scale rates the intensity or severity of tornado events using numeric values from F0 to F5 based on tornado wind speed and damage. An F0 tornado (wind speed less than 73 miles per hour (mph)) indicates minimal damage (such as broken tree limbs), and an F5 tornado (wind speeds of 261 to 318 mph) indicates severe damage.

g—the acceleration associated with gravity (%g is an acceleration calculated as a percentage of the acceleration of gravity)

geographic information system (GIS)—a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

goal—a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

greenhouse gases—methane, nitrous oxide and other gases that trap heat and warm the Earth, as a greenhouse traps heat from the sun.

ground shaking—the result of rapid ground acceleration caused by seismic waves passing beneath buildings, roads, and other structures.

hazard—a source of potential danger or adverse condition that could harm people and/or cause property damage.

hazardous material—a substance or combination of substances (biological, chemical, radiological, and/or physical) that, because of its quantity, concentration, or physical, chemical or infectious characteristics, has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.

Hazus (Hazards U.S.)—a nationally standardized, GIS-based multi-hazard risk analysis tool developed and distributed by FEMA

high-hazard dam—a dam that can cause loss of human life from the failure or improper operation of the dam

IBC—International Building Code

intensity—the measure of the effects of a hazard

inventory—the assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

IT—information technology

LiMWA—Limit of Moderate Wave Action

liquefaction—loosely packed, water-logged sediments losing their strength in response to strong shaking, causing major damage during earthquakes.

local government—any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

LRA—local responsibility area

magnitude—the measure of the strength of an earthquake.

mitigation actions—specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

mitigation—a preventive action taken in advance of an event to reduce or eliminate risk to life or property.

mph—miles per hour

Mw—Moment Magnitude Scale

N/A—not applicable

NASA—National Aeronautics and Space Administration

NCEI—National Centers for Environmental Information

NEHRP—National Earthquake Hazard Reduction Program

NFIP—National Flood Insurance Program

NOAA—National Oceanic and Atmospheric Administration

NWS—National Weather Service

OES—Office of Emergency Services (Ventura County Sheriff's)

pandemic—an epidemic of infectious disease that has spread through human populations across a large region, multiple continents, or worldwide.

peak ground acceleration (PGA)—a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

ppm—parts per million

preparedness—actions that strengthen the capability of government, people, and communities to respond to disasters.

probability of occurrence—a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

recurrence interval—the inverse of the probability that a given event will be equaled or exceeded in any given year (sometimes called the return period)

repetitive loss property—any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced—Four or more paid flood losses in excess of $1000.00; or two paid flood losses in excess of $1000.00 within any 10-year period since 1978; or three or more paid losses that equal or exceed the current value of the insured property.

risk assessment—the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards

risk ranking—process to score and rank hazards based on the probability that they will occur and the impact they will have if they do.

risk—the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

riverine—of or produced by a river. Riverine floodplains have readily identifiable channels.

Robert T. Stafford Act (Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107)—the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs. Signed into law November 23, 1988; amended by the Disaster Relief Act of 1974 (Public Law 93-288).

SEMS—Standardized Emergency Management System

SFHA—special flood hazard area

significant-hazard dam—a dam that can cause economic loss, environmental damage or disruption of lifeline facilities, or can impact other concerns, but not necessarily loss of life.

special flood hazard area—the base floodplain delineated on a Flood Insurance Rate Map. The SFHA is mapped as a Zone A in riverine situations and zone V in coastal situations. The SFHA may or may not encompass all of a community's flood problems

SRA—state responsibility area

stakeholder—business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

subsidence—the caving in or sinking of an area of land.

surface fault rupture—an offset of the ground surface when fault rupture extends to the Earth's surface.

thunderstorm—a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours).

tornado—a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds.

USDA—U.S. Department of Agriculture

USDM—U.S. Drought Monitor

USGS—U.S. Geological Survey

vulnerability—an assessment of how susceptible an asset is to damage, based on its construction, contents, and the economic value of its functions

watershed—an area that drains downgradient from areas of higher land to areas of lower land to the lowest point.

Zone X—area determined to be outside the 1 percent and 0.2 percent annual chance floodplains.

zoning ordinance—ordinance that designates allowable land use and intensities for a local jurisdiction.

Executive Summary

Ventura County's hazard mitigation plan update for 2022 defines measures to reduce risks from natural disasters in the Ventura County planning area, which includes unincorporated areas, incorporated cities, and special purpose districts. The plan updates the County's previous plan, the *2015 Ventura County Multi-Hazard Mitigation Plan.* It complies with federal and state hazard mitigation planning requirements to establish eligibility for funding under Federal Emergency Management Agency (FEMA) grant programs for all jurisdictions that participated as planning partners:

- City of Camarillo
- City of Fillmore
- City of Moorpark
- City of Ojai
- City of Oxnard
- City of Port Hueneme
- City of San Buenaventura (Ventura)
- City of Santa Paula
- City of Simi Valley
- City of Thousand Oaks
- California State University, Channel Islands
- Calleguas Municipal Water District
- Casitas Municipal Water District
- Channel Islands Beach Community Services District
- Conejo Recreation & Park District
- Ojai Valley Sanitary District
- Pleasant Valley Recreation & Park District
- Saticoy Sanitary District
- Triunfo Water & Sanitation District
- United Water Conservation District
- Ventura County Fire Protection District
- Ventura County Office of Education
- Ventura County Public Works Agency—Watershed Protection
- Ventura Regional Sanitation District

PLAN DEVELOPMENT APPROACH

Organization

A core planning team consisting of a contract consultant and Ventura County staff was assembled to facilitate this plan update. A planning partnership was formed by engaging eligible local governments and making sure they understood their expectations for compliance under the updated plan. A steering committee was assembled to oversee the plan update, consisting of both governmental and non-governmental stakeholders within the planning area. Coordination with other local, state, and federal agencies involved in hazard mitigation occurred throughout the plan update process. Organization efforts included a review of the County's 2015 hazard mitigation plan, the California statewide hazard mitigation plan, and existing programs that may support hazard mitigation actions.

Public Outreach

The planning team implemented a multi-media public involvement strategy utilizing the outreach capabilities of the planning partnership that was approved by the Steering Committee. The strategy included virtual public meetings, a community hazard mitigation awareness survey, a project website, and multiple print, web-based, and social media releases. Additionally, the Steering Committee was made up of community-based organizations, non-profit organizations, and other agencies that helped amplify public outreach efforts to their networks.

Plan Document Development

The planning team and Steering Committee assembled a document that is designed to meet federal hazard mitigation planning requirements for all partners. The updated plan contains two volumes. Volume 1 contains components that apply to all partners and the broader planning area. Volume 2 contains components that are jurisdiction-specific, including each planning partner's dedicated annex.

Adoption

Once pre-adoption approval has been granted by the California Governor's Office of Emergency Services and FEMA, each planning partner will individually adopt the updated plan. Each partner has up to one year from FEMA approval to adopt the plan.

RISK ASSESSMENT

Risk assessment is the process of measuring the potential loss of life resulting from natural hazards, as well as personal injury, economic injury, and property damage, in order to determine the vulnerability of people, buildings, and infrastructure. For this update, the risk assessment included the following:

- Hazard identification and profiling
- Assessment of the impact of hazards on physical, social, and economic assets
- Identification of particular areas of vulnerability
- Estimates of the cost of potential damage

Based on the risk assessment, each hazard of concern was ranked for the risk it poses to the overall planning area using risk ranking criteria provided by the core planning team. These rankings were reviewed and validated by each planning partner through the jurisdictional annex process. Figure ES-1 shows scores and ratings for the entire Ventura County planning area. All planning partners also rated the hazards for their impacts on their own individual planning areas. Figure ES-2 summarizes how the participating planning partners rated each hazard.

Figure ES-1. Countywide Hazard Risk Rating

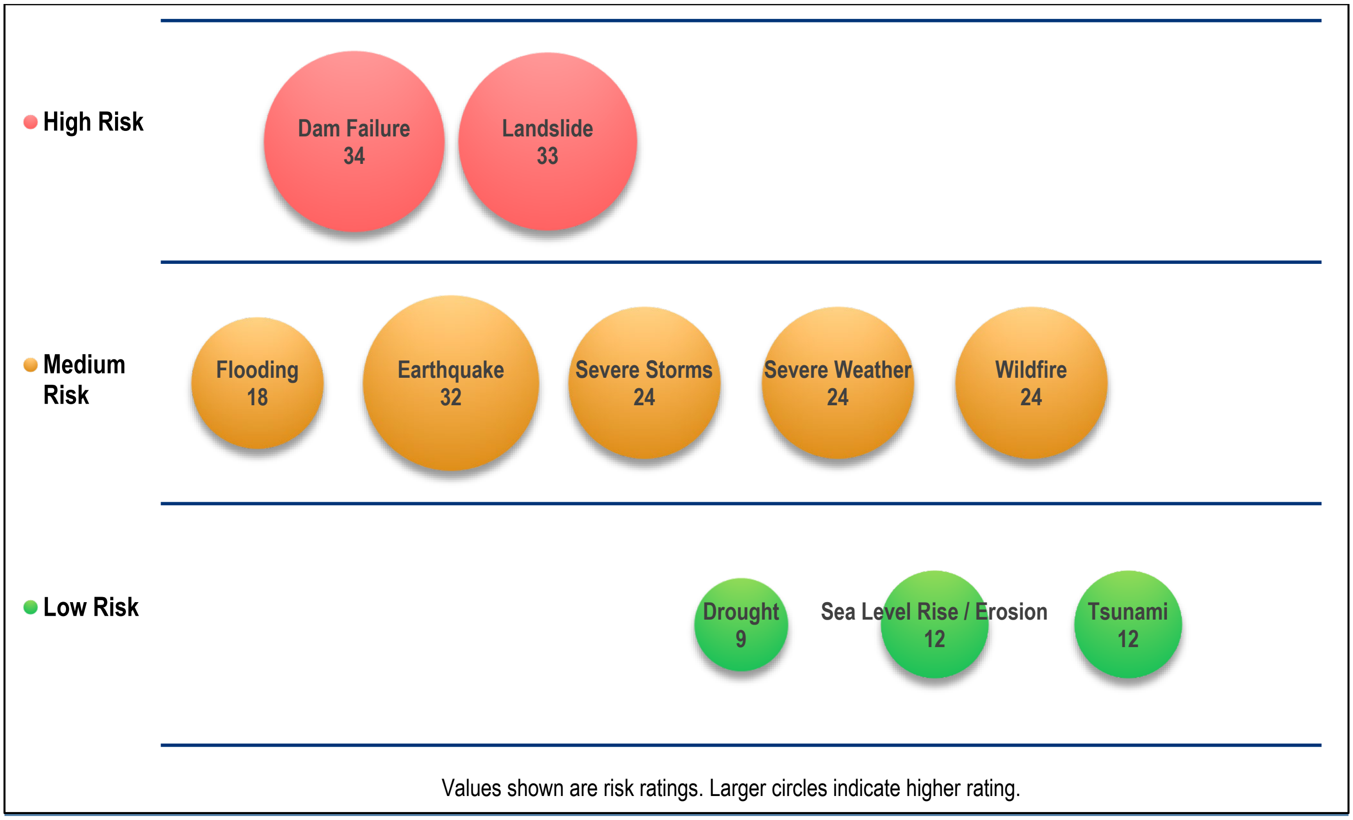
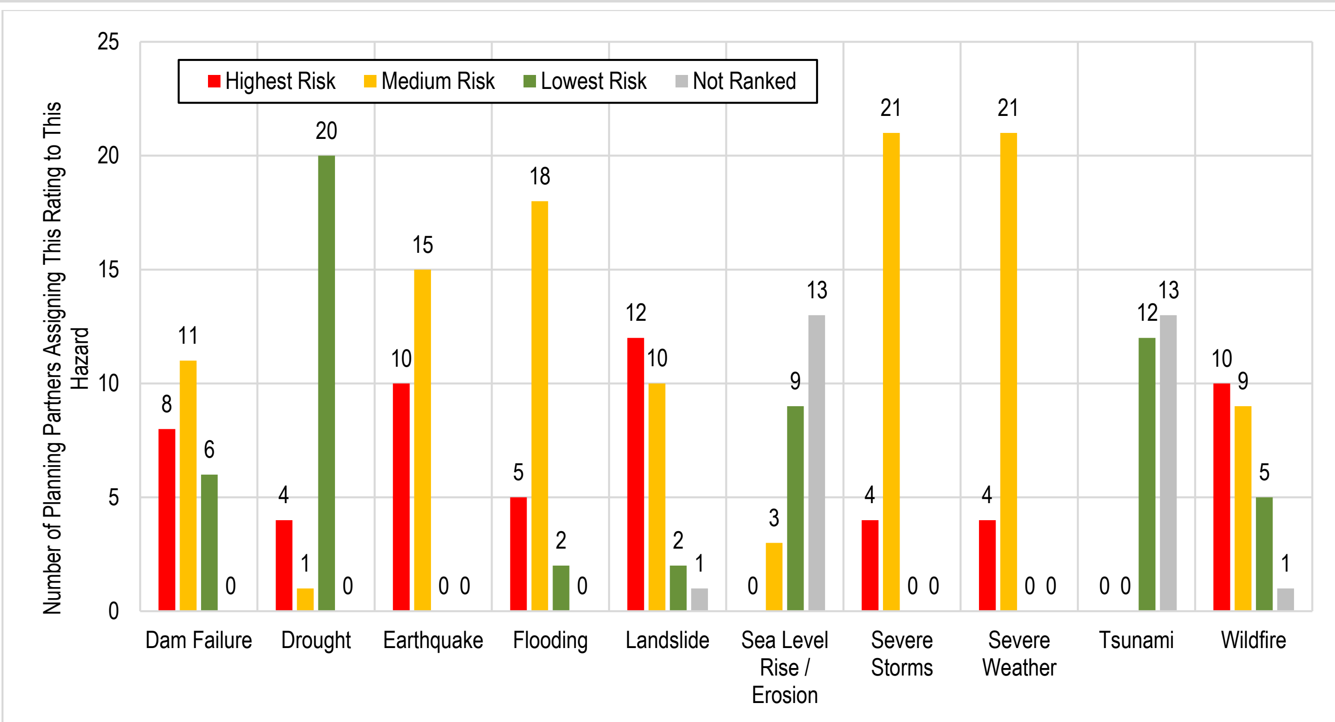


Figure ES-2. Summary of Risk Rating for Individual Planning Partners



The Steering Committee considered the full range of natural hazards that could affect the planning area and then selected those that present the greatest concern for risk assessment in this plan. The process incorporated a review of state and local hazard planning documents as well as information on the frequency of, magnitude of, and costs associated with hazards that have struck the planning area or could do so. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used. Based on the review, this plan includes risk assessments for the following hazards of concern:

- Dam failure
- Drought
- Earthquake
- Flood
- Landslide
- Sea-level rise and coastal erosion
- Severe storms
- Severe weather
- Tsunami
- Wildfire

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

- Agricultural and biological hazards
- Pandemic

Climate change is not assessed as an individual hazard, but a profile is provided describing how climate change could affect the hazards of concern assessed in this plan.

MITIGATION GOALS AND OBJECTIVES

The Steering Committee reviewed the *2015 Ventura County Multi-Hazard Mitigation Plan* and noted that neither a vision statement nor a list of objectives was part of the previous plan. The following vision statement was selected to guide the Steering Committee and planning partners in selecting the actions contained in this plan update:

> *The Ventura County Multi-Jurisdictional Hazard Mitigation Plan will establish and promote a comprehensive mitigation strategy and efforts to equitably reduce risk and increase the resiliency of the community and environment from natural hazards.*

Goals

The Steering Committee and planning team established the following 10 goals for the plan update:

- Protect life, property, and the environment, and minimize displacement due to natural hazard events.
- Effectively communicate natural hazard risks and mitigation strategies to the whole community.
- Pursue development and implementation of feasible, cost-effective, and environmentally sound hazard mitigation measures.
- Prioritize multi-objective hazard mitigation actions and those that reduce risk to vulnerable communities.
- Coordinate with other plans and programs that can support or enhance hazard mitigation.
- Enhance the County's capability and capacity to prepare for, respond to, and recover from the impacts of natural hazards.
- Proactively anticipate the risks of future impacts from hazards.
- Increase the County's adaptive capacity to reduce risk from hazard impacts.
- Promote proactive, self-sufficient mitigation and response abilities.
- Reduce risk to and increase the resilience of critical infrastructure and community lifelines.

The effectiveness of a mitigation strategy is assessed by determining how well these goals are achieved.

Objectives

Each of the selected plan objectives meets multiple goals, serving as a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset of a goal. The objectives were used to help establish priorities for each action identified in the plan. The plan objectives are as follows:

- Utilize the best available data, science, and technology to identify and communicate the risk exposure to hazards to state, regional, and local agencies, as well as the private sector and non-profit groups.
- Support efforts to improve the resilience of community lifelines in socially vulnerable communities.
- Enhance supply chain diversity and improved resilience by supporting local food and energy production and increased multi-modal transportation.
- Research, develop, promote, adopt, and enforce codes and standards to preserve life and property that are affordable and feasible to implement.
- Promote and implement measures to mitigate the risk of wildfires, such as greenbelts and fire breaks around communities and along roadways.
- Support the protection of vital records, and strengthen or replace buildings, infrastructure, and lifelines to minimize post-disaster disruption and facilitate short-term and long-term recovery.
- Improve and expand systems that provide warning and emergency communications to the whole community.

- Continue developing and strengthening inter-jurisdictional coordination and cooperation in the area of emergency services.
- Promote and implement the retrofit or replacement of at-risk structures and lifelines to increase community resilience.
- Incentivize mitigation measures for high-risk and repetitive loss areas to address repairs, major alterations, development plans, and practices to increase community resilience.
- Reduce repetitive property losses due to hazard impacts through acquisition, retrofitting, design, and updated construction and land use regulations.
- Encourage and support leadership within the private sector, non-profit agencies, and community-based organizations to promote and implement local hazard mitigation activities.
- Proactively manage and care for natural resources, including grasslands, forests, oak woodlands, riparian forests, stream channels, coastal wetlands, and beaches, to enhance their ability to withstand and recover from natural disasters and minimize public safety risks.
- Support hazard mitigation measures that promote and enhance natural processes.
- Support hazard mitigation measures, where feasible, that utilize nature-based practices and solutions (e.g., holistic watershed management and green belts) and support and enhance natural processes.
- Encourage the creation of financial and regulatory incentives to motivate stakeholders such as homeowners, private sector businesses, and non-profit community organizations to mitigate hazards and risks.
- Conduct public outreach activities that increase community awareness and understanding of hazard risk, mitigation options, and preparedness strategies.
- Minimize impacts of hazard events on the economic drivers for the County.
- Align the hazard mitigation plan with state mitigation plans; city and county general, community, capital improvement plans; special-purpose district plans; and climate action, resilience, and adaptation plans.

MITIGATION ACTION PLAN

The mitigation actions presented in this update are activities designed to reduce or eliminate losses resulting from natural hazards. The update process resulted in the identification of 300 mitigation actions for implementation by individual planning partners, as presented in Volume 2 of this plan. In addition, the Steering Committee and planning partners identified three countywide actions benefiting the whole partnership, as listed in Table ES-1.

Table ES-1. Countywide Mitigation Initiatives

Action Number and Description	Priority for Implementation	Priority for Grant Pursuit
CW-1— Continue to maintain a website that will house the multi-jurisdictional hazard mitigation plan and any amendments to it adopted during the next 5-year period to provide the planning partners and the public with ongoing access to the plan and its implementation.	High	Low
CW-2— Continue to leverage/support/enhance ongoing, regional public education and awareness programs, such as VCAlert, CERT (Community Emergency Response Team), DART (Disaster Assistance Response Team), TsunamiReady, and StormReady, as methods to educate the public on risk, risk reduction, and community resilience.	High	Low
CW-3— Continue to provide a virtual hub for sharing information on hazard mitigation resources on the readyventuracounty.org website that will support mitigation efforts and awareness of grant funding opportunities to the planning partnership.	High	Low

IMPLEMENTATION

The Steering Committee developed a plan implementation and maintenance strategy that includes monitoring of the plan's implementation, progress reporting, a strategy for continued public involvement, and plan integration with other relevant plans and programs.

Full implementation of the recommendations of this plan will require time and resources. The measure of the plan's success will be its ability to adapt to changing conditions. Ventura County and its planning partners will assume responsibility for adopting the recommendations of this plan and committing resources toward implementation. The framework established by this plan will enable all planning partners to pursue Hazard Mitigation Assistance grant funding for feasible, eligible and cost-effective actions. The planning partnership developed this plan with extensive public input, and public support of the actions identified in this plan will help ensure the plan's success.

Part 1—BACKGROUND AND METHODS

1. INTRODUCTION

1.1 WHY PREPARE THIS PLAN?

Hazard mitigation is defined as any action taken to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster. Hazard mitigation activities include planning efforts, policy changes, programs, studies, improvement projects, and other steps to reduce the impacts of hazards. These actions may be long- or short-term in nature, and are implemented before, as well as during and after disasters.

1.1.1 Federal Eligibility

Disaster Mitigation Act

The federal Disaster Mitigation Act (DMA) emphasizes planning for disasters before they occur. The DMA requires state and local governments to develop hazard mitigation plans in order to be eligible for certain hazard-related federal grant programs. The grant eligibility requires that the hazard mitigation plan be approved by the Federal Emergency Management Agency (FEMA), formally adopted by the local community, and regularly updated. Regulations developed to fulfill the DMA's requirements are included in Title 44 of the Code of Federal Regulations (44 CFR).

The DMA encourages cooperation among state and local authorities in pre-disaster planning. The responsibility for hazard mitigation lies with not only with local, state, and federal governments, but also with private property owners and commercial and institutional interests. The enhanced planning network called for by the DMA helps local governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk-reduction projects.

The DMA also promotes sustainability in hazard mitigation. To be sustainable, hazard mitigation needs to incorporate sound management of natural resources and address hazards and mitigation in the largest possible social and economic context.

Community Rating System

FEMA's Community Rating System (CRS) is a voluntary incentive program that encourages community floodplain management activities that go beyond the minimum requirements of FEMA's National Flood Insurance Program (NFIP). The CRS describes 18 activities that communities can take to reduce or eliminate exposure to floods. To implement these activities, FEMA published the *2013 NFIP CRS Coordinators Manual*, which spells out the credit and credit criteria for CRS activities. Some of these activities can be implemented through the adoption of a qualifying hazard mitigation plan.

1.1.2 Purposes for Planning

Ventura County prepared a hazard mitigation plan in compliance with the DMA in 2005 and has updated the plan every five years since then, most recently in 2015. The *Ventura County Multi-Jurisdictional Hazard Mitigation Plan* 2022 update fulfills the ongoing update requirement.

This update 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 the needs of the County and communities within it. The focus of this plan is on better decision-making to avoid future risk and on activities that will eliminate or reduce current risks.

In preparing this update, the County partnered with local cities and special-purpose districts. Such multi-jurisdictional planning benefits from pooled resources and the elimination of redundant activities. FEMA encourages multi-jurisdictional planning under its guidance for the DMA. The plan will help guide and coordinate mitigation activities throughout the planning area.

The planning effort identified risks posed by hazards and developed strategies to reduce the impact of hazard events on people and property in Ventura County. The plan was developed to meet the following objectives:

- Meet or exceed program requirements specified under the DMA.
- Enable Ventura County to continue to qualify for federal grant funding to reduce risk through mitigation.
- Create a risk assessment that focuses on Ventura County’s hazards of concern.
- Coordinate existing plans and programs so that high-priority mitigation activities are funded and implemented.
- Address the Activity 510 Floodplain Management Planning activities of the CRS for the three participating partners:
  - Ventura County Public Works Agency—Watershed Protection (VCPWA-WP) on behalf of Unincorporated Ventura County, which joined the CRS in 2011 (currently rated at CRS Class 5)
  - The City of Oxnard, which joined the CRS in 2013 (currently rated at CRS Class 7)
  - The City of Simi Valley, which joined the CRS in 1993 (currently rated at CRS Class 5).

1.2 WHO WILL BENEFIT FROM THIS PLAN?

All residents, visitors, and businesses in Ventura County are the ultimate beneficiaries of this hazard mitigation plan update. The plan identifies strategies and actions to reduce risk for those who live in, work in, and visit the planning area. It provides a viable planning framework for all foreseeable natural hazards. Participation by key stakeholders in developing the plan helped ensure that outcomes will benefit the broadest possible range of communities in the county. The plan’s goals and recommendations can lay the groundwork for development and implementation of local mitigation activities and partnerships.

1.3 CONTENTS OF THE PLAN

This plan has been organized into two volumes so that elements that are specific to the individual planning partners can easily be distinguished from those that apply to the whole planning area:

- **Volume 1**—Volume 1 includes all federally required elements that apply to the entire planning area. This includes the description of the planning process, public involvement strategy, goals and objectives, countywide hazard risk assessment, countywide mitigation actions, and a plan maintenance strategy.
- **Volume 2**—Volume 2 includes all federally required jurisdiction-specific elements, in annexes for each participating jurisdiction. It includes a description of the participation requirements confirmed by the core planning team and Steering Committee, as well as instructions and templates that the partners used to complete their individual annexes.

Both volumes include elements required under federal guidelines. The CRS floodplain management planning activities for the participating planning partners are identified in their individual annexes. Where sections of this plan address specific DMA requirements, the CFR section number in which the requirement is found is cited.

The following appendices provided at the end of Volume 1 include information or explanations to support the main content of the plan:

- Appendix A—Public involvement information used in preparation of this update
- Appendix B—A summary of federal and state programs and regulations relevant to hazard mitigation
- Appendix C—A description of data sources and methods used for mapping hazard areas
- Appendix D—Quantitative risk assessment modeling results by jurisdiction
- Appendix E—Peak stream flow levels for waterways within Ventura County
- Appendix F—Plan adoption resolutions from planning partners

Each planning partner will adopt Volume 1 in its entirety and at least the following parts of Volume 2: the introduction, the partner's jurisdiction-specific annex, and the appendices.

2. PLAN UPDATE—WHAT HAS CHANGED?

2.1 PREVIOUS PLANS

2.1.1 2005 Ventura County Hazard Mitigation Plan

The 2005 hazard mitigation plan was prepared by Ventura County and other members of the Local Hazard Mitigation Group—consisting of members of the Inter-Agency Coordination Group, including fire chiefs/officials, emergency managers, safety coordinators, planners, and other officials and staff from 34 local participants including Ventura county, cities, and special districts). Technical support was provided by URS Corporation. The 2005 plan was developed between June 2004 to January 2005. It was adopted by the Ventura County Board of Supervisors on June 7, 2005.

2.1.2 2010 Ventura County Hazard Mitigation Plan

The 2010 Ventura County Hazard Mitigation Plan was a multi-jurisdictional plan covering Ventura County, the Cities of Camarillo, Moorpark, Ojai, Oxnard, Port Hueneme, Santa Paula, Thousand Oaks, and Ventura, eight special purpose districts, and the Ventura County Office of Education. The plan was adopted by the Ventura County Board of Supervisors in December 2010 and was approved by FEMA Region IX in February 2011. The planning process was overseen by a planning committee that was based on the standing Emergency Coordinators' Council. The plan identified eight goals and identified and prioritized 102 actions to be implemented by the planning partners.

2.1.3 2015 Ventura County Multi-Hazard Mitigation Plan

The 2015 update of the Ventura County Multi-Hazard Mitigation Plan was a multi-jurisdictional plan that covered Ventura County, the Cities of Camarillo, Moorpark, Ojai, Oxnard, Port Hueneme, Santa Paula, Thousand Oaks, and Ventura, eight special purpose districts, and the Ventura County Office of Education. Like the 2010 and 2005 plans before it, the 2015 plan focused on the hazards considered to be the greatest risk to the county based on historical disaster events, future probabilities and degree of vulnerability—including wildfire, earthquake, flood, dam and levee failures, landslide, winter storms, tsunamis, and agriculture/biological events.

The 2015 update process was expanded to address the implications that climate change and drought may have on hazard trends in Ventura County. Additionally, the 2015 process was enhanced to meet FEMA's Community Rating System Activity 510 planning requirements.

Based on its assessment of the identified hazards, the 2015 Plan recommended 22 mitigation actions for all partners that addressed the following 12 hazards of concern:

- Agricultural/biological
- Climate change
- Dam failure/inundation
- Drought
- Earthquake
- Flood
- Landslide
- Levee failure inundation
- Post-fire debris flow
- Tsunami
- Wildfire
- Winter storm

The 18 planning partners identified and prioritized 95 actions to be implemented by individual partners.

The planning process was overseen by a planning committee that included staff from County departments and agencies, representatives for each participating city and special district, and other entities, including the California Governor's Office of Emergency Services (Cal OES). The committee met two times during the plan update process. The plan was adopted by the Ventura County Board of Supervisors in May 2016 and was approved by FEMA Region IX in August 2016.

2.2 WHY UPDATE?

2.2.1 Federal Eligibility

Under 44 CFR, hazard mitigation plans must present a schedule for monitoring, evaluating, and updating the plan. This provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there is a need to change the focus of mitigation strategies. A jurisdiction covered by a plan that has expired is not able to pursue elements of federal funding for which a current hazard mitigation plan is a prerequisite.

2.2.2 Changes in Development

Hazard mitigation plan updates need to reflect any changes in development in the planning area that may have increased or decreased the vulnerability of a jurisdiction to hazards since the last plan was approved (44 CFR Section 201.6(d)(3)). The intent of this requirement is to ensure that the mitigation strategy addresses the risk and vulnerability of existing and potential development, as well as taking into consideration possible future conditions that could affect vulnerability.

The following are significant development and demographic changes in Ventura County since the 2015 hazard mitigation plan update:

- As of January 1, 2021, the reported population for Ventura County was 835,459, representing a decrease of 1.7 percent from 2016 (California Department of Finance, 2021)
- The valuation of the general building stock increased by 21.5 percent (County of Ventura Assessor, 2021)
- Based on development permit data provided by the municipal planning partners (see Volume 2), permits were issued for the construction of nearly 20,000 new structures over the past five years. This does not include accessory dwelling units, which are often classified as alterations

to an existing property rather than new construction. More than 80 percent of this development occurred in the cities of Camarillo, Ojai and Thousand Oaks.

Although the population decreased slightly during the performance period of the 2015 plan, the county experienced an overall increase in general building stock (see Volume 2). This plan update assumes that some of this new development occurred in hazard-prone areas. Because all such new development would have been regulated pursuant to local programs and codes, it is assumed that vulnerability did not increase even if exposure did. Ventura County and its incorporated cities and towns have general plans that govern land-use decisions and policymaking, as well as building codes and flood-management regulations based on state and federal mandates. More detailed information on the types and location of new construction over the last five years is available in the city and County annexes located in Volume 2 of this plan.

2.3 THE UPDATED PLAN—WHAT IS DIFFERENT?

The updated plan differs from the 2015 plan in a variety of ways. Table 2-1 indicates the major changes between the two plans as they relate to 44 CFR requirements for hazard mitigation plans.

Table 2-1. Key Changes from Previous Hazard Mitigation Plan

44 CFR Requirement	2015 Plan	Updated Plan
Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: • *An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* • *An 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* • *Review and incorporation, if appropriate, of existing plans, studies, reports and technical information.*	The 2015 plan included all of these components as summarized in Section 3 of the plan. This planning effort included enhanced coordination with floodplain management agencies to meet CRS requirements. The process was overseen by a designated planning committee and facilitated through an oversight hazard mitigation planning committee. The process included a public outreach and stakeholder involvement strategy that included: • Multi-media releases • Website • Web portal • Engagement with the Emergency Planning Council • Town hall • Virtual town hall • Brochure	This plan update utilized many of the same mitigation planning best-management practices but enhanced them on multiple fronts. The update process was facilitated by a planning team consisting of key County staff and a contract consultant, working with a multidiscipline stakeholder steering committee that met more frequently than the committee established for the 2015 effort. The steering committee confirmed a public engagement strategy that included: • Plan website • Story map • Survey • Public meetings • Social media • Media outreach This plan update also included enhanced efforts to coordinate with other agencies and community stakeholders that could support or enhance the outcomes of the update effort.

44 CFR Requirement	2015 Plan	Updated Plan
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce 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.	The 2015 plan included a risk assessment of 12 hazards of concern: • Agricultural/biological • Climate change • Dam failure inundation • Drought • Earthquake • Flood • Landslide • Levee failure inundation • Post-fire debris flow • Tsunami • Wildfire • Winter storm Each hazard was profiled with discussions on nature, history, location, extent, and probability of future events. However, the 2015 plan did not rank the hazards.	Volume 1 Part 2 presents a risk assessment of 10 hazards of concern and risk profiles for two "other hazards of interest" (agricultural/biological and pandemic). The identified hazards of concern are as follows: • Dam failure • Drought • Earthquake • Flood • Landslide • Sea-level rise and coastal erosion • Severe storms • Severe weather • Tsunami • Wildfire Hazard profiles are standardized for each hazard of concern, so that there is uniformity in the discussion of each hazard and the information provided can support rating of risk for each jurisdiction. All profiled hazards of concern were ranked based on their quantified impacts. The "other hazards of interest" profile was added to address agricultural/biological and pandemic hazards. These hazards were not ranked, but were qualitatively assessed to develop a more complete picture of the hazards facing the planning area. A climate change chapter was included that qualitatively profiles the potential impacts of climate change on each hazard of concern.

§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.	Each hazard of concern was profiled with discussions of nature, history, location, extent and probability of future events.	Each hazard of concern was profiled in the following categories:
		• General Background
		• Hazard Profile
		  ○ Past events
		  ○ Location
		  ○ Frequency
		  ○ Severity
		  ○ Warning Time
		  ○ Secondary Hazards
		• Exposure
		• Vulnerability
		• Future trends in development
		• Scenario
		• Issues

44 CFR Requirement	2015 Plan	Updated Plan
§201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community	The vulnerability analysis in the 2015 plan is based solely on exposure and does not estimate loss. The plan does include an overall summary of each hazard's impact based on exposure but does not determine the value of that exposure.	For this plan update, this aspect of the plan was significantly enhanced. Vulnerability was assessed for all hazards of concern. FEMA's Hazus risk assessment platform was used for evaluating dam failure, earthquake, flood, sea-level rise and tsunami hazards. The analyses supplemented the data built into the Hazus program with locally defined city and county data (Hazus refers to this as a Level 2 analysis). Site-specific data on County-identified critical facilities were entered into the Hazus model. Hazus outputs were generated for other hazards by applying an estimated damage function to an asset inventory extracted from Hazus. The risk assessment methodology used is described in Chapter 7 of this volume.
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods	Section 5.5 of the plan was dedicated to FEMA-identified repetitive loss properties	Section 11.2.7 of Volume 1 of this plan includes a comprehensive analysis of repetitive loss areas that includes an inventory of the number and types of structures in the repetitive loss area. Repetitive loss areas are delineated, causes of repetitive flooding are cited, and these areas are reflected on maps. This analysis includes all repetitive loss properties within the county.
§201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure and critical facilities located in the identified hazard area.	The focus of the vulnerability analysis for the 2015 plan was exposure of residential structures and identified critical facilities and infrastructure. The analysis includes no loss estimation.	The current update used Hazus to model impacts from dam failure, earthquake, flood, sea-level rise, and tsunami. A complete inventory of the numbers and types of buildings exposed (both residential and non-residential) was generated for each hazard of concern. Critical facilities were defined for the planning area, and these facilities were inventoried by exposure. Each hazard chapter provides a discussion on future development trends.
§201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	The 2015 vulnerability analysis includes no loss estimation.	Dollar loss estimates were generated for all hazards of concern. These estimates were generated by Hazus for dam failure, earthquake, flood, and tsunami. For the other hazards, loss estimates were generated by applying a regionally relevant damage function to the exposed inventory. In all cases, a damage function was applied to an asset inventory. The asset inventory was the same for all hazards and was generated in Hazus.
§201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	The 2015 Plan does not describe vulnerability in terms of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	There is a discussion of the overall land use within the planning area, and a spatial analysis of land use was performed for hazards with a clearly defined extent and location. There is a discussion on future development trends as they pertain to each hazard of concern. This discussion looks predominantly at the existing land use and the current regulatory environment.

44 CFR Requirement	2015 Plan	Updated Plan
§201.6(c)(3): The plan shall include 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.	The 2015 plan includes two identified goals, overarching potential mitigation actions for all local participants, and jurisdiction-specific actions for each planning partner.	The plan contains a vision statement, goals, objectives, and actions. The actions are jurisdiction-specific and strive to meet multiple objectives. The objectives are broad but measurable. All objectives meet multiple goals and stand alone as components of the plan. Each planning partner was asked to complete a capability assessment that looks at its regulatory, technical, and financial capabilities
§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.	The 2015 plan identified two goals.	A vision statement, 10 goals, and 19 objectives are described in Chapter 21 of this volume. Objectives were identified that meet multiple goals and were used to help establish priorities for the action items identified in the plan. The objectives are the basis for identifying and prioritizing multi-objective actions.
§201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	The 2015 plan prescribes a methodology for identifying potential actions from which each planning partner would draw to prepare an action plan. For each potential action, the methodology identifies the hazard addressed, the mitigation category, and whether action applies to new or existing construction.	Volume 1, Chapter 22 includes a catalog of mitigation best management practices that was developed through a facilitated process. This catalog identifies actions that manipulate the hazard, reduce exposure to the hazard, reduce vulnerability, or increase mitigation capability. The catalog segregates actions by scale of implementation. A table in each planning partner's action plan analyzes each action by mitigation type to illustrate the range of actions selected.
§201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	The 2015 Plan addresses the NFIP in the context of the mapping available within the planning area. The addresses the NFIP as a financial resource available to mitigate the impacts of the flood hazard, and it profiles the unincorporated County's participation in the NFIP.	The plan addresses the NFIP and the participation status of all cities within the county. Each municipal planning partner's annex in volume 2 of the plan profiles its NFIP status. All municipal planning partners that participate in the NFIP identified an action stating their commitment to maintain compliance and good standing under the program.
§201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in section (c)(3)(ii) 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.	The 2015 plan establishes priority project criteria centered on meeting FEMA's Hazard Mitigation Assistance program requirements. All actions identified in the 2015 plan are considered to be "high priority" projects based on these criteria.	Each recommended action was prioritized using a qualitative methodology that looked at the objectives the project will meet, the timeline for completion, how the project will be funded, the impact of the project, the benefits of the project and the costs of the project. This prioritization scheme is detailed in the introduction to Volume 2 of this plan.
§201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	Section 8 of the 2015 plan includes a plan maintenance methodology that meets this requirement	Volume 1, Chapter 24 details a strategy for monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

44 CFR Requirement	2015 Plan	Updated Plan
§201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	Section 8.3 of the 2015 plan includes a plan maintenance methodology that meets this requirement	Volume 1, Chapter 24 details recommendations for incorporating the plan into other planning mechanisms, such as: • Comprehensive plan • Emergency response plan • Capital improvement programs • Municipal code and standards Specific current and future plan and program integration activities are detailed in each participating jurisdiction's annex in Volume 2.
§201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	Section 8.4 of the 2015 plan includes a plan maintenance methodology that meets this requirement.	Volume 1, Chapter 24 details a comprehensive strategy for continuing public involvement.
§201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).	Adoption documentation and the FEMA approval letter are provided in the plan as an appendix.	Volume 1, Appendix F includes all supporting documentation for adoption of the plan by all planning partners

3. PLAN DEVELOPMENT METHODOLOGY

3.1 FUNDING

Funding for this planning effort was supplemented by a FEMA Hazard Mitigation Assistance grant (DR-4344-341-P). Ventura County Sheriff's Office of Emergency Services (OES) was the applicant agent for the grant. The grant covered 75 percent of the cost for development of this plan; the County covered the balance through in-kind match funding.

3.2 FORMATION OF THE CORE PLANNING TEAM

The County of Ventura contracted with Tetra Tech, Inc. to assist with development and implementation of the plan (the procurement process complied with 2 CFR A.II.200). The Tetra Tech project manager managed the overall plan development; Tetra Tech's lead planner was tasked with interacting with the County of Ventura's grant manager. A core planning team was formed to lead the planning effort, made up of the members shown in Table 3-1.

The core planning team met 14 times during the update process to track plan development milestones and identify meeting content for a steering committee established to help with development of the plan.

Table 3-1. Core Planning Team Makeup

Ventura County	
Bonnie Luke, OES, Senior Program Administrator/Grant Manager	Ruth Venus, IT Services, GIS Manager
Kathy Gibson, OES, Program Administrator	Eric Alger, IT Services, GIS Program Analyst
Patrick Maynard, OES, Director	Richard Paschal, IT Services, GIS Program Analyst
Glenn Shephard, VCPWA-WP, Director	Ashley Bautista, CEO, Public Information Officer
Gerard Kapuscik, VCPWA-WP, Staff Services Manager	Jackie Nuñez, CEO, Assistant Public Information Officer
Tetra Tech	
Rob Flaner, Project Manager	Jeana Wiser-Gomez, Public Outreach Lead
Cindy Rolli, Lead Project Planner	Des Alexander, Planner
Carol Baumann, Lead Risk Assessor	Megan Brotherton, Planner

3.3 ESTABLISHMENT OF THE PLANNING PARTNERSHIP

In June 2021, a planning partnership was formed to leverage resources and to meet requirements of the federal Disaster Mitigation Act for as many eligible local governments as possible. Ventura County opened this planning effort to all eligible local government and special districts within the planning area.

The new partnership expanded the partnership that had been established for the 2010 and 2015 hazard mitigation plan updates.

Each jurisdiction wishing to join the planning partnership was asked to provide a letter of intent to participate that designated a point of contact for the jurisdiction and confirmed the jurisdiction's commitment to the process and understanding of expectations. The planning partners covered under this plan are listed in Table 3-2.

Table 3-2. Hazard Mitigation Planning Partners

Jurisdiction	Point of Contact	Title
Cities/County		
City of Camarillo	Carmen Nichols	Assistant City Manager
City of Fillmore	Keith Gurrola	Fire Chief
City of Moorpark	Mackenzie Douglass	Program Manager
City of Ojai	James Vega	City Manager
City of Oxnard	Scott Brewer	Emergency Manger
City of Port Hueneme	Scott Matalon	Emergency Manager (Police)
City of San Buenaventura (Ventura)[a]	Daniel Wall	Emergency Manager
City of Santa Paula	Scott Varner	Emergency Manager
City of Simi Valley	Eileen Connors	Emergency Manager
City of Thousand Oaks	Grahame Watts	Emergency Manager
Ventura County	Bonnie Luke	Senior Program Administrator
Special Purpose Districts		
California State University, Channel Islands	Maggie Tougas	Emergency Manager
Calleguas Municipal Water District	Daniel Cohen	Emergency Response Coordinator
Casitas Municipal Water District	Julia Aranda	Engineering Manager
Channel Islands Beach Community Services District	Peter Martinez	General Manager
Conejo Recreation & Park District	Bill Palermo	Park Operations Analyst
Ojai Valley Sanitary District	Jeff Palmer	General Manager
Pleasant Valley Recreation & Park District	Mary Otten	General Manager
Saticoy Sanitary District	Tim Doyle	Engineering Analyst
Triunfo Water & Sanitation District	Tim Doyle	Engineering Program Manager
United Water Conservation District	Brian Collins	Chief Operations Officer
Ventura County Fire Protection District	Mark Lorenzen	Fire Chief
Ventura County Office of Education	Russ Olsen	Director of Risk Management
Ventura County Public Works Agency—Watershed Protection	Glenn Shephard	Director
Ventura Regional Sanitation District	Tina Rivera	Director of Finance

a. San Buenaventura is the official name of the city commonly called the City of Ventura.

3.4 DEFINING THE PLANNING AREA

The planning area was defined to consist of the unincorporated county areas, incorporated cities, and special purpose districts within the geographical boundary of Ventura County. All partners to this plan have jurisdictional authority within this planning area. A map showing the geographic boundary of the defined planning area for this plan update is provided in Chapter 4, along with a description of the planning area characteristics.

3.5 THE STEERING COMMITTEE

Hazard mitigation planning enhances collaboration among diverse parties who can be affected by hazard losses. A key element of the public engagement strategy for this plan update was the formation of a stakeholder steering committee to oversee all phases of the update. The members of this committee included Ventura County staff, planning partner representatives, and other stakeholders from within the planning area.

For this process, “stakeholder” was defined as any person or public or private entity that owns or operates facilities that would benefit from the mitigation actions of this plan, and/or has an authority or capability to support mitigation actions identified by this plan or be impacted by its recommendations. Stakeholders were separated into two categories:

- **Participatory Stakeholders**—Stakeholders that actively participated in the planning process as planning partners or members of the Steering Committee.
- **Coordinating Stakeholders**—Stakeholders that were not able to commit to actively participating in the process as a participatory stakeholder but were kept apprised of plan development milestones or were able to provide data that was used in the plan development.

The planning team assembled a list of steering committee candidates representing diverse interests within the planning area. Guidance on the committee’s composition was also obtained from reviewing FEMA’s 2017 recommendations on CRS credit for planning committees. The planning team confirmed a committee of 17 members at the May 19, 2021, kickoff meeting. Table 3-3 lists the Steering Committee members and designated alternates.

Table 3-3. Steering Committee Members

Point of Contact	Organization	Title	Alternate
Ashley Bautista	Ventura County Chief Executive Office	Public Information Officer	Jackie Nuñez
Daniel Cohen	Calleguas Municipal Water District	Emergency Response Coordinator	
Doug Graham	American Red Cross of Ventura County	Volunteer Lead	Scott O’Connell
Louise Lampara	Ventura County Coalition of Labor, Agriculture, & Business	Executive Director	
Alyssa Mann	The Nature Conservancy	Project Director, Disaster Resilience	Kat Selm
Brian McCarthy	City of Fillmore	Senior Planner	
Russ Olsen	Ventura County Office of Education	Director of Risk Management	Michelle Kelly
Chris Rosa	Ventura County Emergency Medical Services	Deputy Administrator	Janelle Hahn
Jeff Shea	Ventura County Fire Protection District	Division Chief	Mark Lorenzen
Glenn Shephard	Ventura County Public Works Agency—Watershed Protection	Director	Gerard Kapuscik
John Tolson	Simi Valley Chamber of Commerce	Director of Membership & Marketing	
Maggie Tougas	California State University Channel Islands	Emergency Manager	
	Ventura County Voluntary Organizations Active in Disaster	Chair	
Julie Tumamait-Stenslie	The Barbareño/Ventureño Band of Mission Indians	Tribal Chair	Frank Arrendondo
Lauren Utterback	Independent Living Resource Center	Emergency Preparedness Services Manager	Jamie Zimmerman
Dave Ward	Ventura County Planning Division	Planning Director	Aaron Engstrom
Grahame Watts	City of Thousand Oaks Public Works	Emergency Manager	
Matt Wyatt	Ventura County Building and Safety	District Manager West County Office	Dave Hansen

Leadership roles and ground rules were established during the Steering Committee's initial meeting on May 19, 2021. The Steering Committee then met every one to two months as needed throughout the course of the plan's development. The core planning team facilitated each Steering Committee meeting, which addressed a set of objectives based on an established work plan. The Steering Committee met six times from May 2021 through February 2022. Agendas were posted to the website prior to each scheduled Steering Committee meeting, and meeting summaries were posted to the hazard mitigation plan website following their approval by the Steering Committee.

3.6 COORDINATION WITH STAKEHOLDERS AND AGENCIES

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)). The planning team met this requirement as described below.

3.6.1 Notifications About Plan Development Milestones

The following agencies, organizations and entities were invited to participate in the plan development process, including all steering committee meetings, and were kept apprised of plan development milestones:

- Aera Energy
- American Red Cross of Ventura County
- Amgen
- Barbareño/Ventureño Band of Mission Indians
- California State University Channel Islands
- Calleguas Municipal Water District
- Camrosa Water District
- Casitas Municipal Water District
- Channel Islands Beach Community Services District
- City of Camarillo
- City of Fillmore
- City of Moorpark
- City of Ojai
- City of Oxnard
- City of Port Hueneme
- City of Santa Paula
- City of Simi Valley
- City of Thousand Oaks
- City of Ventura
- Conejo Recreation & Park District
- Independent Living Resource Center
- MICOP (Mixteco/Indigena Community Organizing Project)
- Ojai Valley Sanitary District
- Oxnard Chamber of Commerce
- Pleasant Valley Recreation and Park District
- Saticoy Sanitary District
- Simi Valley Chamber of Commerce
- Strickland Mutual Water Company
- The Nature Conservancy
- Triunfo Water & Sanitation District
- United Water Conservation District
- Ventura Chamber of Commerce

- Ventura County ACS/ARES
- Ventura County Building and Safety
- Ventura County Chief Executive Office
- Ventura County Coalition of Labor, Agriculture, and Business
- Ventura County Emergency Medical Services
- Ventura County Fire Protection District
- Ventura County Health Services Agency
- Ventura County Office of Education
- Ventura County Planning Division
- Ventura County Public Works Agency—Watershed Protection
- Ventura County Sheriff's OES
- Ventura County Voluntary Organizations Active in Disaster
- Ventura Regional Fire Safe Council
- Ventura Regional Sanitation District

These entities received meeting announcements, meeting agendas, and meeting minutes by e-mail throughout the plan development process. Some of them supported the effort by attending meetings or providing feedback on issues.

3.6.2 Pre-Adoption Review

All the entities listed above were provided an opportunity to review and comment on this plan during the public comment period, primarily through the hazard mitigation plan website (see Section 3.8.1). All were sent an e-mail message informing them that draft portions of the plan were available for review. Upon completion of a public comment period, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA for a pre-adoption review to ensure program compliance.

3.7 REVIEW OF EXISTING PROGRAMS

Hazard mitigation planning must include review and incorporation, as appropriate, of existing plans, studies, reports and technical information (44 CFR, Section 201.6(b)(3)). Chapter 6 of this plan provides a review of laws and ordinances in effect within the planning area that can affect hazard mitigation actions. In addition, the following programs can affect mitigation within the planning area:

- California Fire Code
- 2019 California Building Code
- California State Hazard Mitigation Forum
- Local capital improvement programs
- Local emergency operations plans
- Local general plans
- Housing elements
- Safety elements
- Local zoning ordinances
- Local coastal program policies

Assessments of all planning partners' regulatory, technical, and financial capabilities to implement hazard mitigation actions are presented in the individual jurisdiction-specific annexes in Volume 2. Many of these relevant plans, studies and regulations are cited in the capability assessments.

3.8 PUBLIC PARTICIPATION

Broad public participation in the planning process helps ensure that diverse points of view about the planning area's needs are considered and addressed. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval (44 CFR, Section 201.6(b)(1)). The Community Rating System (CRS) expands on these requirements by making CRS credits available for optional public involvement activities. The public outreach process for this plan update consisted of a combination of general outreach and information provided during partner meetings and events.

3.8.1 Strategy

As a result of the ongoing COVID-19 pandemic, in-person events were not able to be held during the course of this plan update. Therefore, the strategy for involving the public in this plan update emphasized the following elements:

- Identify and involve planning area stakeholders.
- Open Steering Committee meetings to members of the public for ongoing input.
- Use a survey to evaluate the public's perception of risk.
- Invite public participation and engagement at virtual meetings, including a call-in option for community members to provide input by phone.
- Attempt to reach as many planning area residents as possible using multiple media sources, including print, website, and social media.
- Publish agendas and minutes for Steering Committee meetings on the website.

In order to engage the broadest segment of the population, all social media posts were posted in both English and Spanish. Additionally, translation into Spanish, Mixteco and American Sign Language was provided during all virtual meetings. Translation services were advertised in meeting announcements and at the beginning of each meeting. Non-English-speaking participants could take advantage of this service by joining a break-out room of the virtual meeting. Recordings of public meetings were posted on the hazard mitigation website.

Stakeholders and the Steering Committee

The inclusion of stakeholders on the Steering Committee (see Section 3.5) served as a significant component of public involvement activities. Stakeholders targeted for this process included the following:

- Ventura County and local jurisdiction departments relevant for hazard mitigation planning
- Members of the academic community
- Community member representatives

- Representatives of humanitarian aid and access and functional needs (AFN) support services
- Tribal representatives
- Local special-purpose districts
- Local businesses and business interests
- Local environmental organizations

Internet

At the beginning of the plan update process in May 2021, the County established a hazard mitigation website (https://www.readyventuracounty.org/local-multijurisdictional-hazards-mitigation-plan-update/) to provide information about the process (see Figure 3-1). The website was used to keep the public informed about milestones and public participation opportunities and to solicit input.

Figure 3-1. Example Page of the Hazard Mitigation Plan Web Site

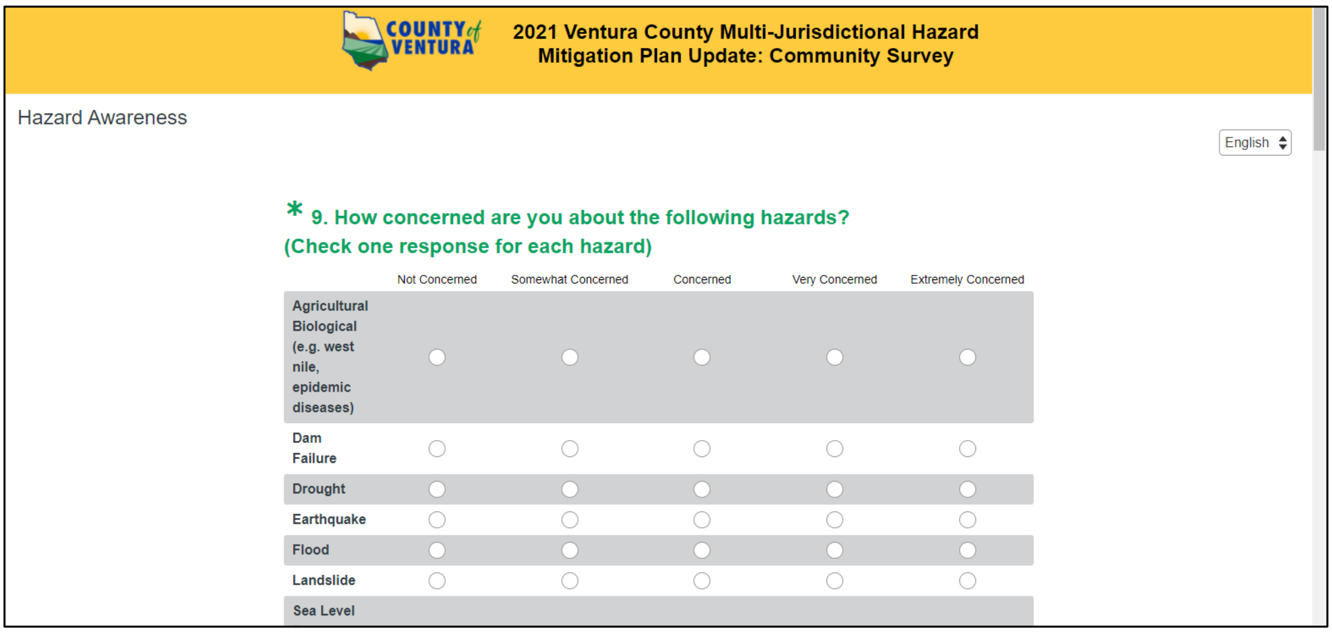
The site's address was publicized in all press releases, mailings, surveys, and public meetings. Information on the plan development process, the Steering Committee, the community awareness survey, and drafts of the plan were made available to the public on the site throughout the process.

Ventura County intends to keep a website active after the plan is complete to keep the public informed about successful mitigation projects and future plan updates.

Hazard Mitigation Survey

The planning team developed a 27-question community awareness survey with guidance from the Steering Committee (see Figure 3-2). The survey was used to gauge household and individual awareness of natural hazards and community members' level of knowledge about tools and techniques to assist them in reducing risk and loss from natural hazards.

Figure 3-2. Sample Page from Survey Distributed to the Public

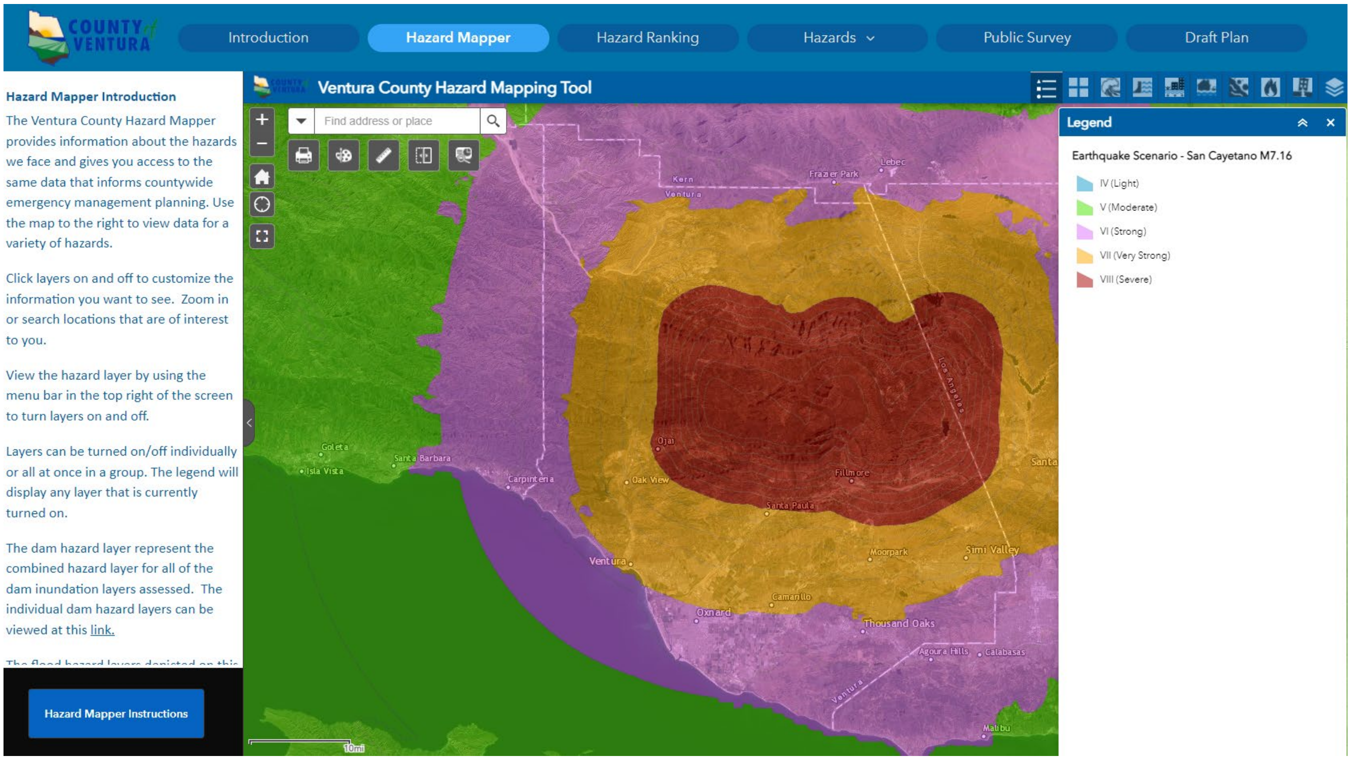


The survey was made available on the hazard mitigation plan website in both Spanish and English and was advertised throughout the course of the planning process (June 2021 to September 2021). Information on the survey was disseminated via an initial press release, the hazard mitigation plan website, social media (Facebook and Twitter), presentations during five publicly held Community Emergency Preparedness Workshops, and emails to emergency management stakeholders and interested parties. Interim results collected through September helped guide the Steering Committee and planning partners in affirming goals and objectives and in developing mitigation strategies. The survey remained active until the end of December 2021 for continued public input.

Story Map

An online "Story Map" was created (using Esri StoryMap software) to communicate the variety and severity of hazards facing Ventura County (see Figure 3-3). During the update process, the Story Map was released to the public and promoted through print and social media, the project website, and during public meetings. It includes risk assessment results for all relevant hazards, an interactive hazard mapping tool, and a report function to produce comprehensive hazard exposure summaries for any given property, block, or defined area. The Story Map expanded the ways in which members of the public could interact with hazard data as the hazard mitigation plan update was underway.

Figure 3-3. Example Story Map Data Page



After completion of the hazard mitigation plan update, the Ventura County Story Map will continue to support visual and data-based communication about the range of hazards relevant in Ventura County. New and revised data can be loaded into the platform in the future to compare hazard risk with any other spatial data set.

Public Meetings

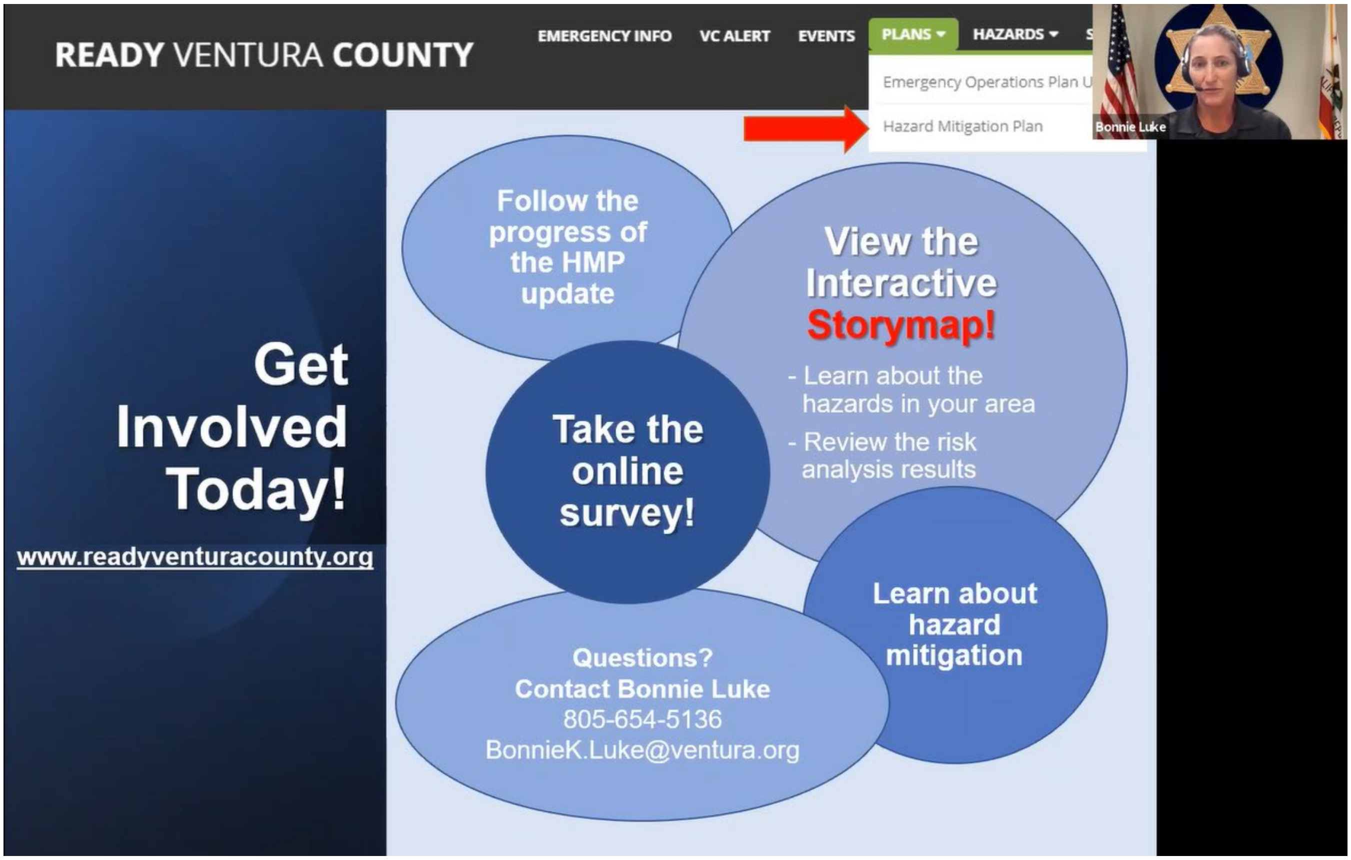
Five virtual public meetings—Community Emergency Preparedness Workshops on September 15, 16, 22, and 23 and October 11, 2021—described the hazard mitigation plan update process and provided information on the Story Map and community survey. Guest panelists from different cities were featured at each workshop to speak about local emergency preparedness efforts and current plan updates. The meetings described how participants could learn about hazard mitigation, follow the progress of the plan update, and participate in the plan update process. Each meeting featured a question-and-answer component and was presented in English, Spanish, Mixteco, and American Sign Language. Recordings of each meeting were posted on the website. Figure 3-4 shows an example screen shot from one of these meetings.

Additionally, the Emergency Planning Council meeting held on November 18, 2021 included an update on the status of the hazard mitigation plan update process.

Social Media

The Ventura County Sheriff's OES social media accounts (Twitter, Facebook, Nixle, and Nextdoor) were used to share information about the hazard mitigation planning process, including the community awareness survey, Community Emergency Preparedness Workshops, and the public comment period.

Figure 3-4. Screenshot from September 16, 2021 Community Emergency Preparedness Workshop



Print and Other Media Outreach

Press releases were distributed over the course of the plan's development as key milestones were achieved and before each public meeting. Each press release was supplemented by meeting announcements on the project website. The planning effort received widespread press coverage, including the following:

- Announcements of hazard mitigation plan update process and requests for community input:
  - June 24, 2021—Nixle
  - June 24, 2021—Citizens Journal
  - June 2021—City of Thousand Oaks Sustainability Blog
  - July 1, 2021—City of Thousand Oaks City Scene
  - July 6, 2021—Ojai Valley News
  - July 7, 2021—VC Reporter
  - July 14, 2021—Ojai Valley News
  - July 19, 2021—The Fillmore Gazette
  - July 21, 2021—Simi Valley Police Department
  - July 21, 2021—VC Reporter
  - July 21, 2021—Simi Valley News
  - September 2, 2021—City of Moorpark
  - July 21, 2021—Citizens Journal
- July 29, 2021—Simi Valley News announcement of the plan update and community survey

- Announcements of the five virtual Community Emergency Preparedness Workshops that included presentations on the plan update process:
  - September 8, 2021—Nixle
  - September 8, 2021—Citizens Journal
  - September 8, 2021—VC Reporter
  - September 15, 2021—VC Reporter
- HMP Update public service announcement (PSA) video release
  - September 2021—A public service announcement was created to support and inform the public about the hazard mitigation plan update and process. The video is posted on the County's hazard mitigation website at Hazard Mitigation Plan – Ready Ventura County.

Public Comment

The public outreach process for this plan update consisted of a combination of general outreach and information provided during partner meetings and events. Five virtual public meetings—on September 15, 16, 22, and 23 and October 11, 2021—described the hazard mitigation plan update process and provided information on the Story Map and community survey. The draft plan was made available to the public for comment during a noticed, three-week period in March 2022. The public comment period gave the public an opportunity to comment on the draft plan update prior to its submittal to Cal OES and FEMA. The principle avenue for public comment on the draft plan was the website established for this plan update.

3.8.2 Public Participation Results

Survey Results

From June through December 2021, more than 800 surveys were completed, covering all geographic areas of the County. The survey and detailed results are included in Appendix A; a summary is as follows:

- 832 surveys were completed.
- Surveys were received from all 10 incorporated cities as well as the unincorporated areas of the County.
- Respondents ranked wildfire as the hazard of greatest concern, followed by drought, earthquake, severe weather (wind, heat, cold), agricultural/biological hazards, severe storms, sea-level rise and coastal erosion, flood, landslide, tsunami, and dam failure.
- 84 percent of respondents have experienced or been affected by a wildfire.
- Nearly half of the respondents felt that their household was not prepared or only somewhat prepared to deal with a hazard event.

  Most respondents (nearly 76 percent) felt that personal experience with one or more natural hazards or disasters provided useful hazard and disaster preparedness to the public, followed by emergency preparedness information from government sources (federal, state, or local) (59 percent).
- The concept of incentives to promote hazard mitigation actions on a personal scale was strongly supported, with 67 percent of the respondents supporting a property tax break or incentive and

63 percent supporting an insurance premium discount to encourage them to spend money to retrofit their homes.

Survey results were provided to the Steering Committee for use in confirming goals, objectives and county-wide actions for this plan update. Additionally, the survey results were included in the toolkit provided to each planning partner through the jurisdictional annex process described in Volume 2. Each planning partner was able to use the survey results to:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

Meeting Attendance and Participation

Table 3-4 summarizes the attendance at the public meetings. As a result of the COVID-19 pandemic, all meetings were held virtually.

Table 3-4. Summary of Public Meetings

Date	Type of Meeting	Number in Attendance
May 19, 2021	Steering Committee Meeting #1	29
June 9, 2021	Steering Committee Meeting #2	27
July 14, 2021	Steering Committee Meeting #3	24
September 8, 2021	Steering Committee Meeting #4	16
September 15, 2021	Community Emergency Preparedness Workshop	106
September 16, 2021	Community Emergency Preparedness Workshop	90
September 22, 2021	Community Emergency Preparedness Workshop	83
September 23, 2021	Community Emergency Preparedness Workshop	55
October 11, 2021	Community Emergency Preparedness Workshop	30
November 10, 2021	Steering Committee Meeting #5	22
November 18, 2021	Ventura County Emergency Planning Council	
January 27, 2022	Presentation at the Santa Clara River Watershed Committee's community organization meeting	Unknown
February 9, 2022	Steering Committee Meeting #6	20
Total		

3.9 PLAN DEVELOPMENT CHRONOLOGY/MILESTONES

Table 3-5 summarizes important milestones in the development of the plan update.

Table 3-5. Plan Development Milestones

Date	Event	Description	Attendance
2021			
1/21	Support Contractor Secured	County selects Tetra Tech to facilitate plan update process	N/A
Feb/ March	COVID-19	COVID-19 pandemic caused delays in onboarding of project lead and initiation of update process	
4/7	Organize Resources	Core planning team formed	N/A
4/8	Core Planning Team Meeting #1	• Core planning team kickoff • Planning process overview and schedule • Steering Committee function defined • Planning partner discussion • Data acquisition • Public outreach strategy • Meeting coordination	11
4/13	Core Planning Team Meeting #2	• Review of 2015 hazards of concern • Steering Committee • Schedule kickoff meeting	11
4/27	Core Planning Team Meeting #3	• Steering Committee • Hazards of concern • Planning partner kickoff meeting • Public outreach	11
5/5	Project Kickoff Meeting	• Review work plan • Discuss planning partner expectations • Obtain input on Steering Committee • Risk assessment data needs • Discuss public involvement strategy	34
5/6	Jurisdictional Annex Process Phase 1	• Planning partners begin the jurisdiction annex update process with the team, profile, trends, and previous plan status updates.	N/A
5/11	Core Planning Team Meeting #4	• Hazard scenarios • Public outreach • Steering Committee confirmation • Planning partner kickoff meeting review	12
5/13	Public Outreach	ReadyVentura County website adapted and expanded for information on 2022 plan update process	N/A
5/19	Steering Committee Meeting #1	• Project overview • Role of the Steering Committee • Discuss public outreach strategy • Review of 2015 hazard mitigation plan	29
5/25	Core Planning Team Meeting #5	• Hazard scenarios confirmed • Draft mission, goals, and objectives • Public outreach—community preparedness survey	14
6/02	Public Outreach	Hazard mitigation community awareness survey deployed and kept open through December 31, 2021. https://www.surveymonkey.com/r/G7T7W5R (Survey closed after December 31, 2021)	N/A
6/08	Core Planning Team Meeting #6	• Public outreach • Finalized hazards of concern and scenarios • Mission and goals discussion • Define FEMA community lifelines	14

Date	Event	Description	Attendance

6/09	Steering Committee Meeting #2	• Finalize and confirm Steering Committee guidelines
		• Public outreach strategy
		  ○ Website
		  ○ Survey
		• Volume 1 and 2 overview
		• Vision and goal setting
		• Hazards of concern accepted and hazard scenarios explained
		• Critical infrastructure / FEMA lifelines definition accepted
			27

6/22	Core Planning Team Meeting #7	• Public outreach, bilingual survey • Mission goals and objectives discussion	13
7/06	Jurisdictional Annex Process Phase 2	• Planning partners continue the jurisdictional annex update process with the capability assessment, integration review, and information sources updates.	N/A

7/14	Steering Committee Meeting #3	• Public outreach
		  ○ Website
		  ○ Survey update
		• Vision, goals, and objectives accepted
		• Planning partner update
		• Story map overview
			24

7/20	Core Planning Team Meeting #8	• Final mission, goals, and objectives • Public outreach • Story map review • Jurisdictional Annex Phase 3 Workshop discussion	9
8/03	Core Planning Team Meeting #9	• Public outreach, survey updates • Jurisdictional Annex Phase 3 Workshop overview	11
8/31	Core Planning Team Meeting #10	• Public outreach update • PSA video update • Story map presentation • Planning partner update • Steering Committee meeting preparation	6

9/08	Steering Committee Meeting #4	• Public outreach
		  ○ Website
		  ○ Survey status
		  ○ Community meetings
		• Story map
		  ○ PSA video
			16

9/14	Core Planning Team Meeting #11	• Story map review • PSA video status	8
9/15	Public Outreach	Community Emergency Preparedness Workshop—Featuring Unincorporated County Areas	106
9/16	Public Outreach	Community Emergency Preparedness Workshop—Featuring the City of Oxnard	90
9/22	Jurisdictional annex Workshop - Municipalities	Workshop for municipal planning partners to assist in completion of Phase 2 of the jurisdictional annex process. Remote technical support provided by Tetra Tech	30
9/22	Public Outreach	Community Emergency Preparedness Workshop—Featuring the City of Camarillo	83
9/23	Jurisdictional annex Workshop – Special Purpose Districts	Workshop for special district planning partners to assist in completion of Phase 2 of the jurisdictional annex process. Remote technical support provided by Tetra Tech	35
9/28	Phase 3 Annex Conference Call #1	Remote technical support provided to planning partners by Tetra Tech in support of Phase 2 annex completion	

Date	Event	Description	Attendance
9/17	Public Outreach	• Closure of hazard mitigation survey • Tabulation of results	
9/23	Public Outreach	Community Emergency Preparedness Workshop—Featuring the City of Simi Valley	55
Sept	Public Outreach	PSA video released in English and Spanish	N/A
10/05	Phase 3 Annex Conference Call #2	Remote technical support provided to planning partners by Tetra Tech in support of Phase 3 annex completion	
10/11	Public Outreach	Community Emergency Preparedness Workshop—Featuring the City of Santa Paula	30
10/12	Phase 3 Annex Conference Call #3	Remote technical support provided to planning partners by Tetra Tech in support of Phase 3 annex completion	
10/19	Phase 3 Annex Conference Call #4	Remote technical support provided to planning partners by Tetra Tech in support of Phase 3 annex completion	
10/26	Core Planning Team Meeting #12	• Planning partner Phase 3 annex status update • Countywide initiatives • Plan maintenance strategy • Public meeting to coordinate with the Emergency Planning Council • Public comment period discussion • Plan development schedule update	
11/10	Steering Committee Meeting #5	• Update on planning partner activities • Review of proposed county-wide initiatives • Confirmation of plan maintenance strategy	22
11/16	Core Planning Team Meeting #13	• Discuss and determine plan maintenance strategy and grant monitoring	5
11/18	Public Outreach	• Emergency Planning Council meeting • Status update on the hazard mitigation plan update	not available
2022			
1/11	Core Planning Team Meeting #14	• Draft plan Volume 1 review • Planning partner update • Plan development schedule	5
2/09	Steering Committee Meeting #6	• Discuss plan progress • Draft plan presentation • Draft plan public comment method • Public comment period • Plan development, submittal and adoption discussion	20
2/08	Core Planning Team Meeting #15	• Draft plan Volume 1 internal review update • Steering Committee meeting preparation • Public comment press release discussion • Plan development schedule updates	5
TBD	Public Outreach	Opening of the 3-week public comment period	N/A
TBD	Public Outreach	Closure of the 3-week public comment period	N/A
TBD	Plan Submittal to Cal OES	Submittal of draft plan to Cal OES for review and approval	N/A
TBD	Plan Submittal to FEMA	Submittal of draft plan to FEMA	
TBD	Approval Pending Adoption	Approval Pending Adoption provided by FEMA	N/A
TBD	Adoption	Adoption window for planning partners opens	N/A
TBD	Approval	Proof of adoption documentation submitted to FEMA and Cal OES	N/A
TBD	Approval	Final approval of the plan by FEMA	N/A

4. VENTURA COUNTY PROFILE

4.1 PHYSICAL SETTING

4.1.1 Geography and Topography

Ventura County covers 2,208 square miles along southern California's Pacific coast (1,845 square miles of land and 363 square miles of water). It is bordered by Kern County to the north, Santa Barbara County to the northwest, the Pacific Ocean to the southwest, and Los Angeles County to the east and southeast. National forest makes up 53 percent of Ventura County's total area. Of the remaining 47 percent (555,953 acres), 59 percent is agricultural and 17.5 percent is urban. Two of California's eight Channel Islands are also part of the county: Anacapa Island, which is the most visited island in Channel Islands National Park, and San Nicolas Island, which is operated by the U.S. Navy.

The topography in the county is highly variable and includes mountainous areas, rolling hills, a fertile river valley and coastal plain, steep coastal bluffs, and sections of rocky coastline. The northern half of the county is mountainous and sparsely inhabited, and contains some of the most unspoiled, rugged and inaccessible wilderness remaining in southern California. Most of this land lies within the Los Padres National Forest, and includes the Chumash Wilderness in the northernmost portion, adjacent to Kern County, as well as the Sespe Wilderness and portions of the Dick Smith Wilderness and Matilija Wilderness (both of which straddle the line with Santa Barbara County) (California Department of Conservation 2021). This is an area of high topographic relief; eight mountains within this portion of the county exceed 6,000 feet in elevation, and the only major river valley is Lockwood Valley.

Conversely, the southwestern portion of the county consists of a large coastal plain known as the Oxnard Plain. The plain was formed by the deposition of sediments from the Santa Clara River and from the streams of the Calleguas-Conejo drainage system. It has a mean elevation of 50 feet, but the elevation is as much as 150 feet at points south of the Santa Clara River and as much as 300 feet at points north of the river. The part east of the Revolon Slough that centers on Camarillo is called Pleasant Valley. Most of the arable land in the county is found on the coastal plain, as well as the cities of Camarillo, Oxnard, Ventura, and Port Hueneme.

A series of smaller east-west trending hills and mountain ranges make up much of the remainder of the county. The Santa Ynez Mountains, the Topatopa Mountains, and the Piru Mountains constitute the northern boundary of the Oxnard Plain. The Santa Susana Mountains lie alongside the eastern boundary of the county, and the Simi Hills and the Santa Monica Mountains are along the southern border with Los Angeles County. These coastal mountains range in elevation from 50 feet along the coast south of the coastal plain to about 3,100 feet in the Santa Monica Mountains. Inland, the low, long South Mountain and Oak Ridge ranges separate Santa Clara Valley from the Las Posas Valley and Simi Valley. The Camarillo Hills and the Las Posas Hills extend from Camarillo to Simi Valley and separate the Las Posas-Simi area from the Santa Rosa Valley and Tierra Rejada Valley (U.S. Department of Agriculture 1970).

4.1.2 Watersheds and Surface Waters

Ventura County contains four main watershed zones. The Santa Clara River is by far the largest river, with a drainage area of 1,625 square miles at its mouth. The Ventura River is also a prominent river in the county, with a drainage area of 263 square miles at the Pacific Ocean. Chapter 11 discusses the watershed areas in greater detail. The county also has numerous lakes and reservoirs. The largest dam-created reservoir by volume is Lake Casitas, which holds 254,000 acre-feet of water. It is used primarily for drinking water, irrigation, flood control, and recreation. Lake Piru, another large dam-created reservoir in the county, has a slightly larger surface area than Lake Casitas but is shallower and only holds 83,244 acre-feet of water. Lake Piru is used for recreation, flood control, surface water conservation and groundwater conservation and replenishment.

4.1.3 Climate

Ventura County features a Mediterranean climate characterized by cool, dry summers near the coast and warm, dry summers inland. Winters are typically mild and wet, with the area receiving 95 percent of its annual rainfall from November through April.

Average precipitation is highly variable across the region and varies dramatically with elevation as well as distance from the coast. For example, average annual rainfall ranges from less than 8 inches in the Cuyama Valley in northwestern Ventura County to approximately 38 inches in the Ventura River watershed west of the City of Ojai. Prevailing weather patterns during winter and the orientation of the mountain ranges in the northern half of the county can also combine to produce extremely high-intensity rainfall. Along the coast near Oxnard, Ventura, Simi Valley, and Thousand Oaks, the average rainfall is 14 inches.

Like most of southern California, Ventura County also observes high interannual precipitation variability, where an average rainfall year is the exception rather than the rule.

Table 4-1 summarizes normal climate date from 2000 through 2020 at the National Centers for Environmental Information (NCEI) weather station at the Oxnard Airport.

Table 4-1. Normal Precipitation and Temperatures, 2000 – 2020

		Temperature (^{o}F)		
	Precipitation (inches)	Minimum	Average	Maximum
Annual	17.6	46.5	58.6	71.3
Winter	10.99	37.7	48.9	60.2
Summer	0.09	55.5	69.3	83.1
Spring	4.29	42.6	54.9	67.1
Autumn	2.16	50.2	61.3	74.6

Weather Station: Oxnard Ventura County Airport
Source: (National Centers for Environmental Information 2021)

4.2 HISTORICAL OVERVIEW

Ventura County was historically inhabited by the Chumash people, who also settled throughout much of Santa Barbara and San Luis Obispo Counties. The Chumash were originally hunters, gatherers, fisherman, and traders, and are known for their rock paintings and basketry.

Spanish explorers began arriving in the area in the mid-1500s, although active occupation did not effectively occur until more than 200 years later. The Spanish encouraged settlement of the area with large land grants called ranchos. The Catholic church established the Mission San Buenaventura in 1782 in what is now the City of San Buenaventura (commonly called the City of Ventura).

The County of Ventura was established on January 1, 1873, when it separated from Santa Barbara County, just 23 years after California's statehood was attained. At this time, the area remained largely rural, consisting of a population of less than 5,000 individuals that engaged predominantly in ranching and the cultivation of grain crops.

During the early 1900s, increased demand from new markets in the burgeoning Los Angeles area led to a significant expansion and diversification of agriculture in Ventura. Together with the discovery of vast oil reserves in the area, this resulted in an influx of immigrants, wealth, and substantial improvements to transportation infrastructure in the region.

A second, intense population boom (>5% annually) occurred beginning in the 1940s with the construction of Port Hueneme and the establishment of a military base at Point Mugu, which brought numerous professionals and ancillary industries to the region. Ventura County, and the Oxnard area in particular, benefited from the hiring of more than 10,000 civilian workers and 21,000 military personnel, thus providing jobs for local residents and reviving the economy following the Depression of the 1930s. By 1950, the population of the county had increased to over 114,000, more than double its population in 1930.

The East County saw a large growth in population starting in the mid-20th century with people moving from the San Fernando Valley in Los Angeles to the Conejo and Simi Valleys. Many working-class people migrated to these areas during the 1960s and 1970s out of East and Central Los Angeles. Making the U.S. 101 a full freeway in the 1960s, and the expansions that followed, helped make commuting to Los Angeles easier and opened the way for development westward. The communities that saw the most substantial development were Calabasas, Hidden Hills, Agoura Hills, Westlake Village, Thousand Oaks, and Newbury Park. The East County area of Simi Valley saw its already considerable population of nearly 60,000 inhabitants in 1970 grow to over 100,000 over the following two decades.

Development moved farther out the U.S. 101 corridor and sent population rising in West County cities as well. The largest population growth there was in Camarillo, Oxnard, and Ventura. Development in the East County and along the U.S. 101 corridor is rare today, because most of these cities are master-planned cities, such as Thousand Oaks and Simi Valley, and are approaching buildout. Although the area still has plenty of open space and land, almost all of it is mandated to never be developed as part of the master plan of each city.

4.3 POPULATION CENTERS, TRANSPORTATION, AND GOVERNMENT

The major population centers in Ventura County today are in the southern part of the county, within the incorporated cities of Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, Santa Paula, Simi Valley, Thousand Oaks, and San Buenaventura (Ventura). Unincorporated communities of note include La Conchita, Lake Sherwood, Meiners Oaks, Oak Park, Oak View, Santa Rosa Valley, El Rio, and Saticoy. The City of Ventura, located along the northwestern coast of the county, is the county seat. The nearby City of Oxnard is the most populous city. Both these cities are located on the Oxnard Plain, a large alluvial fan formed by deposition from the Santa Clara River. The planning area is shown in Figure 4-1. The risk analysis for this hazard mitigation plan assessed risk both countywide and for each planning partner's jurisdictional area.

U.S. Highway 101 is the main highway in the county, running east to west through the southern half of the county, and connecting the cities of Thousand Oaks, Camarillo, Oxnard, and Ventura. U.S. Highway 126 runs east to west along the Santa Clara River Valley, through the cities of Fillmore, Santa Paula, and Ventura, before joining with U.S. Highway 101. Highway 1 follows the coastline along the county's southern boundary. Other major roadways include State Highways 33, 34, 118, and 150. Airports in the county include Camarillo Airport, Oxnard Airport, Santa Paula Airport, and Naval Base Ventura County. Both Camarillo and Oxnard airports are operated by the Ventura County Department of Airports. Santa Paula airport is a privately owned, public-use airport. Naval Base Ventura County is operated by the U.S. Navy. The National Railroad Passenger Corporation (Amtrak) and Metrolink trains carry passengers on track extending from Simi Valley to Oxnard. Amtrak service continues to Ventura and along the coastline/Highway 101 to Santa Barbara County.

The Ventura County Board of Supervisors sits as the governing board of Ventura County and of various special jurisdictions such as the Sonoma County Water Agency, the Ventura County Air Pollution Control District, the Agricultural Preservation and Open Space District, County Sanitation Districts, and the Community Development Commission. The Board is composed of five supervisors elected from supervisorial districts for four-year terms. The boundaries of these districts are included on Figure 4-1.

4.4 DEVELOPMENT

4.4.1 Land Use

The Ventura County 2040 General Plan and its land use maps govern the types of land uses and development that may occur in different areas of the unincorporated county. The focus of current land use policies is to preserve agricultural, rural, and open space lands while directing growth to cities and unincorporated communities. Figure 4-2 shows the distribution of current land uses in the unincorporated county.

4.4.2 Building Count, Occupancy Class and Estimated Replacement Value

Table 4-2 presents planning area building counts by occupancy class; these are broad use classes assigned in the Hazus model. Table 4-3 summarizes estimated replacement value for building structures and contents combined, based on County assessor data.

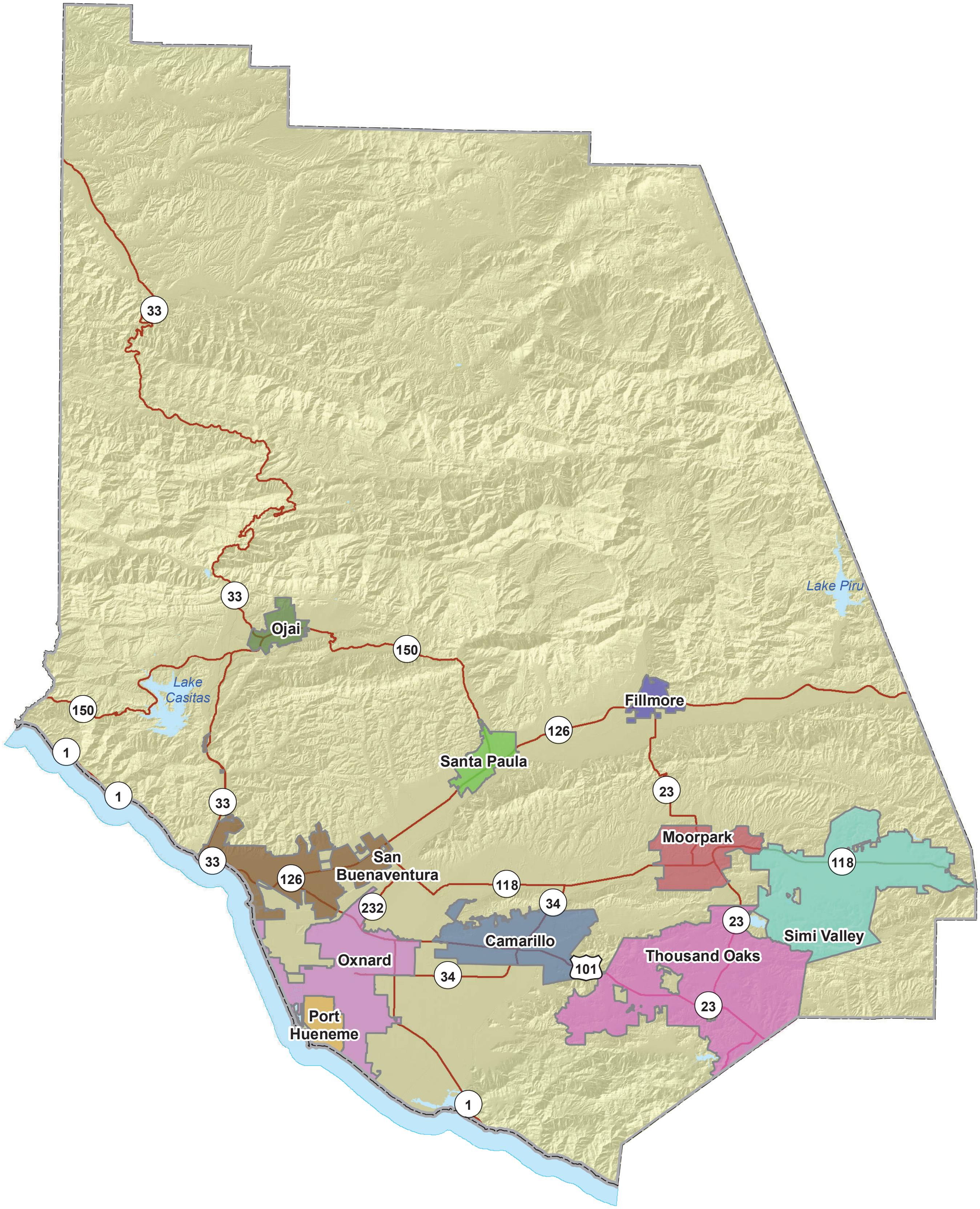
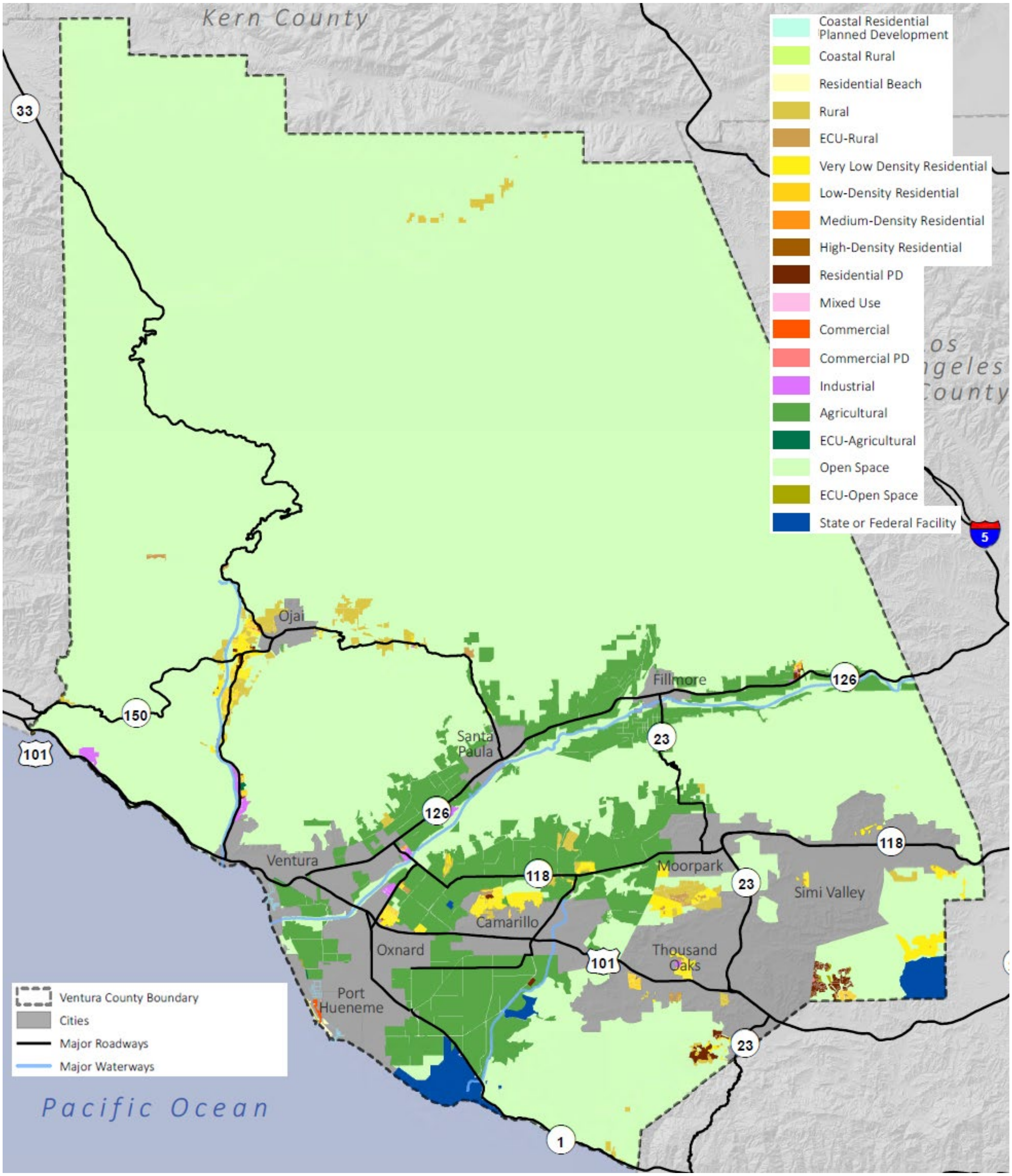


Figure 4-1. Planning Area

Data Sources: Ventura Co., Esri

Figure 4-2. Land Use Classifications in the Planning Area



Source: Ventura County 2020

Table 4-2. Planning Area Building Counts by Occupancy Class

	Number of Buildings							
	Agricultural	Commercial	Education	Government	Industrial	Religion	Residential	Total
Camarillo	24	736	215	280	832	85	19,657	**21,829**
Fillmore	7	328	85	69	39	17	4,310	**4,855**
Moorpark	101	410	183	63	153	18	9,769	**10,697**
Ojai	23	345	56	48	54	87	2,918	**3,531**
Oxnard	92	3,117	654	429	961	150	40,471	**45,874**
Port Hueneme	0	299	57	430	26	18	5,583	**6,413**
San Buenaventura	72	2,933	381	250	788	192	30,694	**35,310**
Santa Paula	55	833	119	50	190	69	7,211	**8,527**
Simi Valley	56	1,210	434	53	301	108	35,640	**37,802**
Thousand Oaks	7	1,442	325	171	286	218	36,348	**38,797**
Unincorporated	11,027	3,172	494	745	523	493	32,568	**49,022**
Total	**11,464**	**14,825**	**3,003**	**2,588**	**4,153**	**1,455**	**225,169**	**262,657**

Table 4-3. Estimated Replacement Value of Planning Area Buildings

	Estimated Total Replacement Value (Structure and Contents)		Estimated Total Replacement Value (Structure and Contents)
Camarillo	$17,707,287,595	**San Buenaventura**	$23,838,143,638
Fillmore	$2,467,839,895	**Santa Paula**	$4,571,072,937
Moorpark	$8,222,512,567	**Simi Valley**	$24,328,139,279
Ojai	$2,340,202,613	**Thousand Oaks**	$30,560,756,798
Oxnard	$32,903,823,044	**Unincorporated**	$29,161,232,550
Port Hueneme	$4,655,956,714	**Total**	$180,756,967,629

Source: Ventura County tax parcel data

4.4.3 Critical Facilities

Critical facilities are those that are essential to the health and welfare of the population. These become especially important after a hazard event. Also included are facilities that hold significant amounts of hazardous materials with a potential to impact public welfare during a hazard event. The risk assessment for each hazard in this plan discusses potential impacts on critical facilities. This plan update uses the following definition of critical facilities:

> A structure, facility, or other improvement that, because of its function, service area, or uniqueness, provides service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security.

The planning team and Steering Committee recommended that this plan update include a definition of critical facilities that aligns with FEMA's "community lifelines" concept. This will position the County for future funding under FEMA grant programs and initiatives. The FEMA-defined lifeline categories are as follows:

- **Safety and Security**—Law enforcement/security, search and rescue, fire services, government service, responder safety, and imminent hazard mitigation

- **Food, Water and Shelter**—Evacuations, schools, food/potable water, shelter, durable goods, water infrastructure and agriculture
- **Health and Medical**—Medical care (hospitals), patient movement, public health, fatality management, health care and supply chain
- **Energy**—Power (grid), temporary power and fuel
- **Communications**—Infrastructure, alerts, warnings, messages, 911 and dispatch, responder communications and financial services
- **Transportation**—Highway/roadway, mass transit, railway, aviation, maritime and pipeline
- **Hazardous Materials**—Facilities, hazardous debris, pollutants, and contaminants

Table 4-4 provides a summary of the critical facilities in the planning area by category and jurisdiction. General locations of identified critical facilities are shown on Figure 4-3 and Figure 4-4. The County and its planning partners consider this information to be subject to change as new information about critical facilities becomes available during the performance period for this plan. Due to the sensitivity of this information, a detailed list of facilities is not provided; however, all critical facilities were analyzed in Hazus to help rank risk and identify mitigation actions. The risk assessment for each hazard discusses critical facilities with regard to that hazard.

Table 4-4. Critical Facilities by Jurisdiction and Category

	Number of Facilities Present							
	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	20	5	34	14	1	32	32	**138**
Fillmore	3	1	4	1	0	10	3	**22**
Moorpark	5	1	7	9	0	19	11	**52**
Ojai	6	1	14	0	1	12	2	**36**
Oxnard	24	33	9	23	2	59	36	**186**
Port Hueneme	7	2	1	2	0	7	8	**27**
San Buenaventura	34	10	6	6	3	54	63	**176**
Santa Paula	5	1	3	3	1	15	20	**48**
Simi Valley	19	4	4	13	1	49	71	**161**
Thousand Oaks	53	7	19	13	1	54	54	**201**
Unincorporated	74	46	91	9	0	69	223	**512**
Total	**250**	**111**	**192**	**93**	**10**	**380**	**523**	**1,559**

4.4.4 Development Trends

An understanding of population and development trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure. The Disaster Mitigation Act requires that communities consider land use trends, which can alter the need for, and priority of, mitigation options over time. Land use and development trends significantly affect exposure and vulnerability to various hazards. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.

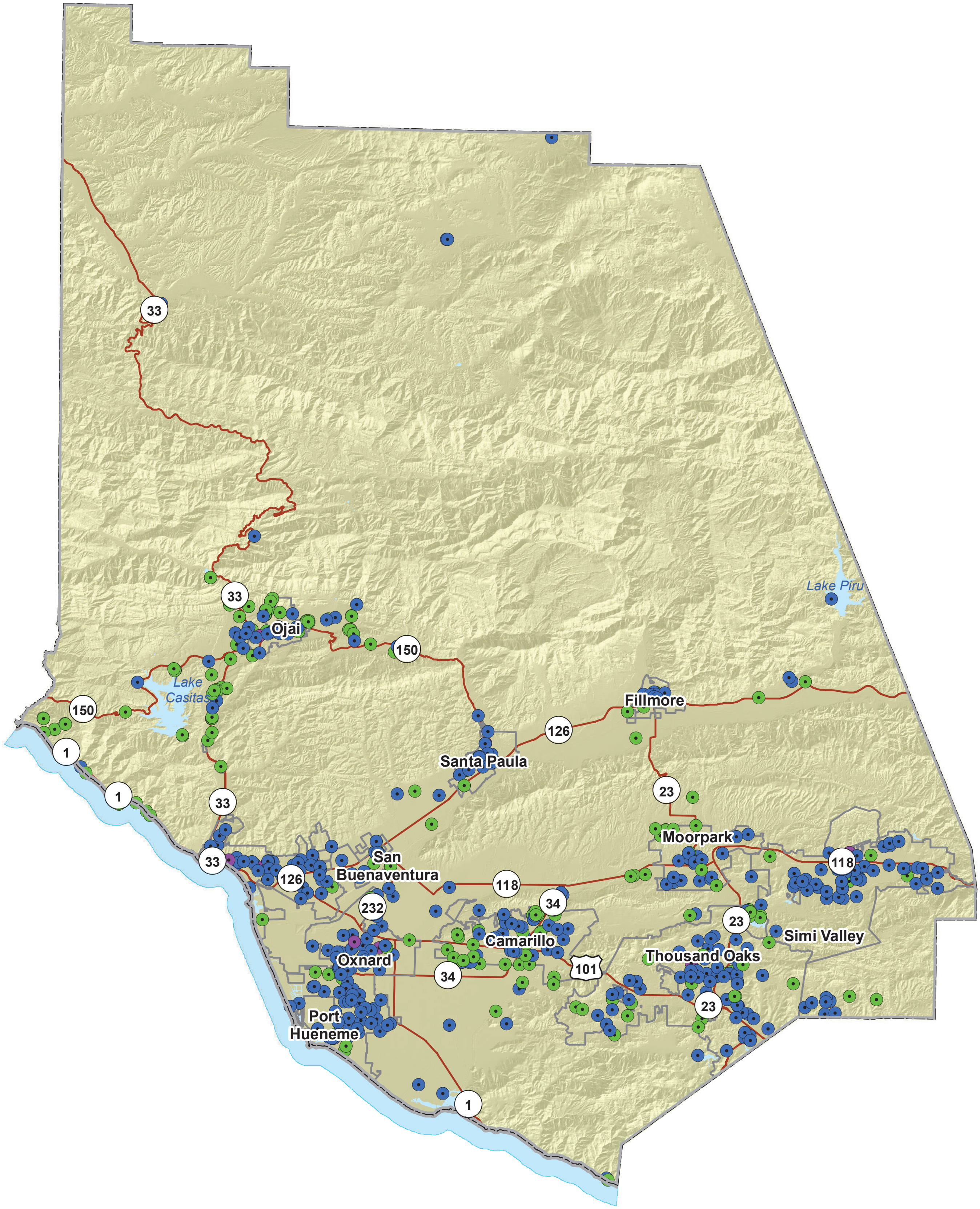


Figure 4-3. Critical Facilities (1 of 2)

Health and Medical
Food, Water, Shelter
Safety and Security
County Boundary
Cities
Major Roads

N
0 3 6 Miles

Data Sources: Ventura Co., VCFD, Casitas MWD, Calleguas MWD, City of Camarillo, CA Energy Commission, Cal Trans, EPA, HIFLD, Esri

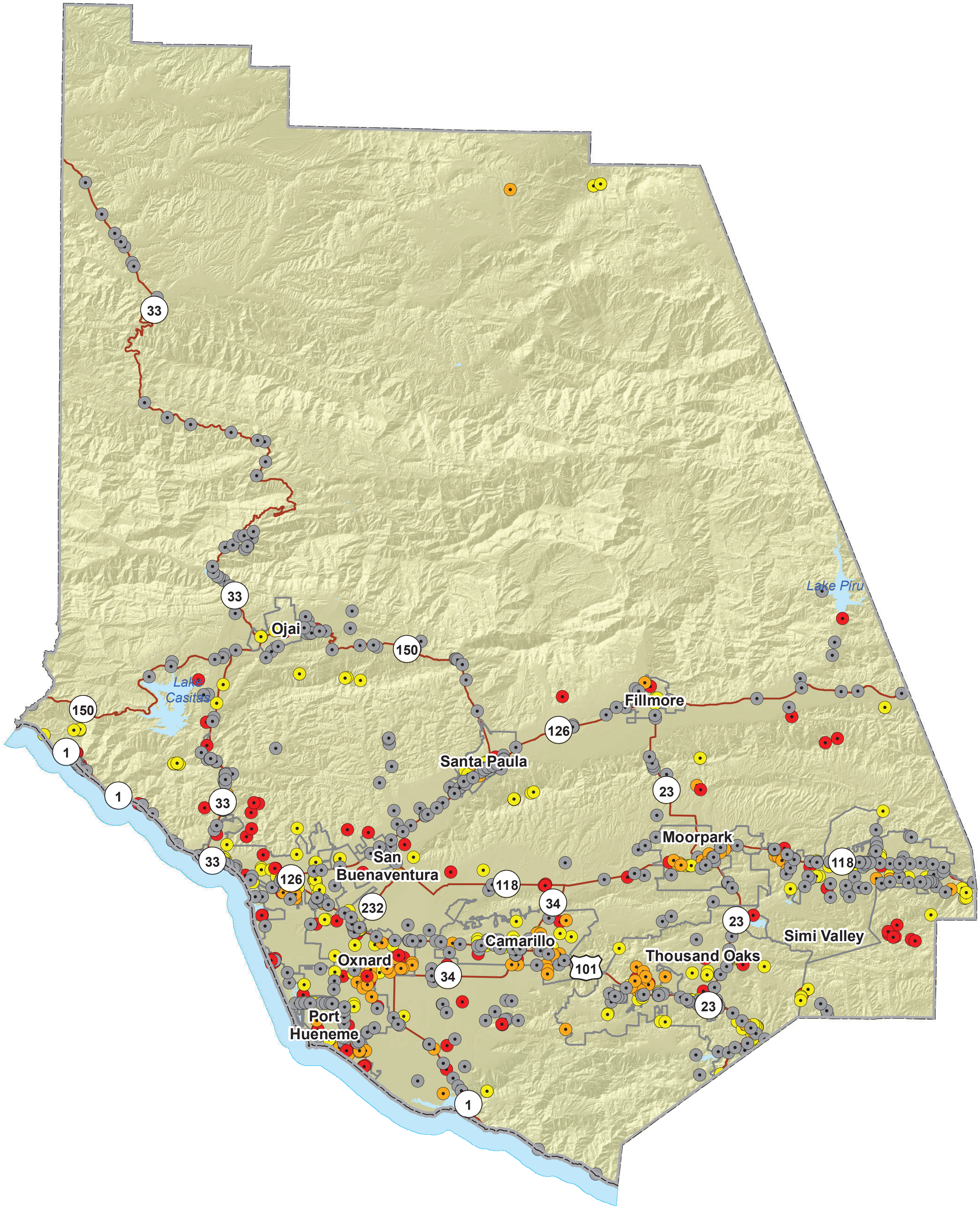


Figure 4-4. Critical Facilities (2 of 2)

- Communications
- Energy
- Hazardous Material
- Transportation
- County Boundary
- Cities
- Major Roads

Data Sources: Ventura Co., VCFD, Casitas MWD, Calleguas MWD, City of Camarillo, CA Energy Commission, Cal Trans, EPA, HIFLD, Esri

Projected Future Trends

The Regional Housing Needs Assessment (RHNA) is mandated by state law as part of the periodic process of updating local general plan housing elements. RHNA quantifies the need for housing within each jurisdiction during specified planning periods. The Southern California Association of Governments is in the process of developing its sixth cycle RHNA allocation plan, which will cover the planning period October 2021 through October 2029 (Southern California Association of Governments 2021a). Ventura County's 2021-2029 allocation is 24,452 housing units (Southern California Association of Governments 2021b).

Planning Framework

Ventura County and all incorporated cities included in this hazard mitigation plan have general plans, adopted under state law, to ensure that their governing bodies take actions that the community has determined to be the most orderly, beneficial, and supportive of the community vision. All partners have committed to link their general plans to this hazard mitigation plan. This will create an opportunity for wise land use decisions as future growth impacts hazard areas.

The County of Ventura has land use regulatory authority over most unincorporated land in the county. The County lacks land use authority within the city limits of incorporated cities and in unincorporated areas that are owned and managed by the state or federal government (e.g., state parks, national parks, Bureau of Land Management areas, and tribal lands), except for portions of state parks and other state land in the coastal zone. Under state law, the County has land use authority over land owned and managed by special districts in the unincorporated area (e.g., school districts, cemetery districts, water districts), subject to limited exceptions (Ventura County 2020).

All city and county planning partners have specific capabilities to manage growth in a way that limits increased risk associated with hazards. Details on these capabilities for each hazard assessed in this plan are provided in Section 6.4. Each of these planning partners reviewed their general plans under the capability assessments performed for this effort, as presented in Volume 2 of the hazard mitigation plan. Deficiencies identified by these reviews can be identified as mitigation actions to increase the capability to deal with future trends in development.

4.5 DEMOGRAPHICS PROFILE

4.5.1 Population Counts

Information about population is a critical part of planning because it directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. Population changes are useful socio-economic indicators. A growing population generally indicates a growing economy, while a decreasing population may signify economic decline. Due to delays associated with the COVID-19 pandemic, some 2020 census information was not yet available at the time of this plan update. The Census Bureau changed the 2020 American Community Survey release schedule.

Current and Historical Population

Table 4-5 shows the population of the County and its incorporated cities from 1990 to 2020. Oxnard and Thousand Oaks are the largest cities in Ventura County, together accounting for 39.4 percent of the planning area's population in 2010 and 39.5 percent in 2020. Unincorporated areas accounted for 11.5 percent of the planning area's population in 2010 and about 11.3 percent in 2020.

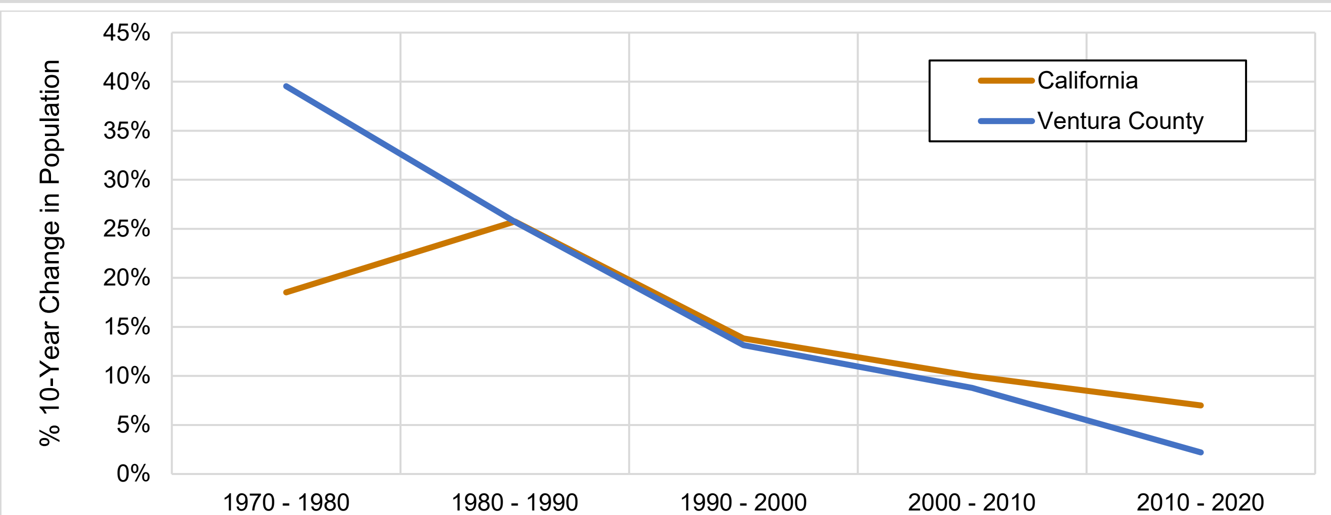
Table 4-5. Recent Population by Jurisdiction

	Population			
	1990	2000	2010	2020
Camarillo	52,297	57,084	65,201	69,964
Fillmore	11,992	13,643	15,002	15,558
Moorpark	25,494	31,415	34,421	36,264
Ojai	7,613	7,862	7,461	7,450
Oxnard	142,560	170,358	197,899	205,950
Port Hueneme	20,322	21,845	21,723	23,707
Ventura	92,557	100,916	106,433	105,878
Santa Paula	25,062	28,598	29,321	30,386
Simi Valley	100,218	111,351	124,237	124,953
Thousand Oaks	104,381	117,005	126,683	126,384
Unincorporated	86,500	93,120	94,937	94,725
Total	**669,016**	**753,197**	**823,318**	**841,219**

Source: California Department of Finance, 2021

Overall decrease in population of the unincorporated areas was 0.2 percent from 2010 to 2020; the City of Oxnard grew 3.9 percent during the same timeframe, and the population of the City of Thousand Oaks decreased 0.2 percent. Figure 4-5 shows the planning area's 10-year population growth rates from 1970 to 2020 compared to those of the state.

Figure 4-5. State of California and Ventura County Population Growth per Decade



Source: California Department of Finance, 2021

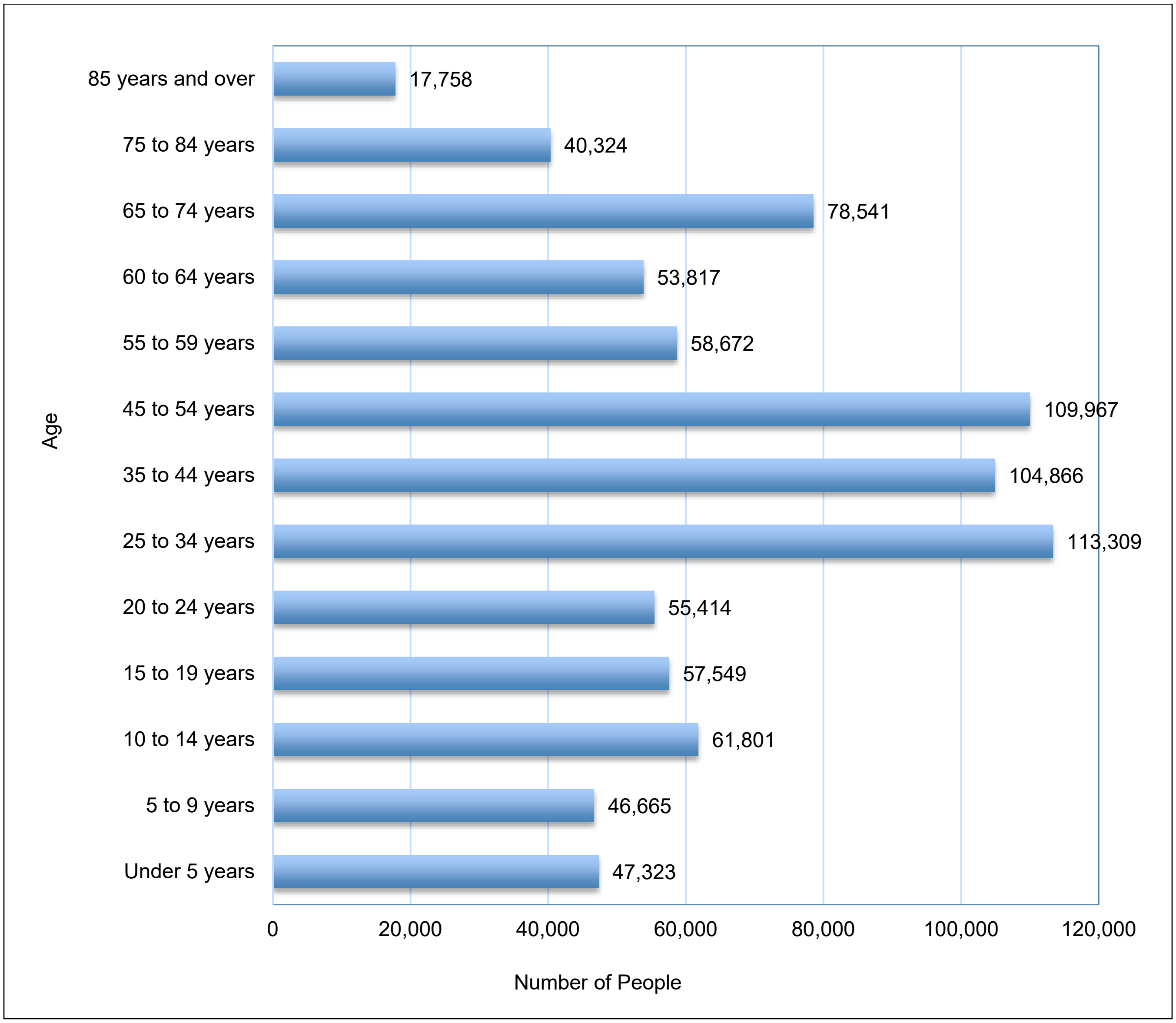
Projected Future Population

According to projections by the California Department of Finance, Ventura County's population is expected to increase to 885,628 by 2040. This represents about a 5 percent increase from the 2020 population of 841,219.

4.5.2 Age Distribution

The overall age distribution for the County is shown in Figure 4-6. Based on U.S. Census 2019 data estimates, 15.9 percent of the planning area's population is 65 or older, compared with the state average of 14.8 percent. It is also estimated that 18.4 percent of the population is 14 or younger, which varies slightly from the state's average of 18.7 percent.

Figure 4-6. Planning Area Age Distribution

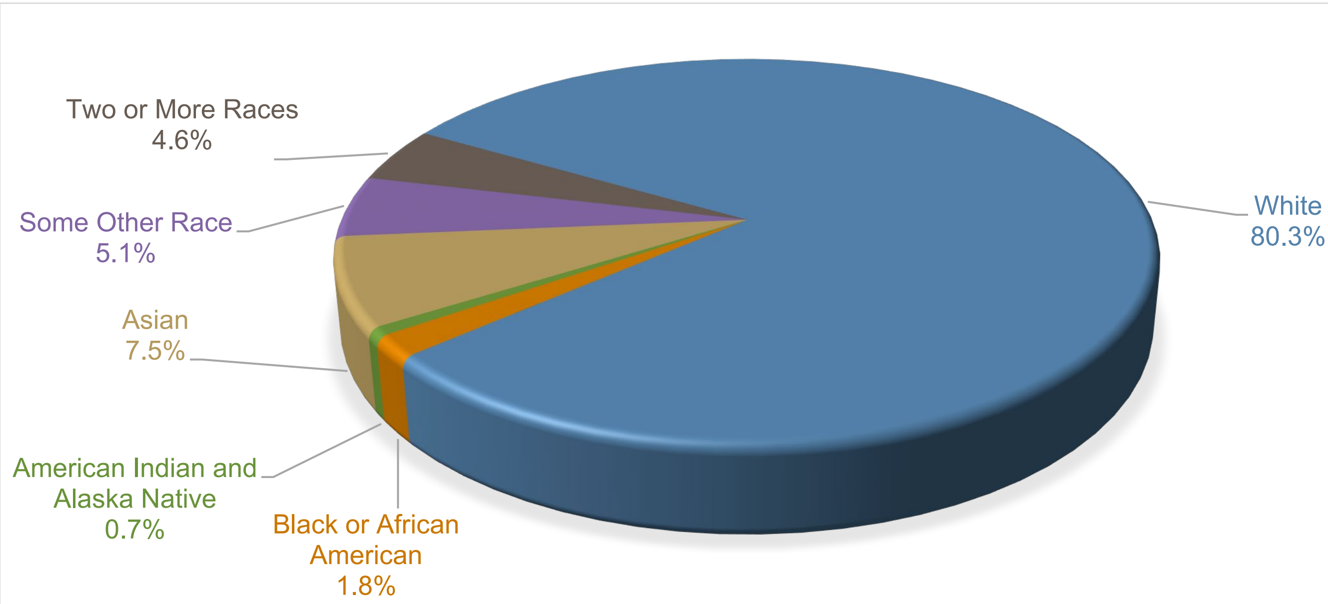


Source: U.S. Census—American Community Survey 5-Year Estimates

4.5.3 Race, Ethnicity and Language

According to the U.S. Census, the racial composition of the planning area is predominantly white, at 56 percent. The largest minority populations are Asian at 7.5 percent, and some other race at 5.1 percent. Figure 4-7 shows the racial distribution in the planning area. Based on the U.S. Census ethnicity definitions, Ventura County consists of 43.2 percent of individuals of Hispanic or Latino ethnicity (of any race). The planning area has a 21.6 percent foreign-born population. Other than English, the most spoken language in the planning area is Spanish. The Census estimates 53.6 percent of the residents speak English “less than very well.”

Figure 4-7. Planning Area Race Distribution



4.5.4 Persons with Disabilities or with Access and Functional Needs

According to the 2018 Census estimates, persons with disabilities or with access and functional needs make up 10.8 percent of the total civilian non-institutionalized population of Ventura County. According to U.S. Census data, 32.1 percent of the over-65 population have disabilities of some kind.

4.6 ECONOMY

4.6.1 Income

Based on 2019 Census data, per capita income in the County of Ventura was $40,293 and the median household income was $92,236. The Department of Housing and Urban Development estimated a 2021 median family income for Oxnard-Thousand Oaks-Ventura of $94,340.

The Census estimates that 7.9 percent of all families in the planning area and 7.2 percent of the over-65 population have incomes below the poverty level. Children under the age of 18 account for 11.3 percent of individuals who are below the poverty line.

4.6.2 Homeownership and Renter-Occupied Housing

According to 2019 American Community Survey estimates, there are 268,524 occupied housing units in Ventura County. Table 4-6 compares general demographic statistics for renter-occupied and owner-occupied housing units.

Table 4-6. Comparative Statistics for Renter-Occupied and Owner-Occupied Housing Units

	Renter-Occupied Housing Units	Owner-Occupied Housing Units
Occupied Housing Units		
Number	100,014	168,510
% of Total	37.2	62.8
Age of Residents		
< 35	26,463	8,547
55 and older	30,084	105,535
Time Living at Current Residence		
Moved in in 2017 or Later	41,142	21,887

4.6.3 Industry, Businesses, and Institutions

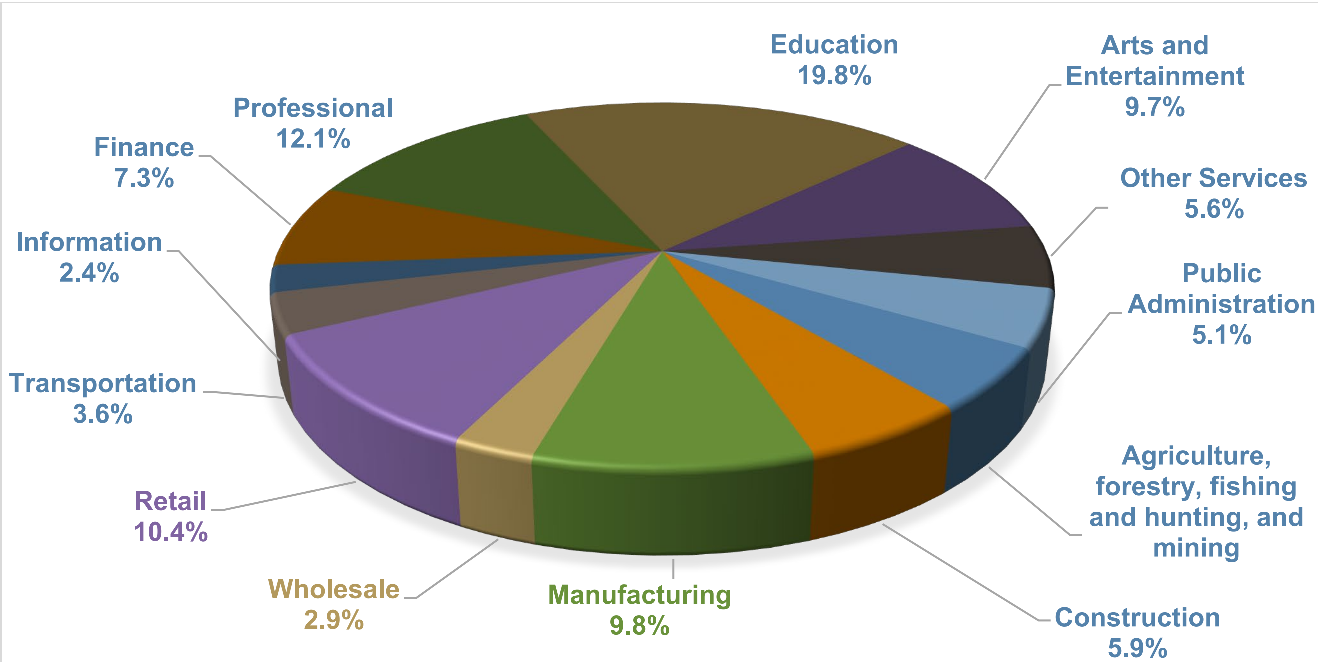
Table 4-7 identifies the principal employers in Ventura County in 2019n as provided by the American Community Survey. Figure 4-8 shows the breakdown of employment in the planning area by industry sector. The County's economy is strongly based in the education/health services sector and the professional/scientific/management sector. Information and wholesale trade make up the smallest sectors of the local economy.

Table 4-7. 2021 Principal Employers within Ventura County

Employer	Employer Type
Adventist Health Simi Valley	Hospitals
Amgen Inc	Biological Specimens-Manufacturers
Baxter Healthcare	Medical Manufacturers
Community Memorial Health System	Health Care Management
County of Ventura	Government
Haas Automation Inc	Machinery-Manufacturers
Harbor Freight Tools	Tools-New & Used
Los Robles Hospital	Hospitals
Moorpark College	Education
Nancy Reagan Breast Center	Diagnostic Imaging Centers
National Guard	Government
Ojai Valley Inn	Hotels & Hospitality
Oxnard College	Education
Pentair Aquatic Systems	Retail
Port Hueneme	Military
Procter & Gamble	Manufacturing
Rancho Simi Recreation Park District	Public Administration

Employer	Employer Type
Sheriff's Department	Government
City of Simi Valley	Government
City of Simi Valley City Manager	Government
St. John's Regional Medical Center	Hospitals
U.S. Department of the Navy	Military
Ventura County Medical Center	Hospital
Ventura County Office of Education	School District

Figure 4-8. Employment in Ventura County by Industry Sector



4.6.4 Employment Trends and Commuting

Ventura County's local employment base has remained nearly the same since 2010. In 2019, the estimated total number of employed Ventura County residents was 422,172, an increase of only 0.58 percent from 2010. Of the working-age population who make up the labor force, 52.1 percent are men and 47.9 percent are women.

Figure 4-9 compares unemployment rates for the State of California and Ventura County from 2010 through 2019. The 2019 Ventura County unemployment rate was the lowest in 10 years at 2.6 percent. The rate peaked at 7.3 percent in 2011 and declined overall through 2019. In each year from 2010 through 2019, the County unemployment rate was lower than that of the state.

Figure 4-10 shows U.S. Census data for the most common occupations for the employed population of Ventura County. This includes wage and salary jobs, and jobs held by business owners and self-employed persons. The total job count does not include unpaid volunteers or family workers, or private household workers.

The 2019 U.S. Census Bureau data shows 78.4 percent of the County's population work and live in Ventura County; 21.6 percent commute to other places. In 2019, 34.4 percent of Ventura County commuters spent more than 30 minutes to travel to work.

Figure 4-9. 10-Year Unemployment Rates for California and Ventura County

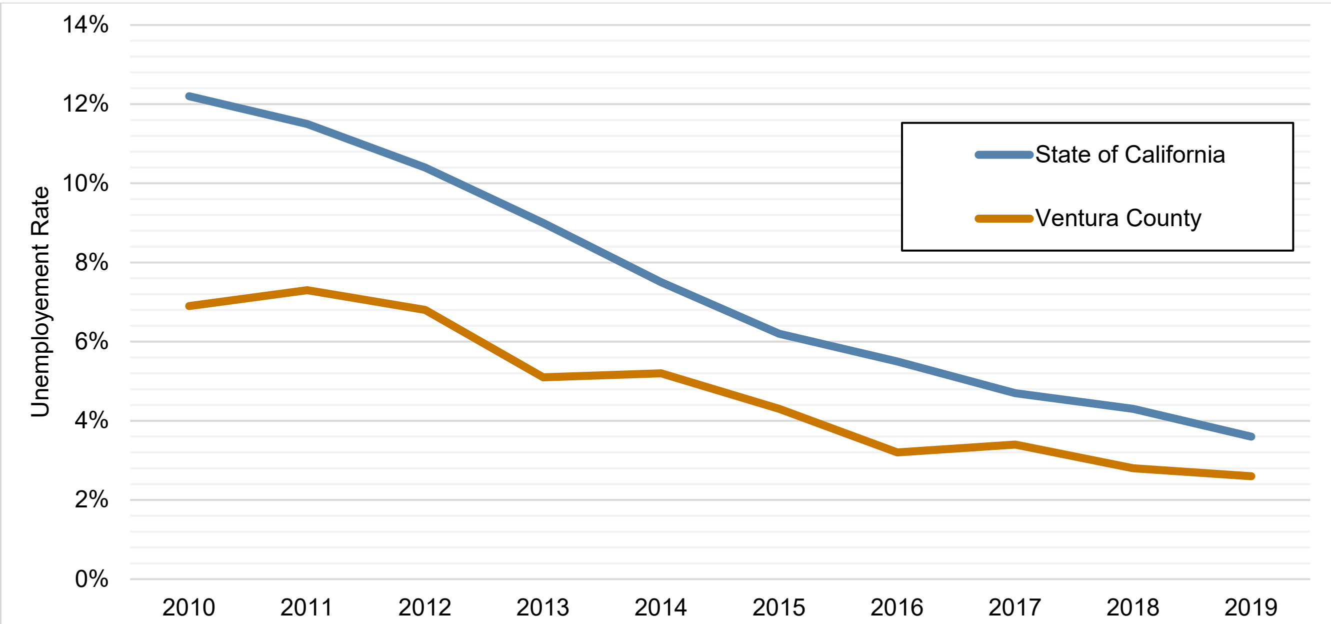
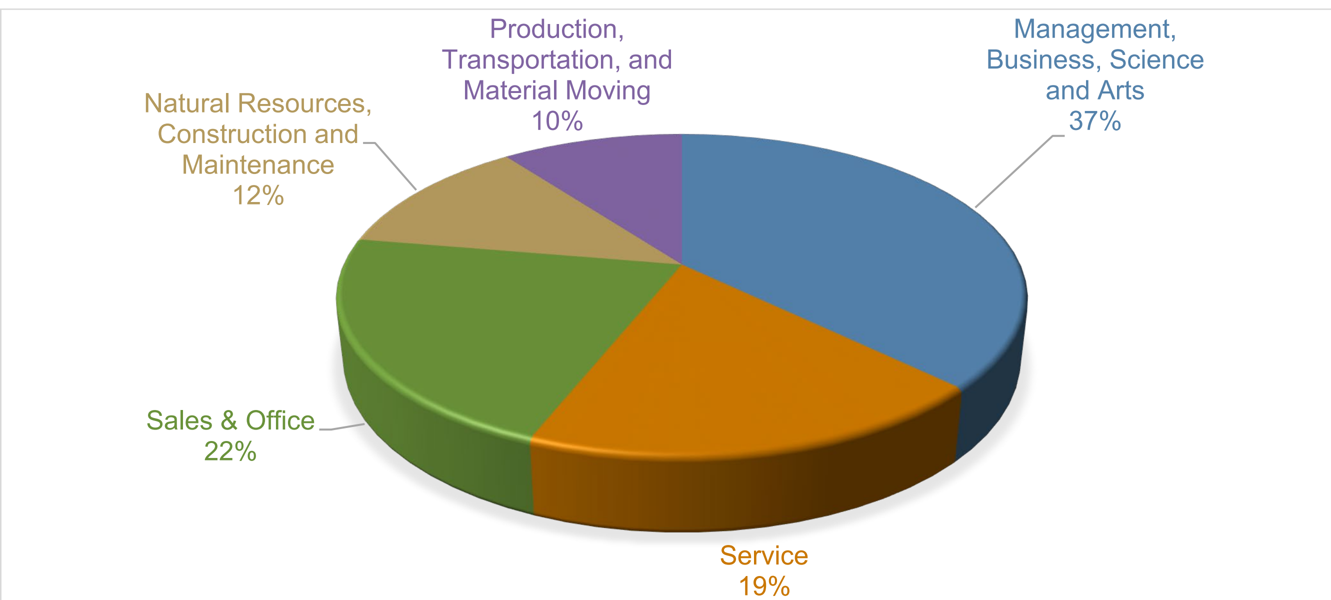


Figure 4-10. Employment in the Planning Area by Type of Work



5. HAZARDS OF CONCERN

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

5.1 MAJOR PAST HAZARD EVENTS

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A federal disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Federal disaster, emergency, or fire management assistance declarations were issued for 46 events since 1954 in the planning area. These events are listed in Table 5-1.

Table 5-1. Federal Disaster Declarations for Hazard Events that Affected the Planning Area

Type of Event	Disaster Declaration #	Date
Flood[a]	DR-15	02/05/1954
Flood[a]	DR-47	12/23/1955
Fire[a]	DR-65	12/29/1956
Flood[a]	DR-82	4/4/1958
Flood[a]	DR-122	3/6/1962
Severe Storm[a]	DR-138	10/24/1962
Flood[a]	DR-145	2/25/1963
Heavy Rains, Flooding	DR-211	December 7, 1965
Severe Storms, Flooding	DR-253	January 26, 1969
Forest, Brush Fires	DR-295	September 29, 1970
Severe Storms, High Tides, Flooding	DR-364	February 8, 1973
Coastal Storms, Mudslides, Flooding	DR-547	February 15, 1978
Severe Storms, Mudslides, Flooding	DR-615	January 8, 1980
Coastal Storms, Floods, Slides, Tornadoes	DR-677	January 21 – March 30, 1983
Grass, Wildlands, Forest Fires	DR-739	June 26 – July 19, 1985
Severe Storms, High Tides, Flooding	DR-812	January 17 – 22, 1988
Severe Freeze	DR-894	December 19, 1990 – January 3, 1991
Snow Storm, Heavy Rain, High Winds, Flooding, Mudslide	DR-935	February 10 – 19, 1992

Type of Event	Disaster Declaration #	Date
Severe Storm, Winter Storm, Mud & Landslides, Flooding	DR-979	January 5 – March 20, 1993
Fires, Mud & Landslides, Soil Erosion, Flooding	DR-1005	October 26 – April 22, 1994
Northridge Earthquake	DR-1008	January 17 – November 30,1994
Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1044	January 3 – February, 1995
Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1046	February 13 – April 19, 1995
Severe Fires	EM-3120	October 21 – 31, 1996
Severe Winter Storms and Flooding	DR-1203	February 2 – April 30, 1998
Severe Storms, Tornadoes, High Winds and Flooding	DR-1267	December 20 – 28, 1998
Wildfires, Flooding, Mudflow and Debris Flow	DR-1498	October 21, 2003 – March 31, 2003
Severe Storms, Flooding, Debris Flows, and Mudslides	DR-1577	December 27, 2004 – January 11, 2005
Severe Storms, Flooding, Landslides, and Mud and Debris Flows	DR-1585	February 16 – 23, 2005
Hurricane Katrina Evacuation	EM-3248	August 29 – October 1, 2005
Topanga Fire	FM-2583	September 28 – October 10, 2005
School Fire	FM-2586	November 18 – 23, 2005
Day Fire	FM-2677	September 25 – 30, 2006
Shekell Fire	FM-2681	December 3 – 6, 2006
Severe Freeze	DR-1689	January 11 – 17, 2007
Wildfires, Flooding, Mudflows, and Debris Flows	DR-1731	October 21 – March 31, 2008
Guiberson Fire	FM-2839	September 22 – 29, 2009
Springs Fire	FM-5024	May 2 – 11, 2013
Thomas Fire	FM-5224	December 4, 2017
Wildfires, Flooding, Mudflows, and Debris Flows	DR-4353	December 4, 2017- January 31, 2018
Wildfires	DR-4407	November 8 – 25, 2018
Saddleridge Fire	FM-5293	October 10, 2019
Getty Fire	FM-5297	October 28, 2019
Easy Fire	FM-5298	October 30, 2019
Maria Fire	FM-5302	November 1, 2019
COVID-19 Pandemic	DR-4482	January 20, 2020 and continuing

a. FEMA did not begin distinguishing declarations by county until 1964. Declarations prior to then are statewide, not county-specific.
Source: FEMA 2021

Review of these events helps identify hazards of concern and targets for risk reduction activities. However, many natural hazard events do not trigger federal disaster declaration protocol but have significant impacts on their communities (e.g. landslides that result in road closures). These events are also important to consider in identifying hazards of concern and establishing their recurrence intervals.

5.2 HAZARDS EVALUATED IN 2015 PLAN

The planning team also reviewed information on hazards from the previous plan update conducted in 2015. That plan addressed the following 12 hazards of concern:

- Agricultural / biological
- Climate change
- Dam failure/inundation
- Drought
- Earthquake
- Flood

- Landslide
- Levee failure inundation
- Post-fire debris flows
- Tsunami
- Wildfire
- Winter storm

5.3 IDENTIFIED HAZARDS FOR THE 2022 UPDATE

The Steering Committee considered the full range of natural hazards that could affect the planning area and then selected those that present the greatest concern for risk assessment in this plan. The process incorporated a review of state and local hazard planning documents as well as information on the frequency of, magnitude of, and costs associated with hazards that have struck the planning area or could do so. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used.

Based on the review, this plan includes risk assessments for the hazards of concern listed in Table 5-2. Climate change is not assessed as an individual hazard, but a profile is provided describing how climate change could affect the hazards of concern assessed in this plan.

Table 5-2. Hazards Addressed in This Hazard Mitigation Plan

Hazards of Concern	Hazards of Interest
• Dam failure inundation • Drought • Earthquake • Flooding (includes levee failures) • Landslide & mass movements • Sea-level rise and coastal erosion • Severe storms • Severe weather (heat/freeze events) • Tsunami • Wildfire	• Agricultural biological incidents • Pandemic

Note: Hazards are listed in alphabetical order in this table and in the risk assessment portion of this plan; the order presented does not indicate the hazards' relative severity or risk.

In addition to the risk assessment of the hazards of concern, this plan provides a qualitative review of the "hazards of interest" listed in Table 5-2. The Steering Committee determined that these other hazards, though not required to be evaluated under federal guidelines for hazard mitigation plans, are important to recognize qualitatively in this plan. Hazard profiles, without quantitative risk assessments, are provided for these hazards of interest.

6. EXISTING REGULATIONS

Existing regulations, agencies and programs at the federal, state, and local level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). Information presented in this section can be used to review local capabilities to implement the action plan this hazard mitigation plan presents. Individual review by each planning partner of existing local plans, studies, reports, and technical information is presented in the annexes in Volume 2.

6.1 FEDERAL AND STATE AGENCIES, PROGRAMS AND REGULATIONS

State and federal regulations and programs that need to be considered in hazard mitigation are constantly evolving. For this plan, a review was performed to determined which regulations and programs are currently most relevant to hazard mitigation planning. The findings are summarized in Table 6-1 and Table 6-2. Short descriptions of each program are provided in Appendix B.

Table 6-1. Summary of Relevant Federal Agencies, Programs and Regulations

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
Americans with Disabilities Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Bureau of Land Management	Wildfire Hazard	The Bureau funds and coordinates wildfire management programs and structural fire management and prevention on BLM lands.
Civil Rights Act of 1964	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Clean Water Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Community Development Block Grant Disaster Resilience Program	Action Plan Funding	This is a potential alternative source of funding for actions identified in this plan.
Community Rating System	Flood Hazard	This voluntary program encourages floodplain management activities that exceed the minimum National Flood Insurance Program requirements.
Disaster Mitigation Act	Hazard Mitigation Planning	This is the current federal legislation addressing hazard mitigation planning.
Emergency Relief for Federally Owned Roads Program	Action Plan Funding	This is a possible funding source for actions identified in this plan.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
Emergency Watershed Program	Action Plan Funding	This is a possible funding source for actions identified in this plan.
Endangered Species Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Federal Energy Regulatory Commission Dam Safety Program	Dam Failure Hazard	This program cooperates with a large number of federal and state agencies to ensure and promote dam safety.
Federal Wildfire Management Policy and Healthy Forests Restoration Act	Wildfire Hazard	These documents mandate community-based collaboration to reduce risks from wildfire.
National Dam Safety Act	Dam Failure Hazard	This act requires a periodic engineering analysis of most dams in the country
National Environmental Policy Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
National Fire Plan	Wildfire Hazard	This plan calls for joint risk reduction planning and implementation by federal, state and local agencies.
National Flood Insurance Program	Flood Hazard	This program makes federally backed flood insurance available to homeowners, renters, and business owners in exchange for communities enacting floodplain regulations
National Incident Management System	Action Plan Development	Adoption of this system for government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards is a prerequisite for federal preparedness grants and awards
National Landslide Preparedness Act	Risk Assessment of Landslide Hazard	This act authorized a national landslide hazards reduction program and a 3D elevation program, providing tools and data to assess the landside hazard.
Presidential Executive Order 11988 (Floodplain Management)	Flood Hazard	This order requires federal agencies to avoid long and short-term adverse impacts associated with modification of floodplains
Presidential Executive Order 11990 (Protection of Wetlands)	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable presidential executive orders.
Rural Development Program	Action Plan Implementation	The program provides project financing and technical assistance to help rural communities provide the infrastructure needed by rural businesses, community facilities, and households.
U.S. Army Corps of Engineers Dam Safety Program	Dam Failure Hazard	This program is responsible for safety inspections of dams that meet size and storage limitations specified in the National Dam Safety Act.
U.S. Army Corps of Engineers Flood Hazard Management	Flood Hazard, Action Plan Implementation, Action Plan Funding	The Corps of Engineers offers multiple funding and technical assistance programs available for flood hazard mitigation actions
U.S. Bureau of Reclamation Safety Evaluation of Existing Dams Program	Dam Failure Hazard	The program emphasizes site evaluations to identify potential safety deficiencies on Interior Department dams and analyses to expedite corrective action decisions.
U.S. Fire Administration	Wildfire Hazard	This agency provides leadership, advocacy, coordination, and support for fire agencies and organizations.
U.S. Fish and Wildlife Service	Wildfire Hazard	This service’s fire management strategy employs prescribed fire throughout the National Wildlife Refuge System to maintain ecological communities.

Table 6-2. Summary of Relevant State Agencies, Programs and Regulations

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
AB 9: Fire safety: Wildfires: Fire Adapted Communities	Wildfire Hazard	Establishes the Regional Forest and Fire Capacity Program to support regional leadership to build local and regional capacity and develop, prioritize, and implement strategies and projects that create fire adapted communities and landscapes by improving watershed health, forest health, community wildfire preparedness, and fire resilience.
AB 32: The California Global Warming Solutions Act	Action Plan Development	This act establishes a state goal of reducing greenhouse gas emissions to 1990 levels by 2020
AB 38: Fire safety: Low-Cost Retrofits: Regional Capacity Review: Wildfire Mitigation	Wildfire Hazard	Directs the California Natural Resources Agency to review the regional capacity of each county that contains a very high fire hazard severity zone and establishes a comprehensive wildfire mitigation and assistance program.
AB 70: Flood Liability	Flood Hazard	A city or county may be required to partially compensate for property damage caused by a flood if it unreasonably approves new development in areas protected by a state flood control project
AB 162: Flood Planning	Flood Hazard	Cities and counties must address flood-related matters in the land use, conservation, and safety and housing elements of their general plans.
AB 267: California Environmental Quality Act: Exemption: Prescribed Fire, Thinning, and Fuel Reduction Projects.	Wildfire Hazard	Extends to January 1, 2026, the exemption from requirements of the California Environmental Quality Act for prescribed fire, thinning, or fuel reduction projects on federal lands to reduce the risk of high-severity wildfire that had been reviewed under the National Environmental Policy Act.
AB 380: Forestry: Priority Fuel Reduction Projects	Wildfire Hazard	Requires the Department of Forestry and Fire Protection to identify priority fuel reduction projects annually and exempts the identified priority fuel reduction projects from certain legal requirements.
AB 431: Forestry: Timber Harvesting Plans: Defensible Space: Exemptions	Wildfire Hazard	Extends to January 1, 2026, the exemption from a requirement to complete a timber harvest plan for maintaining defensible space between 150 feet and 300 feet from a habitable structure.
AB 497: Forestry and Fire Protection: Local Assistance Grant Program: Fire Prevention Activities: Street and Road Vegetation Management	Wildfire Hazard	Appropriates funds for local assistance grants for fire prevention activities with priority for projects that that manage vegetation along streets and roads to prevent the ignition of wildfire.
AB 575: Civil Liability: Prescribed Burning Activities: Gross Negligence	Wildfire Hazard	Provides that a private entity engaging in a prescribed burning activity that is supervised by a person certified as burn boss is liable for damages to a third party only if the prescribed burning activity was carried out in a grossly negligent manner.
AB 642: Wildfires	Wildfire Hazard	This bill is an omnibus fire prevention bill that makes various changes to support cultural and prescribed fire, including the creation of a Cultural Burning Liaison at the Department of Forestry and Fire Protection, and requires a proposal for creating a prescribed fire training center.
AB 747: General Plans—Safety Element	Hazard Mitigation Planning	The safety elements of cities' and counties' general plans must address evacuation routes and include any new information on flood and fire hazards and climate adaptation and resiliency strategies.
AB 800: Wildfires: local general plans: safety elements: fire hazard severity zones.	Wildfire Hazard	This Bill has provisions for wildfire hazard mapping and applications for that mapping in the Safety elements General plans within the state.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
AB 1255: Fire prevention: Department of Forestry and Fire Protection: Grant Programs	Wildfire Hazard	Requires the Natural Resources Agency to develop a guidance document that describes goals, approaches, opportunities, and best practices in each region of the state for ecologically appropriate, habitat-specific fire risk reduction. Requires consultation with counties related to the Department of Forestry and Fire Protection's local fire prevention grant program.
AB 1295: Residential development Agreements: Very High-Risk Fire Areas	Wildfire Hazard	Prohibits the legislative body of a city or county from entering into a residential development agreement for property in a very high fire risk area as designated by a local agency or a fire hazard severity zone classified by the director of CAL FIRE.
AB 1439: Property Insurance Discounts	Wildfire Hazard	Requires residential or commercial property insurance policies to include a discount if a local government where the insured property is located funds a local wildfire protection or mitigation program.
AB 1500: Safe Drinking Water, Wildfire Prevention, Drought Preparation, Flood Protection, Extreme Heat Mitigation, and Workforce Development Bond Act of 2022.	Drought, Flood, Extreme Heat and Wildfire Hazards	If approved by the voters, would authorize the issuance of bonds to finance projects for safe drinking water, wildfire prevention, drought preparation, flood protection, extreme heat mitigation, and workforce development programs.
AB 2140: General Plans—Safety Element	Hazard Mitigation Planning	This bill enables state and federal disaster assistance and mitigation funding to communities with compliant hazard mitigation plans.
AB 2800: Climate Change—Infrastructure Planning	Action Plan Development	This act requires state agencies to take into account the impacts of climate change when developing state infrastructure.
Alquist-Priolo Earthquake Fault Zoning Act	Earthquake Hazard	This act restricts construction of buildings used for human occupancy on the surface trace of active faults.
Board of Forestry and Fire Protection Fire Safe Regulations	Wildfire Hazard	The Fire Safe Regulations set the floor for fire safety standards for perimeters and access to residential, commercial, and industrial building construction.
California Coastal Management Program	Flood, Landslide, Tsunami and Wildfire Hazards	This program requires coastal communities to prepare coastal plans and requires that new development minimize risks to life and property in areas of high geologic, flood, and fire hazard.
California Department of Forestry and Fire Protection (CAL FIRE)	Wildfire Hazard	CAL FIRE has responsibility for wildfires in areas that are not under the jurisdiction of the Forest Service or a local fire organization.
California Department of Parks and Recreation	Wildfire Hazard	State Parks Resources Management Division has wildfire protection resources available to suppress fires on State Park lands.
California Department of Water Resources	Flood Hazard	This state department is the state coordinating agency for floodplain management.
California Division of Safety of Dams	Dam Failure Hazard	This division monitors the dam safety program at the state level and maintains a working list of dams in the state.
California Environmental Quality Act	Action Plan Implementation	This act establishes a protocol of analysis and public disclosure of the potential environmental impacts of development projects. Any project action identified in this plan will seek full California Environmental Quality Act compliance upon implementation.
California Fire Alliance	Wildfire Hazard	The alliance works with communities at risk from wildfires to facilitate the development of community fire loss mitigation plans.
California Fire Plan	Wildfire Hazard	This plan's goal is to reduce costs and losses from wildfire through pre-fire management and through successful initial response.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
California Fire Safe Council	Wildfire Hazard	This council facilitates the distribution of National Fire Plan grants for wildfire risk reduction and education.
California Fire Service and Rescue Emergency Mutual Aid Plan	Wildfire Hazard	This plan provides guidance and procedures for agencies developing emergency operations plans, as well as training and technical support.
California General Planning Law	Hazard Mitigation Planning	This law requires every county and city to adopt a comprehensive long-range plan for community development, and related laws call for integration of hazard mitigation plans with general plans.
California Multi-Hazard Mitigation Plan	Hazard Mitigation Planning	Local hazard mitigation plans must be consistent with their state's hazard mitigation plan.
California Residential Mitigation Program	Earthquake Hazard	This program helps homeowners with seismic retrofits to lessen the potential for damage to their houses during an earthquake.
California State Building Code	Action Plan Implementation	Local communities must adopt and enforce building codes, which include measures to improve buildings' ability to withstand hazard events.
Disadvantaged and Low-Income Communities Investments	Action Plan Funding	This is a potential source of funding for actions located in disadvantaged or low-income communities.
Division of the State Architect's AB 300 List of Seismically At-Risk Schools	Earthquake Hazard, Action Plan Development	The Division of the State Architect recommends that local school districts conduct detailed seismic evaluations of seismically at-risk schools identified in the inventory that was required by AB 300.
Governor's Executive Order S-13-08 (Climate Impacts)	Action Plan Implementation	This order includes guidance on planning for sea-level rise in designated coastal and floodplain areas for new projects.
Office of the State Fire Marshal	Wildfire Hazard	This office has a wide variety of fire safety and training responsibilities.
Senate Bill 12: Local government: planning and zoning: wildfires.	Wildfire Hazard	Requires the safety element to be reviewed and updated as necessary to include a comprehensive retrofit strategy to reduce the risk of property loss and damage during wildfires. Requires the planning agency to submit the adopted strategy to the Office of Planning and Research for inclusion into a central clearinghouse.
Senate Bill 92: Public Resources Portion of Biennial Budget Bill	Dam Failure Hazard	This bill requires dams (except for low-risk dams) to have emergency action plans that are updated every 10 years and inundation maps updated every 10 years, or sooner if specific circumstances change.
Senate Bill 97: Guidelines for Greenhouse Gas Emissions	Action Plan Implementation	This bill establishes that greenhouse gas emissions and the effects of greenhouse gas emissions are appropriate subjects for California Environmental Quality Act analysis.
Senate Bill 99: General Plans: Safety Element: Emergency Evacuation Routes	Action Plan Implementation	This bill requires the safety element must include information to identify residential developments in hazard areas that do not have at least two emergency evacuation routes.
Senate Bill 182: Local Government: Planning and Zoning: Wildfires	Wildfire Hazard	This bill made a number of changes to state law regarding planning for and permitting development in areas designated as very high fire risk areas.
Senate Bill 379: General Plans: Safety Element—Climate Adaptation	Action Plan Implementation	This bill requires cities and counties to include climate adaptation and resiliency strategies in the safety element of their general plans.
Senate Bill 1000: General Plan Amendments—Safety and Environmental Justice Elements	Action Plan Implementation	Under this bill, review and revision of general plan safety elements are required to address only flooding and fires (not climate adaptation and resilience), and environmental justice is required to be included in general plans.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
Senate Bill 1035: Fire, Flood, and Adaptation Safety Element Updates	Action Plan Implementation	Clarifies that revisions to the Safety Element to address fire hazards, flood hazards, and climate adaptation and resilience strategies all must occur upon each revision to a Housing Element or Local Hazard Mitigation Program.
Senate Bill 1241: General Plans: Safety Element—Fire Hazard Impacts	Wildfire Hazard	This bill requires cities and counties to make findings regarding available fire protection and suppression services before approving a tentative map or parcel map.
Standardized Emergency Management System	Action Plan Implementation	Local governments must use this system to be eligible for state funding of response-related personnel costs.
Western Governors Association Ten-Year Comprehensive Strategy	Wildfire Hazard	This strategy implementation plan prepared by federal and Western state agencies outlines measures to restore fire-adapted ecosystems and reduce hazardous fuels.

6.2 LOCAL PLANS, REPORTS AND CODES

Plans, reports, and other technical information were identified and provided directly by participating jurisdictions and stakeholders or were identified through independent research by the planning consultant. These documents were reviewed to identify the following:

- Existing jurisdictional capabilities.
- Needs and opportunities to develop or enhance capabilities, which may be identified within the local mitigation strategies.
- Mitigation-related goals or objectives considered during the development of the overall goals and objectives.
- Proposed, in-progress, or potential mitigation projects, actions and initiatives to be incorporated into the updated jurisdictional mitigation strategies.

The following local regulations, codes, ordinances, and plans were reviewed in order to develop complementary and mutually supportive goals, objectives, and mitigation strategies that are consistent across local and regional planning and regulatory mechanisms:

- General plans (land use, housing, safety, and open space elements)
- Building codes
- Zoning and subdivision ordinances
- NFIP flood damage prevention ordinances
- Stormwater management plans
- Emergency management and response plans
- Land use and open space plans
- Climate action plans
- Community wildfire protection plans

6.3 LOCAL CAPABILITY ASSESSMENT

All participating jurisdictions compiled an inventory and analysis of existing authorities and capabilities called a "capability assessment." A capability assessment creates an inventory of a jurisdiction's mission, programs, and policies, and evaluates its capacity to carry them out. This assessment identifies potential gaps in the jurisdiction's capabilities.

The planning partnership views all core jurisdictional capabilities as fully adaptable to meet a jurisdiction's needs. Every code can be amended, and every plan can be updated. Such adaptability is itself considered to be an overarching capability. If the capability assessment identified an opportunity to add a missing core capability or expand an existing one, then doing so has been selected as an action in the jurisdiction's action plan, which is included in the individual annexes presented in Volume 2 of this plan.

Capability assessments for each planning partner are presented in the jurisdictional annexes in Volume 2. The sections below describe the specific capabilities evaluated under the assessment.

6.3.1 Planning and Regulatory Capabilities

Jurisdictions have the ability to develop policies and programs and to implement rules and regulations to protect and serve residents. Local policies are typically identified in a variety of community plans, implemented via a local ordinance, and enforced through a governmental body.

Jurisdictions regulate land use through the adoption and enforcement of zoning, subdivision, and land development ordinances, building codes, building permit ordinances, floodplain, and stormwater management ordinances. When effectively prepared and administered, these regulations can lead to hazard mitigation.

6.3.2 Fiscal Capabilities

Assessing a jurisdiction's fiscal capability provides an understanding of the ability to fulfill the financial needs associated with hazard mitigation projects. This assessment identifies both outside resources, such as grant-funding eligibility, and local jurisdictional authority to generate internal financial capability, such as through impact fees.

6.3.3 Administrative and Technical Capabilities

Planning, regulatory, and fiscal capabilities provide the backbone for successfully developing a mitigation strategy; however, without appropriate personnel, the strategy may not be implemented. Administrative and technical capabilities focus on the availability of personnel resources responsible for implementing all the facets of hazard mitigation. These resources include technical experts, such as engineers and scientists, as well as personnel with capabilities that may be found in multiple departments, such as grant writers.

6.3.4 NFIP Compliance

Flooding is the costliest natural hazard in the United States and, with the promulgation of recent federal regulation, homeowners throughout the country are experiencing increasingly high flood insurance premiums. Community participation in the NFIP opens up opportunity for additional grant funding associated specifically with flooding issues. Assessment of the jurisdiction's current NFIP status and compliance provides planners with a greater understanding of the local flood management program, opportunities for improvement, and available grant funding opportunities.

6.3.5 Public Outreach Capability

Regular engagement with the public on issues regarding hazard mitigation provides an opportunity to directly interface with community members. Assessing this outreach and education capability illustrates the connection between the government and community members, which opens a two-way dialogue that can result in a more resilient community based on education and public engagement.

6.3.6 Community Classifications

Other programs, such as the Community Rating System, Storm/Tsunami Ready, and Firewise USA, can enhance a jurisdiction's ability to mitigate, prepare for, and respond to natural hazards. These programs indicate a jurisdiction's desire to go beyond minimum requirements set forth by local, state, and federal regulations in order to create a more resilient community. These programs complement each other by focusing on communication, mitigation, and community preparedness to save lives and minimize the impact of natural hazards on a community.

6.3.7 Development and Permitting Capability

Identifying previous and future development trends is achieved through a comprehensive review of permitting since completion of the previous plan and in anticipation of future development. Tracking previous and future growth in potential hazard areas provides an overview of increased exposure to a hazard within a community.

6.3.8 Adaptive Capacity

An adaptive capacity assessment evaluates a jurisdiction's ability to anticipate impacts from future conditions. By looking at public support, technical adaptive capacity, and other factors, jurisdictions identify their core capability for resilience against issues such as sea-level rise. The adaptive capacity assessment provides jurisdictions with an opportunity to identify areas for improvement by ranking their capacity high, medium, or low.

6.3.9 Integration Opportunity

The assessment looked for opportunities to integrate this mitigation plan with the planning and regulatory capabilities identified. Capabilities were identified as integration opportunities if they can support or enhance the actions identified in this plan or be supported or enhanced by components of this plan. Planning partners considered actions to implement this integration as described in their jurisdictional annexes.

6.4 HAZARD MITIGATION CAPABILITIES FOR FUTURE DEVELOPMENT

The identification of hazards of concern and the areas that they affect allows local communities to review expected future development to assess whether it would be at risk from those identified hazards. Avoiding such future risk is a core element of local hazard mitigation. Through the capability assessment described in Section 6.3, all planning partners identified their ability to address risks to future development posed by identified planning area hazards of concern. The planning partners' general plans and other planning activities provide guidance related to hazard mitigation and future development as follows:

- **Dam failure—**Dam failure is currently addressed as a stand-alone hazard in the safety elements of many municipal partners' general plans. Flood-related policies in the general plans will help to reduce the risk associated with dam failure for all future development in the planning area. Municipalities participating in this plan have established comprehensive policies regarding sound land use in identified dam failure inundation hazard areas. Most of the areas vulnerable to the more severe impacts from dam failure intersect the mapped flood hazard areas. However, there are structures on the perimeter of the dam failure inundation outside of the regulated floodplain that are not subject to floodplain management codes and standards. These structures would be considered to be more vulnerable than those constructed with floodplain codes and standards.
- **Drought—**Each municipal planning partner in this effort has an established general plan that includes policies directing land use and dealing with issues of water supply and the protection of water resources. These plans provide the capability at the local municipal level to protect future development from the impacts of drought. In addition, water providers in the planning area have plans and programs in place to balance competing needs for water resources within the planning area.
- **Earthquake**—Ventura County and participating cities strictly enforce all seismic building codes and design standards to prevent loss of life and property caused by earthquake. Municipal planning partners are encouraged to establish general plans with policies directing land use and dealing with issues of seismic safety. These plans provide the capability at the local municipal level to protect future development from the impacts of earthquakes. Public education, cooperation with the development community, and individual preparedness are essential as the planning area welcomes thousands of new residents and hundreds of new businesses to each year.
- **Flood**—All municipal planning partners have general plans that address frequently flooded areas in their safety elements. Additionally, all municipal planning partners are participants in the NFIP and have adopted flood damage prevention ordinances in response to its requirements. With 20 percent of communities and the County participating in the CRS program, there is incentive to adopt consistent, appropriate, higher regulatory standards in communities with the highest degree of flood risk. All municipal planning partners have committed to maintain their good standing under the NFIP through initiatives identified in this hazard mitigation plan. Communities participating or considering participation in the CRS program will be able to refine this commitment using CRS programs and templates as a guide.
- **Landslide**—The State of California has adopted the International Building Code (IBC) by reference in its California Building Standards Code. The IBC includes provisions for geotechnical analyses in steep slope areas that have soil types considered susceptible to landslide hazards. These provisions assure that new construction is built to standards that reduce the vulnerability to landslide risk.

- **Sea-Level Rise and Coastal Erosion—**Sea-level rise and coastal erosion are addressed as part of climate change adaptation and resilience in the general plans of Ventura County and coastal cities. By coordinating their general plans with climate change adaptation strategies, cities and the County will be better able to make wise land use decisions as future growth impacts coastal areas affected by sea-level rise and coastal erosion.
- **Severe Storms**—Impacts from winter storms and thunderstorms can be addressed through proactive planning and utilization of best available information in making land use decisions. Severe storms are not currently addressed as a stand-alone hazard in the safety elements of municipal partners' general plans, but programs such as building code enforcement, public information, and early warning will help Ventura County manage the likely impacts of severe storm events as the County expands and grows.
- **Severe Weather**—The most common severe weather events that impact the planning area are damaging winds, extreme temperatures, and heavy rain. Many of the impacts associated with severe weather hazards, including wind events, can be addressed through proactive planning and utilization of best available information in making land use decisions. Severe weather is not currently addressed as a stand-alone hazard in the safety elements of municipal partners' general plans, but programs such as building code enforcement, public information, and early warning will help Ventura County manage the likely impacts of severe weather as the County expands and grows.
- **Tsunami**—The tsunami inundation maps provided by the California Department of Conservation offer jurisdictions a way to guide development away from tsunami-prone areas. By coordinating their general plans, cities and the County will be better able to make wise land use decisions as future growth impacts tsunami hazard areas.
- **Wildfire—**The expansion of development into high wildfire hazard areas can be managed with strong land use and building codes. The planning area is well equipped with these tools, and this planning process has asked each planning partner to assess its capabilities with regards to the tools. As Ventura County experiences future growth, it is anticipated that the exposure to this hazard will remain as assessed or even decrease over time due to these capabilities.
- **Other hazards of interest—**Agricultural and biological as well as pandemic hazards primarily result in ecological, recreational, economic, and vital impacts, but are not considered in the future development and land use decisions of municipal partners' general plans.

Part 2—RISK ASSESSMENT

7. RISK ASSESSMENT METHODOLOGY

This plan evaluated risks associated with each identified hazard of concern for individual incorporated cities and for the unincorporated portion of Ventura County. The following steps were used to assess risk for each hazard:

- **Identify and profile the hazard**—The following information is given for each hazard:
  - A summary of past events that have impacted the planning area
  - Geographic areas most affected by the hazard
  - Event frequency estimates
  - Severity descriptions
  - Warning time likely to be available for response.
- **Determine exposure to the hazard**—Exposure was assessed by overlaying hazard maps with an inventory of structures, facilities, and systems to decide which of them would be exposed to each hazard.
- **Assess the vulnerability of exposed facilities**—Vulnerability of exposed structures and infrastructure was evaluated by estimating potential impacts on people and damage to property and the environment in the event of a hazard incident.

For each hazard, one of the following assessment approaches was used, depending on the nature of information available for the hazard:

- **Quantitative assessment**—Performed when numerical data is available to define risk. Available hazard data may include financial impact, probability, or the number of injuries and deaths.
- **Qualitative assessment**—Uses words to describe and categorize the likelihood and consequences of a risk when numerical data is unavailable. In this type of analysis, defined terms (words) can represent a range of possibilities.

7.1 RISK ASSESSMENT TOOLS

7.1.1 Mapping

National, state, and county databases were reviewed to locate available spatially based data relevant to this planning effort. Maps were produced using geographic information system (GIS) software to show the spatial extent and location of hazards when such datasets were available. These maps are included in the hazard profile chapters of this document and the jurisdiction-specific annexes in Volume 2. Details regarding the data sources and methodologies employed in these mapping efforts is located in Appendix C.

7.1.2 Modeling

Overview

FEMA developed the GIS-based program Hazards U.S. (Hazus) to identify areas that face high risk from earthquakes, hurricanes, floods, and tsunamis by estimating losses. Hazus provides a wide range of inventory data, such as demographics, building stock, critical facilities, transportation and utility infrastructure, and multiple models to estimate potential losses from natural disasters. The program maps and calculates hazard data and damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

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

Levels of Detail for Evaluation

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

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the planning area.
- **Level 2**—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

7.2 RISK ASSESSMENT APPROACH

7.2.1 Hazard Profile Development

Hazard profiles were developed through web-based research and review of previously developed reports and plans, including community general plans and state and local hazard mitigation plans. Frequency and severity indicators include past events and the expert opinions of geologists, emergency management specialists, and others.

7.2.2 Exposure and Vulnerability

Flood, Dam Failure, Earthquake, and Tsunami

Community exposure and vulnerability to the following hazards were evaluated using Hazus:

- **Dam Failure, Flood, and Tsunami**—A Level 2 (user-defined) analysis was performed for general building stock and for critical facilities. Current mapping for the planning area was used to delineate hazard areas for flood, dam failure, and tsunami and estimate potential losses. To estimate damage that would result from these inundation-based hazards, Hazus uses pre-defined relationships between water depth at a structure and resulting damage, with damage given as a percent of total replacement value. Curves defining these relationships have been developed for damage to structures and for damage to typical contents within a structure. By inputting inundation depth data and known property replacement cost values, dollar-value estimates of damage were generated.
- **Earthquake**—A Level 2 analysis was performed to assess earthquake exposure and vulnerability for four scenario events and one probabilistic event:
  - A Magnitude-7.16 event on the Oak Ridge Fault with an epicenter 4.5 miles northwest of Moorpark.
  - A Magnitude-7.16 event on the San Cayetano Fault with an epicenter 10 miles north-northwest of Fillmore.
  - A Magnitude-8.03 event on the San Andreas Fault with an epicenter 27.5 miles north-northeast of Fillmore.
  - A Magnitude-7.12 event on the Ventura-Pitas Point Fault with an epicenter 2.5 miles north of San Buenaventura.
  - The standard Hazus 100-year probabilistic event.

Landslide, Sea-Level Rise & Coastal Erosion, Severe Storms, Severe Weather, and Wildfire

Historical datasets were not adequate to model future losses for these hazards of concern. However, areas and inventory susceptible to some of the hazards of concern were mapped by other means to evaluate exposure. A qualitative analysis was conducted for other hazards using the best available data and professional judgment.

Drought

The risk assessment methodologies used for this update focus on damage to structures. Because drought does not impact structures, the risk assessment for this hazard was more limited and qualitative than the assessment for the other hazards of concern.

7.3 SOURCES OF DATA USED IN MODELING AND EXPOSURE ANALYSES

7.3.1 Building and Cost Data

Replacement cost is the cost to replace an entire structure with one of equal quality and utility. Replacement cost is based on industry-standard cost-estimation models published in the 2021 edition of *RS Means Square Foot Costs*. It is calculated using the RS Means square foot cost for a structure, which is based on the Hazus occupancy class (i.e., multi-family residential or commercial retail trade), multiplied by the square footage of the structure. The construction class and number of stories for single-family residential structures also factor into determining the square foot costs.

Replacement cost values and detailed structure information derived from parcel and building footprints data were loaded into Hazus. When available, an updated inventory was used in place of the Hazus defaults for critical facilities and infrastructure.

7.3.2 Hazus Data Inputs

The following hazard datasets were used for the Hazus Level 2 analysis conducted for the risk assessment:

- **Flood**—The effective Digital Flood Insurance Rate Map (DFIRM) for the planning area was used to delineate flood hazard areas and estimate potential losses from the FEMA 1-percent-annual chance and 0.2-percent-annual-chance (100- and 500-year) flood events. Using the DFIRM floodplain boundaries and base flood elevation information, and the USGS's 1-meter digital elevation model data, flood depth grids were generated and integrated into the Hazus model.
- **Dam Failure**—Dam failure inundation area boundaries and depth grids data for were provided by the California Department of Water Resources the following dams: Arundell Barranca, Bouquet Canyon, Castaic, Lake Eleanor, Lake Sherwood, Lang Creek Detention Basin, Las Llajas, Matilija, Pyramid, Runkle, Santa Felicia, Senior Canyon, Sinaloa Lake, Stewart Canyon Debris Basin, Sycamore Canyon, Westlake Reservoir, and Wood Ranch. The individual dam depth grids were combined, and the combined depth grid was integrated into the Hazus model. Where dam inundation areas overlapped the maximum depth was used.
- **Tsunami**— California Geological Survey tsunami inundation zone data and NOAA's 5-meter digital elevation model data were used to develop an inundation depth grid that was integrated into the Hazus model.
- **Earthquake**—Earthquake ShakeMaps and probabilistic data prepared by USGS were used for the analysis of this hazard. A National Earthquake Hazard Reduction Program soils map from the California Department of Conservation was integrated into the Hazus model, as were liquefaction zones and susceptibility to deep-seated landslide data from the California Geological Survey.

7.3.3 Other Local Hazard Data

Locally relevant information on hazards was gathered from a variety of sources. Data sources for specific hazards were as follows:

- **Drought—** No GIS format drought hazard area datasets were identified for Ventura County.
- **Landslide**—The California Geological Survey provided data on susceptibility to deep-seated landslides. Areas categorized as very high and high susceptibility (Categories X, XI, VIII, and VII) were used in the exposure analysis.
- **Sea-Level Rise and Coastal Erosion**—Sea-level rise data were provided by USGS's Our Coast, Our Future tool. Sea-level rises of 25 cm (no storm) and 100 cm (no storm) were used for the exposure analysis. The 25-cm scenario was chosen as the level nearest to the "high"

projection of 8 inches (20 cm) of sea-level rise by 2030 used by the VC Resilient Project. The 100-cm scenario was chosen as the interval nearest to the State of California Sea-Level Rise Guidance (2018 Update) of 3.5 feet (106 cm) by 2050.

- **Severe Storms**—No GIS format severe storm area datasets were identified for Ventura County.
- **Severe Weather**—No GIS format severe weather area datasets were identified for Ventura County.
- **Wildfire**—Fire severity zone data for local and state responsibility areas were acquired from California Department of Forestry and Fire Protection (CAL FIRE). Very high and high fire severity zones were used in the exposure analysis.

7.3.4 Data Source Summary

Table 7-1 and Table 7-2summarizes the data sources used for the risk assessment for this plan.

Table 7-1. Hazus Model Property and Hazard Data Documentation

Data	Source	Date	Format
Property parcel data including building information (use code, square footage, year built)	Ventura County	2021	Digital (GIS)
Building footprints	Ventura County	2018	Digital (GIS)
Building replacement (square foot) costs	RS Means	2021	Digital (pdf)
Dam breach inundation maps (inundation boundaries and depth grids)	California Department of Water Resources	2018-20	Digital (GIS)
ShakeMaps—Oak Ridge (Onshore) M7.16; San Cayetano M7.16; S. San Andreas (PK+CH+CC+BB+NM+SM+NSB+SSB) M8.03; Ventura-Pitas Point M7.12	USGS	2017	Digital (GIS)
NEHRP soils (VsMapV3_Geology)	California Department of Conservation	2015	Digital (GIS)
Seismic Hazard Zone Maps for Liquefaction	California Geological Survey	2017	Digital (GIS)
Digital Flood Insurance Rate Map (DFIRM) – Ventura County effective 1/29/2021 with latest LOMR effective date 6/18/2021	FEMA	2021	Digital (GIS)
Susceptibility to deep-seated landslides	California Geological Survey	2011	Digital (GIS)
Sea-level rise data (USGS Coastal Storm Modeling System v3.0, Phase 2)	Our Coast Our Future (OCOF)	2018	Digital (GIS)
Tsunami Inundation Map for Emergency Planning	California Emergency Management Agency, California Geological Survey, and University of Southern California – Tsunami Research Center	2009	Digital (GIS)
Very High Fire Hazard Severity Zones in Local Responsibility Areas	California Department of Forestry and Fire Protection	2007	Digital (GIS)
Fire Hazard Severity Zones for State Responsibility Areas	California Department of Forestry and Fire Protection	2007	Digital (GIS)
USGS 1-meter LiDAR digital elevation model	U.S. Geological Survey	2018	Digital (GIS)
NOAA Coastal Services Center Coastal Inundation Digital Elevation Model (5-meter resolution)	National Oceanic and Atmospheric Administration	2012	Digital (GIS)

Table 7-2. Hazus Model Critical Facilities Data Documentation

Data	Source	Date	Format
Sheriff stations	Ventura County	Provided 2021	Digital (GIS)
Fire stations	Ventura County	Provided 2021	Digital (GIS)
Schools	Ventura County	Provided 2021	Digital (GIS)
Wastewater treatment plants	Ventura County	Provided 2021	Digital (GIS)
Sewer lift stations	Ventura County	Provided 2021	Digital (GIS)
Recycled water pumps	Ventura County	Provided 2021	Digital (GIS)
Red Cross shelters	Ventura County	Provided 2021	Digital (GIS)
Hospitals	Ventura County	Provided 2021	Digital (GIS)
Fire district facilities	Ventura County Fire Protection District	Provided 2021	Digital (GIS)
Potable water system facilities	Casitas Municipal Water District	Provided 2021	Digital (GIS)
Potable water system facilities	Calleguas Municipal Water District	Provided 2021	Digital (GIS)
Potable water system facilities	City of Camarillo	Provided 2021	Digital (GIS)
California jurisdictional dams	California Department of Water Resources	Downloaded 2020	Digital (GIS)
Wastewater treatment facilities	California State Water Resources Control Board	Downloaded 2020	Digital (GIS)
Power plants	California Energy Commission	Downloaded 2020	Digital (text)
Electric substations	California Energy Commission	Downloaded 2020	Digital (GIS)
Natural gas stations	California Energy Commission	Downloaded 2018	Digital (GIS)
California rail stations	California Department of Transportation	Downloaded 2020	Digital (GIS)
Public airports	California Department of Transportation	Downloaded 2020	Digital (GIS)
Military airports	California Department of Transportation	Downloaded 2020	Digital (GIS)
Ports	California Department of Transportation	Downloaded 2020	Digital (GIS)
Local highway bridges	California Department of Transportation	Downloaded 2020	Digital (GIS)
State highway bridges	California Department of Transportation	Downloaded 2020	Digital (GIS)
Local Emergency Operations Centers	Homeland Infrastructure Foundation-Level Data	Downloaded 2020	Digital (GIS)
Veterans Health Administration Medical Facilities	Homeland Infrastructure Foundation-Level Data	Downloaded 2020	Digital (GIS)
Cellular towers	Homeland Infrastructure Foundation-Level Data	Downloaded 2022	Digital (GIS)
FM transmission towers	Homeland Infrastructure Foundation-Level Data	Downloaded 2020	Digital (GIS)
AM transmission towers	Homeland Infrastructure Foundation-Level Data	Downloaded 2022	Digital (GIS)
TV analog station transmitters	Homeland Infrastructure Foundation-Level Data	Downloaded 2022	Digital (GIS)
FDIC insured banks	Homeland Infrastructure Foundation-Level Data	Downloaded 2022	Digital (GIS)
Toxic Release Inventory (TRI) facilities extracted from EPA Facility Registry Service (FRS): Facility Interests Dataset	U.S. Environmental Protection Agency	Downloaded 2020	Digital (GIS)
Critical facilities identified in the planning partner annexes for the Ventura County Multi-Jurisdictional Hazard Mitigation Plan	Planning partners (California State University Channel Islands, Calleguas Municipal Water District, Ojai Valley Sanitary District, Saticoy Sanitary District, United Water Conservation District, Ventura County)	2021	Digital (text)

7.4 LIMITATIONS

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

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

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

8. DAM FAILURE

8.1 GENERAL BACKGROUND

8.1.1 Definition and Classification of Dams

A dam is an artificial barrier that can store water, wastewater, or liquid-borne materials for many reasons—flood control, human water supply, irrigation, livestock water supply, energy generation, containment of mine tailings, recreation, or pollution control. Many dams fulfill a combination of these functions. They are an important resource in the United States. In California, dams are regulated by the State of California Division of Safety of Dams. Additional regulatory oversight of dams is cited in Chapter 6 and described in Appendix B.

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

- Is 25 feet or more in height from the natural bed of the stream or watercourse at the downstream toe of the barrier (or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse) to the maximum possible water storage elevation; or
- Has an impounding capacity of 50 acre-feet or more.

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

8.1.2 Causes of Dam Failure

A dam failure can damage ecosystems and communities downstream. Partial or full failure can occur as a result of one or a combination of the following reasons (Federal Emergency Management Agency 2016):

- Overtopping caused by floods that exceed the dam capacity (inadequate spillway capacity)
- Prolonged periods of rainfall and flooding
- Deliberate acts of sabotage (terrorism)
- Structural failure of materials used in dam construction
- Movement and/or failure of the foundation supporting the dam

- Settlement and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate or negligent operation, maintenance, and upkeep
- Failure of upstream dams on the same waterway
- Earthquake (liquefaction/landslides).

Many dam failures in the United States have been secondary results of other disasters. The most common causes are earthquakes, landslides, extreme storms, equipment malfunction, structural damage, foundation failures, and sabotage. Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

8.1.3 Planning Requirements

State of California

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

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

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

Federal Energy Regulatory Commission

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

These plans are frequently updated and tested to ensure that in emergency situations everyone knows what to do, thus saving lives and minimizing property damage.

8.1.4 Secondary Hazards

Dam failure can cause secondary hazards of landslides, bank erosion, and downstream habitat destruction. It may worsen the severity of a drought by releasing water that might have been used as a potable water source.

8.2 HAZARD PROFILE

8.2.1 Past Events

There is no record of a failure of any dam located in Ventura County. However, the failure of one dam in another county had catastrophic effects in Ventura County. The St. Francis Dam in the San Francisquitos Canyon in Los Angeles County (within the Santa Clara River watershed) was constructed to provide 38,000 acre-feet of storage for water from the Los Angeles–Owens River Aqueduct. The midnight collapse of the dam in March 1928 occurred after the newly constructed concrete-arch dam was completely filled for the first time. The resulting flood swept through the Santa Clara Valley in Ventura County toward the Pacific Ocean, about 54 miles away. At its peak, the wall of water was reported to be 78 feet high; by the time it hit Santa Paula, 42 miles south of the dam, the water was estimated to be 25 feet deep. Almost everything in its path was destroyed, including structures, railways, bridges, livestock, and orchards. By the time the flood subsided, parts of Ventura County lay under 70 feet of mud and debris. Nearly 500 people were killed, and damage estimates exceeded $20 million. The communities of Piru, Fillmore, Santa Paula, Bardsdale, Saticoy, Montalvo, and El Rio sustained extensive life and property loss from the flood (Ventura County 2015).

According to the *2013 State of California Multi-Hazard Mitigation Plan*, there have been nine failures of federally regulated dams in the state since 1950. Overtopping caused two of the nine dam failures in the state, and the others were caused by seepage or leaks. The state's most recent dam emergency occurred in February 2017 when the Oroville Dam in Butte County was on the verge of overflow. The dam's concrete spillway was damaged by erosion and a massive hole developed. The auxiliary spillway was used to prevent overtopping of the dam, and it experienced erosion problems also. Evacuation orders were issued in advance of a potential large uncontrolled release of water from Lake Oroville, but such a release did not occur.

After this incident, state officials ordered that flood-control spillways be reinspected on 93 California dams with potential geologic, structural or performance issues that could jeopardize their ability to safely pass a flood event. The 2017-2018 Ventura County Grand Jury investigated the condition of more than 20 dams in or adjoining Ventura County. The Grand Jury found that 14 of these dams (10 in Ventura County and 4 in Los Angeles County) could cause significant loss of life and property if they failed. Four of these dams, all under the jurisdiction of the State of California Division of Safety of Dams (DSOD), are identified as having existing or potential deficiencies (Ventura County 2018).

8.2.2 Location

List of High-Hazard Dams

There are 10 state regulated dams in Ventura County, and 4 state regulated dams outside the County whose failure could lead to inundation in Ventura County. In particular, if dams in the Santa Clara River watershed in Los Angeles County fail, the resulting flood would affect the Santa Clara River corridor, which includes Fillmore, Santa Paula, Oxnard, and Port Hueneme, as demonstrated by the 1928 event (Ventura County 2015). Table 8-1 lists the dams that constitute failure hazards for Ventura County. Their locations are shown on Figure 8-1. The National Inventory of Dams (NID) provides the most recent inspection dates for these dams, as shown in Table 8-2.

Table 8-1. Ventura County Dams with Potential to Endanger Lives and Property

Name	National ID#	Hazard Potential	Owner	Year Built	Dam Type	Crest Length (feet)	Height (feet)	Storage Capacity (acre-feet)	Condition Assessment
Arundell Barranca	CA01412	Extremely High	VCPWA-WP[a]	1996	Earthen Embankment	368	57	155	Satisfactory
Casitas	CA10139	High	Federal	1959	Earthen Embankment	N/A	334	283,727	N/A
Ferro Debris Basin	CA01299	Significant	VCPWA-WP[a]	1986	Earthen Embankment	265	45	24	Satisfactory
Lake Eleanor	CA00737	High	COSCA[b]	1881	Constant Radius Arch	140	37	104	Satisfactory
Lake Sherwood	CA00736	Extremely High	SDC[c]	1904	Constant Radius Arch	350	45	2,600	Satisfactory
Lang Creek Detention Basin	CA01368	Extremely High	VCPWA-WP[a]	2004	Earthen Embankment	345	67	263	Satisfactory
Las Llajas	CA01217	Extremely High	VCPWA-WP[a]	1981	Earthen Embankment	580	96	1,250	Satisfactory
Matilija	CA00312	Extremely High	VCPWA-WP[a]	1949	Variable Radius Arch	620	163	1,800	Poor
Runkle	CA00313	Extremely High	VCPWA-WP[a]	1949	Earthen Embankment	250	41	100	Satisfactory
Santa Felica	CA00805	Extremely High	UWCD[d]	1955	Earthen Embankment	1,275	213	100,000	Fair
Senior Canyon	CA01019	High	SCMWC[e]	1964	Earthen Embankment	970	76	72	Satisfactory
Silt Pond	CA01589	High	Brett Jones	N/A	Earthen Embankment	N/A	80	20	N/A
Sinaloa Lake	CA01018	High	SLOA[f]	1925	Earthen Embankment	800	30	205	Satisfactory
Stewart Canyon	CA01159	Extremely High	VCPWA-WP[a]	1963	Earthen Embankment	1,263	34	890	Satisfactory
Sycamore Canyon	CA01266	Extremely High	VCPWA-WP[a]	1981	Earthen Embankment	1,520	40	890	Satisfactory
Wood Ranch	CA00850	Extremely High	CMWD[g]	1965	Earthen Embankment	1,020	146	11,000	Satisfactory

a. Ventura County Public Works Agency—Watershed Protection
b. Conejo Open Space Conservation Agency
c. Sherwood Development Company
d. United Water Conservation District
e. Senior Canyon Mutual Water Company
f. Sinaloa Lake Owners Associates, Inc.
g. Calleguas Municipal Water District

Sources: California Department of Water Resources Division of Safety of Dams, 2020; U.S. Army Corp of Engineers National Inventory of Dams, 2021

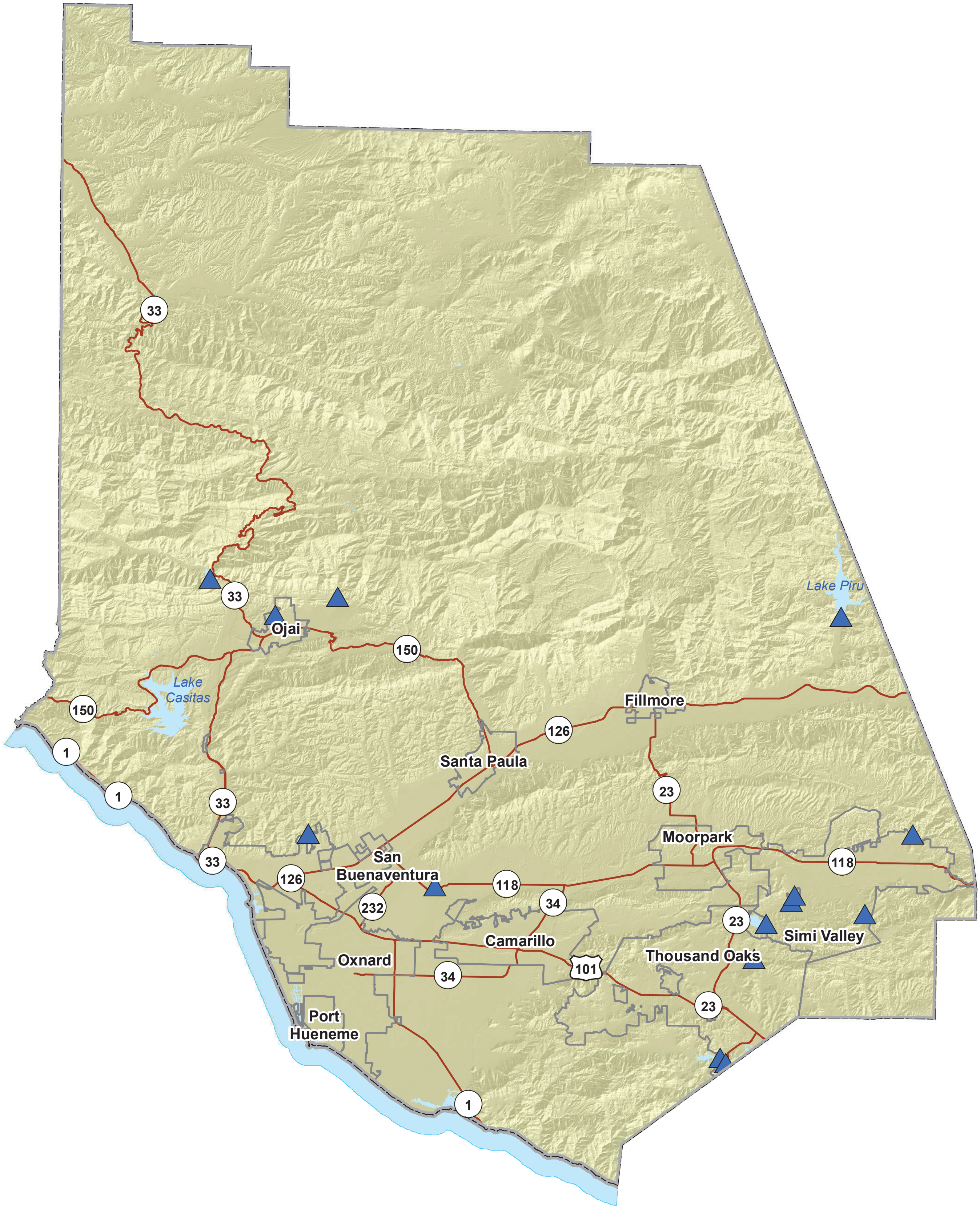


Figure 8-1. Locations of Dams in Ventura County

California Jurisdictional Dams
County Boundary
Cities
Major Roads

N
0 3 6 Miles

Data Sources: Ventura Co., CA DWR, Esri

Table 8-2. Ventura County Dam Inspection Dates

Dam	Inspection Date	Dam	Inspection Date
Arundell Barranca	2/13/2018	Runkle	2/14/2018
Casitas	N/A	Santa Felica	5/10/2017
Ferro Debris Basin	2/13/2018	Senior Canyon	5/24/2018
Lake Eleanor	5/25/2018	Silt Pond	N/A
Lake Sherwood	5/24/2018	Sinaloa Lake	5/23/2018
Lang Creek Detention Basin	2/14/2018	Stewart Canyon	2/13/2018
Las Llajas	2/14/2018	Sycamore Canyon	2/14/2018
Matilija	2/13/2018	Wood Ranch	5/23/2018

The Ventura County Public Works Agency—Watershed Protection (VCPWA-WP) owns and operates the Matilija Dam, which received a "Poor" rating by the DSOD. The DSOD rating was based on concerns as to the ability of the dam—specifically the wing walls—to withstand a 7.5 magnitude earthquake. While the analysis did not appear to indicate complete failure, it indicated a likelihood of significant weakening. There are roughly 8 million cubic yards of debris behind Matilija Dam, and a big storm could push huge amounts of mud and water over the top, overwhelming bridges, culverts and roads below (Ventura County 2018). The VCPWA-WP is working to complete the feasibility analyses, design engineering, CEQA, and implementation of a project to remove the Matilija Dam.

The United Water Conservation District owns and operates Santa Felicia Dam on Lake Piru. The District is currently designing improvements to the existing outlet and spillway. The dam's "Fair" rating is primarily due to deficiencies in the dam's outlet that could result in damage should a maximum credible earthquake occur before the District completes the planned upgrades (Ventura County 2018).

Inundation Mapping

A key element for EAPs required for dams in California is a map defining the potential downstream inundation should the dam fail. For this risk assessment, dam failure inundation areas for which inundation mapping was available were combined into a single inundation area. These included all extremely high and high hazard dams where dam breach inundation area data is available. The combined dam failure inundation area is shown in Figure 8-2. Simultaneous failure of all dams is highly unlikely, but the assessment provides information adequate for planning purposes.

8.2.3 Frequency

Dam failure events are infrequent and usually coincide with or follow events such as earthquakes, landslides and excessive rainfall and snowmelt. Only one recorded failure has occurred on a dam that impacted the planning area, so no estimate of frequency or probability of future occurrence can be developed based on the historical record. Although the 2017 Oroville event raised public concern about dam failure, the probability of such failures remains low in today's regulatory environment.

Figure 8-2. Dam Failure Inundation Area Used for Risk Assessment

Data Sources: Ventura Co., CA DWR, Esri

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

8.2.4 Severity

California's Division of Safety of Dams has developed a hazard potential classification system for state-jurisdiction dams, as shown on Table 8-3. This system is modified from federal guidelines, which recommend three-tier classification. The California system adds a fourth hazard classification of "extremely high." Dams classified as extremely high hazard are expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more. (California Division of Safety of Dams 2021) Dams within state jurisdiction listed in Table 8-1 are classified in this system.

Table 8-3. State of California Downstream Hazard Potential Classification

Hazard Category	Direct Loss of Life	Economic, Environmental, and Lifeline Losses
Low	None expected	Low and principally limited to dam owner's property
Significant	None expected	Yes
High	Probable (one or more expected)	Yes, but not necessary for this classification
Extremely High	Considerable	Yes, major impacts to critical infrastructure or property

Source: California Division of Safety of Dams, 2021

8.2.5 Warning Time

Advance Warning of Failure

Warning time for dam failure varies depending on the cause of the failure. Events of extreme precipitation or massive snowmelt can be predicted in advance, so evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, there may be no or limited warning time. The USGS Earthquake Hazards Program has several dam-safety related earthquake programs, including dam-specific earthquake monitoring programs in California to help monitor safety concerns following seismic events.

Time for Failure to Occur

The process of the dam failure affects warning time. Earthen dams do not tend to fail completely or instantaneously. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach as one or more monolith sections are forced apart by escaping water. The time of breach formation ranges from a few minutes to a few hours.

Time After Failure Before Downstream Areas Are Affected

Flood waters from a failure of the Wood Ranch dam at Bard Reservoir would reach the City of Camarillo in approximately 1 hour and 40 minutes. The natural drainage would enter Camarillo along the Las Posas Arroyo through Somis (City of Camarillo 2007). The number of people to be alerted and evacuated can vary widely. There may be few people along the river in winter, when only permanent residents are apt to be present; but there may be many more people in summer, with the presence of recreational visitors.

Another factor that must be considered is the initial flow in the river when the failure occurs. The initial flow is normally very low on all the rivers from May through October. During the winter, the initial flow is much higher and at times may even be equal to or greater than flood stage. This wide variation in initial flow has a significant impact on the areas that must be evacuated.

8.3 EXPOSURE

Exposure to the dam failure hazard was assessed by overlaying the mapped combined inundation area in Figure 8-2 with planning area features including general building stock and critical facilities. Detailed results by jurisdiction are included in Appendix D; countywide summaries are provided below.

8.3.1 Population

The estimated total population living in the evaluated dam failure inundation zone is 267,136 (31.7 percent of the total planning area population).

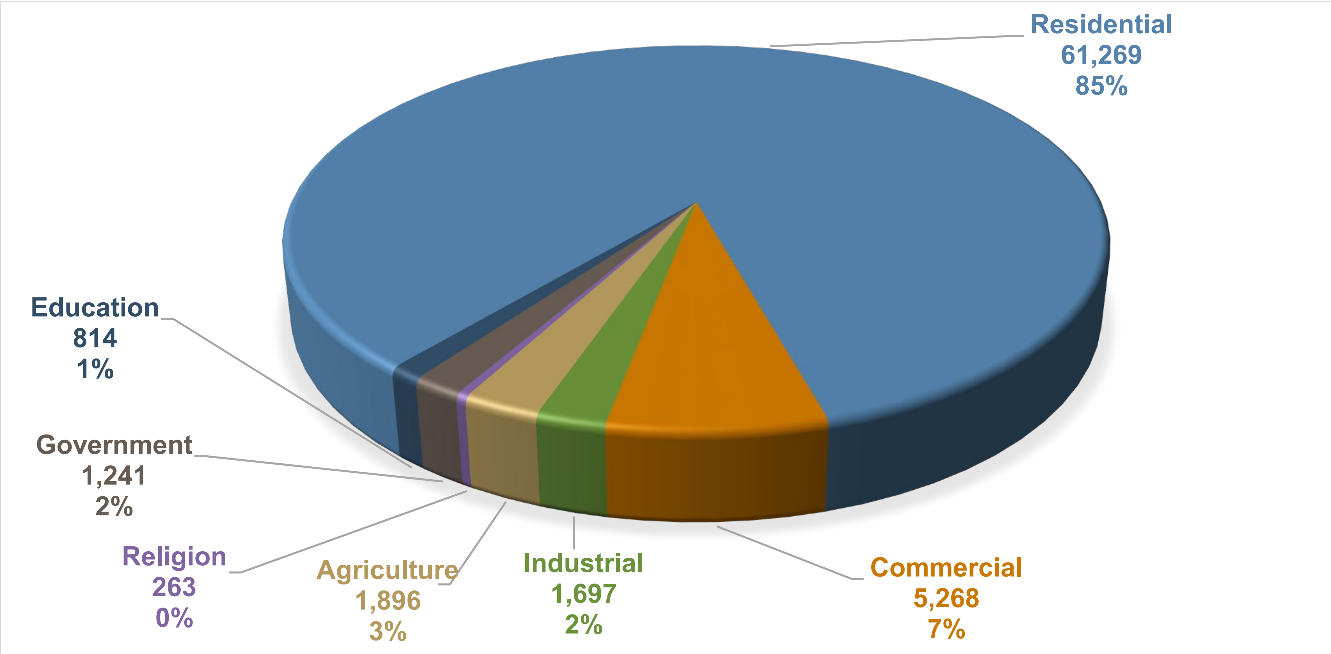
8.3.2 Property

Table 8-4 summarizes the estimated property exposure in the evaluated dam failure inundation area. Figure 8-3 shows the Hazus-defined occupancy class of all buildings in the combined dam failure inundation area. These occupancy classes provide an indication of land use within the mapped hazard area. Some land uses are more vulnerable to dam failure inundation, such as single-family homes, while others are less vulnerable, such as agricultural land or parks.

Table 8-4. Exposed Property in Evaluated Dam Failure Inundation Area

Acres of Inundation Area	254,761
Number of Buildings Exposed	72,448
Value of Exposed Structures	$28,821,842,548
Value of Exposed Contents	$22,630,155,206
Total Exposed Property Value	$51,451,998,753
Total Exposed Value as % of Planning Area Total	*28.5%*

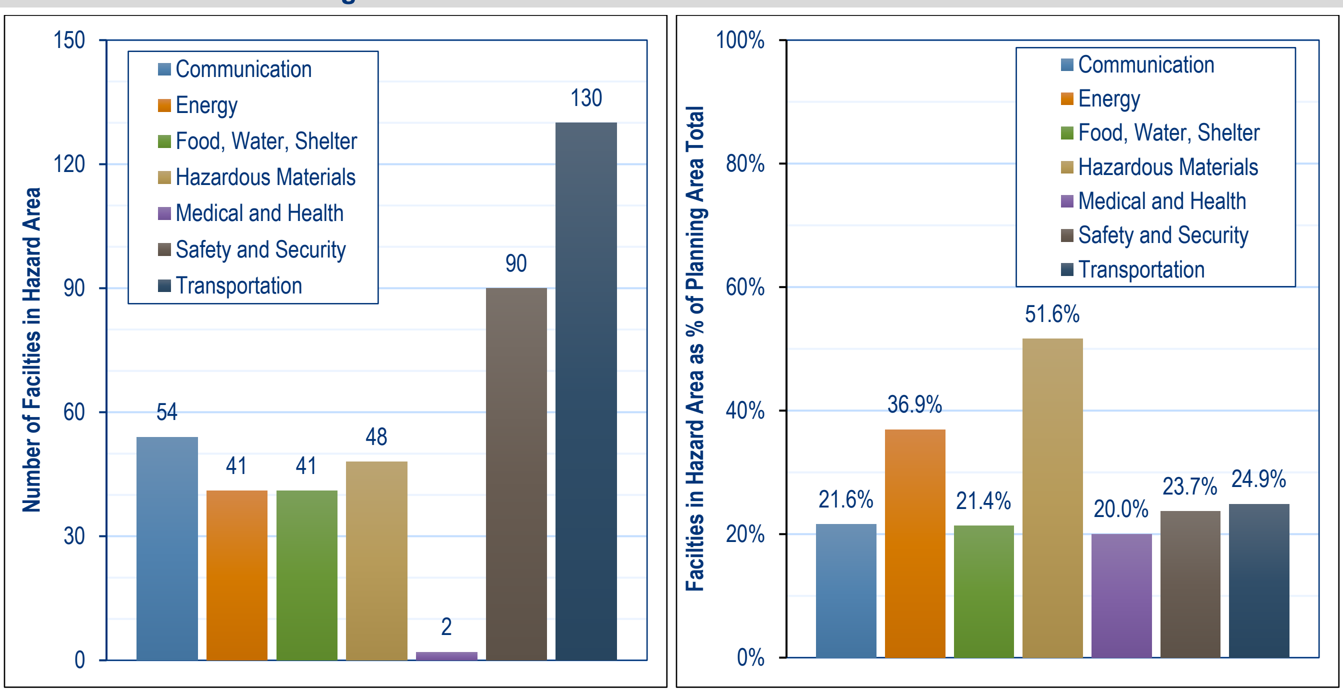
Figure 8-3. Building Count by Occupancy Class in the Dam Failure Inundation Zone



8.3.3 Critical Facilities

Figure 8-4 shows critical facilities located in the dam failure inundation zone by facility type. The total count of critical facilities in the dam failure inundation zone (406) represents 26 percent of the planning area total of 1,559. A breakdown by municipality is provided in Appendix D.

Figure 8-4. Critical Facilities in Dam Failure Inundation Area



8.3.4 Environment

All natural features in the dam failure inundation zone are at risk from the dam failure hazard.

8.4 VULNERABILITY

The vulnerability of people, property, and critical facilities was evaluated for the combined dam failure inundation area. Appendix D shows results by jurisdiction; countywide summaries are provided below.

8.4.1 Population

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area before floodwaters arrive. This population includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television, radio emergency warning system, siren, or cell phone alert. Impacts on persons and households for the combined dam failure inundation area are estimated through the Level 2 Hazus analysis. Table 8-5 summarizes the results.

Table 8-5. Estimated Dam Failure Impacts on Population

Number of Persons Displaced	207,158
Number of Residents Requiring Short-Term Shelter	14,254

8.4.2 Property

Properties closest to the dam failure inundation zone would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. Properties in the dam failure inundation zone that are built to National Flood Insurance Program (NFIP) minimum construction standards may have some level of protection against dam failure inundation, depending on the velocity and elevation of the inundation waters. These properties also are more likely to have flood insurance. Table 8-6 summarizes the loss estimates for dam failure.

Table 8-6. Estimated Impact of a Dam Failure in the Planning Area

Number of Buildings Impacted	63,936
Estimated Loss, Structures	$6,795,872,395
Estimated Loss, Contents	$8,126,268,419
Estimated Loss, Total	**$14,922,140,815**
Total Loss as % of Total Replacement Value	***8.3%***

8.4.3 Critical Facilities

Significant facilities predicted by Hazus to be affected by the modeled dam failure include the following:

- 10 wastewater treatment facilities
- 36 hazardous material sites
- 1 hospital
- 18 fire stations or battalion headquarters
- 60 schools
- 120 road bridges

Hazus was used to estimate the number of critical facilities affected by dam failure and the resulting percent of damage to the building and contents. Figure 8-5 compares the predicted number of affected facilities to the number of exposed facilities. Between 50 and 96 percent of exposed facilities are predicted to experience some damage, depending on the category.

Figure 8-5. Critical Facilities Exposed to and Affected by Mapped Dam Failure Inundation Area

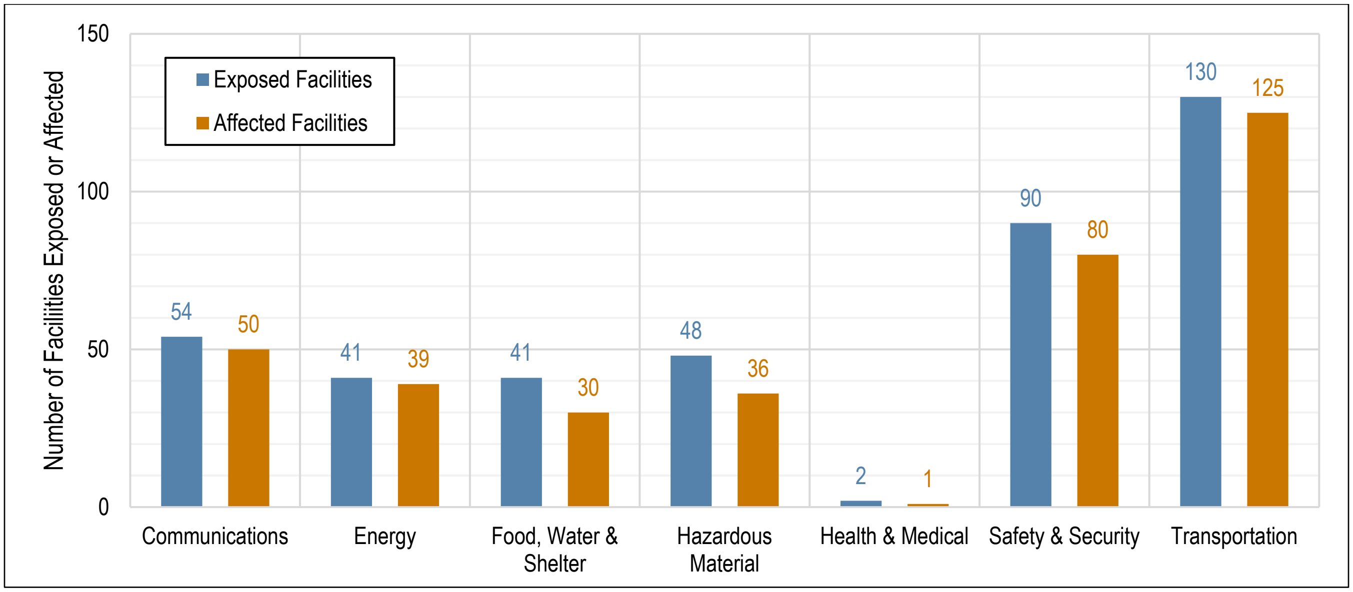
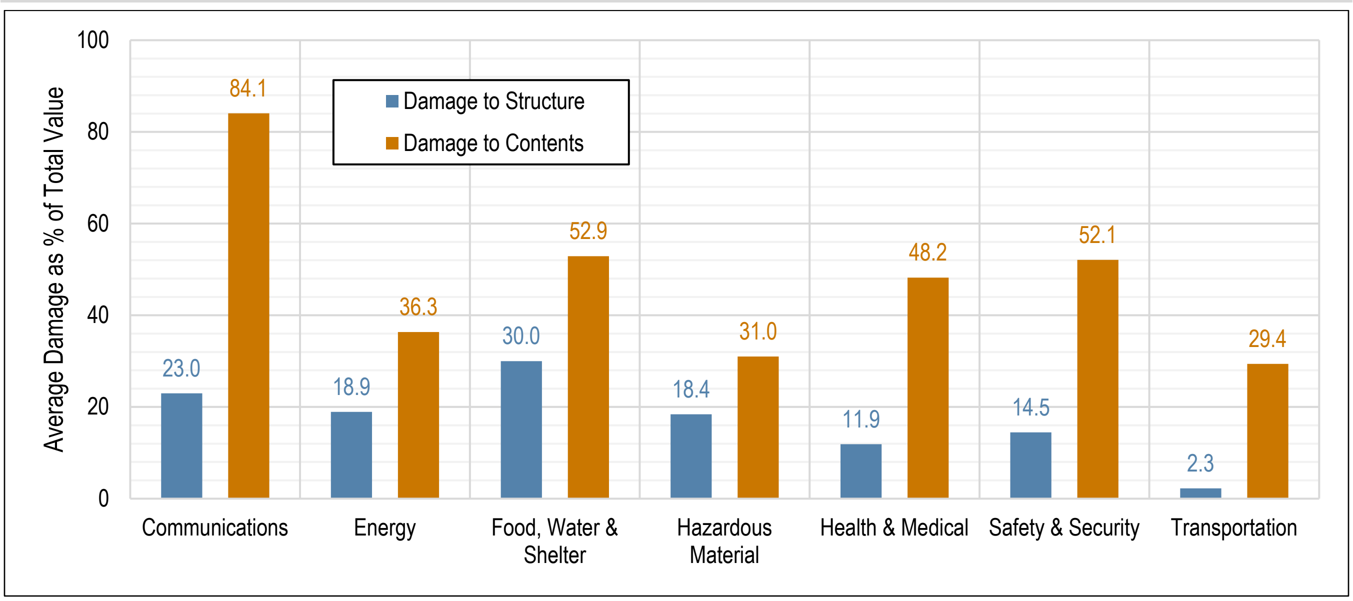


Figure 8-6 shows the estimated damage to critical facilities for the modeled dam failure. Depending on critical facility category, the average amount of damage to structures, measured as a percentage of total value, ranges from 2.3 to 30.0 percent of total value, and average damage to contents ranges from 29.4 to 84.1 percent.

Figure 8-6. Average % of Damage to Critical Facilities Caused by Modeled Dam Failure



Typical vulnerabilities of these facilities include the following:

- Transportation routes are vulnerable to dam failure inundation and have the potential to be wiped out, creating isolation issues and significant disruption to travel. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge.
- Utilities such as overhead power lines, cable and phone lines in the inundation zone could also be vulnerable. If phone lines were lost, significant communication issues may occur in the planning area due to limited cell phone reception in many areas.
- In addition, emergency response would be hindered due to the loss of transportation routes as well as some protective-function facilities in the safety and security category located in the inundation zone. Recovery time to restore many critical functions after an event may be lengthy.

8.4.4 Environment

The environment would be vulnerable to a number of risks in the event of dam failure. The inundation could introduce foreign elements into local waterways, resulting in destruction of downstream habitat and detrimental effects on many species of animals, especially endangered species such as the tidewater goby.

8.5 SCENARIO

An earthquake in the region could lead to liquefaction of soils around a dam, without warning during any time of the day. A human-caused incident such as a terrorist attack also could trigger a catastrophic failure of a dam that would impact the planning area. Failure of a high hazard dam in the County would likely result in losses of life, roadways, structures, and property, and exert severe impacts on the local economy. While the possibility of failure is remote, results would be devastating.

The worst-case scenario would involve failure of the Santa Felicia Dam. In addition to severe property damage and potential injuries or loss of life, loss of water from Lake Piru could lead to reduction in available water used to replenish underground basins in the County. Coupled with the ongoing drought throughout the state and already low water supply availability, this damage could lead to significant water shortages.

8.6 ISSUES

The most significant issues associated with dam failure involve properties and populations within inundation zones. Flooding as a result of a dam failure would significantly impact these areas. Warning time for dam failure plausibly would be limited. Moreover, dam failure is frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits predictability of dam failure and compounds the hazard. Important issues associated with dam failure hazards are as follows:

- A significant number of the structures located in the dam failure inundation zone are located outside of special flood hazard areas, meaning that they are not constructed to withstand floodwaters and are less likely to be covered by flood insurance. Even structures that have been designed with flood hazards in mind may not be able to withstand the height and velocity of flow from a dam failure event.

- Addressing security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials.
- California law requires that a property's location in a dam failure inundation be disclosed to a buyer if the seller or the seller's agent has knowledge of the property's location within the hazard area or if the local jurisdiction has compiled a list of parcels that are in the inundation area and has posted at the offices of the county recorder, county assessor, and county planning agency a notice that identifies the location of the list. This information is only available by request from county planning.
- Dam failure inundation areas are often not considered special flood hazard areas under the National Flood Insurance Program, so flood insurance coverage in these areas is not common.
- Dam infrastructure may require repair and improvement to withstand climate change impacts, such as changing in the timing and intensity of rain events.
- Federally regulated dams have an adequate level of oversight and sophistication in the development of emergency action plans for public notification in the unlikely event of failure. However, the protocol for notification of downstream residents of imminent failure needs to be tied to local emergency response planning.
- In the event of a dam failure that interrupted land line phone service, significant issues with communication could occur.
- Limited financial resources for dam maintenance during economic downturns result in decreased attention to dam structure operational integrity, because available funding is often directed to more urgent needs. This could increase potential for maintenance failures.
- Mapping for federally regulated dams is already required and available; however, mapping for non-federally regulated dams that estimates inundation depths is needed to better assess risks associated with failure of these dams.
- Although mapping is required for federally regulated dams, development downstream of dams and upgrades to older dams may have altered inundation areas; however, these inundation maps may not have been updated for significant periods of time. Encouraging property owners of dams to update EAPs and inundation maps will ensure availability of the most accurate data to assist emergency planners and local officials.
- Most dam failure mapping required at federal levels requires determination of the probable maximum flood. While the probable maximum flood represents a worst-case scenario, it is generally the event with the lowest probability of occurrence. Mapping of dam failure scenarios for non-federal-regulated dams that are less extreme than the probable maximum flood, but have a higher probability of occurrence, can be valuable to emergency managers and community officials downstream of these facilities. This type of mapping can illustrate areas potentially impacted by more frequent events to support emergency response and preparedness actions.
- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.
- There may be dams located in the planning area that do not meet regulatory thresholds for jurisdiction under State of California or federal programs.

9. DROUGHT

9.1 GENERAL BACKGROUND

Drought is a significant decrease in water supply relative to what is typical in a given location. It is a normal phase in the climate cycle of most regions, originating from a deficiency of precipitation over an extended period of time, usually a season or more. This leads to a water shortage for some activity, group or environmental sector. Drought can be characterized based on various impacts or measurements:

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

Drought is a normal phase in the climatic cycle of most geographical regions. If the weather pattern that causes a drought lasts a short time (a few weeks or a couple of months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

9.1.1 Monitoring and Categorizing Drought

National Oceanic and Atmospheric Administration Drought Indices

The National Oceanic and Atmospheric Administration (NOAA) has developed several indices to measure drought impacts and severity and to map their extent and locations:

- The ***Crop Moisture Index*** measures short-term drought weekly to assess impacts on agriculture.
- The ***Palmer Z Index*** measures short-term drought on a monthly scale.
- The ***Palmer Drought Severity Index*** is based on long-term weather patterns. The intensity of drought in a given month is dependent on current weather plus the cumulative patterns of

previous months. Weather patterns can change quickly, and the Palmer Drought Severity Index can respond fairly rapidly.

- The ***Palmer Hydrological Drought Index*** quantifies hydrological effects (reservoir levels, groundwater levels, etc.), which take longer to develop and last longer. This index responds more slowly to changing conditions than the Palmer Drought Index.
- The ***Standardized Precipitation Index*** considers only precipitation. A value of zero indicates the median precipitation amount; the index is negative for drought and positive for wet conditions. The Standardized Precipitation Index is computed for time scales ranging from one month to 24 months.

Figure 9-1 shows examples of these indices as of mid-November 2021.

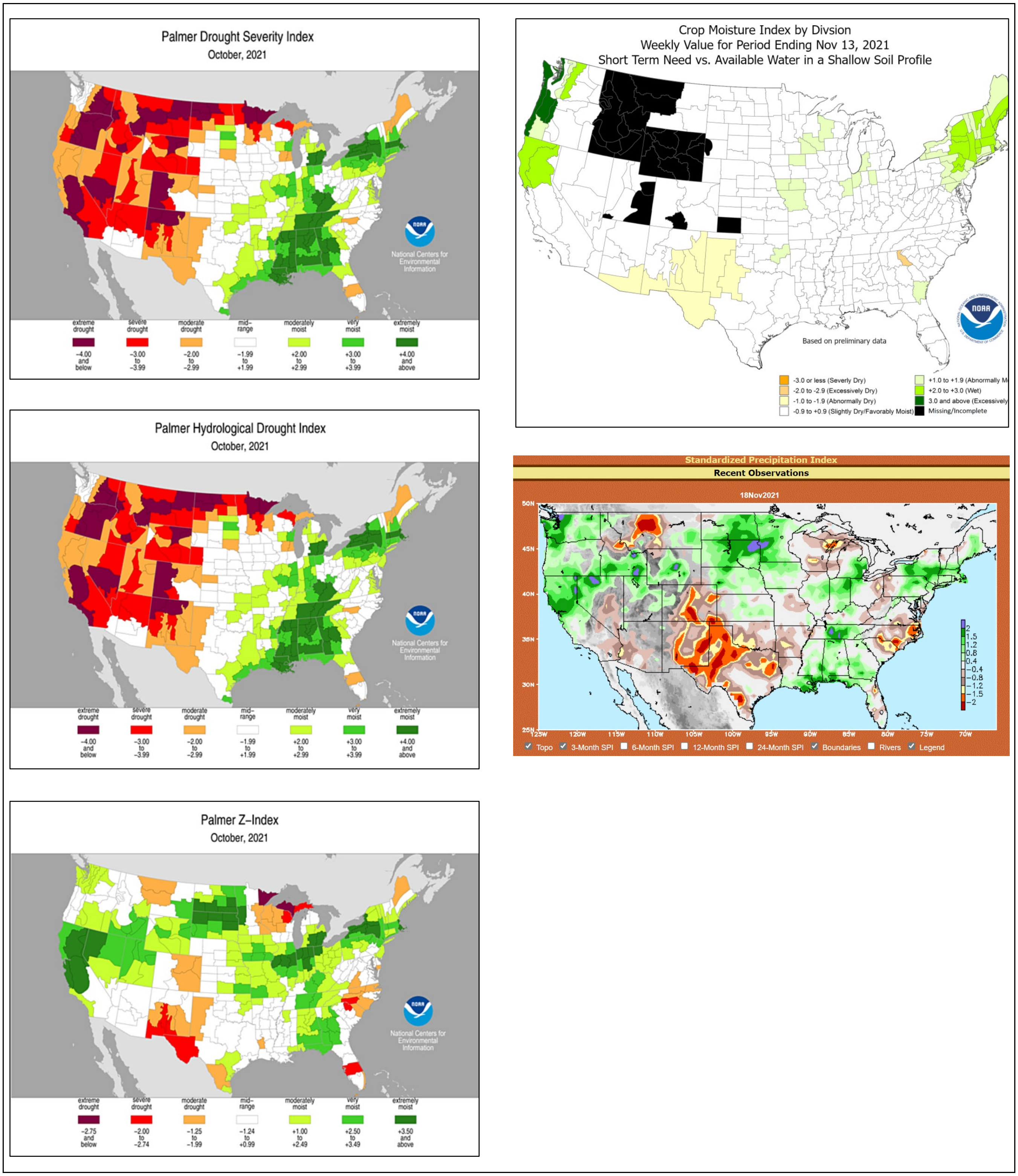
U.S. Drought Monitor

The U.S. Drought Monitor (USDM) is a map that is updated weekly to show the location and intensity of drought across the country. The USDM uses a five-category system (National Integrated Drought Information System 2021):

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

The USDM categories show experts' assessments of conditions related to drought. These experts check variables including temperature, soil moisture, water levels in streams and lakes, snow cover, and meltwater runoff. They also check whether areas are showing drought impacts such as water shortages and business interruptions. Associated statistics show what proportion of various geographic areas are in each category of dryness or drought, and how many people are affected. U.S. Drought Monitor data go back to 2000.

Figure 9-1. Example Drought Index Maps, Current as of November 18, 2021



9.1.2 Drought Impacts

Drought can have a widespread impact on the environment and the economy, although it typically does not result in loss of life or damage to structures, as do other natural disasters. The National Drought Mitigation Center uses three categories to describe likely drought impacts:

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

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

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

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

Drought generally does not affect groundwater sources as quickly as surface water supplies, but groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Droughts can affect groundwater storage as reserves are drawn down in anticipation of drought impacts. Such conjunctive use assists in drought resilience, but it can take years to replenish the water that was stored. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest.

9.1.3 Defined Drought Stages in California

During critically dry years, the California State Water Resources Control Board can mandate water entitlements on water right holders to address statewide water shortages. Table 9-1 shows the state drought management program stages mandated to water right holders.

Table 9-1. State Drought Management Program

Drought Stage	State Mandated Customer Demand Reduction	Rate Impacts
Stage 0 or 1	<10%	Normal rates
Stage 2	10 to 15%	Normal rates; Drought surcharge
Stage 3	15 to 20%	Normal rates; Drought surcharge
Stage 4	>20%	Normal rates, Drought surcharge

9.1.4 Secondary Hazards

The secondary impact most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. In addition, lack of sufficient water resources can stress trees and other vegetation, making them more vulnerable to infestation from pests, which in turn, can make them more vulnerable to ignition.

9.2 HAZARD PROFILE

9.2.1 Planning Area Water Supply and Drought Response

Water Supply Strategy

Groundwater provides about 67 percent of the locally utilized water in Ventura County (Ventura County Public Works Agency 2020). Additionally, more than 100,000 acre-feet of potable water is imported annually from the Metropolitan Water District of Southern California. The remainder of local water comes from surface and recycled water sources.

Calleguas Municipal Water District (MWD), Casitas MWD, and United Water Conservation District (UWCD) are the main water providers for much of Ventura County, allowing other jurisdictions, water districts, and private utilities to coordinate in order to ensure continual water supply necessary to maintain health, safety, and economic well being of residents, businesses, and community organizations. These three water districts have developed long-term water supply strategies for customers in Ventura County:

- Calleguas MWD is active in regional water planning, conservation, watershed protection and development of reclaimed water.
- Casitas MWD is actively engaged in managing existing local water resources and planning for water security.
- UWCD offers unique approaches to regional watershed management, responsibly conserving and enhancing resources, and protecting the environment while meeting water demands.

Water supply strategies recognize that drought year shortfalls could be significant. Dry years could result in cutbacks of up to 20 percent, but 10 to 15 percent is the more consistent standard. Calleguas MWD and Casitas MWD maintain Urban Water Management Plans that outline the following:

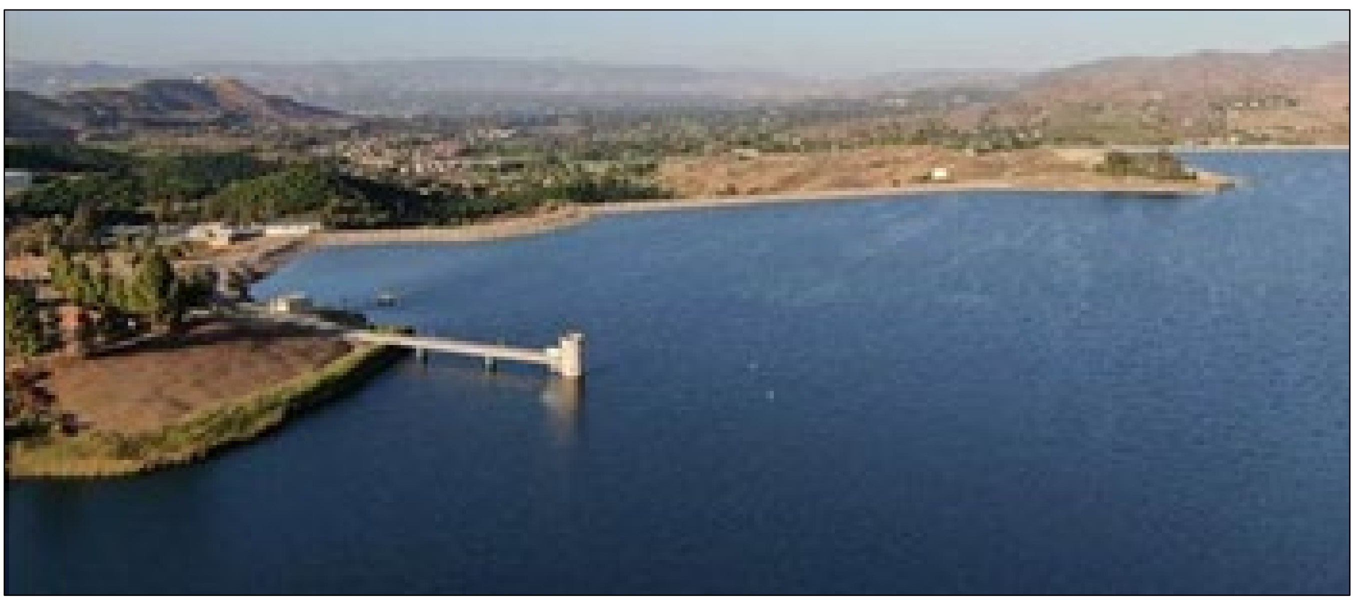
- Water source reliability over a 20-year timeframe
- Water shortage contingency plans
- Drought risk assessment

While the three districts are the primary water service agencies in the County, they are not the only option for residents and businesses. Some water purveyors and residents in the County have wells on their property. The last available report shows 4,016 active water wells in Ventura County (Ventura County Watershed Protection District 2015).

Water Supply Infrastructure

Calleguas MWD receives water from the Metropolitan Water District of Southern California brought south by the State Water Project. Calleguas MWD built a pipeline network to bring water into Ventura County, including the Santa Susana Tunnel that connects to Metropolitan's system in Los Angeles County. Lake Bard reservoir (Figure 9-2) was built to store water for peak summer and emergency demand. Las Posas Aquifer Storage and Recovery Well Field is also used to store water that is not immediately distributed to purveyors. The stored water is treated before entering the Calleguas MWD system.

Figure 9-2. Calleguas MWD's Lake Bard Reservoir



Source: Calleguas MWD

Only 17 percent of the Casitas MWD's water comes from groundwater; 83 percent comes from Lake Casitas (Figure 9-3). The lake fills primarily from the natural flow of local creeks and the Robles Diversion. The diversion is a large canal that brings water about 7 miles from the Ventura River. This diversion accounts for about one-third of the lake's water each year.

Figure 9-3. Casitas MWSD's Lake Casitas

Source: Casitas MWD

UWCD built the Freeman Diversion (Figure 9-4) to redirect water from the Santa Clara River to spreading basins for groundwater recharge. The Santa Felicia Dam and Lake Piru Reservoir recharge downstream groundwater basins through conservation releases when downstream basins are at their seasonal lows. The Pumping Trough Pipeline delivers surface water from the Santa Clara River and deep wells to agricultural users.

Figure 9-4. UWCD's Freeman Diversion

Source: The Fillmore Gazette

Defined Drought Levels

Ventura County does not have a defined drought level. County and regional drought response is determined case by case, and response priorities are typically based on imminence of potential water shortages. Drought stages defined by the California State Water Resources Control Board (see Table 9-1) can serve as a reference for County and stakeholder agencies when determining need for response.

Calleguas MWD adopted a resolution on August 18, 2021, declaring a Stage 2 water shortage and calling for enhanced water use efficiency efforts. For Casitas MWD, drought conditions remain in effect since the Board of Directors declared Stage 3 water supply conditions on April 27, 2016. The primary source of water for UWCD is managed by the Fox Canyon Groundwater Management Authority, which sets allocations for each water pumper and imposes water shortage contingency plan levels. Significant penalties are levied on purveyors if they take delivery of water in excess of their allocations.

9.2.2 Past Events

California Department of Water Resources hydrologic data from the early 1900s shows multi-year droughts from 1912 to 1913, 1918 to 1920, 1922 to 1924, and 1929 to 1934, 1959 to 1961 (California Department of Water Resources 2003). The following sections describe more-recent prolonged droughts that have impacted the planning area.

2020 Ongoing Drought

The 2020-21 water year was the second driest year on record, with a near record low storage in California’s largest reservoirs. August 2021 was the driest and hottest August on record since reporting began. The executive proclamation of drought emergency includes Ventura County. Executive orders include water conservation and a ban on wasteful water practices.

2012 to 2017 Drought

The period from 2012 to 2014 ranked as the driest three consecutive years for statewide precipitation. Calendar year 2014 set new records for statewide average temperatures and for record-low water allocations from the State Water Project and the federal Central Valley Project. Calendar year 2013 set minimum annual precipitation records for many communities. Detailed executive orders and regulations addressed water conservation and management. The statewide drought emergency was lifted in April 2017.

2007 to 2009 Drought

The state proclaimed a statewide drought emergency on June 4, 2008 after spring 2008 was the driest spring on record, with low snowmelt runoff. On February 27, 2009, the state proclaimed a state of emergency for the entire state as severe drought continued. The largest court-ordered water restriction in state history (at the time) was imposed.

1987 to 1992 Drought

California received precipitation well below average levels for four consecutive years. While the Central Coast was most affected, Southern California counties were also affected. In 1991, the State Water Project sharply decreased deliveries to water suppliers. By February 1991, all 58 counties in California were experiencing drought. Urban areas as well as agricultural areas were impacted.

1976 to 1977 Drought

California had a severe drought due to lack of rainfall during the winters of 1976 and 1977. 1977 was the driest period on record in California at that time, with the previous winter recorded as the fourth driest in California's hydrological history at that time. The cumulative impact led to widespread water shortages and severe water conservation measures statewide. Over $2.6 billion in crop damage was recorded in 31 counties. FEMA declared a drought emergency (Declaration 3023-EM) on January 20, 1977.

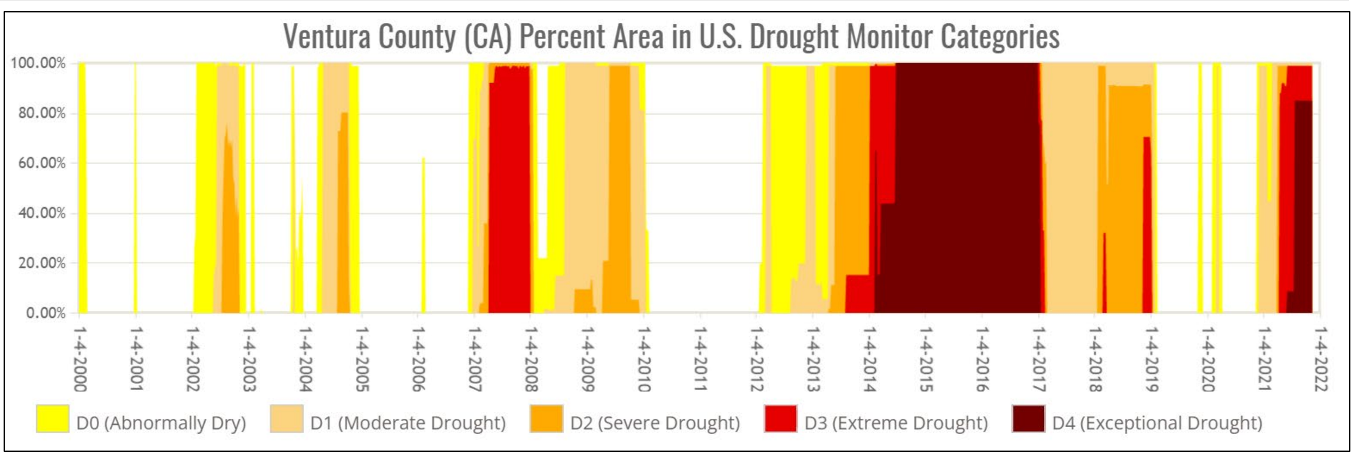
9.2.3 Location

Drought is a regional phenomenon that has the potential to impact the entire planning area. A drought affects all aspects of the environment and the community simultaneously and has the potential to directly or indirectly impact every person in the planning area as well as adversely affect the local economy.

9.2.4 Frequency

Drought has a high probability of occurrence in the planning area. From January 2000 to November 2021, some part of Ventura County experienced a USDM rating of D1 or higher in 604 out of 1,142 weeks— more than half the time (see Figure 9-5). The planning area has also been included in USDA drought disaster declarations in eight of the past nine years (U.S. Department of Agriculture 2021a). Historical drought data for the planning area indicate there have been four significant multi-year droughts in the last 45 years (1976 to 2021), amounting to a severe drought every 10 to 11 years on average.

Figure 9-5. Percent of Ventura County Affected by Each USDM Rating, 2000 – 2021



Source: U.S. Drought Monitor, 2021

9.2.5 Severity

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

U.S. Drought Monitor Ratings

Ventura County has a history of severe droughts. As shown in Figure 9-5, at least part of the county has experienced extreme (D3) or exceptional (D4) droughts more than once since 2000.

Drought Impact Reporter

The National Drought Mitigation Center developed the Drought Impact Reporter in response to the need for a national drought impact database for the United States. Information comes from a variety of sources: on-line, drought-related news stories and scientific publications, members of the public who visit the website and submit a drought-related impact for their region, members of the media, and staff of government agencies. The database is being populated beginning with the most recent impacts and working backward in time.

The Drought Impact Reporter indicates 1,316 impacts from drought that specifically affected Ventura County from January 2011 through November 15, 2021 (National Drought Mitigation Center 2021). Most (70.2 percent) are based on media reports. The rest are from the Community Collaborative Rain, Hail & Snow Network. The following are the reported numbers of impacts by category (some incidents are assigned to more than one impact category):

- Agriculture—323
- Business and Industry—107
- Energy—15
- Fire—195
- Plants and Wildlife—361
- Relief, Response, and Restrictions—601
- Society and Public Health—340
- Tourism and Recreation—137
- Water Supply and Quality—769

9.2.6 Warning Time

Predicting drought depends on the ability to forecast precipitation and temperature. Scientists at this time do not know how to predict drought more than a month in advance for most locations. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

Determination of when drought begins is based on impacts on water users and assessments of available water supply, including water stored in reservoirs or groundwater basins. Different water agencies have different criteria for defining drought. Some issue drought watch or drought warning announcements.

9.3 EXPOSURE

All people, property and environments in the planning area would be exposed to some degree to the impacts of moderate to extreme drought conditions.

9.4 VULNERABILITY

9.4.1 Population

The entire population of the County is vulnerable to drought events. Drought can affect people's health and safety, including health problems related to low water flows, poor water quality, or dust. Droughts can also lead to loss of human life (National Centers for Environmental Information 2021). Other possible impacts include recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and hygiene; compromised food and nutrition; and increased incidence of illness and disease (Centers for Disease Control and Prevention 2020).

9.4.2 Property

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can have significant impacts on other types of property such as landscaped areas and economically important natural resources. Drought causes the most significant economic impacts on industries that use water or depend on water for their business, most notably agriculture and related sectors (forestry, fisheries, and waterborne activities), power plants, and oil refineries. In addition to losses in yields in crop and livestock production, drought is associated with increased insect infestations, plant diseases, and wind erosion. Drought can lead to other losses because so many sectors are affected - losses that include reduced income for farmers and reduced business for retailers and others who provide goods and services to farmers. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue. Prices for food, energy, and other products may also increase as supplies decrease.

9.4.3 Critical Facilities

Critical facilities as defined for this plan will continue to be operational during a drought. Critical facility features such as landscaping may not be maintained due to limited water resources, but the risk to critical facility core functions is low.

9.4.4 Environment

Groundwater and Streams

Drought generally does not affect groundwater sources as quickly as surface water supplies, but groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest. Where stream flows are reduced, development that relies on surface water may seek to establish new groundwater wells, which could further increase groundwater depletion.

Other Potential Losses

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects. The following are potential impacts of drought:

- Wildlife habitat may be degraded through the loss of wetlands, lakes and vegetation. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity.
- Drought conditions greatly increase the likelihood of wildfires, a major threat to agricultural resources.
- Water shortages and severe drought conditions would have a significant impact on Native American tribes' way of life in fishing and farming subsistence.
- Scenic resources in the County are vulnerable to the increased likelihood of wildfires associated with droughts.
- Drying up of recreational reservoirs could reduce tourist values.
- Any shortage of water supply can have significant economic impacts.

9.5 SCENARIO

A multi-year drought that impacts the entire west or the State of California, similar to the 2012 to 2017 drought, is the worst-case scenario for the planning area. The 2012-2017 drought and the wildfires and floods that followed it caused extensive damage to natural systems. If another severe multi-year drought occurs before these systems have a chance to recover, it could exacerbate the stress already placed on existing planning area water resources.

9.6 ISSUES

The planning team has identified the following drought-related issues:

- Alternative water supplies need to be identified and developed, as well as alternative strategies to allocate and distribute existing water sources.
- Alternative techniques (groundwater recharge, water recycle, local capture and reuse, desalination, and transfer) could stabilize and offset snowpack water supply shortfalls that may affect imported water.
- There is a need for local or regional drought-level indicators to correspond with water conservation measures.
- Drought in the county could increase and expand fire-prone areas and adversely affect the agricultural economy.
- If tension increases over surface water, additional draw-downs to groundwater supplies may occur.
- More studies need to be done regarding overall county water usage and how it relates to the economy to prepare for a worst-case scenario drought.
- Planning must address the degree of future development in drought-prone areas.
- Drought frequencies and durations may increase due to climate change.
- Water conservation should be promoted to a greater extent, even during non-drought periods.
- Frequent or prolonged droughts may limit the County’s and residents’ ability to successfully recover from or prepare for more occurrences.

10. EARTHQUAKE

10.1 GENERAL BACKGROUND

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

10.1.1 Earthquake Location

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

10.1.2 Earthquake Geology

Tectonic Plates

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

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

Faults

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

Faults are more likely to have future earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve the accumulating tectonic stresses. Geologists classify faults by their relative hazards. "Active" faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). "Potentially active" faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years) (California Department of Conservation 2019a).

Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. The majority of the seismic hazards are on well-known active faults. However, inactive faults, where no displacements have been recorded, also have the potential to reactivate or experience displacement along a branch sometime in the future. An example of a fault zone that has been reactivated is the Foothills Fault Zone. The zone was considered inactive until evidence of an earthquake (approximately 1.6 million years ago) was found near Spenceville, California. Then, in 1975, an earthquake occurred on another branch of the zone near Oroville, California (now known as the Cleveland Hills Fault). The State Division of Mines and Geology indicates that increased earthquake activity throughout California may cause tectonic movement along currently inactive fault systems.

10.1.3 Earthquake-Related Hazards

According to the U.S. Geological Survey (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect resident's normal activities. This includes the following:

- **Surface Faulting**—Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
- **Ground Motion (shaking)**—The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
- **Landslid**e—A movement of surface material down a slope.
- **Liquefaction**—A process by which water-saturated sediment temporarily loses strength and acts as a fluid. Earthquake shaking can cause this effect.
- **Tectonic Deformation**—A change in the original shape of a material due to stress and strain.
- **Tsunami**—A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or violent underwater volcanic eruptions.

10.1.4 Earthquake Classifications

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

Magnitude

An earthquake's magnitude is a measure of energy released at the earthquake source. It is commonly expressed by ratings on the moment magnitude scale (M_W). Most people have heard about the Richter scale, but the moment magnitude scale is a more accurate measure of magnitude (U.S. Geological Survey 2021c). It is based on the product of the distance a fault moved and the force required to move it. The scale is as follows:

- Great— $M_W > 8$
- Major— $M_W = 7.0 – 7.9$
- Strong— $M_W = 6.0 – 6.9$
- Moderate— $M_W = 5.0 – 5.9$
- Light— $M_W = 4.0 – 4.9$
- Minor— $M_W = 3.0 – 3.9$
- Micro— $M_W < 3$

Intensity

The most commonly used intensity scale is the modified Mercalli intensity scale. Table 10-1 lists perceived shaking and damage potential for structures using this scale. The scale is represented visually using shake maps, which show the expected ground shaking produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A shake map shows the variation of ground shaking in a region immediately following significant earthquakes (for technical information about shake maps see (U.S. Geological Survey 2021e)).

Table 10-1. Mercalli Scale and Peak Ground Acceleration Comparison

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

a. PGA = peak ground acceleration. Measured in percent of g, where g is the acceleration of gravity
Sources: (U.S. Geological Survey 2021b); (U.S. Geological Survey 2011)

10.1.5 Ground Motion

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

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

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage “short period structures” (e.g. single-family dwellings). Longer period response components determine the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). Table 10-1 lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

10.1.6 Earthquake Mapping Programs

ShakeMaps

The USGS Earthquake Hazards Program produces maps called ShakeMaps that map ground motion and shaking intensity following significant earthquakes. ShakeMaps focus on the ground shaking caused by the earthquake, rather than on characteristics of the earthquake source, such as magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth’s crust.

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

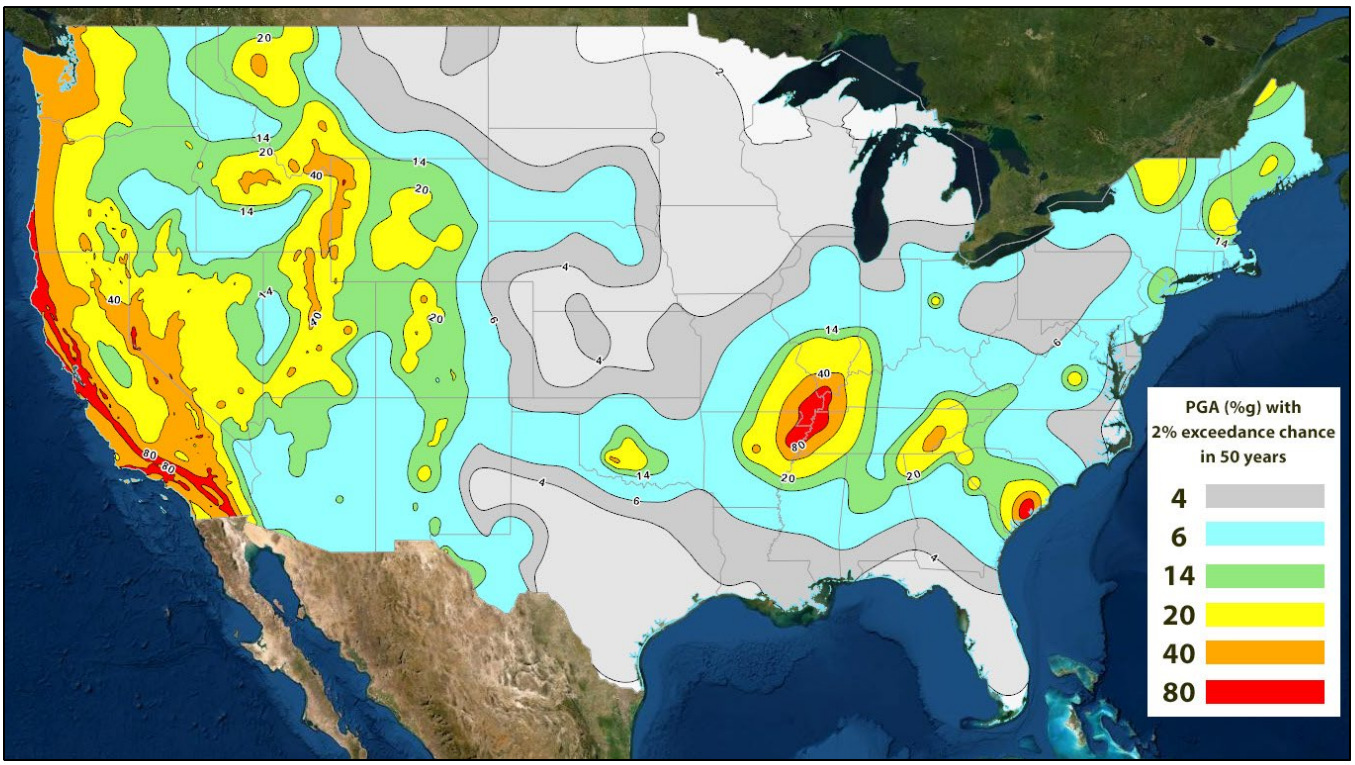
- Scenario ShakeMaps of hypothetical earthquakes of an assumed magnitude on known faults
- Probabilistic ShakeMaps, based on predicted shaking from all possible earthquakes over a 10,000-year period. In a probabilistic map, information from millions of scenario maps are combined to make a forecast for the future. The maps indicate the ground motion at any given

point that has a given probability of being exceeded in a given timeframe, such as a 100-year (1-percent-annual chance) event.

National Seismic Hazard Map

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown, et al. 1998). The USGS updated the National Seismic Hazard Maps in 2018. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. The 2018 map, shown in Figure 10-1, represents the best available data as determined by the USGS.

Figure 10-1. Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years



Source: USGS, 2018

Alquist-Priolo Zone Maps

Alquist-Priolo zone maps generated by the State of California show regulatory zones for potential surface fault rupture where fault lines intersect with future development and populated areas. The purpose of these maps is to assist in geologic investigation before construction to ensure that new structures are not located on an active fault. Alquist-Priolo maps were referenced, but not specifically used, in the assessment of risk for this plan. They are available online at: http://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps.

10.1.7 Liquefaction and Soil Types

Soil liquefaction occurs when water-saturated sands, silts or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, making the ground like a pudding. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing damage to the environment and people.

A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. NEHRP soil types define the locations that will be significantly impacted by an earthquake. Table 10-2 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E and F (Southern California Earthquake Center 2018). In general, these areas are also most susceptible to liquefaction. The areas that are most commonly affected by ground shaking have NEHRP Soils D, E and F.

Table 10-2. NEHRP Soil Classification System

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

10.1.8 Secondary Hazards

Earthquakes can cause disastrous landslides. River valleys are vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Earthen dams and levees are highly susceptible to seismic events, and the impacts of their eventual failures can be considered secondary risk exposure to earthquakes. Depending on the location, earthquakes can also trigger tsunamis. Additionally, fires can result from gas lines or power lines that are broken or downed during the earthquake. It may be difficult to control a fire, particularly if the water lines feeding fire hydrants are also broken.

10.2 HAZARD PROFILE

10.2.1 Past Events

Although no large (M 5.0>) earthquakes have occurred recently within Ventura County's boundaries, a number of relatively large earthquakes in other areas have caused damage within the county. These earthquakes occurred in 1925 (Santa Barbara), 1927 (Point Arguello), 1933 (Long Beach), 1941 (Santa Barbara), 1952 (Tehachapi), 1971 (San Fernando), and 1994 (Northridge). Additionally, damaging earthquakes occurred in the County in 1950 (north of Ojai), 1957 (Hueneme), 1963 (Camarillo), and 1973 (Point Mugu). The three most recent events are as follows (Ventura County 2015):

- **San Fernando, M 6.5, February 9, 1971**—This event was caused by oblique-slip reverse faulting in the San Fernando fault zone. The earthquake caused the destruction of freeway interchanges, houses, and buildings and severe damage to three hospitals in the San Fernando Valley. The earthquake claimed 65 lives. Although the epicenter was within 25 miles of Ventura County, damage sustained within the County was minor.
- **Point Mugu, M 5.3, February 21, 1973**—The Point Mugu earthquake was responsible for at least five injuries and more than $1 million damage in the Point Mugu–Oxnard area, though damage was confined mainly to the vicinity of the epicenter. Large boulders fell down onto State Route 1 at Point Mugu, partially blocking the road. More than 7,000 customers lost electricity for several hours. Most reported damage was to windows, ceilings, plaster, chimneys, and shelved goods, though structural damage and broken pipes were also reported. Although much less powerful than the San Fernando earthquake of 1971, the Point Mugu earthquake was similar in focal mechanism.
- **Northridge, M 6.7, January 17, 1994**—This blind thrust earthquake occurred along the Northridge thrust fault. It was the strongest earthquake instrumentally recorded in an urban setting in North America and caused parking structures, apartments, office buildings, and sections of freeways to collapse. Approximately 25,000 dwellings were rendered uninhabitable. Total damage exceeded $44 billion. The incident resulted in 51 deaths.

Table 10-3 lists recent earthquakes with a magnitude of 5.0 or greater within a 100-mile radius of Ventura County.

Table 10-3. Recent Earthquakes Magnitude 5.0 or Larger Within 100-mile Radius of Planning Area

Date	Magnitude	Epicenter Location
April 5, 2018	5.3	29km SW of Santa Cruz Island
March 29, 2014	5.1	2km NW of Brea Springs
July 29, 2008	5.4	5km S of Chino Hills, California

Source: USGS

10.2.2 Location

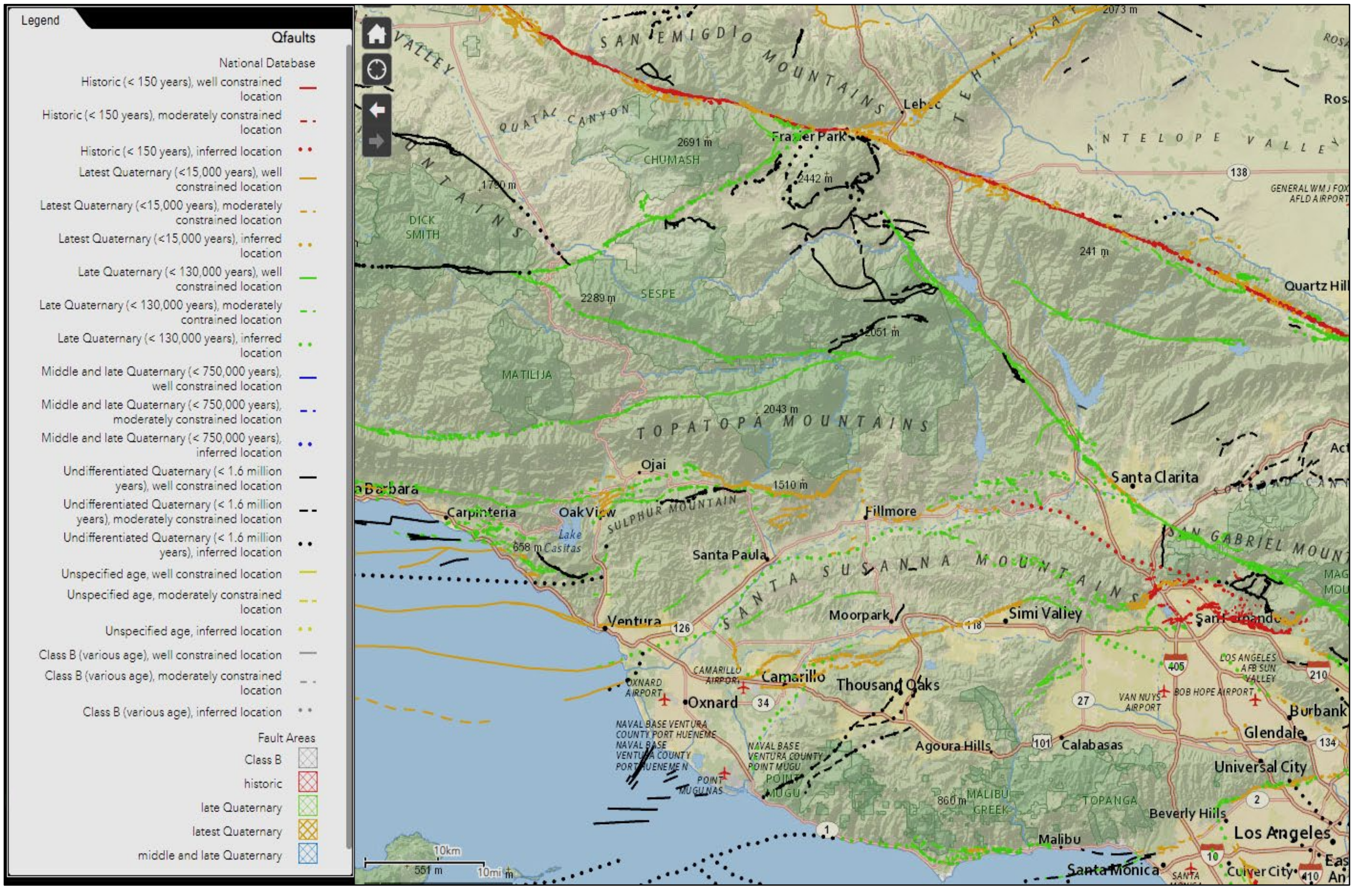
Fault Locations

As in most of southern and coastal California, the potential for earthquake damage exists throughout Ventura County because of the number of active faults within and near the county. These faults are shown on the California Geological Society Fault Activity Map of California. Descriptions of the active faults are provided below. The locations of the active and potentially active faults are shown on Figure 10-2.

Significant faults are as follows (Ventura County 2015):

- **Malibu Coast fault system**—The Malibu Coast fault system includes the Malibu Coast, Santa Monica, and Hollywood faults. The system begins in the Hollywood area, extends along the southern base of the Santa Monica Mountains, and passes offshore a few miles west of Point Dume. The 1973 Point Mugu earthquake, described in the previous section, is believed to have originated on this fault system.

Figure 10-2. Local Fault Locations



Source: (U.S. Geolgoical Survey 2021a)

- **Oak Ridge fault system**—The Oak Ridge fault system is a steep (65 degrees) southerly dipping reverse fault that extends from the Santa Susana Mountains westward along the southerly side of the Santa Clara River Valley and into the Oxnard Plain. The system is more than 50 miles long on the mainland and may extend an equal or greater distance offshore. Several recorded earthquake epicenters on land and offshore may have been associated with the Oak Ridge fault system. Portions of the system are zoned by the state as active.
- **Pine Mountain thrust fault and Big Pine fault**—These two large faults occur in the mountainous portion of Ventura County north of the Santa Ynez fault; the faults are located 9 and 16 miles north of the City of Ojai, respectively. The Pine Mountain thrust fault is reported to have ruptured the ground surface for a distance of 30 miles along its length during the northern Ventura County earthquakes of November 1852.
- **San Andreas fault**—San Andreas is the longest and most significant fault in California. Because of clearly established historical earthquake activity, this fault has been designated as active by the State of California. The last major earthquake on this fault near Ventura County was the Fort Tejon earthquake of 1857, which was estimated at M 8.0 and would have caused considerable damage if there had been structures in the southern part of the county. There is a 59 percent chance that an M 6.7 quake or larger will occur on this fault within the next 30 years.

- **San Cayetano–Red Mountain–Santa Susana fault system**—This fault system consists of a major series of north-dipping reverse faults that extend over 150 miles from Santa Barbara County into Los Angeles County. Within this system, the San Cayetano fault is the greatest hazard to Ventura County; it is a major, north-dipping reverse fault that extends for 25 miles along the northern portion of the Ventura Basin. The San Fernando earthquake of 1971, described in the previous section, was caused by activity along this fault.
- **Simi–Santa Rosa fault system**—This fault system extends from the Santa Susana Mountains westward along the northern margin of the Simi and Tierra Rejada valleys and along the southern slope and crest of the Las Posas Hills to their westerly termination.
- **Ventura-Pitas Point fault**—The western half of this fault is known as the Pitas Point fault, and the eastern half is known as the Ventura fault. The Pitas Point fault extends offshore into the Pacific Ocean and is roughly 14 miles long. The Ventura fault extends into the communities of Ventura and Sea Cliff and runs roughly parallel to portions of U.S. 101 and State Route 126. The fault is roughly 12 miles long. The Ventura-Pitas Point fault is a left-reverse fault.

NEHRP Soil Type and Liquefaction Mapping

Figure 10-3 shows NEHRP soil classifications in Ventura County. Figure 10-4 shows areas in that have moderate, high or very high susceptibility to liquefaction.

10.2.3 Frequency and Severity

The California Department of Conservation probabilistic ground shaking maps, based on current information about fault zones, show the PGA that has a certain probability of being exceeded in a 50-year period. Figure 10-5 shows the expected peak horizontal ground accelerations for a probability of 10 percent. Ventura County is in a high-risk area, with a peak PGA exceeding 60 percent of gravity near the northern border of the County (California Department of Conservation 2019b). Ongoing field and laboratory studies suggest the likely maximum magnitudes and recurrence intervals for the major local faults shown in Table 10-4.

Table 10-4. Likely Maximum Magnitudes and Recurrence Intervals

Fault	Likely Maximum Magnitude	Recurrence Interval
Malibu Coast fault system	M 6.7	2,908 years
Oak Ridge fault system	M 6.9	299 years
Red Mountain fault system	M 6.8	507 years
San Andreas fault	M 8.0	300 years
San Cayetano fault system	M 6.8	150 years
Santa Susana fault system	M 6.6	138 years
Simi–Santa Rosa fault system	M 6.7	933 years
Ventura-Pitas Point fault system	M 6.9	not available

Source: (U.S. Geolgoical Survey 2021a)

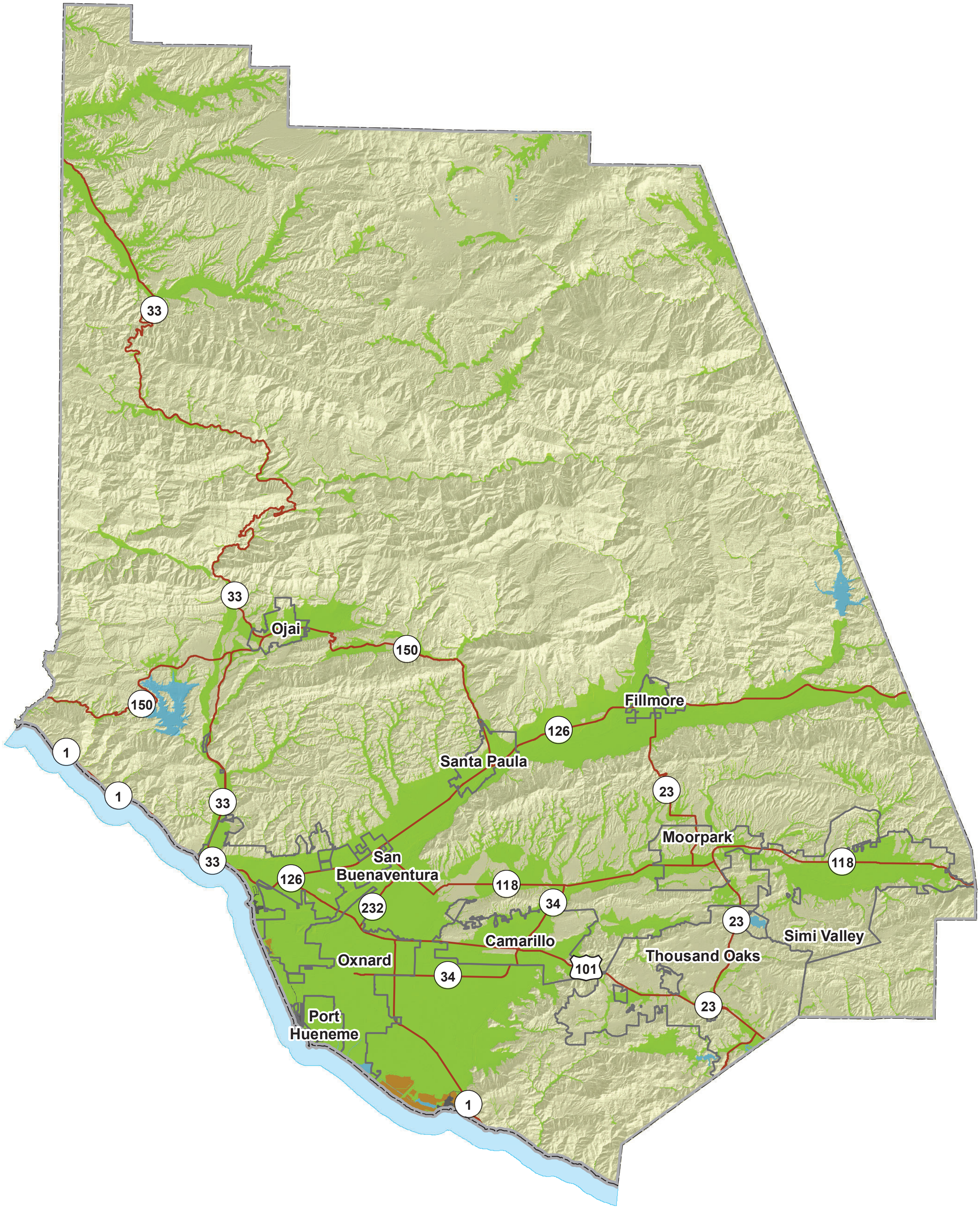


Figure 10-3. NEHRP Soil Class

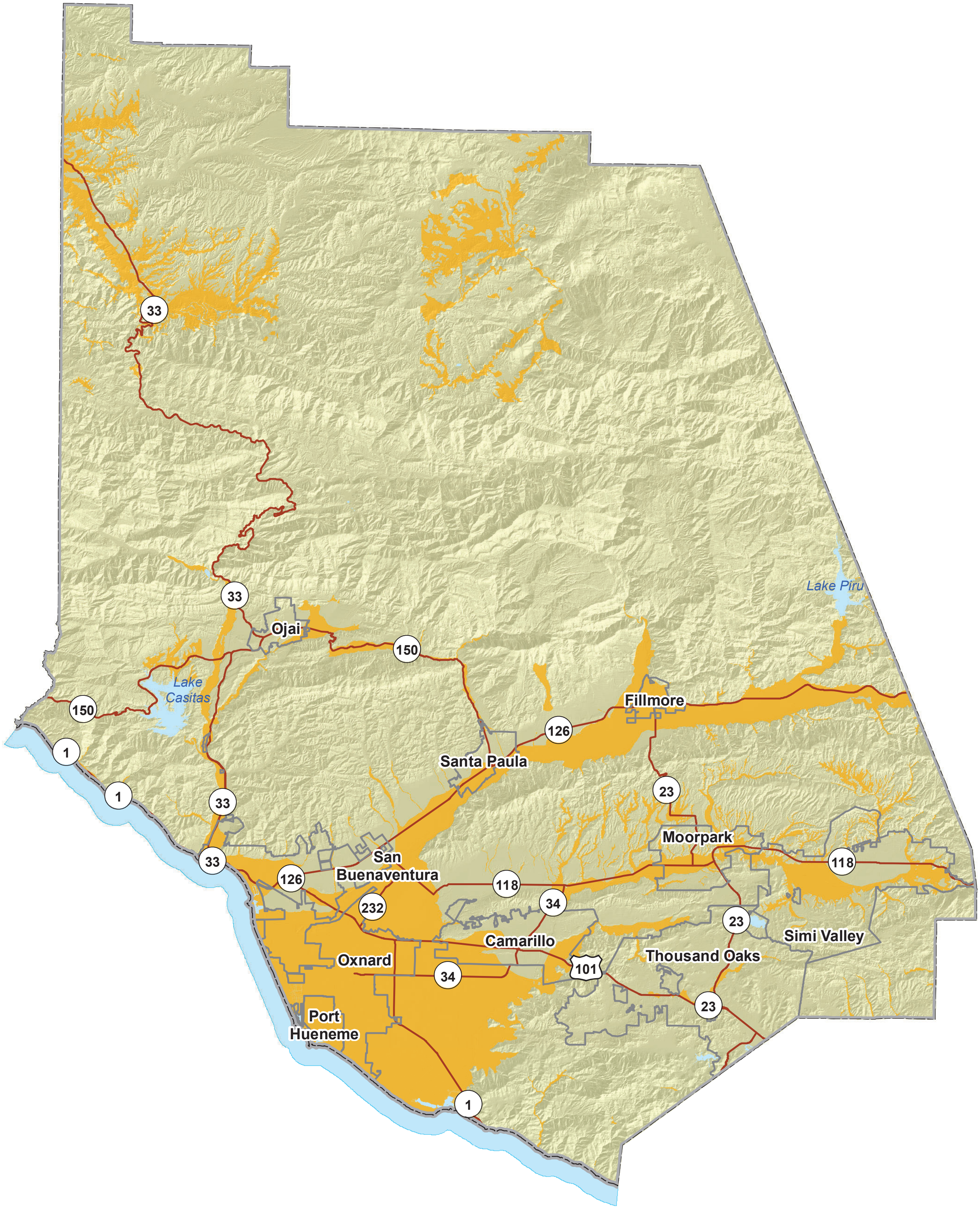
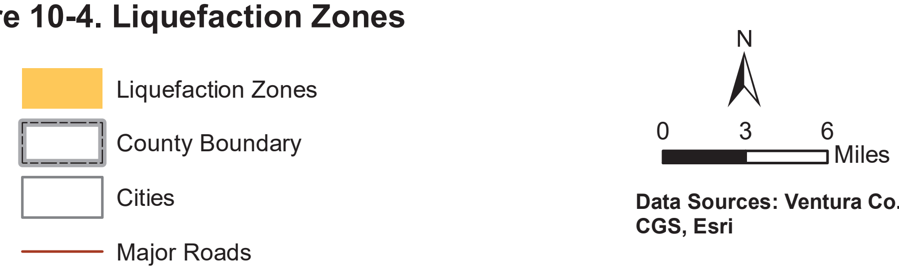
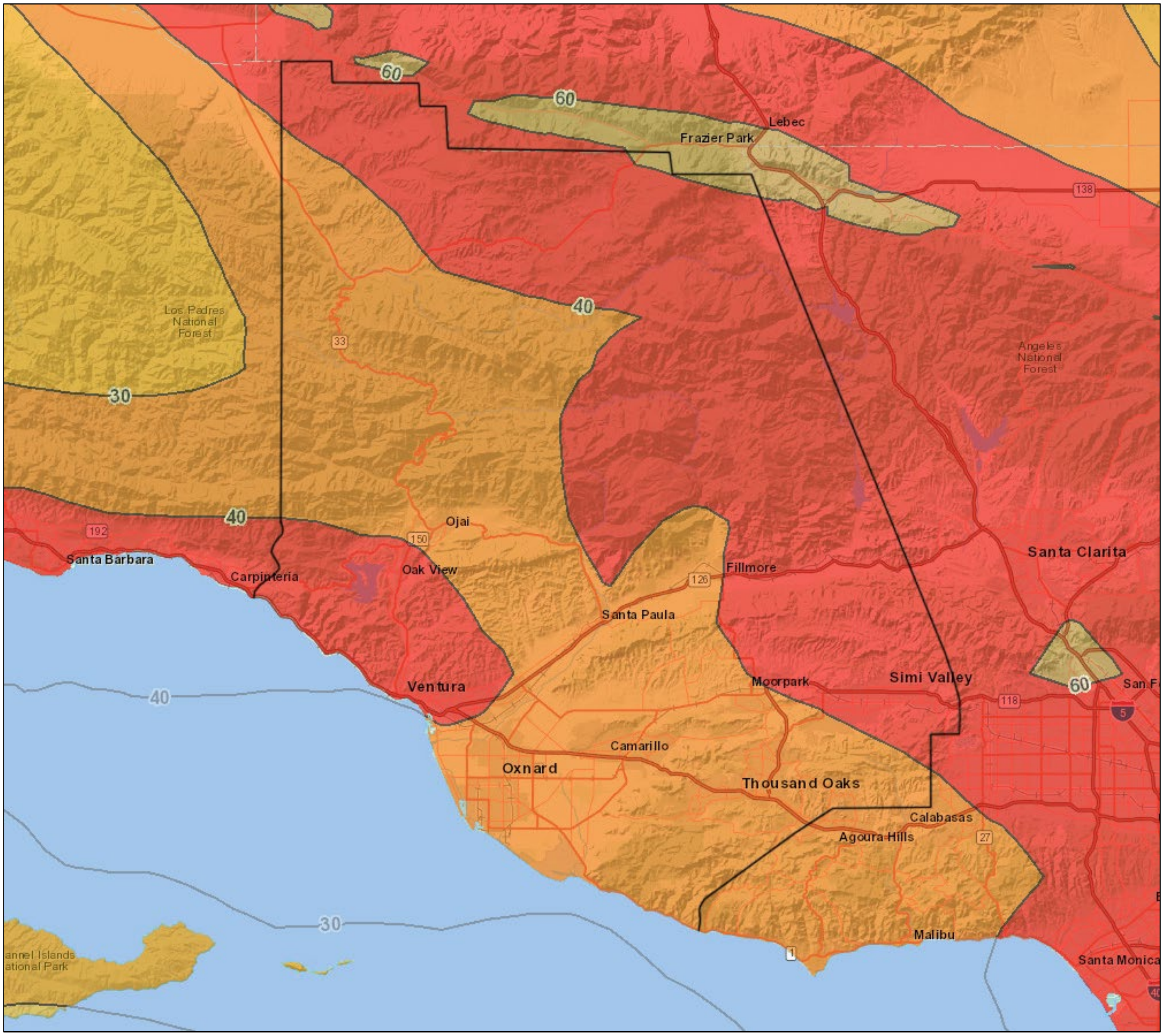


Figure 10-4. Liquefaction Zones



Data Sources: Ventura Co., CGS, Esri

Figure 10-5. Peak Ground Acceleration (%g) with 10% Probability of Exceedance in 50 Years



10.2.4 Warning Time

There is no current reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that detect the lower energy compressional waves (P waves) that precede the secondary waves (S waves) experienced as an earthquake. Earthquake early warning systems may provide a few seconds' or a few minutes' notice that a major earthquake is about to occur. The warning time is very short, but it could allow for someone to get under a desk, pause hazardous or high-risk work, or initiate protective automated systems in structures or critical infrastructure.

New technology is being developed for early warnings. For example, MyShake is a global smartphone seismic network for early warning that can keep users informed about earthquakes. It monitors for earthquakes using data from smartphone sensors. More information about the MyShake technology and the USGS ShakeAlert project is available online at https://myshake.berkeley.edu/about-us.html.

10.3 EXPOSURE

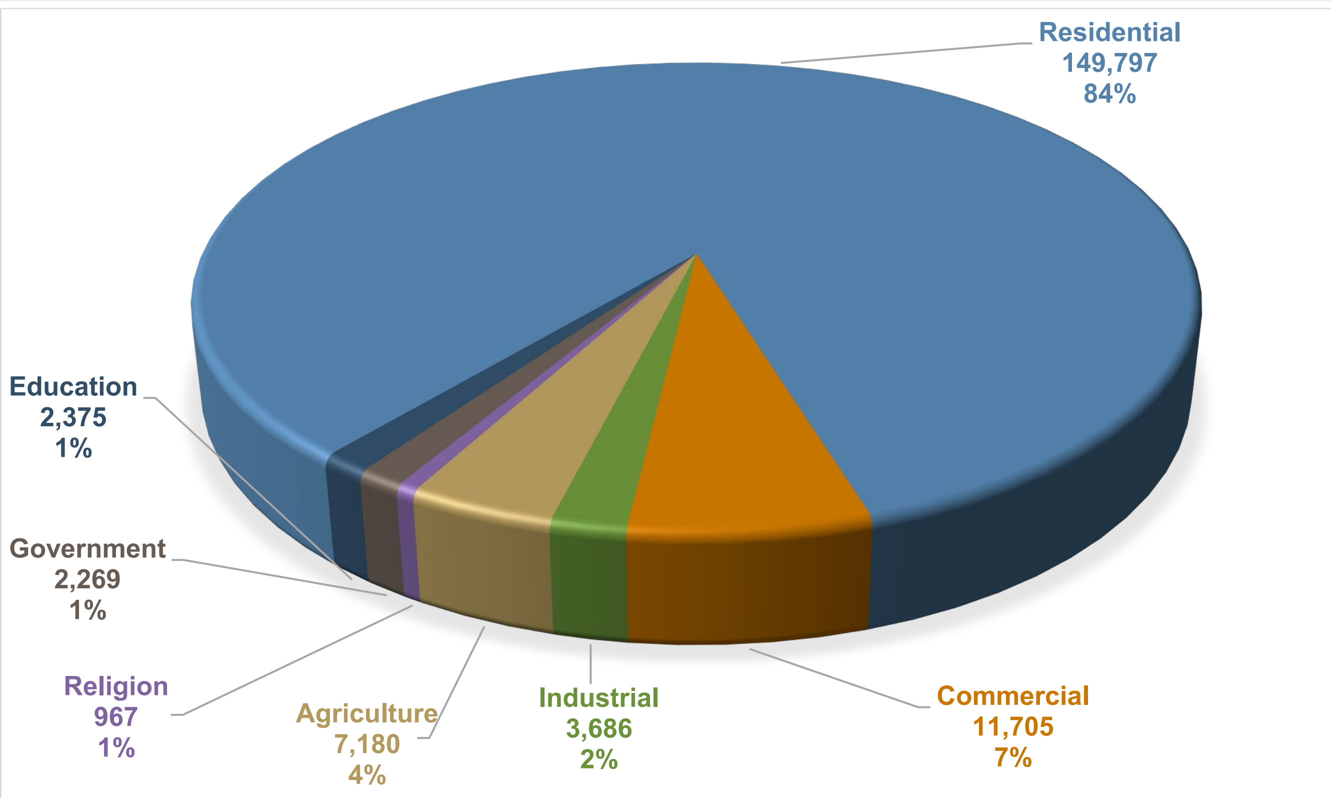
10.3.1 Population

The entire population of the planning area (843,843) is potentially exposed to direct damage from earthquakes or indirect impacts such as business interruption, road closures, and loss of function of utilities. There are estimated to be 588,376 people in the planning area living on NEHRP D or E soils, which make buildings more susceptible to damage from earthquakes. This is about 70 percent of the total population.

10.3.2 Property

According to County Assessor records, there are 262,657 buildings in the planning area. Most of the buildings (86 percent) are residential. All buildings are considered to be exposed to the earthquake hazard. There are estimated to be 178,000 buildings in the planning area (68 percent of the total) on NEHRP D or E soils, which make buildings more susceptible to damage from earthquakes. Figure 10-6 shows the Hazus-defined occupancy class of all buildings on these soil types.

Figure 10-6. Building Count by Occupancy Class on NEHRP D or E soils

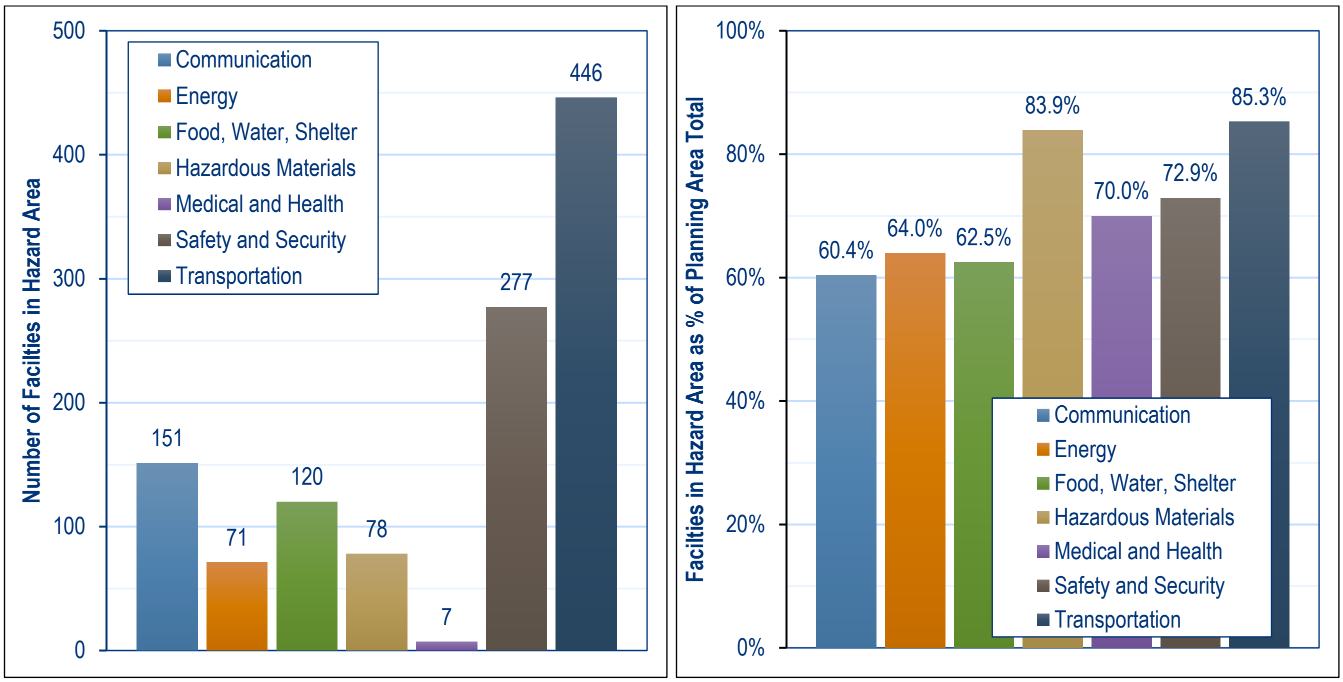


10.3.3 Critical Facilities

Since the entire planning area has exposure to the earthquake hazard, all critical facilities components are considered to be exposed. The breakdown of the numbers and types of facilities is presented in Table 4-4.

Critical facilities constructed on NEHRP Type D and E soils are particularly at risk from seismic events. Figure 10-7 shows the exposure of critical facilities built on these soils in the planning area, by type of facility. The total count of critical facilities on NEHRP Type D and E soils (1,150) represents 74 percent of the planning area total of 1,559. A breakdown by municipality is provided in Appendix D.

Figure 10-7. Critical Facilities on NEHRP D and E Soils



10.3.4 Environment

The entire planning area is exposed to the earthquake hazard, including all natural resources, habitat, and wildlife.

10.4 VULNERABILITY

Earthquake vulnerability data for the risk assessment was generated using a Hazus Level 2 (user-defined) analysis for the for the events listed in Table 10-5. The analysis results are summarized in the sections below. Detailed information, broken down by municipality, can be found in Appendix D.

10.4.1 Population

Hazus estimated impacts on persons and households in the planning area for the evaluated earthquake scenarios as summarized in Table 10-6.

Table 10-5. Earthquakes Modeled for Risk Assessment

Event	Magnitude	Focal Depth	Epicenter Location	PGA
100-Year Probabilistic	N/A	N/A	N/A	Figure 10-8
Oak Ridge Scenario	7.16	8.0 miles	34.314°N 118.960°W	Figure 10-9
San Cayetano Scenario	7.16	6.3 miles	34.539°N 118.953°W	Figure 10-10
S San Andreas Scenario	8.03	4.1 miles	38.399°N 123.110°W	Figure 10-11
Ventura-Pitas Point Scenario	7.12	6.2 miles	34.322°N 119.281°W	Figure 10-12

Table 10-6. Estimated Earthquake Impact on Persons

	Displaced Households		Persons Requiring Short-Term Shelter	
Scenario	Number	% of Total	Number	% of Total
100-Year Probabilistic	205	0.07%	147	0.02%
Oak Ridge Scenario	160	0.06%	127	0.02%
San Cayetano Scenario	14	0.01%	11	0.00%
S San Andreas Scenario	0	0%	0	0%
Ventura-Pitas Point Scenario	112	0.04%	79	0.01%

10.4.2 Property

Loss Potential

Table 10-7 summarizes Hazus estimates of earthquake damage in the planning area for the evaluated scenarios. The debris estimate includes only structural debris; it does not include additional debris that may accumulate, such as from trees. These estimates do not include losses that would occur from any local tsunamis or fires stemming from an earthquake.

Table 10-7. Estimated Impact of Earthquake Scenario Events in the Planning Area

	Structure Debris		Structure + Contents Damage	
Earthquake Scenario Event	x 1,000 Tons	Truckloads	Value	% of Total Value
100-Year Probabilistic Earthquake	503.31	20,132	$7,983,590,943	4.4%
Oak Ridge Scenario	3,418.21	136,728	$21,516,138,914	11.9%
San Cayetano Scenario	613.21	24,528	$7,794,984,008	4.3%
S San Andreas Scenario	153.94	6,158	$2,004,237,540	1.1%
Ventura-Pitas Point Scenario	2,078.98	83,159	$14,556,417,724	8.1%

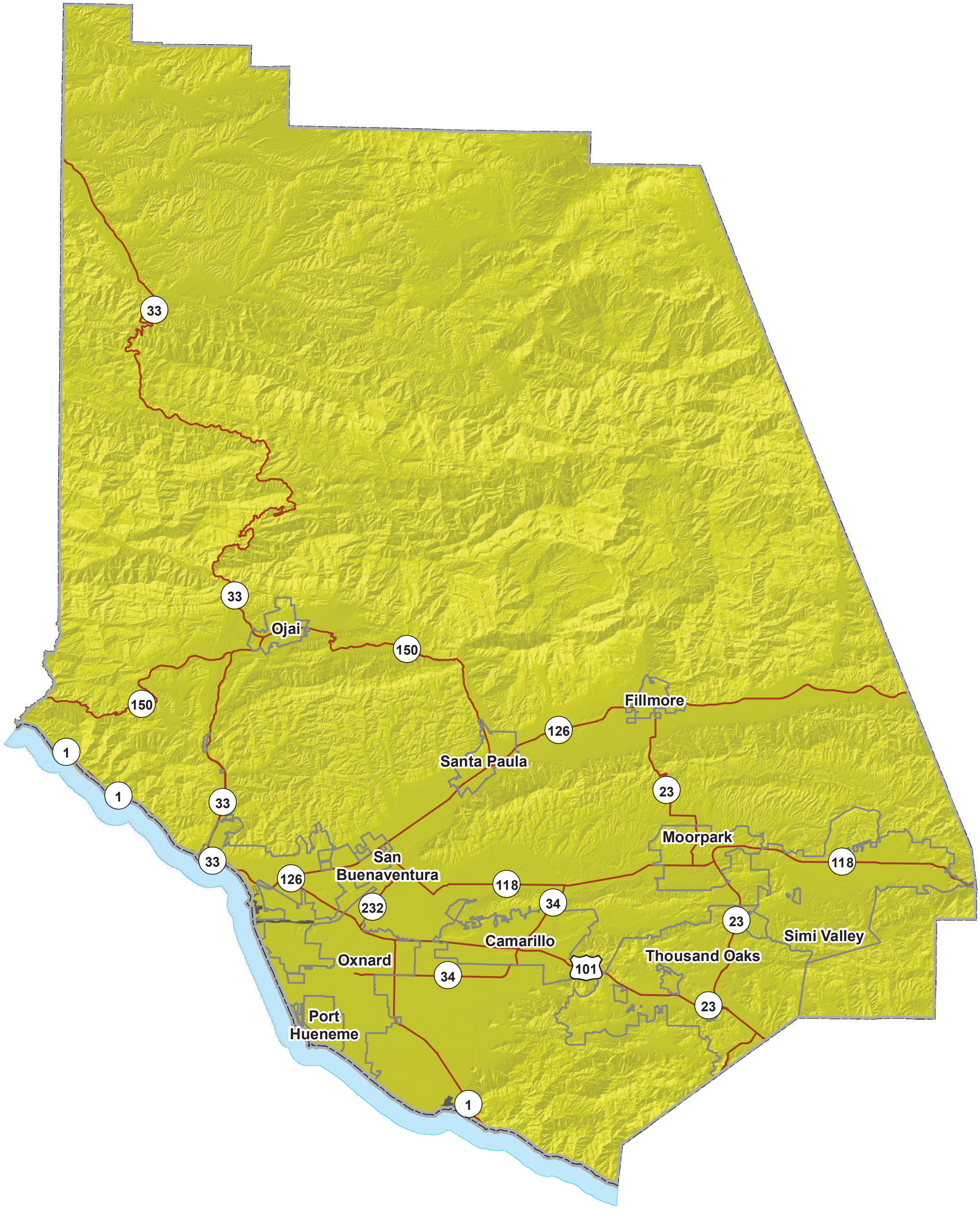


Figure 10-8. Intensity Scale for 100-Year Probabilistic Earthquake Scenario

Mercalli Intensity Scale

VII (Very Strong/Moderate)

Intensity scale described as:
(perceived shaking / potential damage)

County Boundary

Cities

Major Roads

N

0 3 6 Miles

Data Sources: Ventura Co., USGS, Esri

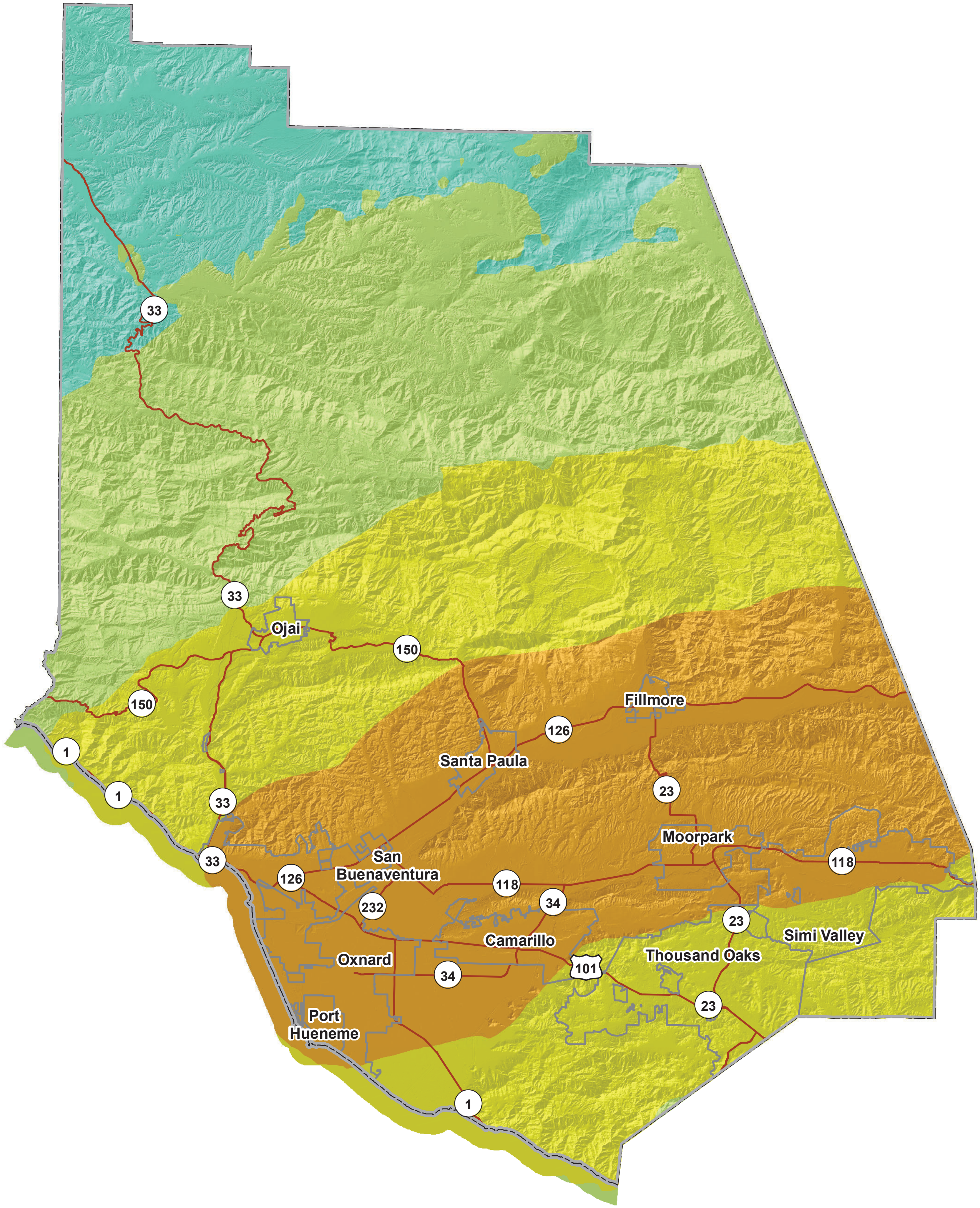


Figure 10-9. Intensity Scale for Oak Ridge M7.16 Earthquake Scenario

Mercalli Intensity Scale

- V (Moderate/Very Light)
- VI (Strong/Light)
- VII (Very Strong/Moderate)
- VIII (Severe/Moderate-Heavy)

- County Boundary
- Cities
- Major Roads

Intensity scale described as:
(perceived shaking / potential damage)

N

0 3 6 Miles

Data Sources: Ventura Co., USGS, Esri

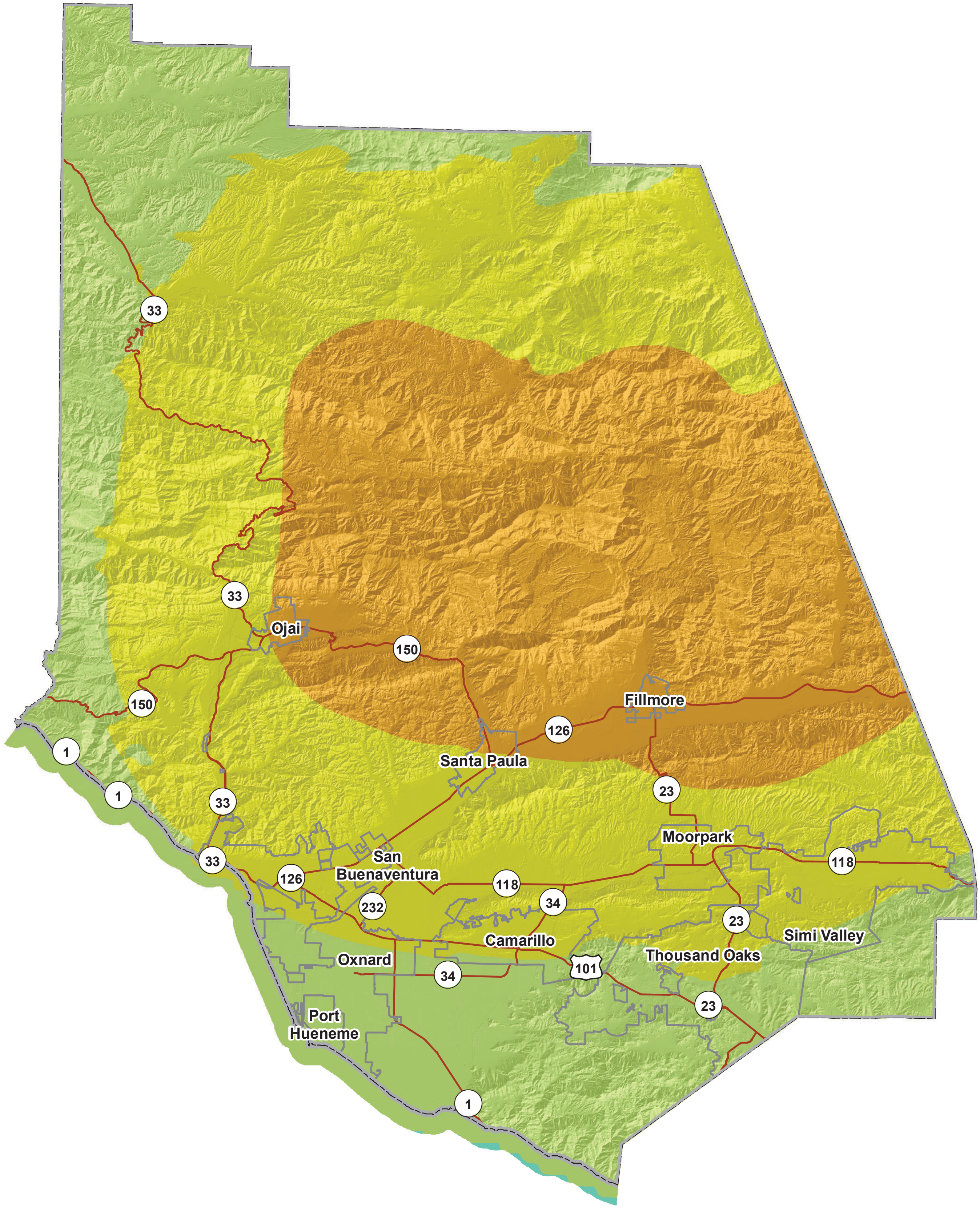


Figure 10-10. Intensity Scale for San Cayetano M7.16 Earthquake Scenario

Mercalli Intensity Scale

- V (Moderate/Very Light)
- VI (Strong/Light)
- VII (Very Strong/Moderate)
- VIII (Severe/Moderate-Heavy)

- County Boundary
- Cities
- Major Roads

Intensity scale described as:
(perceived shaking / potential damage)

N

0 3 6 Miles

Data Sources: Ventura Co., USGS, Esri

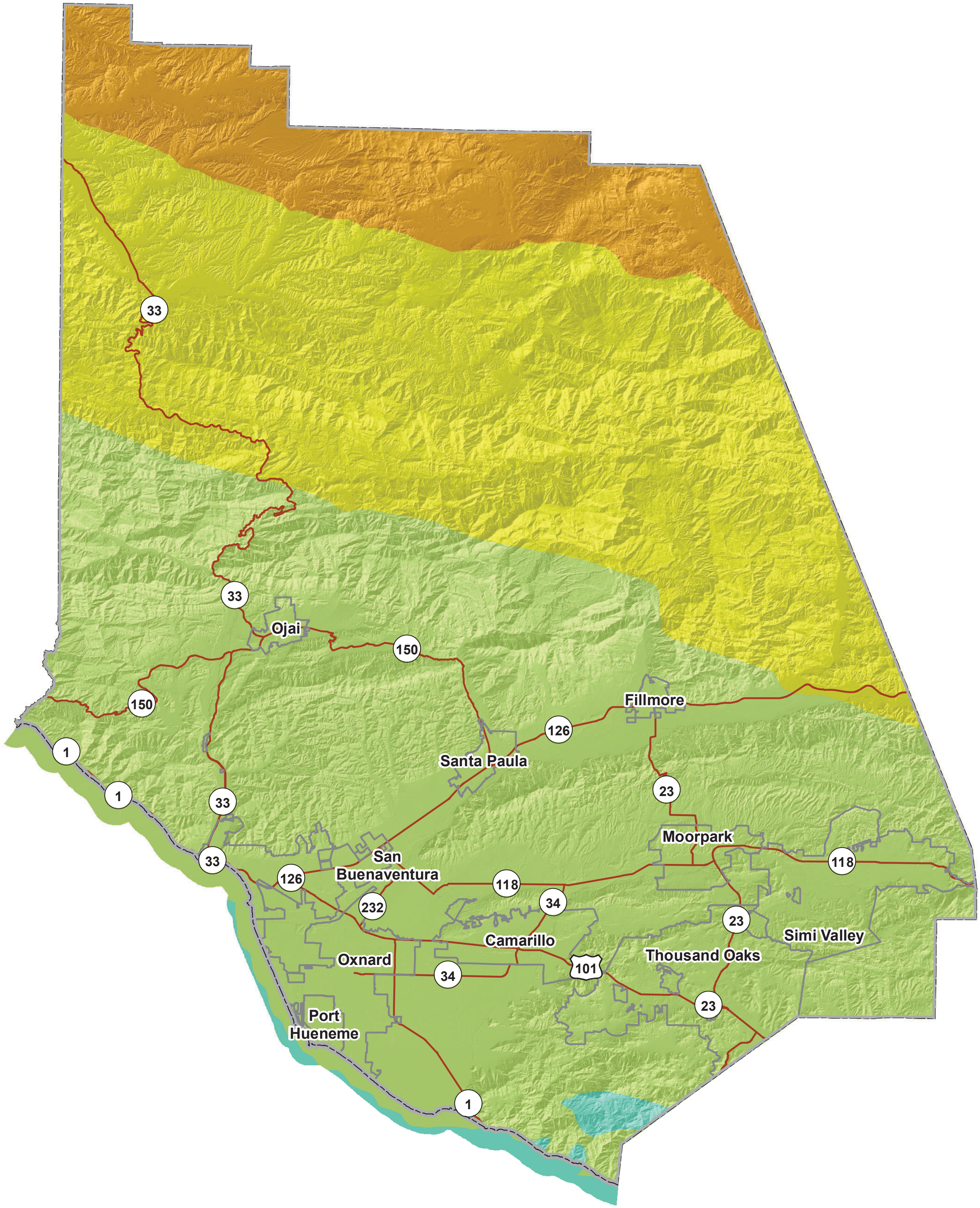


Figure 10-11. Intensity Scale for South San Andreas M8.03 Earthquake Scenario

Mercalli Intensity Scale

- V (Moderate/Very Light)
- VI (Strong/Light)
- VII (Very Strong/Moderate)
- VIII (Severe/Moderate-Heavy)

County Boundary

Cities

Major Roads

Intensity scale described as: (perceived shaking / potential damage)

N

0 3 6 Miles

Data Sources: Ventura Co., USGS, Esri

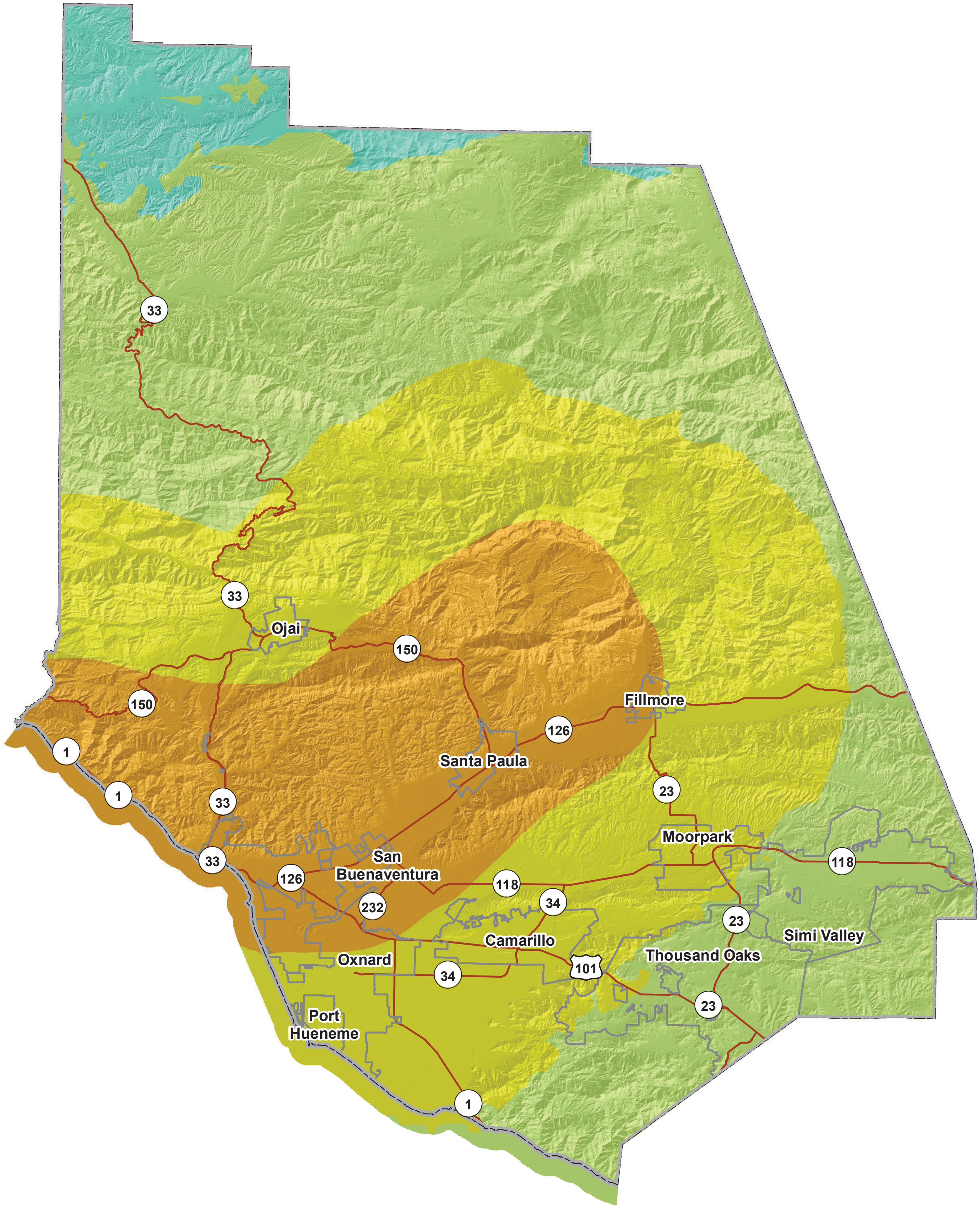


Figure 10-12. Intensity Scale for Ventura-Pitas Point M7.12 Earthquake Scenario

Mercalli Intensity Scale

- V (Moderate/Very Light)
- VI (Strong/Light)
- VII (Very Strong/Moderate)
- VIII (Severe/Moderate-Heavy)

County Boundary

Cities

Major Roads

Intensity scale described as:
(perceived shaking / potential damage)

N

0 3 6 Miles

Data Sources: Ventura Co., USGS, Esri

Building Age

Table 10-8 identifies significant milestones in building and seismic code requirements that directly affect the structural integrity of development. Using U.S. Census estimates of housing stock age, estimates were developed of the number of housing units constructed before each of these dates. Almost 18 percent of the planning area's housing units were constructed after the Uniform Building Code was amended in 1994 to include seismic safety provisions. Housing units built before 1939 when there were no building permits, inspections, or seismic standards, account for 3.6 percent. Many of the housing units in the planning area are detached, single-family residences of wood construction, which generally perform well during earthquake events.

Table 10-8. Age of Housing Units in Planning Area

Time Period	Number of Current Planning Area Housing Units Built in Period	% of Total Housing Units	Significance of Time Frame
Pre-1939	10,455	3.6	Before 1933, there were no explicit earthquake requirements in building codes. State law did not require local governments to have building officials or issue building permits.
1940-1959	36,544	12.7	In 1940, the first strong motion recording was made.
1960-1979	123,979	42.9	In 1960, the Structural Engineers Association of California published guidelines on recommended earthquake provisions. In 1975, significant improvements were made to lateral force requirements.
1980-1999	81,631	28.2	In 1994, the Uniform Building Code was amended to include provisions for seismic safety.
2000-present	36,287	12.6	Seismic code is currently enforced.
Total	**288,896**	**100%**	

Note: Number and percent estimates are approximation as housing unit age information does not correspond directly with the time periods indicated. In addition, there are significant margins of error associated with the Census estimates.

Source: 2019 American Community Survey, Ventura County, California

10.4.3 Critical Facilities

The following are significant critical facilities that Hazus predicts would have at least a 50 percent change of at least moderate damage for the Oak Ridge scenario earthquake:

- 1 water reclamation plant
- 18 wastewater treatment facilities
- 92 hazardous material sites
- 7 hospitals
- 65 fire stations or battalion headquarters
- 6 sheriff stations
- 271 schools
- 4 port facilities
- 1 airports

Level of Damage

Hazus classifies the vulnerability of critical facilities to earthquake as no damage, slight damage, moderate damage, extensive damage, or complete damage. Hazus was used to assign a category to each critical facility in the planning area for the assessed earthquake scenarios. Figure 10-13 through Figure 10-17 show the results for the evaluated events as the average estimated probability for all facilities in each category.

Time to Return to Functionality

Hazus estimates the time to restore critical facilities to fully functional use. Results are presented as probability of being functional at specified time increments: 1, 3, 7, 14, 30 and 90 days after the event. For example, Hazus may estimate that a facility has 5 percent chance of being fully functional at Day 3, and a 95-percent chance of being fully functional at Day 90. The analysis of critical facilities in the planning area was performed for the assessed earthquake scenarios. Figure 10-18 through Figure 10-22 show the results as the average estimated probability for all facilities in each category.

Figure 10-13. Critical Facility Damage Potential, 100-Year Probabilistic Earthquake Scenario

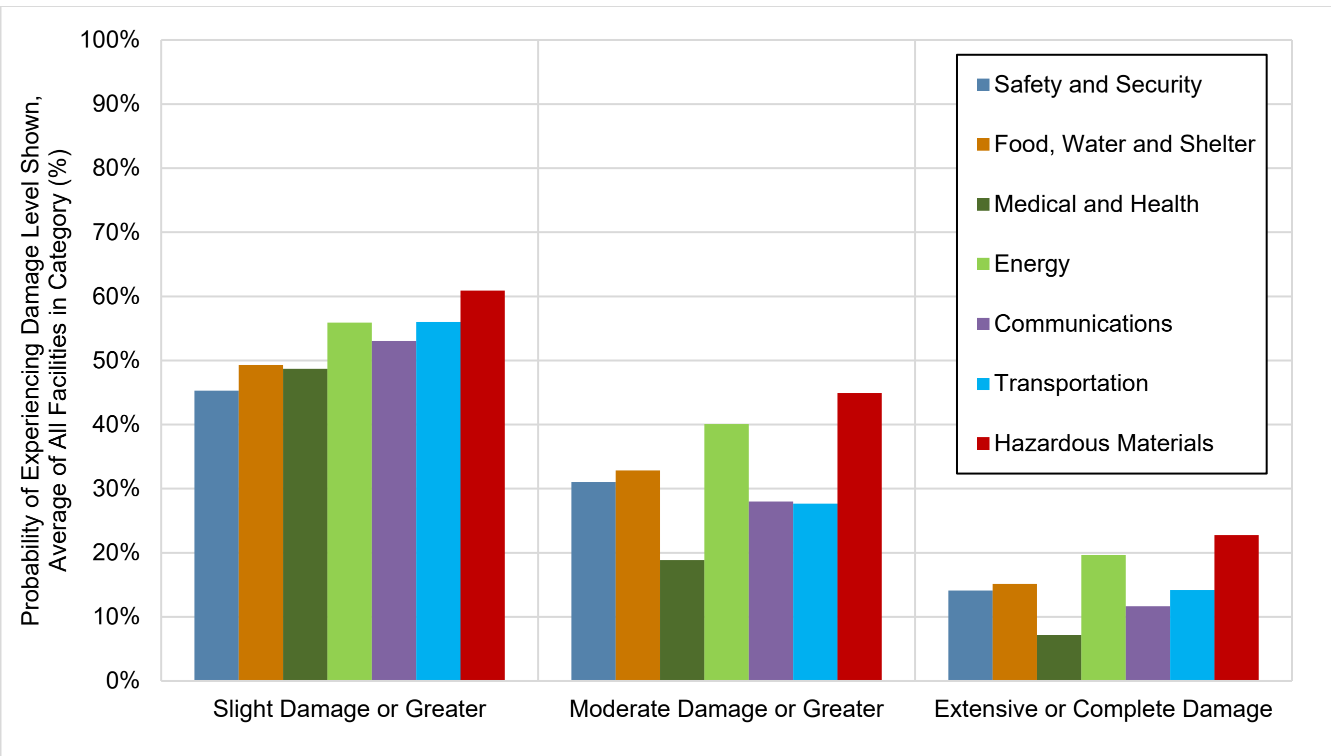


Figure 10-14. Critical Facility Damage Potential, Oak Ridge M7.16 Earthquake Scenario

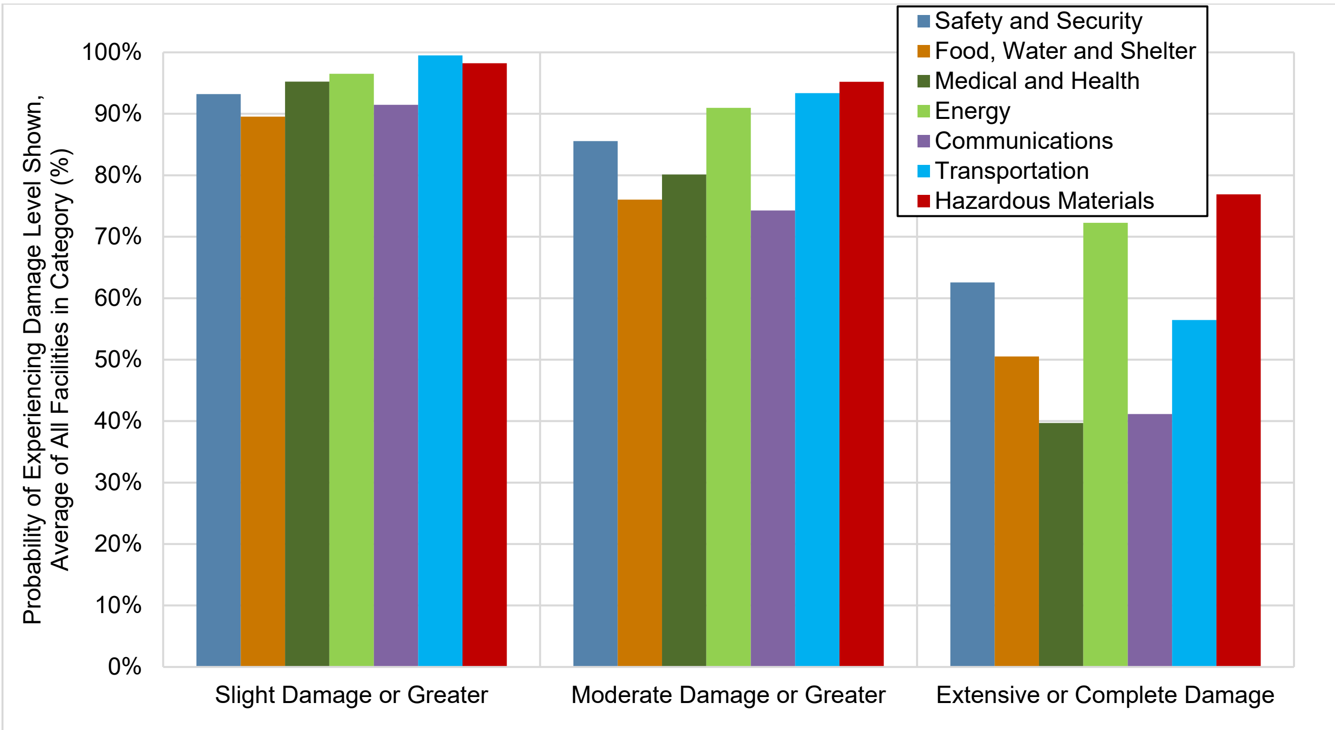


Figure 10-15. Critical Facility Damage Potential, San Cayetano M7.16 Earthquake Scenario

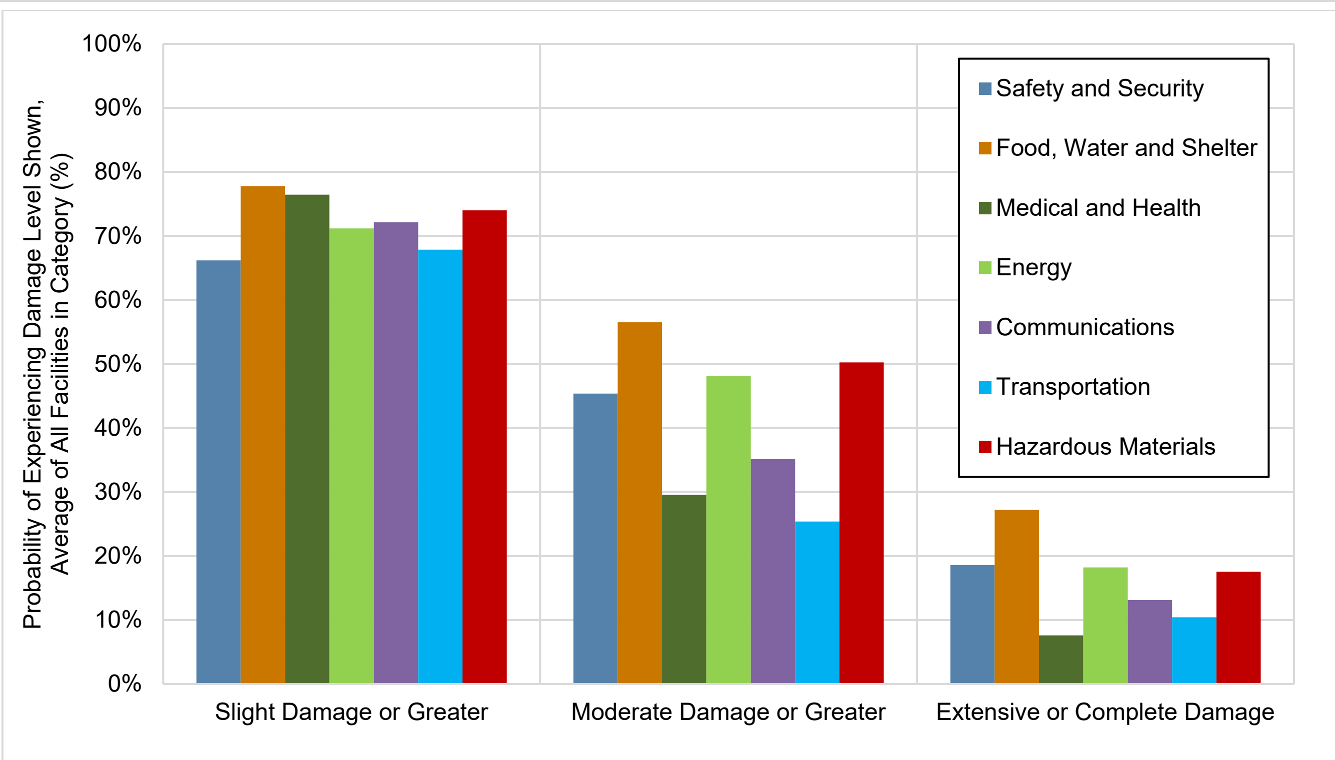


Figure 10-16. Critical Facility Damage Potential, S San Andreas M8.03 Earthquake Scenario

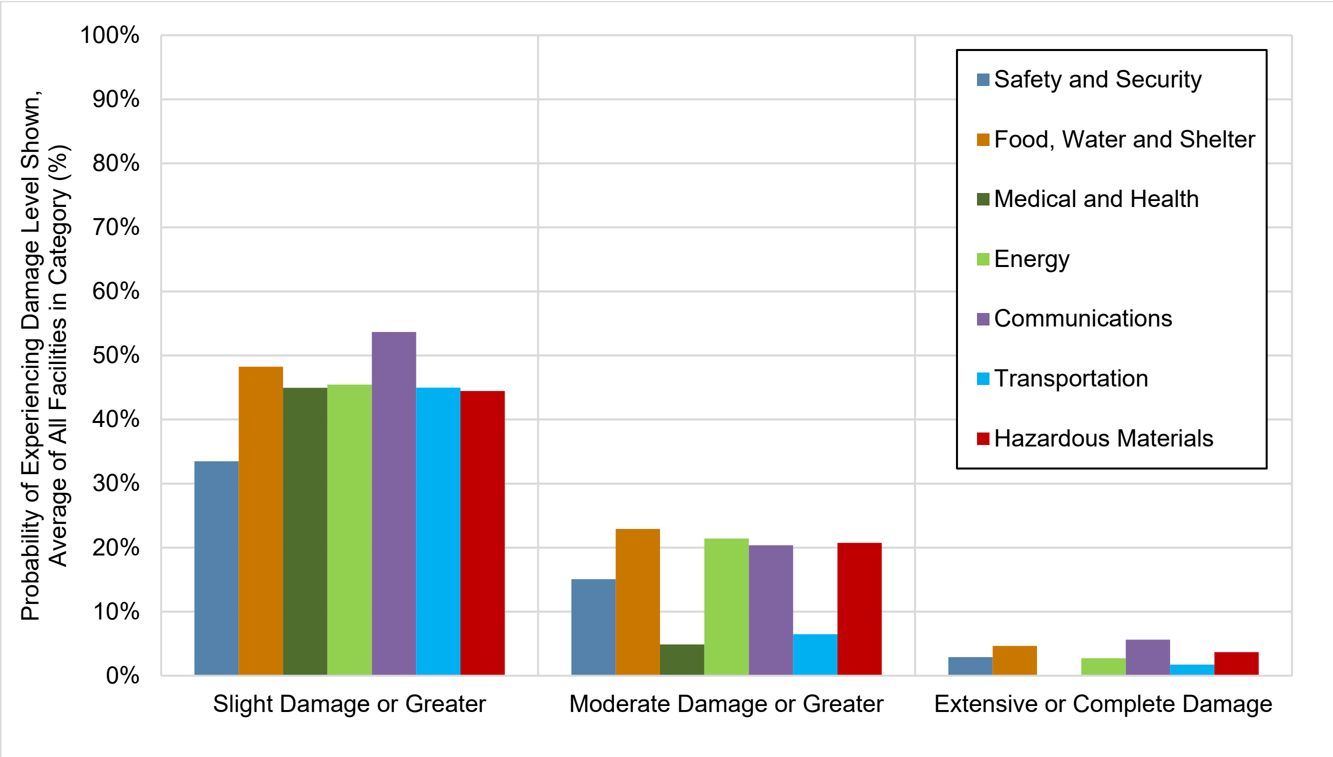


Figure 10-17. Critical Facility Damage Potential, Ventura-Pitas Point M7.12 Earthquake Scenario

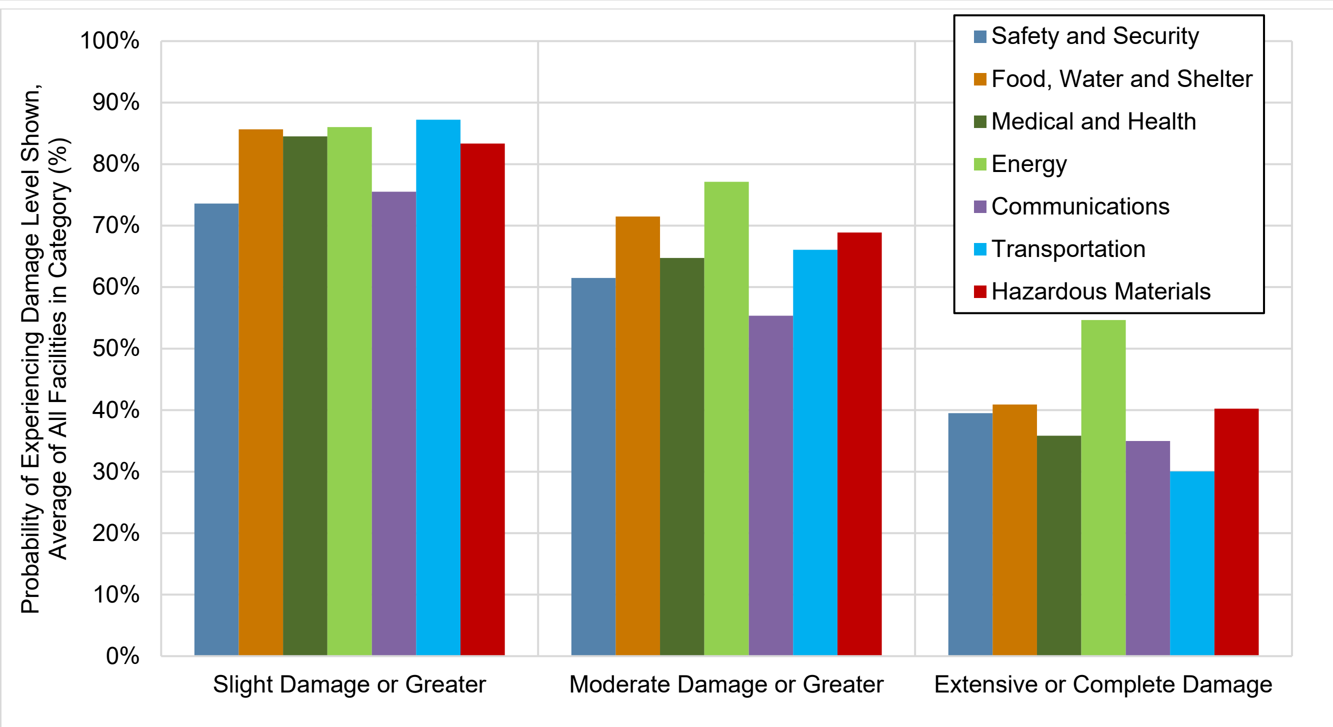


Figure 10-18. Critical Facility Functionality, 100-Year Probabilistic Earthquake Scenario

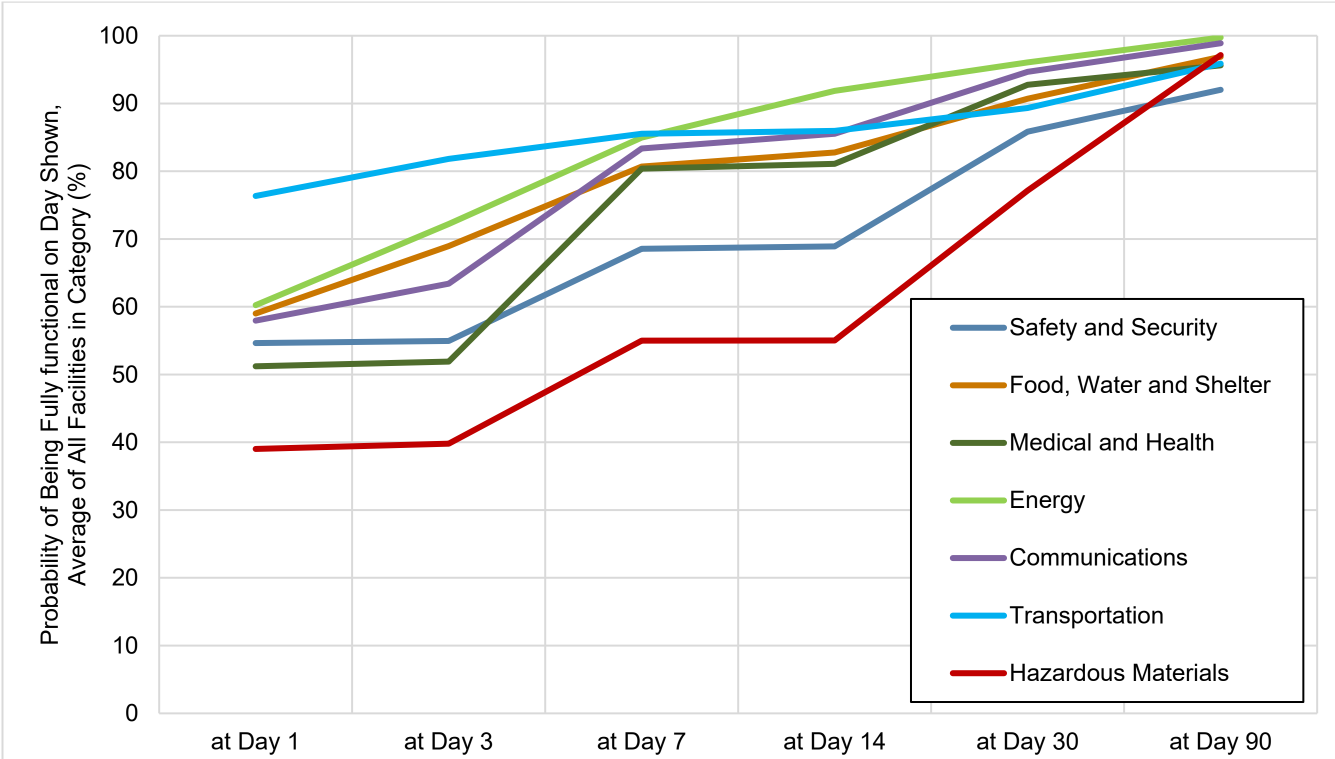


Figure 10-19. Critical Facility Functionality, Oak Ridge M7.16 Earthquake Scenario

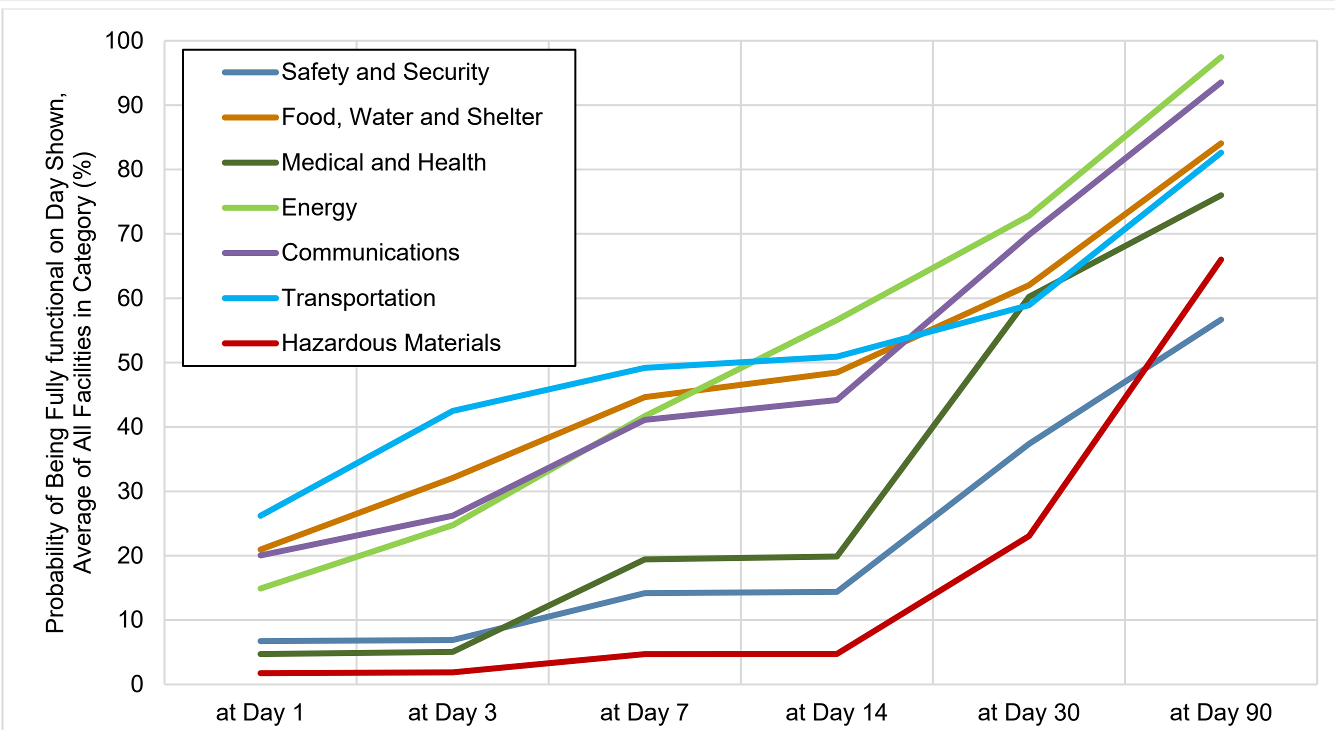


Figure 10-20. Critical Facility Functionality, San Cayetano M7.16 Earthquake Scenario

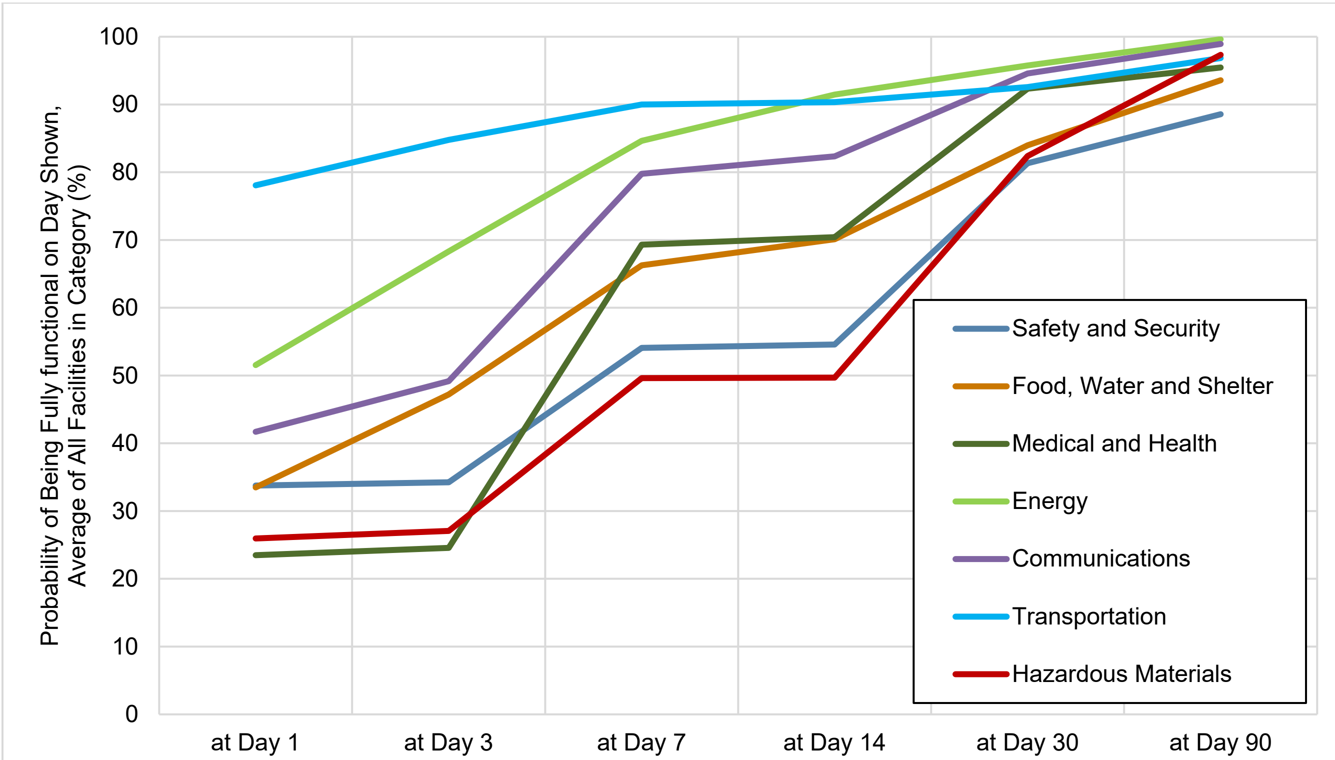


Figure 10-21. Critical Facility Functionality, S San Andreas M8.03 Earthquake Scenario

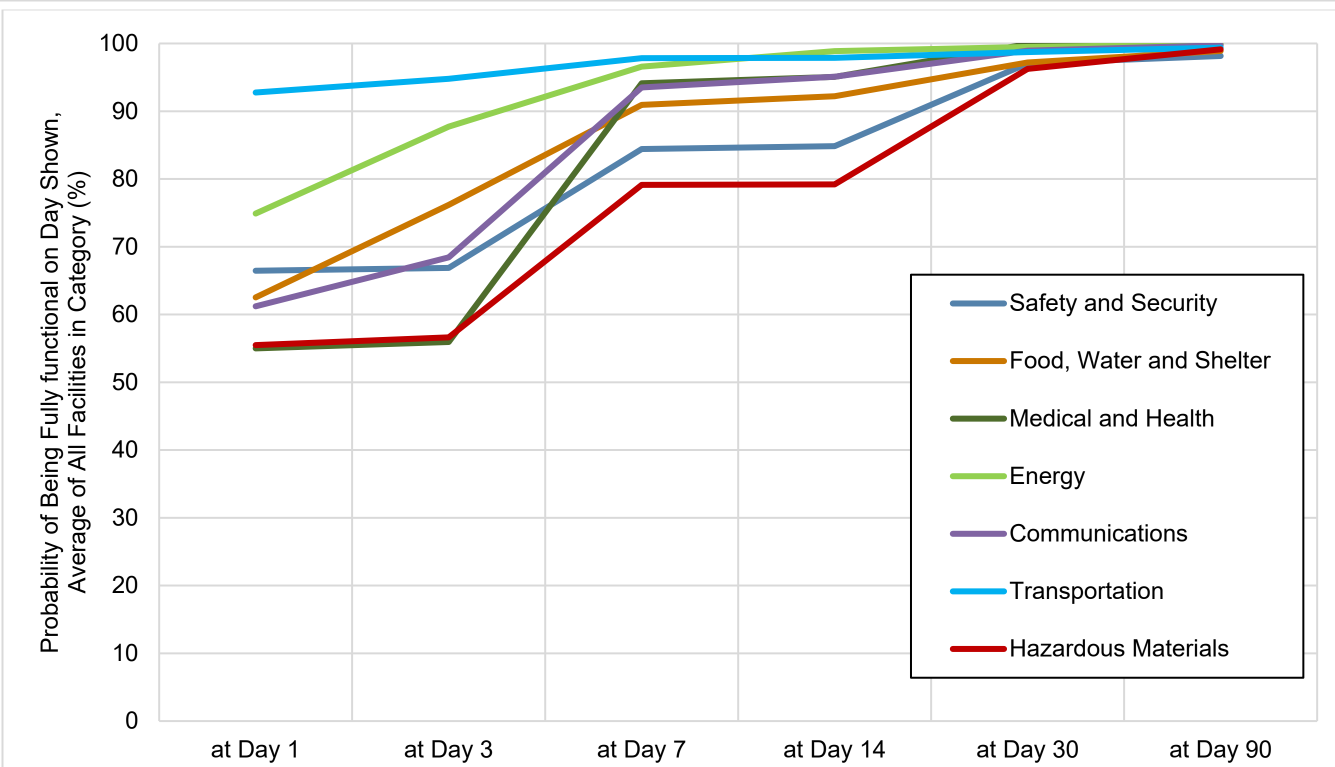
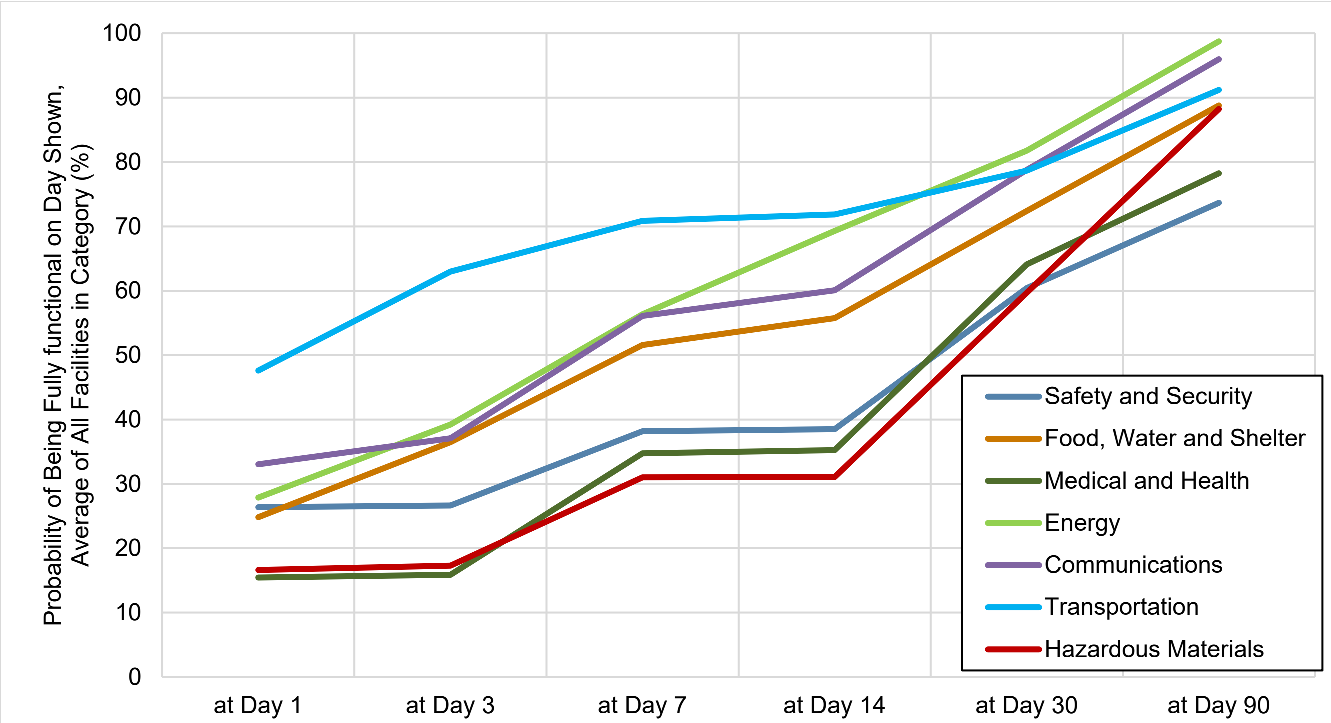


Figure 10-22. Critical Facility Functionality, Ventura-Pitas Point M7.12 Earthquake Scenario



10.4.4 Environment

Environmental problems as a result of an earthquake can be numerous. Secondary hazards will likely have some of the most damaging effects on the environment. Earthquake-induced landslides can significantly damage surrounding habitat. It is also possible for streams to be rerouted after an earthquake. Rerouting can change the water quality, possibly damaging habitat and feeding areas. Streams fed by groundwater wells can dry up because of changes in underlying geology.

10.5 SCENARIO

Based on history and geology, the planning area will be frequently impacted by earthquakes. The worst-case scenario is a higher-magnitude event (7.5 or higher) with an epicenter within 50 miles of the county. Earthquakes of this magnitude or higher could lead to massive structural failure of property on soils prone to liquefaction. Building and road foundations would lose load-bearing strength. Injuries could occur from debris, such as parapets and chimneys that could topple or be shaken loose and fall on those walking or driving below. Levees and revetments built on these poor soils would likely fail, representing a loss of critical infrastructure. An earthquake event of this magnitude located off the coast could cause a significant local tsunami that would further damage structures and jeopardize lives. An earthquake may also cause minor landslides along unstable slopes, which put at risk major roads and highways that act as sole evacuation routes. This would be even more likely if the earthquake occurred during the winter or early spring.

10.6 ISSUES

Important issues associated with an earthquake include the following:

- More information is needed on the exposure and performance of soft-story construction within the planning area.
- Based on the modeling of critical facility performance performed for this plan, a high number of facilities in the planning area are expected to suffer complete or extensive damage from scenario events. These facilities are prime targets for structural retrofits.
- Critical facility owners should be encouraged to create or enhance Continuity of Operations Plans using the information on risk and vulnerability contained in this plan.
- Geotechnical standards should be established that take into account the probable impacts from earthquakes in the design and construction of new or enhanced facilities.
- There are a large number of earthen dams within the planning area. Dam failure warning and evacuation plans and procedures should be reviewed and updated to reflect the dams' risk potential associated with earthquake activity in the region. The County levees should also be included in any assessments for earthquake risk.
- Earthquakes could trigger other natural hazard events such as dam failures, flooding, fire, and landslides, which could severely damage the County.
- A worst-case scenario would be the occurrence of a large seismic event during a flood or high-water event. Levees would fail at multiple locations, increasing the impacts of the individual events.
- Residents are expected to be self-sufficient up to 3 days after a major earthquake without government response agencies, utilities, private-sector services, and infrastructure components. Education programs are currently in place to facilitate development of individual, family, neighborhood, and business earthquake preparedness. Government alone can never make this region fully prepared. It takes individuals, families, and communities working in concert with one another to truly be prepared for disaster.
- After a major seismic event, Ventura County is likely to experience disruptions in the flow of goods and services resulting from the destruction of major transportation infrastructure across the broader region.

11. FLOOD

11.1 GENERAL BACKGROUND

11.1.1 Types of Flooding in the Planning Area

Riverine Floods

Riverine flooding is overbank flooding of rivers and streams. Natural processes of riverine flooding add sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Two types of flood hazards are generally associated with riverine flooding:

- **Inundation**—Inundation occurs when floodwater is present and debris flows through an area not normally covered by water. These events cause minor to severe damage, depending on velocity and depth of flows, duration of the flood event, quantity of logs and other debris carried by the flows, and amount and type of development and personal property along the floodwater's path.
- **Channel Migration**—Erosion of banks and soils worn away by flowing water, combined with sediment deposition, causes migration or lateral movement of a river channel across a floodplain. A channel can also abruptly change location (termed "avulsion"); a shift in channel location over a large distance can occur within as short a time as one flood event.

The frequency and severity of flooding for river systems are based on discharge probability. The discharge probability is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for different discharge levels and storm surge levels. These measurements reflect statistical averages only; it is possible for multiple floods with a low probability of occurrence (such as a 1-percent-annual-chance flood) to occur in a short time period. For riverine flooding, the same flood event can have flows at different points on a river that correspond to different probabilities of occurrence.

Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas inundated by the 1-percent-annual-chance flood with flood depths of only 1 to 3 feet. These areas are generally flooded by low-velocity sheet flows of water.

Stormwater Runoff Floods

Stormwater flooding is a result of local drainage issues and high groundwater levels. Locally, heavy rain, especially during high lunar tide events, may induce flooding within areas other than delineated floodplains or along recognizable channels due to presence of storm system outfalls inadequate to provide gravity drainage into the adjacent body of water. If local conditions cannot accommodate intense precipitation through a combination of infiltration and surface runoff, water may accumulate and cause flooding problems. Flooding issues of this nature generally occur within areas with flat gradients, and generally increase with urbanization, which speeds accumulation of floodwaters because of impervious areas. Shallow street flooding can occur unless channels have been improved to account for increased flows.

Urban drainage flooding is caused by increased water runoff due to urban development and drainage systems. Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent localized flooding on streets and within other urban areas. These systems utilize a closed conveyance system that channels water away from an urban area to surrounding streams, and bypasses natural processes of water filtration through the ground, containment, and evaporation of excess water. Because drainage systems reduce the amount of time surface water takes to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than prior to development within that area.

Flash Floods

The National Weather Service defined a flash flood as follows (National Weather Service 2009a):

> “a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within 6 hours of the causative event (e.g., intense rainfall, dam failure). However, the actual time threshold may vary in different parts of the country. Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters”

Flash floods can tear out trees, undermine buildings and bridges, and scour new channels. In urban areas, flash flooding is an increasingly serious problem due to removal of vegetation and replacement of ground cover with impermeable surfaces such as roads, driveways, and parking lots. The greatest risk from flash floods is occurrence with little to no warning. Major factors in predicting potential damage are intensity and duration of rainfall, and steepness of watershed and streams.

Coastal Floods

Coastal floods are usually caused by coastal storms that, when combined with normal tides, push water toward the shore. This is commonly referred to as storm surge. The result can be waves that extend further inland, causing damage to development that would not normally be subject to wave action. Coastal floodplains are adjacent to the ocean and other tidally influenced areas. The floodplains may be broad or narrow, depending on local topography and natural flood defenses such as dune systems or tidal wetlands.

Levee-Failure Floods

Levees can help reduce the risk of flooding, but they do not eliminate the risk. Levees deteriorate over time and must be maintained to retain their effectiveness. A levee failure can occur when a levee is damaged, experiences surface or foundation erosion, or is overtopped by floodwaters or storm surge that are higher than the lowest crest of the levee system. When levees fail or are overtopped, the results can be catastrophic. The resulting damage can be greater than if the levee had not been built.

11.1.2 FEMA Regulatory Flood Zones

The extent of flooding associated with a 1-percent annual probability of occurrence (also called the base flood) is used as a regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

Mapped Flood Zones

FEMA defines flood hazard areas as areas expected to be inundated by a flood of a given magnitude. These areas are determined via statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Flood hazard areas are delineated on DFIRMs (Digital Flood Insurance Rate Maps), which provide the following information:

- Locations of specific properties in relation to special flood hazard areas
- Base flood elevations (1-percent-annual-chance) at specific sites
- Magnitudes of flood in specific areas
- Undeveloped coastal barriers where flood insurance is not available
- Regulatory floodways and floodplain boundaries (1-percent and 0.2-percent-annual-chance floodplains).

Land covered by floodwaters of the base flood is the special flood hazard area on a DFIRM—an area where NFIP floodplain management regulations must be enforced, and where mandatory purchase of flood insurance applies. This regulatory boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities, because many communities have maps showing the extent of the base flood and likely depths that will occur.

The base flood elevation (the water elevation of a flood that has a 1-percent chance of occurring in any given year) is one of the most important factors in estimating potential damage from flooding. A structure within a 1-percent-annual-chance floodplain has a 26-percent chance of undergoing flood damage during the term of a 30-year mortgage. The 1-percent-annual-chance flood is used by the NFIP as the basis for insurance requirements nationwide. DFIRMs also depict 0.2-percent-annual-chance flood designations.

DFIRMs and other flood hazard information can be used to identify the expected spatial extent of flooding from a 1 percent and 0.2 percent-annual-chance event. They depict the following SFHAs and other areas:

- **Zone A (Also known as Unnumbered A-zones**)—SFHAs where no base flood elevations or depths are shown because detailed hydraulic analyses have not been performed.

- **Zones A1-30 and AE—**SFHAs that are subject to inundation by the base flood, determined using detailed hydraulic analysis. Base flood elevations are shown within these zones.
- **Zone AH—**SFHAs that are subject to shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
- **Zone AO—**SFHAs subject to inundation by types of shallow flooding where average depths are between 1 and 3 feet. These are normally areas prone to shallow sheet flow flooding on sloping terrain.
- **Zone AR—**Areas with a temporarily increased flood risk due to the building or restoration of flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements apply, but rates do not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
- **Zone A99—**Areas with a 1 percent annual chance of flooding that will be protected by a federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
- **Zone B and X (shaded)—**Zones where the land elevation as been determined to be above the base flood elevation, but below the 500-year flood elevation. These zones are not SFHAs.
- **Zones C and X (unshaded)—**Zones where the land elevation has been determined to be above both the base flood elevation and the 500-year flood elevation. These zones are not SFHAs.

Floodways

The FEMA designated floodway is the channel of a water course and portion of the adjacent floodplain that is needed to convey the base flood without increasing flood levels by more than a specified amount (typically, 1 foot). A floodway may be designated within the SFHA where the deepest, highest velocity flow is expected and any infrastructure will be at risk. Floodways should be kept free of obstructions and development to allow floodwaters to move downstream unobstructed. Any development in a floodway is subject to severe damage and high risks for occupants and emergency responders.

Unmapped Flood Areas

Flood damage may occur outside of SFHAs. FEMA typically does not designate SFHAs for areas subject to flooding from local drainage problems, particularly in urban areas; drainage basins of less than 1 square mile in area; or hillside areas subject to runoff, erosion, and mudflow. FEMA does not map flooding along the length of all streams or in areas that are undeveloped.

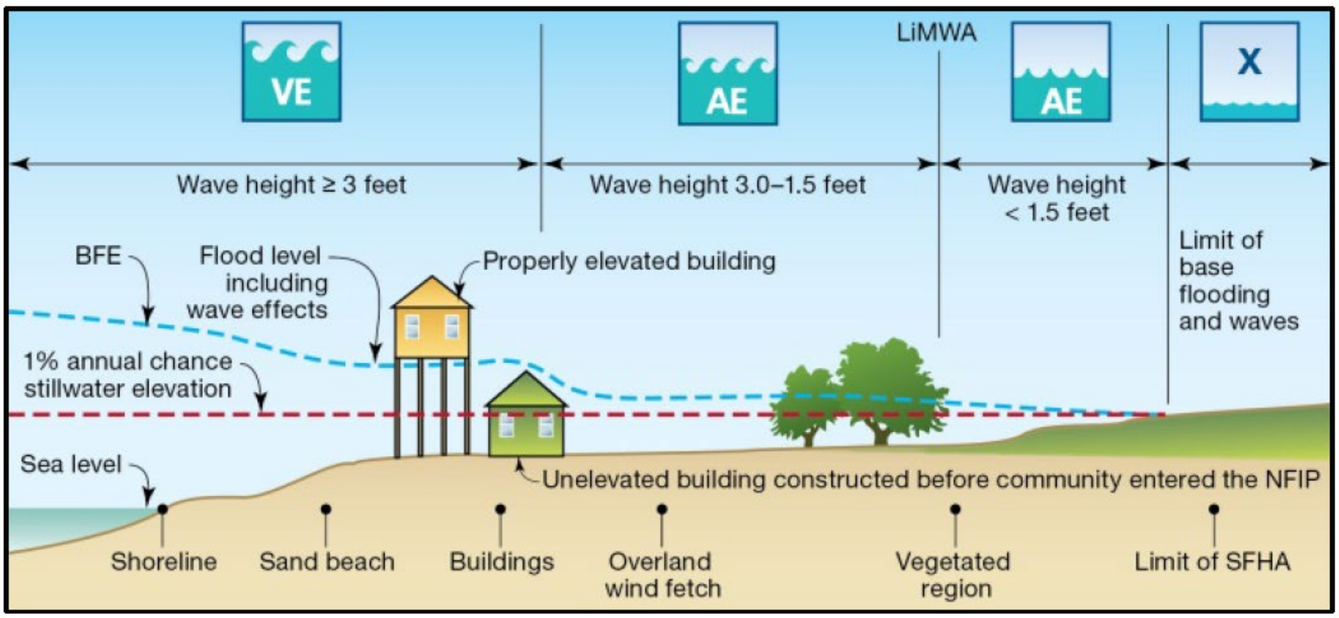
Coastal Flood Hazard Zones

Coastal floods are characterized by inundation of normally dry lands by ocean waters, often caused by storm surge associated with severe storms, tsunamis, or extreme high tide events that result in shallow flooding of low lying coastal areas. Storm surge floods typically result in coastal erosion, salinization of freshwater sources, and contamination of water supplies. These floods are also responsible for significant agricultural losses, loss of life, and damage to public and private structures and infrastructure. DFIRMS depict two coastal flood hazard zones:

- Zone VE, where the flood elevation includes wave heights equal to or greater than 3 feet.
- Zone AE, where flood elevation includes wave heights less than 3 feet.

Wave heights as low as 1.5 feet can cause significant damage to structures built without consideration of coastal hazards. Newer DFIRMs for coastal areas include a line showing the limit of moderate wave action (LiMWA), the inland limit of the area expected to receive 1.5-foot or greater breaking waves during the 1-percent annual-chance flood event (Figure 11-1). The area between Zone VE and the LiMWA is subject to flood hazards associated with floating debris and high-velocity flow that can erode and scour building foundations and, in extreme cases, cause foundation failure. Addition of LiMWA area to DFIRMs alerts property owners that their properties may be affected by 1.5-foot or higher breaking waves, and may therefore be at significant risk during a 1-percent-annual-chance flood event (Federal Emergency Management Agency 2020).

Figure 11-1. Limit of Moderate Wave Action



Source: Journal of Marine Science and Engineering 2020

11.1.3 Floodplains

A floodplain is the area adjacent to a river, creek, lake or the ocean that becomes inundated during a flood. Riverine floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

Floodplain Ecosystems and Beneficial Functions

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

Floodplains have many natural beneficial functions, and disruption of them can have long-term consequences for entire regions. Some well-known, water-related functions of floodplains (noted by FEMA) include:

- Natural flood and erosion control
- Provide flood storage and conveyance
- Reduce flood velocities
- Reduce flood peaks
- Reduce sedimentation
- Surface water quality maintenance
- Filter nutrients and impurities from runoff
- Process organic wastes
- Moderate temperatures of water
- Provide groundwater recharge
- Promote infiltration and aquifer recharge
- Reduce frequency and duration of low surface flows

Areas in the floodplain that typically provide these natural functions are wetlands, riparian areas, sensitive areas, and habitats for rare and endangered species.

Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; riverine floodplain land is fertile and suitable for farming; transportation by water is easily accessible; land is flatter and easier to develop; and there is value placed in ocean views. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels or causing erosion of natural flood protection systems such as dunes. Flood potential can be increased in several ways: reducing a stream's capacity to contain flows; increasing flow rates or velocities downstream; and allowing waves to extend further inland. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

11.1.4 Secondary Hazards

The most problematic secondary hazard for riverine flooding is bank erosion, in some cases more harmful than actual flooding. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but scour banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers, or storm sewers.

11.2 HAZARD PROFILE

11.2.1 Federal Flood Program Participation

National Flood Insurance Program

Table 11-1 lists flood insurance statistics that help identify vulnerability within the planning area. Nearly 6,300 policies are in force, providing more than $1.7 million in insurance. According to FEMA statistics, 1,174 flood insurance claims were paid between January 1, 1978, and March 31, 2021, for a total of $13,243,730, an average of $11,281 per claim.

Table 11-1. Flood Insurance Statistics

	Date of Entry	# of Flood Insurance Policies, as of 3/31/2021	Insurance in Force	Total Annual Premiums	Claims, 1/1/1978 to 3/31/2021	Value of Claims Paid, 1/1/1978 to 3/31/2021
Camarillo	9/29/1986	664	$203,471,400	$534,728	21	$1,135,612
Fillmore	10/17/1978	74	$22,517,800	$34,315	37	$226,509
Moorpark	9/29/1986	117	$39,692,000	$114,239	2	$33,576
Ojai	10/17/1978	79	$25,299,000	$41,007	43	$223,301
Oxnard	3/1/1979	497	$166,210,700	$323,235	71	$244,574
Port Hueneme	9/24/1984	57	$17,732,000	$37,235	7	$846
Santa Paula	4/15/1980	1,021	$306,954,400	$604,233	63	$134,387
Simi Valley	9/27/1991	1,624	$425,325,500	$1,337,947	82	$116,840
Thousand Oaks	9/29/1978	336	$109,948,800	$253,564	62	$341,390
Ventura	9/29/1986	471	$161.828,500	$374,421	62	$660,191
Unincorporated	10/31/1985	1,346	$395,320,600	$1,327,849	724	$10,126,504
Total		**6,286**	**$1,712,472,200**	**$4,982,773**	**1,174**	**$13,243,730**

Properties constructed after adoption of a FIRM or DFIRM are considered less vulnerable to flooding because they were constructed after adoption of regulations and codes to decrease vulnerability. Properties built before adoption of a FIRM or DFIRM are more vulnerable to flooding because either they do not meet code or are within hazardous areas. The first flood maps of the planning area became available in 1974 and 1975.

Community Rating System

Ventura County and the Cities of Oxnard and Simi Valley currently participate in the CRS program. Table 11-2 summarizes the CRS status of each. Many of the mitigation actions identified in this plan are creditable activities under the CRS program. Therefore, successful implementation of this plan offers potential to enhance the CRS classification.

Table 11-2. CRS Status of Participating Jurisdictions

Jurisdiction	NFIP Community #	CRS Entry Date	Current CRS Classification	Premium Discount	
				SFHA	Non-SFHA
Oxnard	060417	5/1/2013	7	15	5
Simi Valley	060421	10/1/1993	5	25	10
Ventura County	060413	10/1/2011	5	25	10

11.2.2 Ventura County Public Works Agency—Watershed Protection

Ventura County Public Works Agency—Watershed Protection (VCPWA-WP), formerly known as the Ventura County Flood Control District, was formed on September 12, 1944, by an act of the California State Legislature. It is a dependent county special district (governed by a city or county council or board or its appointees). The Ventura County Board of Supervisors governs VCPWA-WP, and it is administratively housed in the Ventura County Public Works Agency. Its mission is to protect life, property, and community infrastructure from flood events, improve water resources management, and enhance the health and natural function of watersheds in Ventura County. The goals of VCPWA-WP include the following:

- Comprehensive, long range watershed planning
- Collaboration with watershed stakeholders
- Administration of adopted regulations, policies, and resolutions
- Responsible and accountable use of public resources
- Excellence in public service

11.2.3 Ventura County Watershed Zones

The sections below describe watershed zones in Ventura County that VCPWA-WP uses for planning.

Zone 1 Ventura River

The watershed of the Ventura River and its tributaries, covering the west-center portion of Ventura County, is the major watershed in Flood Zone 1. Significant tributaries to the Ventura River are Matilija Creek, North Fork Matilija Creek, Coyote Creek, Senior Canyon, Reeves Creek, Thacher Creek, Lion Canyon, Coyote Creek, San Antonio Creek, and Cañada Larga. The Ventura River watershed covers 223 square miles—a little less than half of it within the Los Padres National Forest. The Ventura River discharges directly to the Pacific Ocean and serves as the western boundary of the City of San Buenaventura (Ventura).

Zone 2 Santa Clara River

The major river in Flood Zone 2 is the Santa Clara River with a watershed area of 1,634 square miles. Most streams in Zone 2 are tributaries to the Santa Clara River with eventual drainage to the Pacific Ocean. The only exceptions are minor water courses in coastal watershed areas of the Cities of Oxnard, San Buenaventura, and Port Hueneme that drain directly to the Pacific Ocean. The largest of these direct-coastal drainages is the Arundell Barranca, which collects and channels runoff from Lake and Sexton Canyons in the City of San Buenaventura foothill areas before discharging into Ventura Harbor.

Zone 3 Calleguas Creek

The major river in Flood Zone 3 is Calleguas Creek with a watershed area of 341 square miles. All stream flows in Zone 3 eventually end up in Mugu Lagoon before entering the Pacific Ocean. Major tributaries to Calleguas Creek are Revolon Slough (drains a portion of Flood Zone 2), Conejo Creek, Arroyo Santa Rosa, Arroyo Conejo, Arroyo Las Posas/Arroyo Simi, Happy Camp Canyon, Lang Creek, and Tapo Canyon. Virtually the entire watershed is within Ventura County, with dozens of smaller creeks.

Zone 4 South and North

Ventura County Flood Zone 4 covers 225,000 acres in three unconnected areas:

- The southeast area (Zone 4 South) includes 61,000 acres of coastal drainages for tributaries to Malibu Canyon (or Malibu Creek), areas surrounding Lake Sherwood, Potrero Creek, Westlake Village, and the coastal streams of Deer Canyon and Big and Little Sycamore Creeks, draining the northern tip of the Santa Monica Mountains directly into the Pacific Ocean.
- The northwest area (see Zone 4 North) is primarily the watershed of the Cuyama River, which covers about 150,000 acres within Ventura County.
- The remaining 14,000 acres in the relatively undeveloped northeast corner of the county (Zone 4 Northeast) drains outside the County to the north and then to the east. This area includes Frazier Mountain Creek and Mill Canyon Creek, which are tributaries to Cuddy Creek in Kern County. Cuddy Creek follows the San Andreas Fault trace before terminating in the enclosed runoff basin called Castac Lake.

Coastal Creeks

The following areas near the coastline drain directly to the Pacific Ocean (Ventura County Public Works Agency 2020b):

- North Coast—At the Santa Barbara-Ventura County Line and south of it, several coastal creeks drain the face of the Santa Ynez Mountains. This area is referred to as the North Coast of Ventura County (sometimes also called the Rincon coast). It includes the principal stream of Rincon Creek, as well as Las Sauces Creek, Madranio Canyon, Javon Canyon, Padre Juan

Canyon, and Line Canyon. The southern boundary is at the northern banks of the Ventura River.

- Mid Coast—The Mid Coast (sometimes also called the Oxnard Plain Coastal Area) includes minor stream courses between the Ventura River and Calleguas Creek-Mugu Rock. This stretch of coastline is dominated by urban runoff carrying high pollutant concentrations from residential and industrial activities.
- South Coast—Runoff channels and stream courses between Mugu Rock and the Ventura-Los Angeles County Line are referred to as South Coast streams. These include La Jolla Canyon, Big Sycamore Canyon, Little Sycamore Canyon, and Deer Creek Canyon—all of which drain to the western extent of the Santa Monica Mountains. The next drainage to the south—Arroyo Sequit-Triunfo Canyon Creek—is just past the county line and thus under Los Angeles County control.

11.2.4 Principal Flooding Sources and Floodplains

Upland Flooding

The mountainous terrain of northern Ventura County and the hills in the central and eastern parts of the county give rise to numerous annual streams, many draining into steep canyons. These streams are subject to floods of relatively short duration, often following high-intensity rainfall. Such floods may occur with little warning and carry large quantities of sediment and debris. Communities adjacent to the upland areas, such as Fillmore, Ojai, Piru, and Santa Paula, are subject to this hazard. Many of the watersheds in question contain dams or basins designed to attenuate flow and trap debris, reducing the effects on downstream communities.

Broad Floodplains

The watersheds of the Santa Clara River (watershed area of 1,650 square miles), the Ventura River (watershed area of 226 square miles), and Calleguas Creek (watershed area of 325 square miles) drain to the broad coastal plain in the southern part of Ventura County. This plain is subject to inundation during longer intervals of rain, typically as the result of a series of winter storms. These floods typically have longer duration and may be forecast with more warning time. Because of its sediment load, the Santa Clara River has migrated across the valley floor during significant floods. Numerous levees have been built in the Santa Clara River Valley to protect agricultural lands along the river. The levees are typically not sufficient to withstand severe flood events.

Coastal Flooding

The County's 43-mile coastline is subject to tidal flooding, storm surge, and wave action, all of which usually occur during winter storms. Severe wave action is generally confined to narrow areas immediately adjacent to the tidal zone, including Sea Cliff Colony, Oxnard Shores, Silver Strand Beach, and several sections of U.S. 101 from Rincon Point to Emma Wood State Park. The effects of coastal flooding can be severe. In addition to wave action, beach and bluff erosion can cause significant damage to coast-side homes and infrastructure. Coastal flooding may also occur as the result of tsunamis caused by earthquakes or undersea landslides.

Winter coastal storms can cause minor coastal erosion along the shores of Ventura County. Coastal erosion is a natural process that occurs particularly in winter, when coastal storms wear away land by the action of waves and tides. Material deposited on beaches during the mild summer and fall months gets redistributed by the waves. According to City of San Buenaventura engineers, most of the sand is pulled just off coast and then comes back to shore over time. Although most receding sand stays fairly close to shore, some is driven south by currents until it reaches Hueneme Canyon, a large deep-water depression near the Port of Hueneme.

Unmapped Flood Hazard Areas

Unmapped flood hazard areas include numerous small channels. Agricultural drainage ditches and urban drains cover much of the flatter parts and urban areas of Ventura County. Flooding in these areas is due to high-intensity rainfall over a very short period. The flooding is usually shallow and mainly affects roadways and other low-lying areas. The Hollywood Beach and Silver Strand residential coastal communities have historically experienced localized flooding conditions, primarily due to inadequate storm drainage infrastructure and topography. These residential coastal communities (largely built out) are not currently mapped by FEMA in the Zone VE coastal high hazard SFHA. They have historically been mapped by FEMA as a Zone B and most recently under the DFIRMs as a Zone X-Shaded (500-year floodplain).

11.2.5 Natural and Beneficial Floodplain Functions

The county's floodplains drain into five major wetlands as described in the sections below. A wetland is an area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes, and bogs; the water found in wetlands can be saltwater, freshwater, or a mixture of both.

McGrath Lake Wetlands

Located on the western city limits of Oxnard, the McGrath Lake wetlands extend south from the Santa Clara River. A small lake within the wetlands helps to attract more than 200 species of birds. The Santa Clara Estuary Natural Preserve on the northern boundary of McGrath Lake Park offers a refuge for birds and habitat for burrowing animals. In April 2010, the Nature Conservancy, the State of California, and the U.S. Fish and Wildlife Service purchased 141 acres of prime riparian habitat, agriculture fields, and floodplains within the McGrath Lake Wetlands to become part of the Santa Clara River Parkway. The parkway was established to protect and restore the river's floodplain and functions, and to provide recreational opportunities such as hiking and bird watching.

Mugu Lagoon

The Mugu Lagoon consists of 1,474 acres of wetlands on the Point Mugu Naval Base, 8 miles southeast of the City of Oxnard. Calleguas Creek flows into the lagoon. In addition, there is a tidal connection through an inlet in the barrier beach. High concentrations of banned pesticides are found in lagoon's sediment. The Navy has undertaken several wetland restoration projects since the mid-1990s, restoring several acres of tidal mudflats, sandflats, channels, ponds, salt marsh, and sand islands. A number of special-status species inhabit the lagoon.

Ormond Beach Wetlands

The Ormond Beach wetlands, located in the City of Oxnard between the Port of Hueneme and the Point Mugu Naval Base, support many rare plants and hundreds of species of migratory birds. A secondary metal smelter, operating at Ormond Beach from 1965 to 2004, created such a large amount toxic pollution that the site is now a U.S. Environmental Protection Agency Superfund site. The California State Coastal Conservancy, the City of Oxnard, and The Nature Conservancy are spearheading efforts to permanently protect habitat and expand and restore the wetlands. As of late 2020, these groups had acquired 650 acres of the wetlands (ESA 2021).

Santa Clara River Estuary

The 49-acre Santa Clara River Estuary is at the mouth of the Santa Clara River and the Pacific Ocean near the City of San Buenaventura. The river drains a 1,600-square-mile watershed.

Ventura River Estuary

The 110-acre Ventura River Estuary, directly west of the City of San Buenaventura, drains a 226-square-mile watershed. The estuary is home to several special-status species. In 1996, the Ventura River Estuary Enhancement Plan was implemented to restore and enhance the estuary. The plan outlines riparian restoration along the river, its floodplain, and the surrounding dunes; re-creation of habitat types; habitat protective fencing; and trail soil stabilization.

Treatment Plant Discharge to the Santa Clara River Estuary

The City of San Buenaventura's sewage treatment plant discharges up to 9 million gallons per day of tertiary treated wastewater into the Santa Clara River Estuary. This discharge—one of the last remaining estuary discharges in California—is in conflict with the State Water Resources Control Board's *Water Quality Control Policy for the Enclosed Bays and Estuaries of California* (Resolution No. 74-43, 1974), which mandates that the discharge of municipal and industrial wastewaters to enclosed bays and estuaries be phased out. Exceptions to this policy are limited to circumstances in which a regional water quality control board finds that the treated wastewater enhances the quality of receiving waters.

The City of San Buenaventura has been granted an exception since 1977 on the basis that the treatment plant's discharge enhanced fish and wildlife habitat and non-contact water recreation. However, more recent information about the relationship of the discharge to the ecological function of the estuary is lacking.

Issues associated with the discharge include impacts of nutrient-rich water in the estuary and the artificial hydrology created by the volume of water. With this discharge, the lagoon fills up and breaches more frequently than it would under natural conditions. In 2008, the Los Angeles Regional Water Quality Control Board required the City of San Buenaventura, as a condition to continue the current discharge practice, to perform three studies to evaluate environmental solutions.

The Santa Clara River Estuary Scientific Review Panel convened in 2017 to determine how much, if any, discharge from the Ventura Water Reclamation Facility is needed to protect and sustain the native and endangered species known to use the Santa Clara River Estuary, and how much discharge could be eliminated to protect these species and sustain additional priority beneficial uses.

The panel recommended a 90 percent diversion from the current discharge volumes (Santa Clara River Estuary Scientific Review Panel 2018). In 2019 Ventura City Council approved a $200 million wastewater treatment plant to increase drinking water resources and reduce the treated wastewater released into the Santa Clara River estuary. The city plans to reduce its estuary discharge to less than 500,000 gallons per day by 2030 (Tuser 2019).

11.2.6 Past Events

Major Historical Floods

Damaging floods in Ventura County were reported as early as the middle of the 1800s. A 1945 report by the Ventura County Flood Control District described floods that caused extensive damage in 1862, 1867, 1884, 1911, 1914, 1938, 1941, 1943, and 1944.

The largest and most damaging natural floods recorded in the Santa Clara and Ventura watersheds occurred in January and February of 1969. The January flood was a result of the highest monthly precipitation total ever recorded in Ventura County at that time. The February flood was a result of intense rainfall similar in magnitude to the rainfall that caused the record-breaking flood in January. The combined effects of the 1969 floods were disastrous: 13 people lost their lives, and property damage was estimated at $60 million (1969 dollars). Homes in Casitas Springs, Live Oak Acres, and Fillmore were flooded, and 3,000 residents in Santa Paula and several families in Fillmore were evacuated twice. A break in the Santa Clara River levee threatened the City of Oxnard. Agricultural land, primarily citrus groves, was seriously damaged or destroyed. All over the county, transportation facilities, including roads, bridges, and railroad tracks, were damaged. The Fillmore, Oak View, and Ventura sewage treatment plants were severely damaged and dumped raw sewage into the Santa Clara and Ventura Rivers. The untreated sewage polluted the rivers and the beaches at their outlets into the ocean. Sewer trunk lines broke along the Ventura River and San Antonio Creek. Suspended sediment concentrations and discharge in many streams greatly exceeded any previously measured levels in the flood-affected areas (Ventura County 2015).

In 1980, Calleguas Creek breached its levee in the Oxnard Plain, and flooding and sediment deposition caused $9 million (in 1980 dollars) in damage to the Point Mugu Naval Base. Floodwaters covered about 1,500 acres of farmland. The peak discharge was 9,310 cubic feet per second at the Madera Road Bridge in Simi Valley.

In 1983, a federal disaster was declared because of storm damage. Repairs to flood-control facilities have been estimated to cost $15 million (in 1983 dollars). Improved channels in Moorpark and Simi Valley suffered severe damage from erosion during this event, and Calleguas Creek experienced record flooding. Damage to other public and private facilities has been estimated at $39 million, with little more than half of that total due to damage to agricultural lands.

Recent Floods

Table 11-3 lists major flood events to affect Ventura County since 2000.

Table 11-3. History of Flood Events

Date	Event Type	Locations	Deaths or Injuries	Property Damage
June 2, 2019	Flash Flood	Wheeler Springs	0	N/A
May 29, 2019	Flash Flood	Wheeler Springs	0	N/A
March 22-23, 2018	Flash Flood	Seacliff	0	N/A
March 22-23, 2018	Flash Flood	Haines	0	N/A
February 17, 2017	Flash Flood	Dulah	0	N/A
February 17, 2017	Flash Flood	Newbury Park	4	N/A
February 17, 2017	Flash Flood	Somis	0	N/A
March 7, 2016	Flash Flood	Dulah	0	N/A
January 6, 2016	Flash Flood	Dulah	0	N/A
January 6, 2016	Flash Flood	Piru	0	N/A
January 5, 2016	Flash Flood	Dulah	0	N/A
July 30, 2015	Flash Flood	Wheeler Springs	0	N/A
June 12, 2015	Flash Flood	Wheeler Springs	0	N/A
March 1, 2015	Flash Flood	Point Mugu	0	N/A

Date	Event Type	Locations	Deaths or Injuries	Property Damage
December 12, 2014	Flash Flood	Santa Susana	0	N/A
December 12, 2014	Flash Flood	Camarillo	0	Ten homes severely damaged
July 22, 2013	Flash Flood	Gorman	0	N/A
September 13, 2011	Flash Flood	Wheeler Springs	0	N/A
July 5, 2011	Flash Flood	Wheeler Springs	0	N/A
July 4, 2011	Flash Flood	Lockwood Valley	0	N/A
October 2, 2010	Flash Flood	Wheeler Springs	0	Vehicle damaged
January 20, 2010	Flash Flood	Moorpark	1	N/A
July 13-14, 2008	Flash Flood	Wheeler Springs	0	N/A
January 25, 2008	Flash Flood	Moorpark	0	N/A
January 4, 2008	Flash Flood	Santa Paula	0	N/A
January 4, 2008	Flash Flood	Fillmore	0	N/A
October 14, 2006	Flash Flood	Piru	0	N/A
July 24, 2006	Flash Flood	Ventura County[a]	0	N/A
July 23, 2005	Flash Flood	Ventura County[a]	0	N/A
February 20-21, 2005	Flood, Flash Flood	Ventura County[a]	0	$8 million
February 18, 2005	Flash Flood	Ventura County[a]	0	N/A
January 9-10, 2005	Flash Flood	Ventura County[a]	0	N/A
January 21, 2005	Coastal Flood	Ventura County[a]	0	N/A
January 3, 2005	Flash Flood	Ventura County[a]	0	N/A
February 25-26, 2004	Flash Flood	Simi Valley	0	N/A
March 15, 2003	Flood	Ventura County[a]	0	N/A
December 17, 2002	Flood	Ventura County Coast[a]	0	N/A
November 30, 2002	Flash Flood	Santa Paula	0	N/A
December 20, 2001	Flood	City of San Buenaventura[b]	0	N/A
November 24, 2001	Flood	City of San Buenaventura[b]	0	N/A
November 12, 2001	Flood	City of San Buenaventura[b]	0	N/A
November 12, 2001	Flood	El Rio	0	N/A
November 12, 2001	Flood	Newbury Park	0	N/A
September 3, 2001	Flash Flood	Ventura County[a]	0	N/A
July 7, 2001	Flash Flood	Ventura County[a]	0	N/A
March 5, 2001	Flood	Ventura County[a]	0	N/A
January 11-12, 2001	Flood	Ventura County Coast[a]	0	N/A
August 1, 2000	Flash Flood	Ventura County[a]	0	N/A
April 17, 2000	Flood	Ventura County[a]	0	N/A
February 20-21, 2000	Flood	Ventura County[a]	0	N/A
February 20, 2000	Flash Flood	Ojai	0	N/A

a. Multiple locations are associated with this event.
b. The City of San Buenaventura is commonly called the City of Ventura.
Source: NCEI Storm Events Database 2021

11.2.7 Location

Levee-Protected Areas

Sixty-eight miles of levees are located throughout Ventura County. Two of these levees have undergone detailed economic analysis studies: the 2.65-mile-long Ventura River Levee (VR-1) and the

4.72-mile-long Santa Clara River Levee (SCR-1). Figure 11-2 and Figure 11-3 show the flood hazard areas defined in the levee studies, which were used in the risk assessment scenario of this plan. For consistency with the FEMA data, the 1 percent-annual chance and 0.2 percent-annual chance flood hazard areas of the levee studies were used (indicated on the figures as 100-year and 500-year floods).

Figure 11-2. Floodplains Mapped in the Ventura River Levee Study

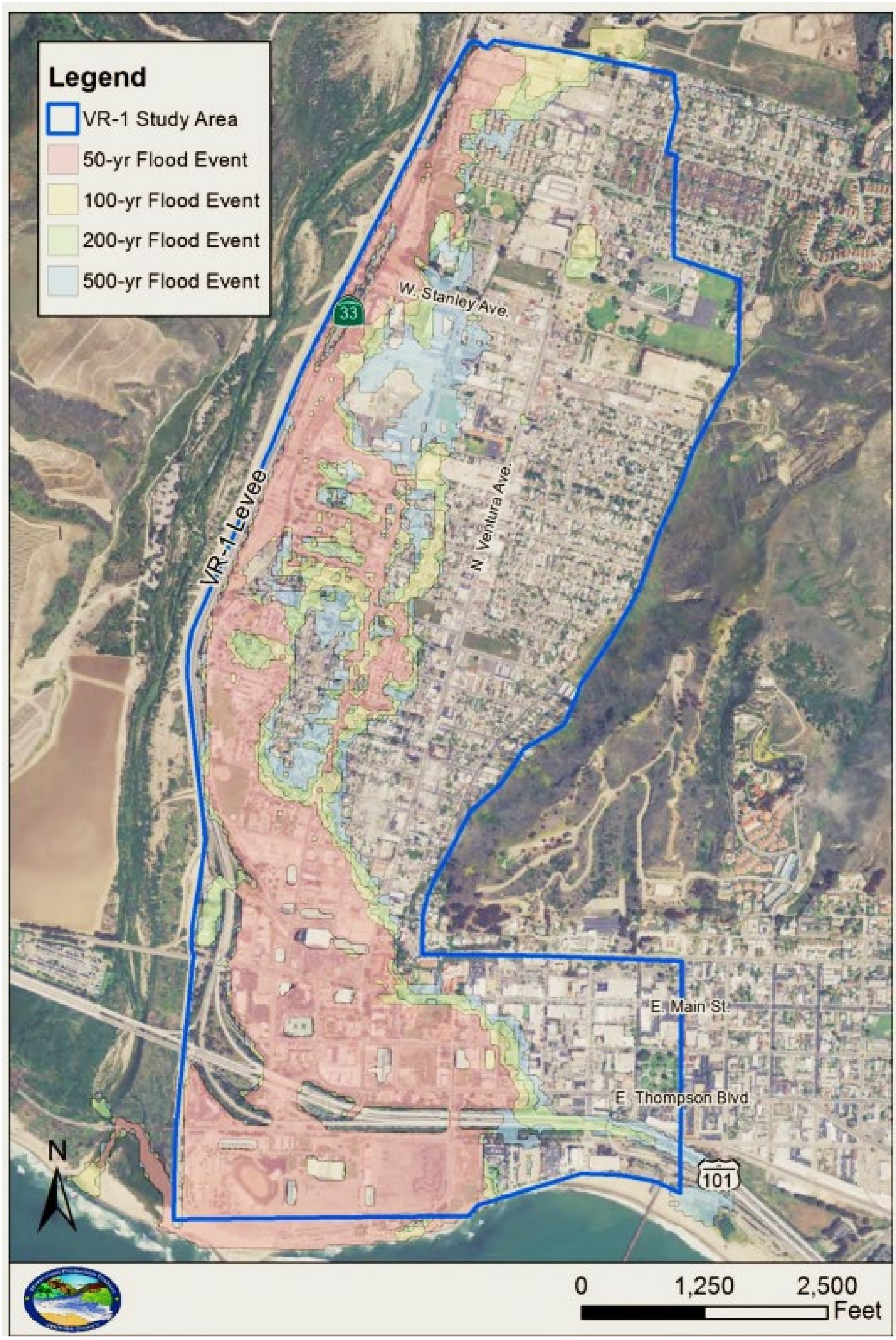


Figure 11-3. Floodplains Mapped in the Santa Clara River Levee Study

Mapped Flood Zones

Flooding in Ventura County has been documented by gage records, high water marks, damage surveys, and personal accounts. This documentation was the basis for the January 2021 Flood Insurance Study that is incorporated in the current effective DFIRMs. The DFIRMs are the most detailed and consistent data source available for determining flood extent. Data from the January 2021 Flood Insurance Study was used in this risk assessment to map extents and locations of the 1 percent-annual chance and 0.2 percent-annual chance flood hazard areas, as shown on Figure 11-4.

Repetitive Loss

A repetitive loss property is an NFIP-insured property that has experienced repeated flood damage. A repetitive loss area is the portion of a floodplain holding structures that FEMA has identified as repetitive loss properties. Identifying repetitive loss areas helps to identify structures that are at risk but are not on FEMA's list of repetitive loss structures. FEMA-sponsored programs, such as the CRS, require participating communities to identify repetitive loss areas. Repetitive loss properties in Ventura County are listed in Table 11-4.

Figure 11-4. FEMA Flood Hazard Areas

1% Annual Chance Flood (100-Year)

0.2% Annual Chance Flood (500-Year)

County Boundary

Cities

Major Roads

N

0 3 6 Miles

Data Sources: Ventura Co., FEMA, Esri

Table 11-4. Repetitive Loss Properties in Ventura County

Jurisdiction[a]	Repetitive Loss Properties	Properties That Have Been Mitigated	Number of Corrections	Corrected Number of Repetitive Loss Properties
City of Camarillo	0	*	*	*
City of Fillmore	0	*	*	*
City of Moorpark	0	*	*	*
City of Ojai	0	*	*	*
City of Oxnard	7	*	*	*
City of Port Hueneme	0	*	*	*
City of San Buenaventura	4	*	*	*
City of Santa Paula	3	*	*	*
City of Thousand Oaks	5	*	*	*
Ventura County Unincorporated Areas	63	*	*	*
Totals	**82**	*	*	*

a. Special purpose district planning partners to this plan have no identified repetitive loss properties because districts are not eligible participants in the NFIP.

* Data not available to support this planning effort due to FEMA's Privacy Act policies and the time associated with processing the requisite Information Sharing Access Agreement (ISAA).

Source: September 9, 2021, FEMA Report of Repetitive Losses

11.2.8 Frequency

Recurrence intervals and average annual numbers of flood events in Ventura County were calculated as follows based on events from 2000 to 2021 recorded in the NCEI Storm Events Database:

- Coastal floods have a 4.6 percent chance of occurring in any given year
- Flash floods have a 173 percent chance
- Other floods have a 54.6 percent chance of occurrence
- Total estimated percent chance of occurrence for any type of flood in a given year is 232 percent, meaning that flooding will likely continue to be an annual hazard.

The NCEI database lists 51 significant flooding events in Ventura County from 2000 to 2021, most of which have been flash floods. Smaller floods may occur more frequently and be categorized in the database under a different hazard event type, typically severe weather or severe storms.

11.2.9 Severity

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity—especially when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges. Peak flows used by FEMA to map floodplains within the planning area are listed in Appendix E. A summary list of only the sources with drainage areas of 20 square miles or greater is provided in Table 11-5.

Table 11-5. Summary of Peak Discharges in Large Ventura County Drainages

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Arroyo Las Posas					
Upstream of confluence of Peach Hill Wash	117.4	8,260	17,120	22,090	36,520
Downstream of confluence of Long Canyon Creek	143.4	9,390	19,460	25,100	41,500
Arroyo Simi					
Downstream of confluence with Happy Camp Canyon Creek	113.20	8,300	17,200	22,190	36,670
Downstream of Alamos Canyon	88.70	5,670	13,060	17,460	31,200
Downstream of North Simi Canyon	69.50	5,600	12,890	17,240	30,810
Upstream of Bus Canyon Drain	61.50	5,110	11,950	15,900	28,580
Upstream of Tapo Canyon Channel	32.30	4,440	10,220	13,670	24,420
Downstream of Meier Canyon	30.90	4,460	10,270	13,730	24,540
Calleguas Creek					
At Highway 1[b]	262.00	12,230	28,140	37,630	67,240
Downstream of confluence of Conejo Creek	248.30	16,000	30,610	38,460	61,030
Upstream of Conejo Creek & Lewis Drain	168.70	10,390	21,520	27,770	45,900
At Seminary Road	164.90	10,350	21,450	27,680	45,760
Conejo Creek					
At confluence with Calleguas Creek	77.60	9,300	17,800	22,300	35,500
At Highway 101 bridge	71.90	9,560	18,300	22,000	36,500
Downstream of confluence of Arroyo Conejo	60.00	9,660	18,500	23,200	36,900
Coyote Creek					
Upstream of confluence with Ventura River	41.10	680	1,980	3,410	4,830
Approximately 570 feet downstream of Casitas Dam Spillway	40.10	671	1,953	3,363	4,766
At Casitas Dam Spillway	38.50	120	370	2,590	3,750
Piru Creek					
At confluence with Santa Clara River	441	2,500	33,000	41,000	60,000
Revolon Slough					
Downstream of Camarillo Hills Drain	38.70	2,500	7,100	10,000	20,000
At Highway 101	30.00	2,200	6,200	8,700	16,500
San Antonio Creek					
At confluence with Ventura River[a]	51.1	9,960	24,715	32,679	51,450
Approximately 410 feet upstream of North Ventura Avenue	49.7	9,930	26,946	37,893	73,689
Upstream of confluence of San Antonio Creek Tributary	46.5	10,430	28,300	39,800	77,690
Upstream of confluence with Lion Canyon Creek	33.8	7,760	21,050	29,600	57,780
Downstream of Stewart Canyon Creek	31.3	8,590	23,320	32,800	64,030
Upstream of confluence of Steward Canyon Creek	26.5	7,620	20,690	29,100	56,800
Downstream of confluence of Thacher Creek	25.4	7,490	20,330	28,600	55,830

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second) 10-Percent	2-Percent	1-Percent	0.2- Percent
Santa Clara River					
At mouth	1,625	41,000	116,000	161,000	270,000
At Willard Bridge	1,534	41,000	116,000	161,000	270,000
Upstream of confluence of Santa Paula Creek	1,505	40,000	113,000	157,000	265,000
Downstream of confluence of Sespe Creek	1,500	40,000	113,000	157,000	265,000
Upstream of confluence of Sespe Creek	1,182	23,000	66,000	92,000	160,000
Downstream of confluence of Hopper Creek	1,174	40,000	113,000	157,000	265,000
Downstream of confluence of Piru Creek	1,100	40,000	113,000	157,000	265,000
At Ventura County/Los Angeles County boundary	644	15,000	43,000	60,000	104,000
Santa Paula Creek					
At stream gauging station	40	6,800	18,000	26,000	48,000
Sespe Creek					
Approximately 4,000 feet downstream of Highway 126	263	33,000	72,000	92,000	145,000
Approximately 5,000 feet upstream of Southern Pacific Railroad	259	29,000	62,000	80,000	131,000
Tapo Canyon Channel					
At confluence with Arroyo Simi	20.70	*	*	8,500	*
Ventura River					
At Pacific Ocean[b]	226	34,000	67,000	78,000	103,000
At Shell Chemical Plant	223	41,300	67,900	78,900	105,500
Approximately 0.6 mile upstream of confluence of Canada Larga	191	36,583	59,999	70,055	93,593
At Casitas Vista Road	188	36,400	59,700	69,700	93,100
Approximately 1,400 feet upstream of Casitas Vista Road	148	35,529	57,135	67,239	90,127
Approximately 1,000 feet downstream of confluence of San Antonio Creek	144	35,000	56,600	66,600	89,000
Approximately 300 feet upstream of confluence of San Antonio Creek	92.8	16,449	25,493	29,104	37,856
At Baldwin Road	83.0	16,000	24,800	28,300	36,700
Approximately 1,120 feet upstream of Camino Cielo	72.4	15,000	24,000	27,100	35,200
Upstream of confluence of North Fork Matilija Creek	56.4	12,500	18,800	21,600	27,900

Note: All locations are at mouth unless otherwise noted. Locations do not include jurisdictional boundaries.
* Data not available
a. Decrease due to overbank losses upstream
b. Discharges are larger than those downstream due to updated hydrology (San Antonio Creek & Ventura River)
Source: Ventura County FIS 06111CV002E, FEMA January 29, 2021

11.2.10 Warning Time

Potential warning time available to a community for response to a flooding threat depends on the time between the first measurable rainfall and the first occurrence of flooding. The time needed to recognize a flood threat reduces potential warning time for a community. Because of the sequential pattern of weather conditions needed to cause serious flooding, occurrence of a flood without warning is unusual.

Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but populations in potential hazard areas can be warned in advance of flash flooding danger.

National Weather Service Watches and Warnings

The National Weather Service (NWS) issues watches and warnings when forecasts indicate rivers may approach bank-full levels. Flood extent or severity categories used by NWS include minor flooding, moderate flooding, and major flooding, based on property damage and public threat:

- **Minor Flooding**—Minimal or no property damage, but possibly some public threat or inconvenience.
- **Moderate Flooding**—Some inundation of structures and roads near streams. Some necessary evacuations of people and/or transfer of property to higher elevations.
- **Major Flooding**—Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (National Weather Service 2009b).

When a watch is issued, the public should prepare for the possibility of a flood. When a warning is issued, the public is advised to stay tuned to a local radio station for further information and be prepared to take quick action if needed. A warning means a flood is imminent, generally within 12 hours, or is occurring. Local media broadcast NWS warnings. Alerts are also sent via Twitter, Everbridge, and email and posted to the VCPWA-WP website.

Ventura County ALERT System

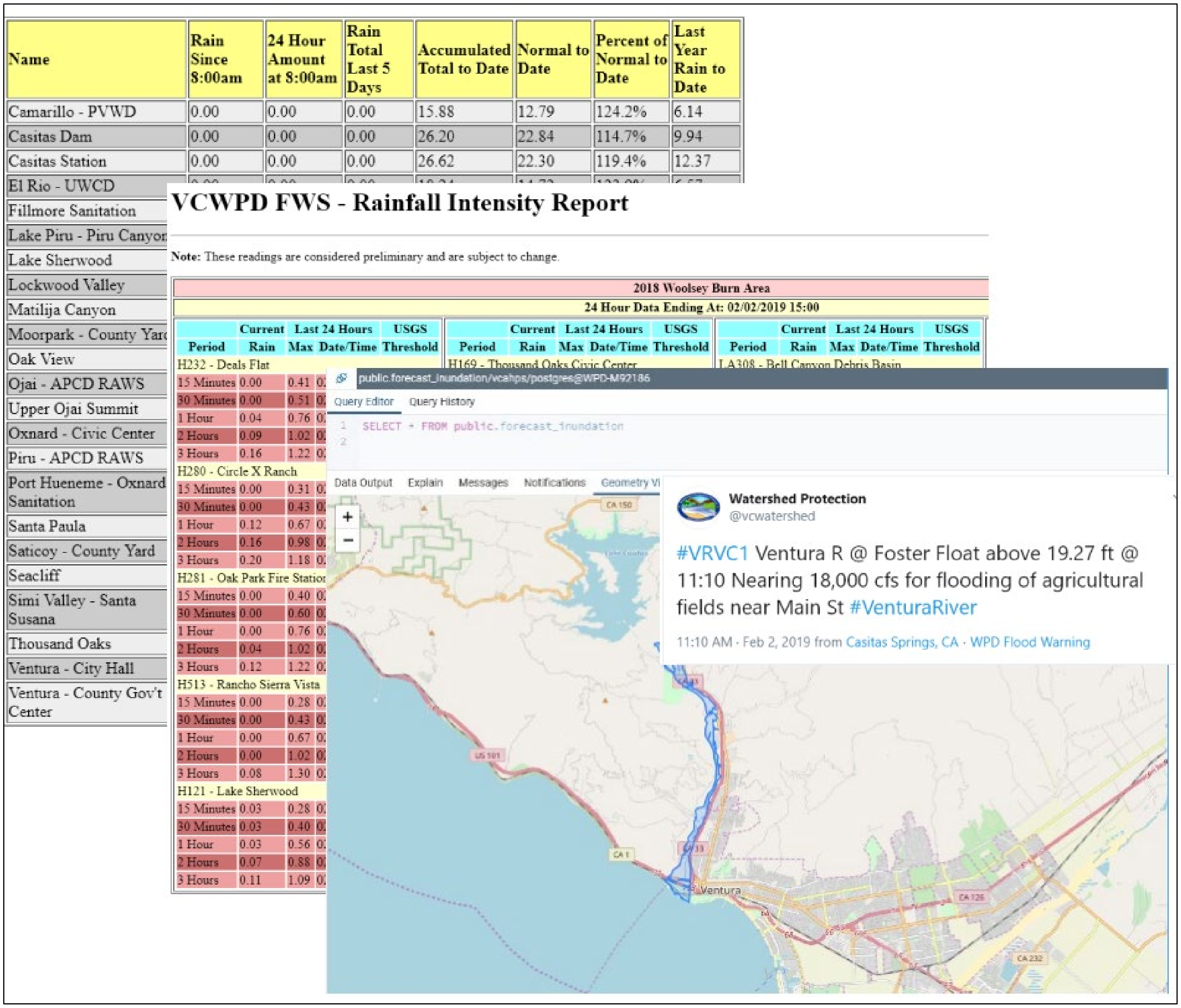
VCPWA-WP operates 90 self-reporting rain gages and 30 self-reporting stream gages. VCPWA-WP also receives telemetered data from 65 additional rain gages and 23 stream gages operated by other agencies. The real-time rain gage data are fed into watershed hydrologic models to predict flow hydrographs and stream levels at stream gage stations installed at strategic locations throughout the County.

The Automated Local Evaluation in Real-Time (ALERT) network is the essential component of the flood warning system. Ventura County implemented a flood warning system for Sespe Creek after a flood in 1978 that caused significant damage in Fillmore. Six rain gages were installed in 1979 in the Sespe Creek and Santa Paula Creek watersheds. All six of these gages remain in operation today.

In response to the 1980 Calleguas Creek flood and with some funding provided by the US Navy, a nine-gage system was installed in the Calleguas Creek watershed. Three are still in their original locations.

The 1980s saw improvement in the technology which included both hardware and software. ALERT transmitters were connected to stream gages so water levels could be monitored in real-time, just like rainfall. Computer software also improved, allowing for display of rainfall and stream flow in graphs and maps. The ALERT network continued to grow with the addition of gages in the Ventura River watershed in response to the 1985 Wheeler Fire. This was the first time that all three of Ventura County watersheds were covered by the ALERT system (Ventura County Public Works Agency 2020a). Figure 11-5 shows an example of the local flood warning system.

Figure 11-5. Ventura County Flood Warning System Example



11.3 EXPOSURE

A quantitative assessment of exposure to the flood hazard was conducted using the flood mapping shown in Figure 11-4 and the asset inventory developed for this plan. Detailed results by municipality are provided in Appendix D; results for the total planning area are presented below.

11.3.1 Population

Table 11-6 summarizes the estimated population living in the evaluated flood hazard areas.

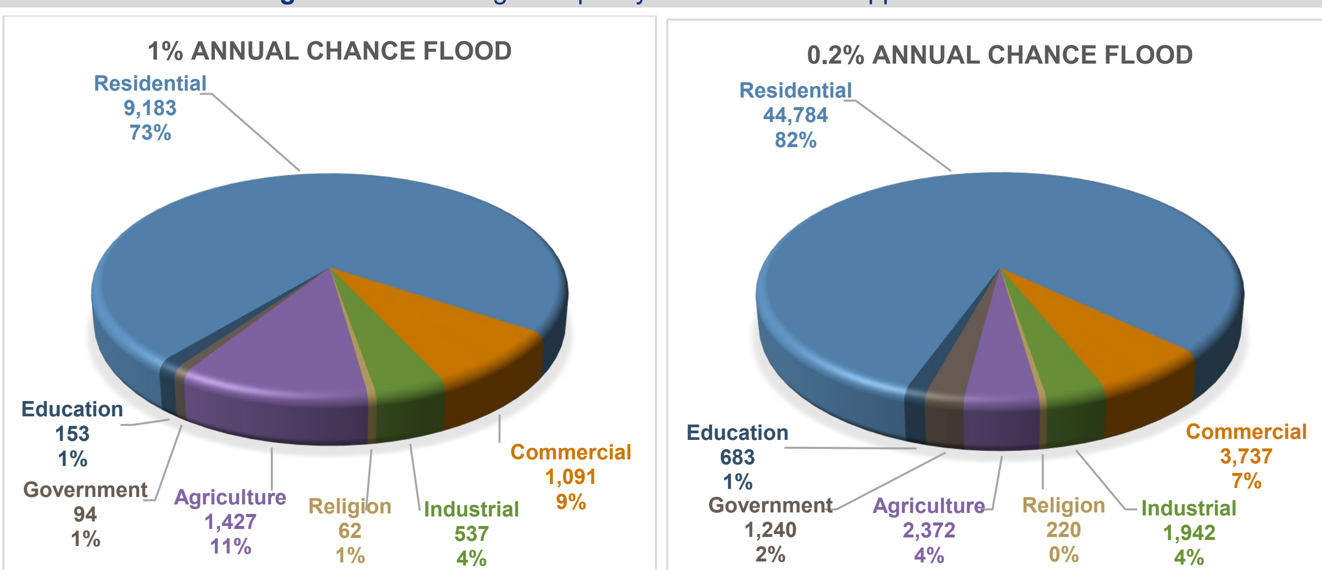
Table 11-6. Exposed Population in Evaluated Flood Hazard Zones		
	1% Annual Chance Flood Zone	**0.2% Annual Chance Flood Zone**
Population Exposed	33,202	180,772
% of Total Planning Area Population	3.9%	21.4%

11.3.2 Property

Table 11-7 summarizes the estimated property exposure in the evaluated flood hazard areas. Figure 11-6 shows the occupancy class defined by Hazus for all buildings in the mapped floodplains. These occupancy classes provide an indication of land use within the mapped hazard area. Some land uses are more vulnerable to flood risks, such as single-family homes, while others are less vulnerable, such as agricultural land or parks.

Table 11-7. Exposed Property in Evaluated Flood Hazard Zones		
	1% Annual Chance Flood Zone	**0.2% Annual Chance Flood Zone**
Acres of inundation area	68,046	102,019
Number of Buildings Exposed	12,547	54,978
Value of Exposed Structures	$5,265,874,679	$23,232,737,392
Value of Exposed Contents	$4,681,379,253	$19,502,977,592
Total Exposed Property Value	**$9,947,253,933**	**$42,735,714,984**
Total Exposed Value as % of Planning Area Total	***5.5%***	***23.6%***

Figure 11-6. Building Occupancy Classes in the Mapped Flood Zones



11.3.3 Critical Facilities

Figure 11-7 and Figure 11-8 show critical facilities located in the 1 percent-annual-chance and 0.2 percent-annual-chance floodplains, respectively, by facility type. A breakdown by municipality is provided in Appendix D. Critical facilities exposed to the flood hazard represent the following percentages of all critical facilities in the planning area:

- 15 percent (233 facilities) of all critical facilities are in the 1 percent-annual-chance flood hazard area.
- 30 percent (466 facilities) of all critical facilities are in the 0.2 percent-annual-chance flood hazard area.

Figure 11-7. Critical Facilities in 1% Annual Chance Floodplain

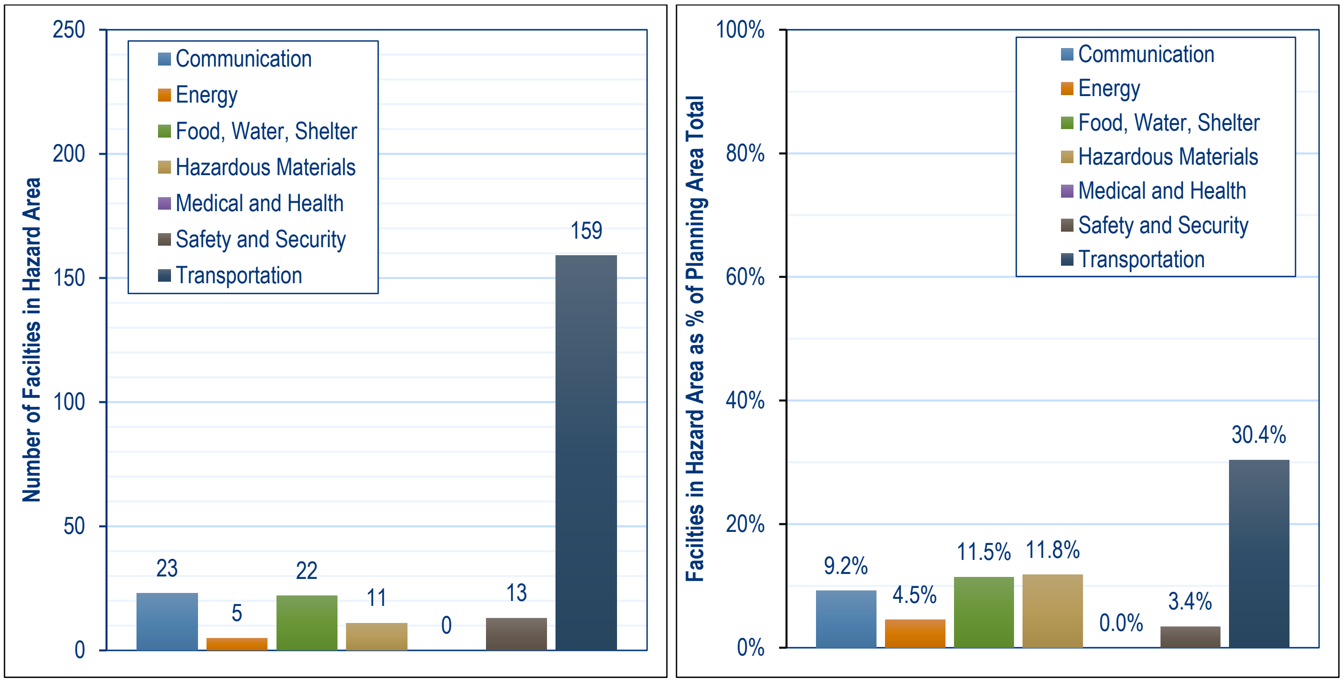
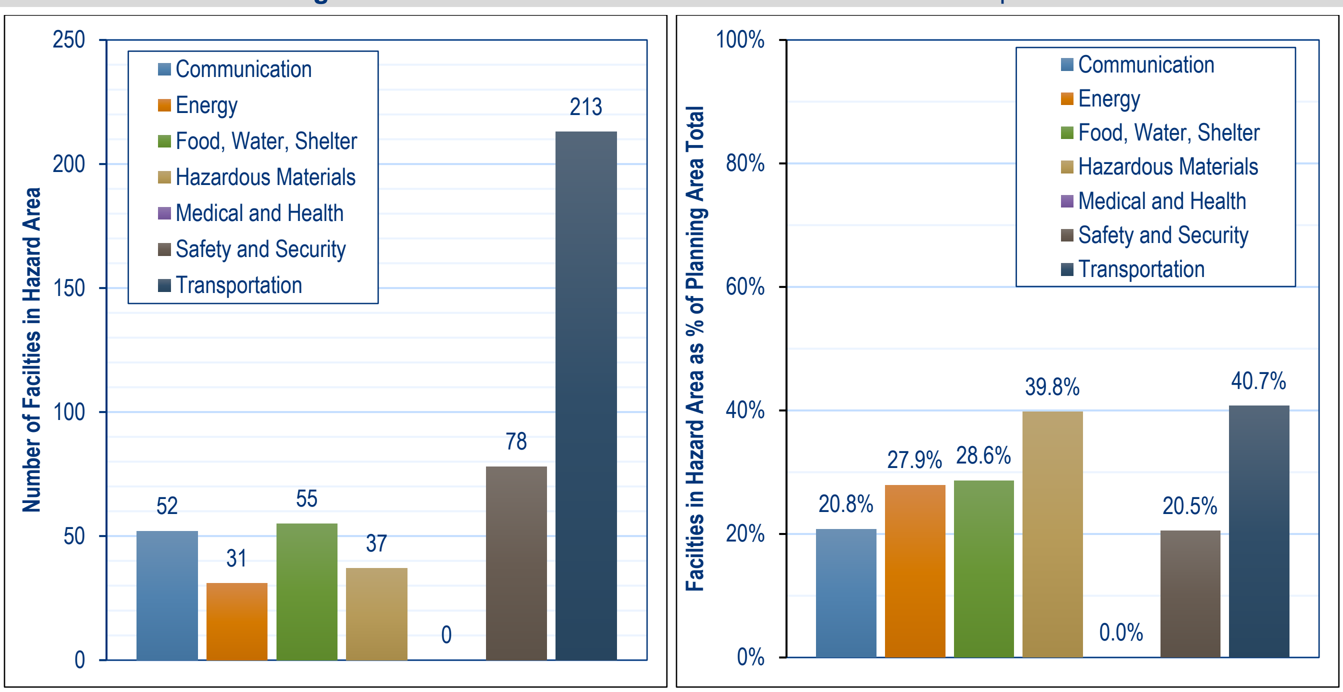


Figure 11-8. Critical Facilities in 0.2% Annual Chance Floodplain



11.3.4 Environment

Because floodplain management measures place restrictions on development in areas affected by flooding, floodplains often have a higher portion of area that is undeveloped open space or natural area. These undeveloped areas represent environment exposed to the flood hazard.

11.4 VULNERABILITY

The results of the vulnerability assessment indicate estimated damage for the 1-percent, and 0.2-percent-annual-chance flood hazards. Detailed results by jurisdiction are included in Appendix D; countywide summaries are provided below.

11.4.1 Population

Flood impacts on persons and households were estimated for each event through the Level 2 Hazus analysis. Table 11-8 summarizes the results.

Table 11-8. Estimated Flood Impacts on Persons and Households

	Number of Persons Displaced	Number of Persons Requiring Short-Term Shelter
1% Annual Chance Flood Zone	10,829	785
0.2% Annual Chance Flood Zone	117,102	8,221

11.4.2 Property

Table 11-9 summarizes Hazus estimates of flood damage in the planning area. The debris estimate includes only structural debris and building finishes; it does not include additional debris that may result from a flood event, such as from trees, sediment, building contents, bridges, or utility lines.

Table 11-9. Estimated Impact of a Flood Event in the Planning Area

Damage Type	1% Annual Chance Flood Zone	0.2% Annual Chance Flood Zone
Structure Debris (Tons)	96,710	396,325
Buildings Impacted	7,885	27,662
Total Value (Structure + Contents) Damaged	$743,893,665	$5,725,626,424
Damage as % of Total Replacement Value	0.4%	3.2%

11.4.3 Critical Facilities

Significant facilities predicted by Hazus to be affected by the 1 percent-annual-chance flood include the following:

- 1 water reclamation plant
- 11 hazardous material sites
- 1 airport
- 11 schools
- 2 fire stations
- 105 road bridges

Estimated Damage

Hazus was used to estimate the number of critical facilities affected by flooding and the resulting percent of damage to the building and contents. Figure 11-9 compares the predicted number of affected facilities to the number of exposed facilities, for the 1 percent and 0.2 percent-annual chance flood events. Results for the 1 percent-annual-chance-event are as follows:

- All exposed facilities in the hazardous materials and safety/security categories are predicted to experience some damage
- For all other categories with exposure, between 30 and 70 percent of exposed facilities are predicted to experience some damage

Figure 11-10 shows the estimated damage to critical facilities for both modeled flood events. For the 1 percent-annual-chance-event, the average amount of damage to structures, measured as a percentage of total value, ranges from 1.4 to 17.1 percent of total value and average damage to contents ranges from 11.6 to 47.1 percent, depending on critical facility category.

Figure 11-9. Facilities Exposed to and Affected by the 1% and 0.2% Annual Chance Floods

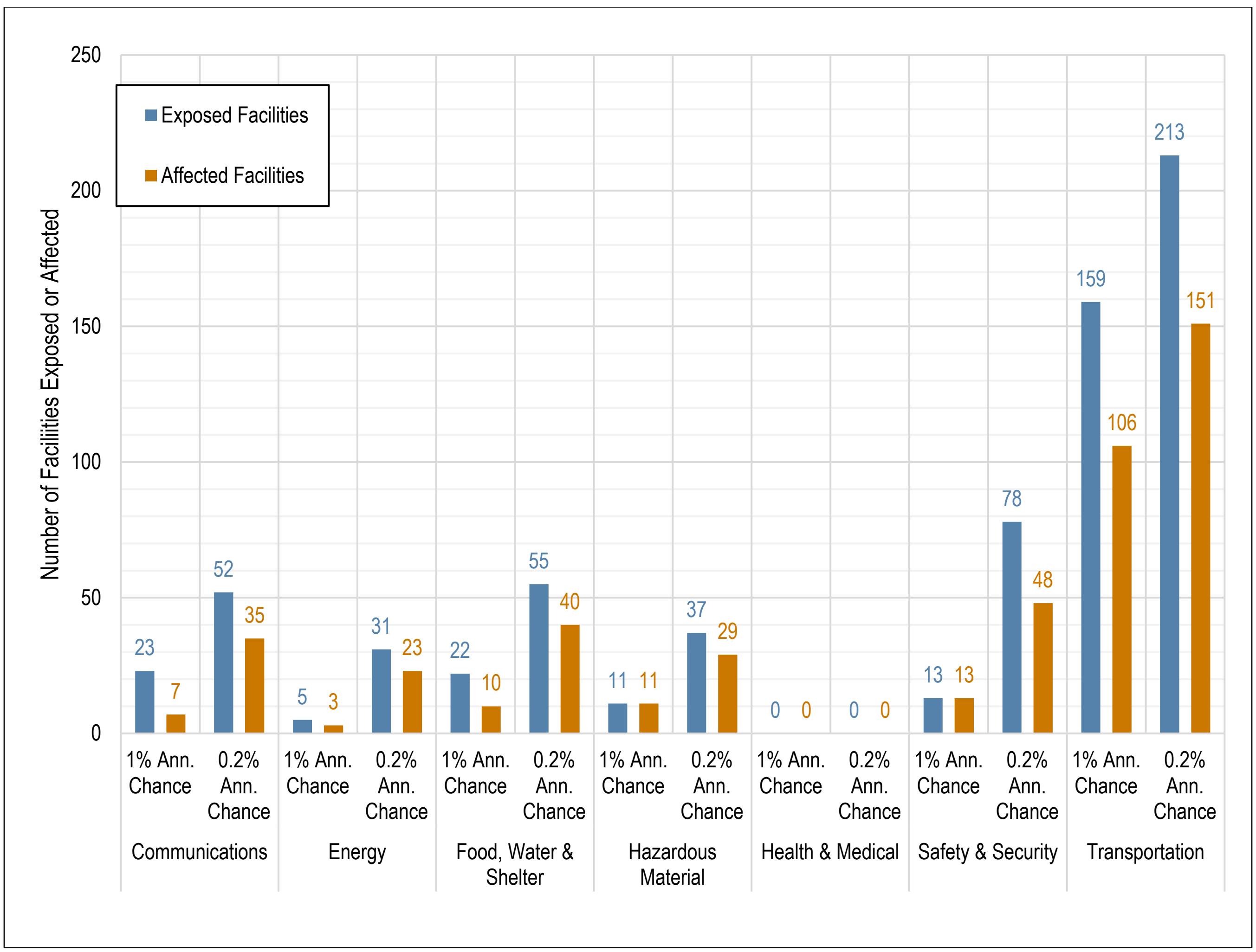
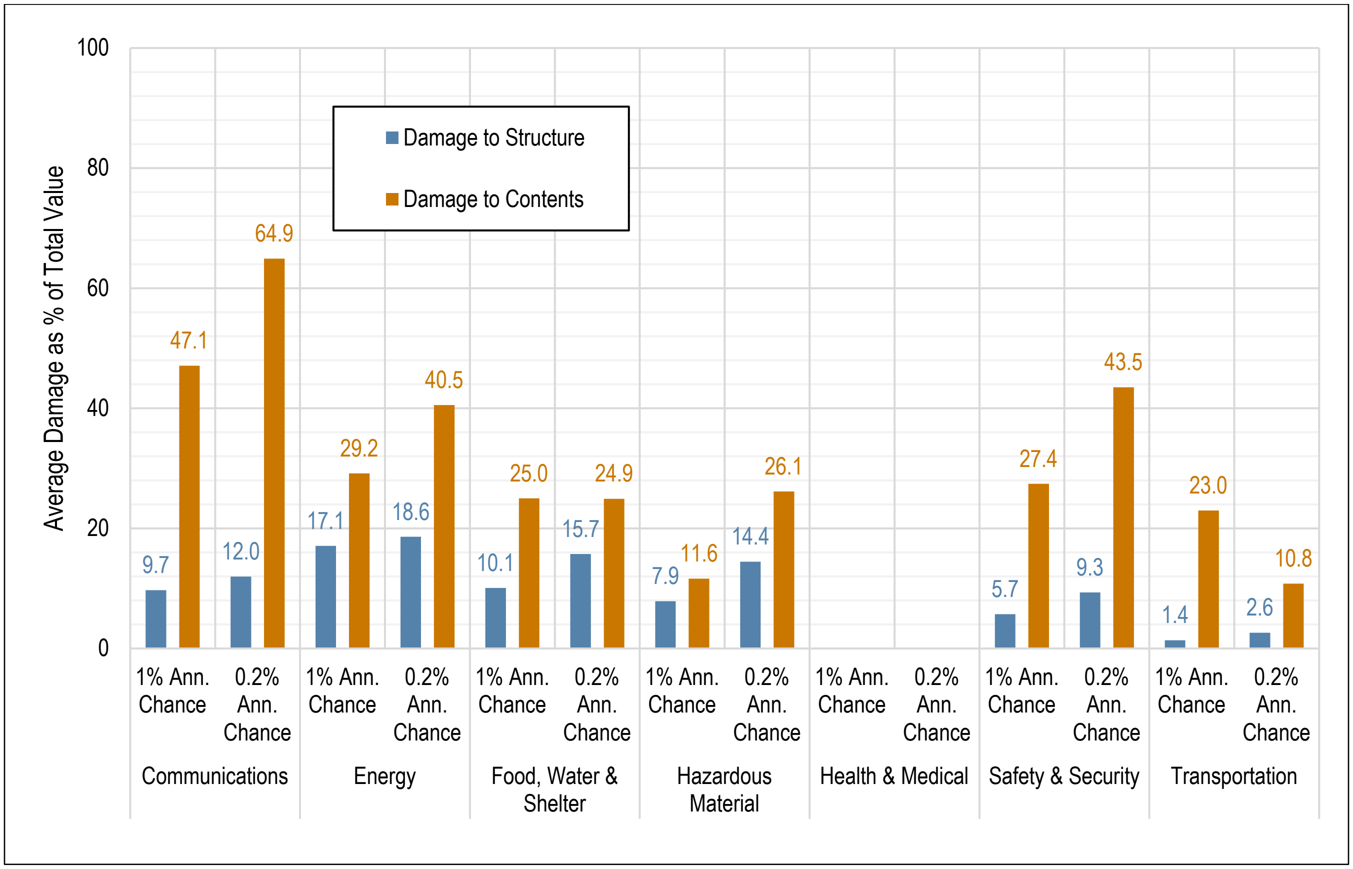


Figure 11-10. Average Damage to Critical Facilities from 1% and 0.2% Annual Chance Floods



Impacts on Hazardous Materials

During a flood event, containers holding hazardous materials can rupture and leak into the surrounding area. These facilities could release chemicals that cause cancer or other human health effects, significant adverse acute human health effects, or significant adverse environmental effects.

Impacts on Utilities and Infrastructure

Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Underground utilities can be damaged. Levees can fail or be overtopped, inundating the land that they protect. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers, and streams.

11.4.4 Environment

Flooding can impact the environment in negative ways. Migrating fish can wash into roads or over dikes into flooded fields, with no possibility of escape. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development, such as bridge abutments, levees, or logjams from timber harvesting, can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

Many species of mammals, birds, reptiles, amphibians, and fish live in the planning area in plant communities that are dependent upon streams, wetlands, and floodplains. Wildlife and fish are impacted when plant communities are eliminated or fundamentally altered to reduce habitat. Since water supply is a major limiting factor for many animals, riparian communities are of special importance.

Loss estimation platforms such as Hazus are not currently equipped to measure environmental impacts of flood hazards. The best gauge of vulnerability of the environment would be a review of damage from past flood events. Loss data that segregates damage to the environment was not available at the time of this plan. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future updates.

11.5 SCENARIO

The major river systems in Ventura County flood at irregular intervals, but generally in response to a succession of intense winter rainstorms. Storm patterns of warm, moist air usually occur between early November and late March. A series of such storms can cause severe flooding in Ventura County. The worst-case scenario is a series of storms that flood numerous drainage basins in a short time. This would overwhelm local response and floodplain management departments. Major roads would be blocked, preventing access for many residents and critical functions. High river flows could cause rivers to scour, possibly washing out roads and creating more isolation problems. In the case of multi-basin flooding, the county would not be able to make repairs quickly enough to restore critical facilities.

11.6 ISSUES

The planning team has identified the following flood-related issues relevant to the planning area:

- Accuracy of existing flood hazard mapping by FEMA regarding true flood risk within the planning area is questionable. This is most prevalent within areas protected by levees not accredited by the FEMA mapping process.
- Extent of flood protection currently provided by flood control facilities (dams, dikes, and levees) is not known due to lack of established national policy on flood protection standards.
- The levee system within the planning area is not consistently adequate to mitigate effects of a 1 percent-annual-chance flood.
- Risk associated with the flood hazard overlaps risks associated with other hazards such as earthquakes, landslides, and coastal erosion. This provides opportunity to seek mitigation alternatives with multiple objectives that can reduce risks from multiple hazards.
- Land-use practices are not consistent with the scope of regulatory floodplain management within the planning area.
- How climate change will affect flood conditions in Ventura County is uncertain.
- More information is needed regarding flood risk to support the concept of risk-based analysis of capital projects.

- To determine cost-effectiveness of future mitigation projects, sustained effort is necessary to gather damage reports and historical damage data such as high-water marks on structures.
- Ongoing flood hazard mitigation will require funding from multiple sources.
- A coordinated hazard mitigation effort is necessary among jurisdictions affected by flood hazards within the County.
- Floodplain residents must continue to seek and receive information about flood preparedness and resources available during and after floods.
- The concept of residual risk should be considered in design of future capital flood control projects and should be communicated to residents living in the floodplain.
- Promotion of flood insurance as a means of protecting private property owners from economic impacts of frequent flood events should continue.
- Existing floodplain-compatible uses such as agricultural and open space must be maintained. Pressure is constant to convert these existing uses to more intense uses within the planning area during times of moderate to high growth.
- The economy affects a jurisdiction’s ability to manage its floodplains. Budget cuts and personnel losses can strain resources needed to support floodplain management.

12. LANDSLIDE

12.1 GENERAL BACKGROUND

A landslide is a mass of rock, earth or debris moving down a slope. Landslides may be minor or large and can move at slow to very high speeds. Mudslides are rivers of rock, earth, organic matter, and other soil materials saturated with water. They develop in the soil overlying bedrock on sloping surfaces when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt.

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

In spite of their destructive potential, landslides can serve beneficial functions to the natural environment. They supply sediment and large wood to the channel network and can contribute to complexity and dynamic channel behavior critical for aquatic and riparian ecological diversity.

12.1.1 Landslide Causes

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

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

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

12.1.2 Landslide Risk Areas

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

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

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

12.1.3 Secondary Hazards

Landslides that block rivers or streams can contribute to flooding.

12.2 HAZARD PROFILE

12.2.1 Past Events

Table 12-1 lists known landslide events that affected Ventura County between 1995 and 2021.

Table 12-1. Landslide Events in the Planning Area

Date	Event Type	FEMA Declaration Number	Location
March 8, 2016	Mudslide	N/A	Solimar
Losses/Impacts: Near the Solimar burn area, heavy rain produced a mud and debris flow across Highway 101.			
December 2014	Landslide, Mudslide	N/A	Camarillo Springs
Losses/Impacts: Heavy rains destabilized the wildfire char area above Camarillo Springs. 13 homes were damaged and considered uninhabitable.			
February 16 – 23, 2005	Severe Storms, Flooding, Landslides, and Mud and Debris Flows	DR-1585	Ventura County
Losses/Impacts: Seven Southern California counties were included in the declaration.			
Winter 2005	Landslide, Debris Flow, Severe Storm	N/A	West of Santa Paula
Losses/Impacts: A large landslide that transformed into a debris flow and smaller landslides was triggered by strong winter storms			
January 10, 2005	Landslide	N/A	La Conchita
Losses/Impacts: The landslide occurred at the end of a 15-day period that produced record and near-record amounts of rainfall in many areas of southern California. It consisted of a remobilization of a portion of the 1995 landslide deposit. It destroyed 13 homes and severely damaged 23 others. Ten people died.			
Dec. 27, 2004 – Jan. 11, 2005	Severe Storms, Flooding, Debris Flows, and Mudslides	DR-1577	Ventura County
Losses/Impacts: Eight Southern California counties were included in the declaration.			
March 4, 1995	Landslides, Debris Flow, Severe Storm	N/A	La Conchita
Losses/Impacts: After seasonal rainfall approximately twice the normal amount, the hill behind La Conchita failed, destroying or severely damaging nine homes. Several days later, debris flows from a canyon to the northwest damaged five additional homes.			
February 13 – April 19, 1995	Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1046	Ventura County
Losses/Impacts: All California counties except Del Norte were included in this declaration. More than 100 stations recorded their greatest ever 1-day rainfall total.			
Jan. 3 – Feb. 10, 1995	Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1044	Ventura County
Losses/Impacts: 42 California counties were included in this declaration.			

Source: USGS 2005, TWC 2015, FEMA 2021

The bluff above La Conchita, which is underlain by two rock formations separated by the Red Mountain fault, has been associated with a variety of landslide activity. Historical accounts date back to 1865. More recently, two small slides occurred in 1988 and 1991, followed by large movements in 1995 and 2005. The 1995 landslide, which occurred one month after the heaviest rainfall of an extraordinarily wet year, was considered to be a deep, slow-moving landslide. This landslide destroyed nine houses. The January 2005 event was a shallow and highly fluid remobilization of the same material that carried a thick layer of dry, viscous material. This landslide, which occurred at the peak of an extremely wet two-week period, killed 10 people and destroyed 13 homes. Approximately 400,000 tons of debris cascaded down the slope behind the La Conchita housing development.

12.2.2 Location

In 2011, the California Geological Survey conducted a statewide analysis using a combination of regional rock strength and slope data to create classes of susceptibility to deep-seated landslides. The analysis assumed, in general, that susceptibility to deep-seated landslides is low on very low slopes in all rock materials and increases with slope and in weak rocks. The analysis also factored in locations of past landslides. Figure 12-1 shows deep-seated landslide susceptibility classes (none, low, moderate, high, and very high).

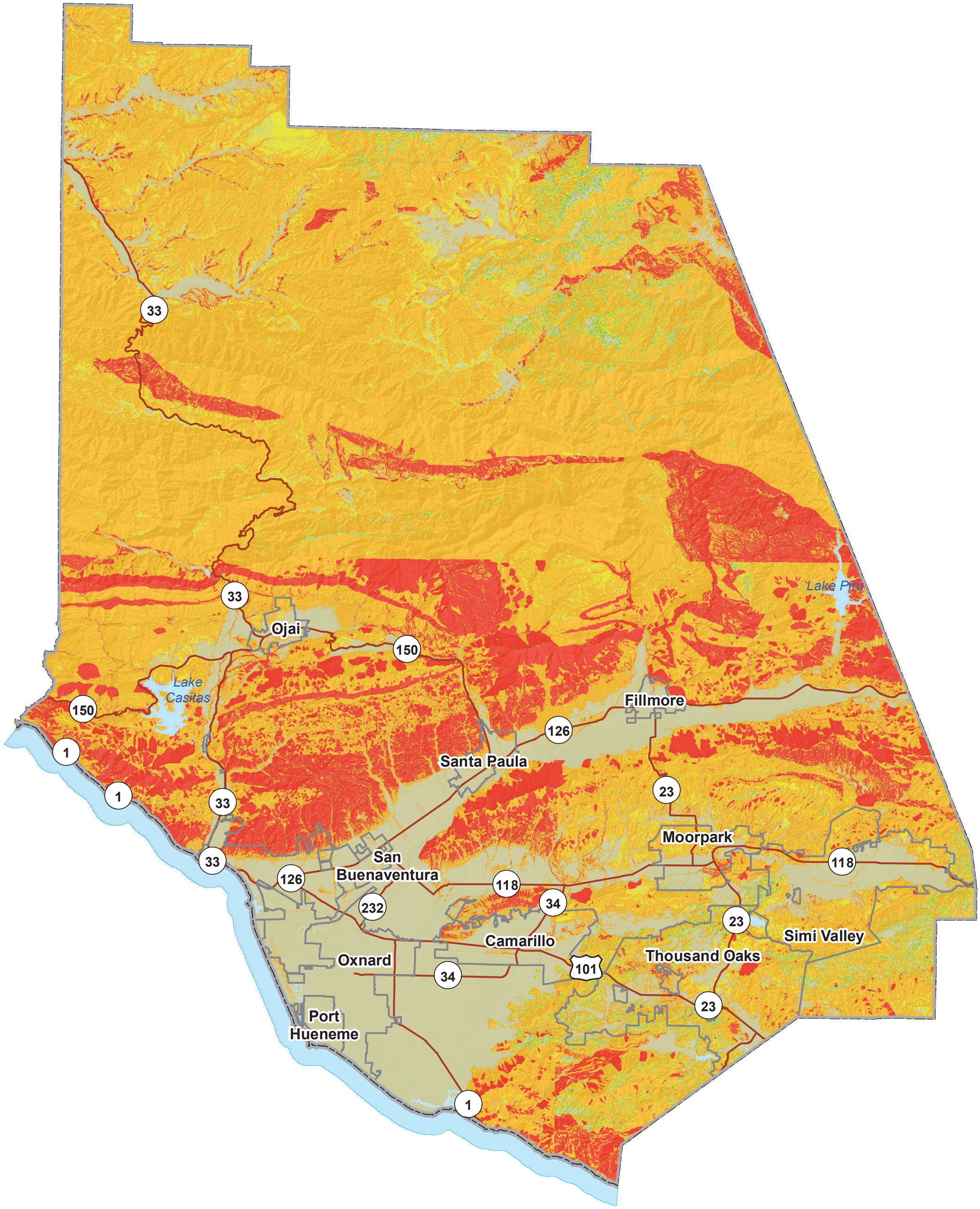
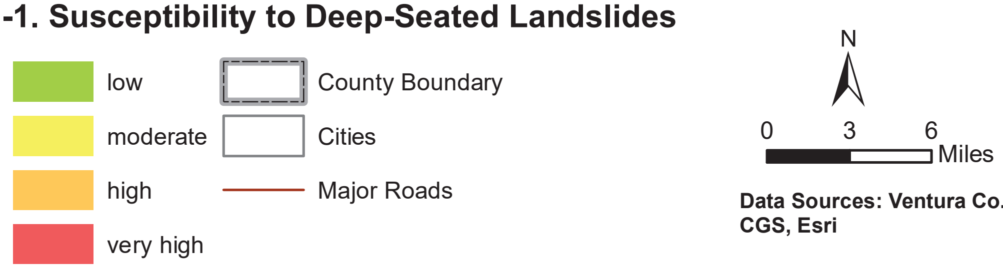


Figure 12-1. Susceptibility to Deep-Seated Landslides



Data Sources: Ventura Co., CGS, Esri

Landslides have occurred in areas along the Rincon Fault and on hillsides south of the Santa Clara River and east of the Ventura River. The most damaging recent landslides in Ventura County occurred in the coastal community of La Conchita, just southeast of the Santa Barbara county line. La Conchita has been the site of multiple non-earthquake-induced landslides. The community was built on ground that had been graded by the Southern Pacific Railroad after a 1909 landslide slid into the railroad tracks. The land was intended to be a buffer zone between the retreating and eroding cliff and the Pacific Ocean, but it was subdivided into residential lots in 1924.

12.2.3 Frequency

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

The probability of a landslide event occurring in the County in any given year is high. Table 12-1 lists nine landslide events in the County between 1995 and 2021. Federal disaster declarations were issued for four of these—an average of one such major event every six years.

12.2.4 Severity

Landslides destroy property and infrastructure and can claim human lives. They have the potential of destabilizing the foundation of structures, which may result in monetary loss for residents. Slope failures in the United States result in an average of 25 to 50 lives lost per year (U.S. Geological Survey 2020). Over the past 26 years, 10 lives have been lost in Ventura County from slope failures. Slides can pose a serious hazard to properties on or below hillsides. They can block access to roads, which can isolate residents and businesses and delay commercial, public, and private transportation. This can result in economic losses for businesses. Trees or utility poles on slopes can be knocked over, resulting in possible losses to power and communication lines. Landslides also can damage rivers or streams, potentially harming water quality, fisheries, and spawning habitat.

12.2.5 Warning Time

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

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements, or sidewalks
- Soil moving away from foundations
- Ancillary structures such as decks and patios tilting or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities

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

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

12.3 EXPOSURE

A quantitative assessment of exposure to the mass movement/landslide hazard was conducted using the landslide hazard mapping and the asset inventory developed for this plan, with an emphasis on the zones with the highest degree of susceptibility (Zones V through X). Detailed results by jurisdiction are provided in Appendix D. Results for the whole planning area are presented in the sections below.

12.3.1 Population

Population exposure was estimated by calculating the number of buildings in each hazard area as a percent of total planning area buildings, and then applying this percentage to the estimated planning area population. Table 12-2 summarizes the estimated countywide population living in the mapped landslide risk areas.

Table 12-2. Exposed Population in Mapped Landslide Hazard Zones

	Moderate Landslide Risk (Susceptibility Categories V and VI)	High Landslide Risk (Susceptibility Categories VII, VIII, IX)	Very High Landslide Risk (Susceptibility Category X; Includes existing landslides)
Population Exposed	35,958	151,866	12,500
% of Total Planning Area Population	4.3%	18.0%	1.5%

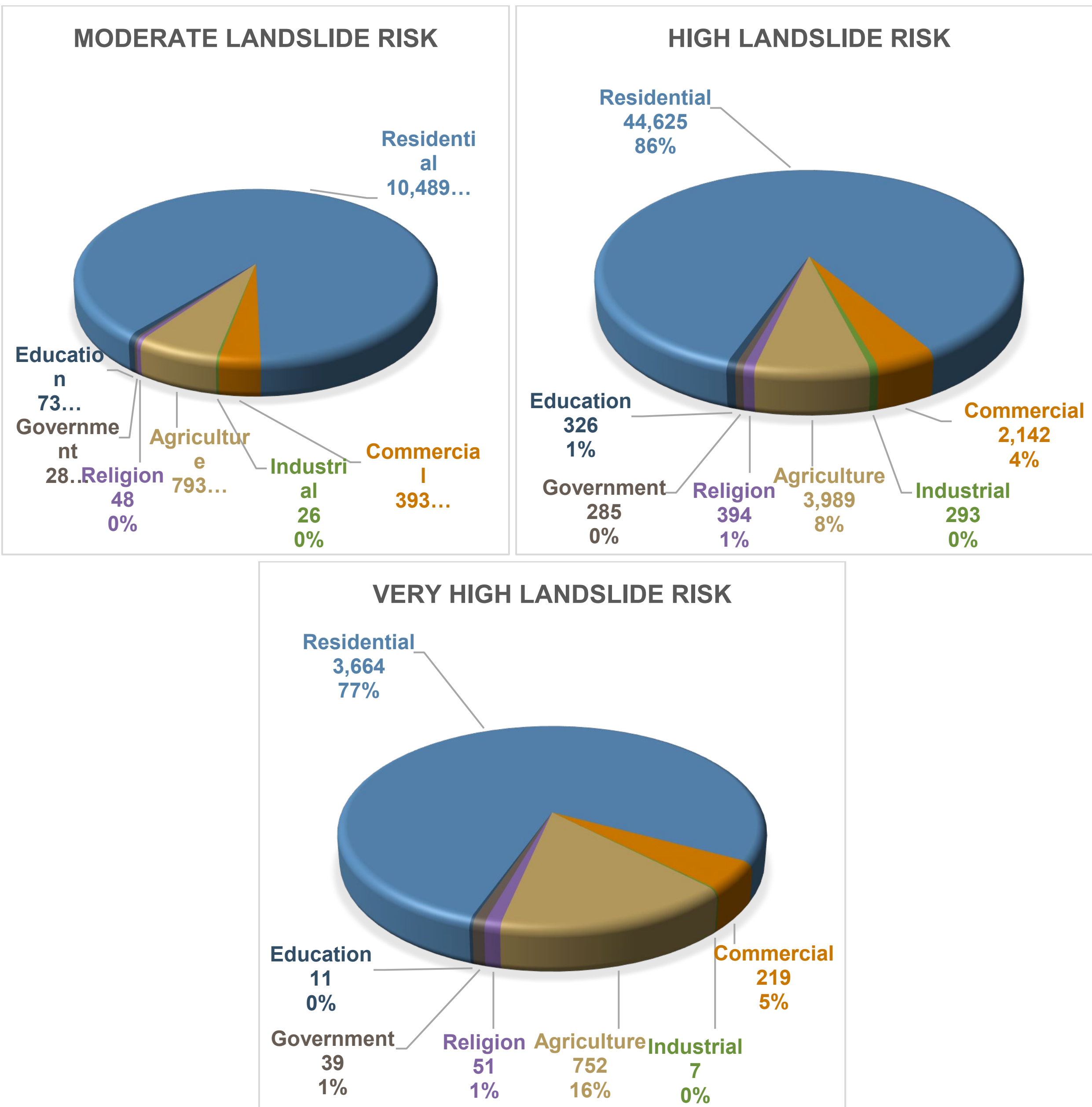
12.3.2 Property

Table 12-3 summarizes the estimated property exposure in the evaluated landslide hazard areas. Figure 12-2 shows the occupancy class defined by Hazus for all buildings in the mapped landslide hazard areas. These occupancy classes provide an indication of land use within the mapped hazard area. Some land uses are more vulnerable to landslides, such as single-family homes, while others are less vulnerable, such as agricultural land or parks.

Table 12-3. Exposed Property in Mapped Landslide Hazard Zones

	Moderate Landslide Risk (Susceptibility Categories V and VI)	High Landslide Risk (Susceptibility Categories VII, VIII, IX)	Very High Landslide Risk (Susceptibility Category X; Includes existing landslides)
Number of Buildings Exposed	11,850	52,054	4,743
Value of Exposed Structures	$4,978,606,389	$20,201,170,128	$1,802,233,448
Value of Exposed Contents	$2,924,877,062	$12,899,948,351	$1,122,397,897
Total Exposed Property Value	$7,903,483,451	$33,101,118,479	$2,924,631,346
Total Exposed Value as % of Planning Area Total	*4.4%*	*18.3%*	*1.6%*

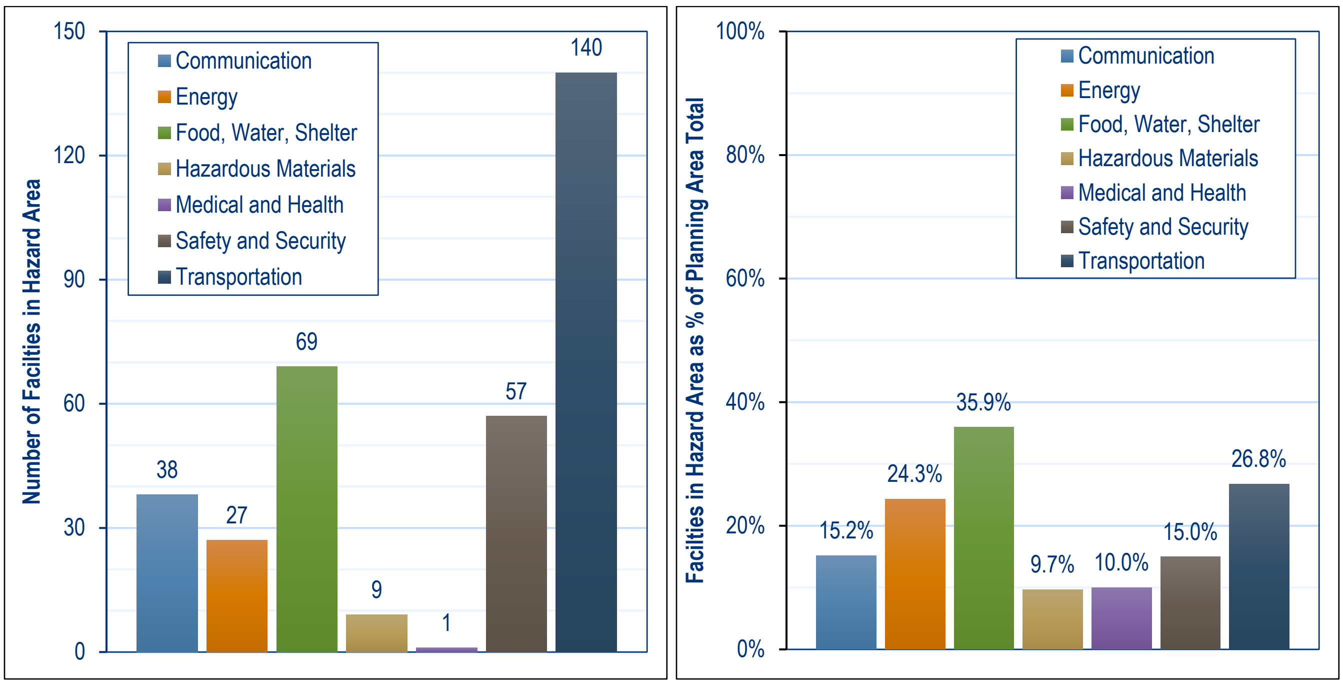
Figure 12-2. Building Occupancy Classes in the Mapped Landslide Hazard Zones



12.3.3 Critical Facilities

Figure 12-3 shows critical facilities located in the high or very high landslide risk areas, by facility type. The total count of critical facilities in these risk areas (341) represents 22 percent of the planning area total of 1,559. A breakdown by municipality is provided in Appendix D.

Figure 12-3. Critical Facilities in High or Very High Landslide Risk Areas



12.3.4 Environment

All natural areas within the high susceptibility zones for landslide are considered to be exposed to the hazard.

12.4 VULNERABILITY

Vulnerability estimates for the landslide hazard are described qualitatively. No loss estimation of these facilities was performed because damage functions have not been established for the landslide hazard.

12.4.1 Population

All people exposed the landslide hazard are potentially vulnerable to landslide impacts. Populations with access and functional needs as well as elderly populations and the very young are more vulnerable to the landslide hazards as they may not be able to evacuate quickly enough to avoid the impacts of a landslide.

12.4.2 Property

Estimates of potential losses associated with landslides were developed representing 10 percent, 30 percent, and 50 percent of the replacement value of structures exposed to the landslide hazard. This allows emergency managers to assess potential economic impact based on assumptions about the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure.
Table 12-4 shows potential losses in the areas with the highest degree of landslide susceptibility.

Table 12-4. Loss Estimation for Landslide

	Exposed Value (Structure Only)	Loss Value	Loss as % of Total Planning Area Replacement Value
Moderate Landslide Susceptibility Zone			
Loss = 1% of Exposed Value	$4,978,606,389	$49,786,064	0.03%
Loss = 10% of Exposed Value		$497,860,639	0.28%
Loss = 30% of Exposed Value		$1,493,581,917	0.83%
Loss = 50% of Exposed Value		$2,489,303,195	1.38%
High Landslide Susceptibility Zone			
Loss = 1% of Exposed Value	$20,201,170,128	$202,011,701	0.11%
Loss = 10% of Exposed Value		$2,020,117,013	1.12%
Loss = 30% of Exposed Value		$6,060,351,038	3.35%
Loss = 50% of Exposed Value		$10,100,585,064	5.59%
Very High Landslide Susceptibility Zone			
Loss = 1% of Exposed Value	$1,802,233,448	$18,022,334	0.01%
Loss = 10% of Exposed Value		$180,223,345	0.10%
Loss = 30% of Exposed Value		$540,670,034	0.30%
Loss = 50% of Exposed Value		$901,116,724	0.50%

12.4.3 Critical Facilities

There are 341 critical facilities exposed to the landslide hazard to some degree. An in-depth analysis of mitigation measures taken by these facilities should be completed to evaluate whether they could withstand impacts of a landslide. No loss estimates were developed as a result of the lack of established damage functions for the landslide hazard.

12.4.4 Environment

Environmental problems as a result of landslides can be numerous. A landslide alters the landscape. In addition to changes in topography, vegetation and wildlife habitats may be damaged or destroyed, and soil and sediment runoff will accumulate downslope, potentially blocking waterways and roadways and impairing the quality of streams and other water bodies. Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost for prolonged periods of time due to landslides.

12.5 SCENARIO

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

Landslides are becoming a greater concern as development moves outside of city centers and into areas with less developed infrastructure. Most landslides would be isolated events affecting specific areas. It is probable that private and public property, including infrastructure, would be affected. Landslides could affect bridges that pass over landslide-prone ravines and knock out rail service through the County. Road obstructions caused by landslides would create isolation problems for residents and businesses in sparsely developed areas. Property owners exposed to steep slopes may suffer damage to property or structures. Landslides carrying vegetation such as shrubs and trees may cause a break in utility lines, cutting off power and communications to residents.

Continued heavy rains and flooding would complicate the problem further. As emergency response resources are applied to problems with flooding, it is possible they will be unavailable to assist with landslides across Ventura County.

12.6 ISSUES

Important issues associated with landslides in the planning area include the following:

- The data and science regarding mapping and assessing landslide hazards are constantly evolving. As new data and science become available, assessments of landslide risk should be re-evaluated.
- The impact of climate change on landslides is uncertain. If climate change affects atmospheric conditions, the exposure to landslide risks in Ventura County could increase.
- There are existing homes in landslide risk areas throughout the County. The degree of vulnerability of these structures depends on the codes and standards applied in constructing the structures.
- Future development could lead to more homes in landslide risk areas.
- Landslides may cause negative environmental consequences, including water quality degradation.
- The risk associated with the landslide hazard overlaps the risk associated with other hazards, including earthquake, flooding, and wildfire. The County has an opportunity to seek mitigation alternatives with multiple objectives that can reduce risk for multiple hazards.

13. SEA-LEVEL RISE AND COASTAL EROSION

13.1 GENERAL BACKGROUND

13.1.1 Coastal Erosion

Coastal erosion occurs when strong wave action, coastal floods, and local sea-level rise wear away rocks, soil, and sand along a coastline. In the United States, coastal erosion causes roughly $500 million in property loss each year. Coastal erosion affects all shorelines, but erosion rates and potential impacts are highly localized (U.S. Climate Resilience Toolkit 2021). Coastal erosion can exacerbate high surf or tsunami/run-up incidents along coast flood zones subject to wave action. Coastal erosion includes:

- Beach erosion, when sand is carried away from a beach and deposited farther from shore
- Dune erosion, when sand or sediment not normally affected by wave action is carried away from land and deposited farther from shore

Low air pressure during a storm causes an immediate rise in sea level above predicted tides, referred to as storm surge. It also increases wind activity, generating erosive waves on top of the already high sea level. This combination of factors can cause widespread damage in coastal areas. Sandy beaches and dunes are at risk from inundation and erosion related to sea-level rise and climate change-induced storms (The Nature Conservancy 2021a).

The following human activities may increase coastal erosion:

- Shoreline hardening such as building seawalls, which may protect land directly behind the structure but can accelerate coastal erosion on the waterward side of the structure due to scouring.
- Dune leveling for development, which removes the natural protection from high waves and sea-level rise.
- Canalization to control flash flooding, which may trap sand in coastal channel mouths. Accumulated sand may be removed offsite, leaving a deficiency in the immediate beach area.
- Salt mining

13.1.2 Sea-Level Rise

Sea-level rise will increase the risk of erosion and the adverse impacts of storm surge and high waves. Short-term variations in sea level occur daily as a result of waves, tides, or specific flood events. Long-term variations in sea level occur over various time scales, from monthly to yearly, and may be repeatable cycles, gradual trends, or intermittent differences. Seasonal weather patterns, changes in coastal and ocean circulation, anthropogenic influences, vertical land motion, and other factors may influence changes in the sea level over time. When sea level trends are estimated, a minimum of 30 years of data are used to account for long-term sea level variations and reduce errors in computing sea level trends based on the monthly mean sea level (National Oceanic and Atmospheric Administration 2021).

The two major causes of sea-level rise are thermal expansion caused by the warming of the oceans and loss of land-based ice (glaciers and polar ice caps) through increased melting. A steady increase in global atmospheric temperature creates an expansion of saltwater molecules, increasing ocean volume. The melting of glaciers and continental ice masses contributes significant amounts of freshwater to the earth's oceans. Ice-mass loss has caused twice as much sea-level rise since 1900 as has thermal expansion. The acceleration in sea-level rise since the 1970s has resulted from the combination of thermal ocean expansion and increased ice-mass loss from Greenland (Frederikse, et al. 2020).

There are two types of sea level: global and relative. Global sea level refers to the average sea level worldwide. Global sea level has been rising over the past century, and the rate has increased in recent decades. In 2014, global sea level was 2.6 inches above the 1993 average—the highest annual average change in the satellite record (1993 to present). Sea level continues to rise at a rate of about one-eighth of an inch per year (National Oceanic and Atmospheric Administration 2021).

Local sea level refers to the height of water measured along the coast relative to a specific point on land. The heights of both the land and water are changing, so the land-water interface can vary spatially and temporally and must be defined over time. Measurements at any given tide station include the effects of both global sea-level rise and vertical land motion (subsidence, glacial rebound, or large-scale tectonic motion). Water level measurements at tide stations are referenced to stable vertical points on the land, and a known relationship is established. Changes in local sea level over time are typically the most critical sea level trend for coastal applications such as coastal mapping, marine boundary delineation, coastal zone management, coastal engineering, and sustainable habitat restoration (National Oceanic and Atmospheric Administration 2021).

13.1.3 Secondary Hazards

Loss of beaches due to erosion and sea-level rise can have negative impacts on ecosystems, native species, cultural and historical sites, recreation, subsistence practices, and tourism.

13.2 HAZARD PROFILE

13.2.1 Past Events

Coastal Erosion

Known coastal erosion events affecting Ventura County between 1980 and 2021 are identified in Table 13-1.

Table 13-1. History of Coastal Erosion Events

Date	Event Type	FEMA Declaration Number	Location
January 2021	Coastal Erosion	N/A	Surfer's Point, City of San Buenaventura
Losses/Impacts:	The 2021 damage was more than anticipated, as relatively calm conditions were predicted with "La Niña" conditions dominating the Pacific Ocean. However, an anomalous storm track developed producing a series of large swell events during the entire month of January, some coinciding with the year's highest tides. Erosion undermined the bike path and several parking spaces.		
February 2014	Coastal Erosion	N/A	Port Hueneme
Losses/Impacts:	14 feet of sand washed away during the month of February		
February 27, 2010	Tsunami, Coastal Erosion	N/A	Ventura Harbor
Losses/Impacts:	Tsunami waves in excess of 3 feet affected the coastal areas of Ventura County. At Ventura Harbor, the tsunami damaged at least 21 docks, displaced several buoys, and produced some significant beach erosion.		

Sources: KABC 2014, venturariver.org 2021, NOAA 2021

The beaches south of Channel Islands Harbor are subject to continual erosion. Every two years, the harbor is dredged to remove sand that has accumulated from beach erosion and sand migration. The sand is used to replenish eroded sand at Port Hueneme Beach (U.S. Army Corps of Engineers 2021).

The City of San Buenaventura has had ongoing erosion at Surfer's Point, a popular surfing spot adjacent to the mouth of the Ventura River. A California State Park bike path along the shoreline and an adjacent county fairground parking lot have also experienced frequent damage from erosion. To protect the point, the City placed boulders in the 1980s above the mean high tide line. The project ended up exacerbating erosion further down the coast and the fairground parking lot and bike path have continued to erode into the ocean; in some places more than 60 feet of land have been lost (Georgetown Climate Center 2011). The Surfers' Point Managed Shoreline Retreat Project has since pulled existing structures inland to make room for natural beach processes. Though the situation has improved, rising sea levels will continue to threaten the beach (U.S. Climate Resilince Toolkit 2021).

Sea-Level Rise

The average annual mean sea level recorded by NOAA at the Los Angeles station for 1950 was 2.5955 feet. By 2020, the elevation had risen to 2.9724 feet. This represents a sea-level rise of more than 4.5 inches in 70 years (National Oceanic and Atmospheric Administration 2021).

13.2.2 Location

Ninety-three percent of Ventura County's shoreline consists of sandy beaches. Sea-level rise and coastal erosion are likely to affect all coastal areas of the county. The North Coast beaches are highly vulnerable to erosion and wave damage. Dredging operations in Santa Barbara Harbor alter sand transport down coast. Without adequate replacement sand, high tides and waves erode the beaches. The Central Coast is subject to erosion during periods of high tides and wave action. Major erosion occurs on the South Coast during winter, including nearly 2 feet of annual erosion at Sycamore Beach (Ventura County 2020). The Our Coast Our Future sea-level rise data was used in the risk assessment for this hazard mitigation plan. The data indicate sea-level rise inundation areas for a sea-level rise of 25 centimeters and 100 centimeters. The mapped inundation areas for these two scenarios (25-cm SLR and 100-cm SLR) are shown on Figure 13-1 and Figure 13-2.

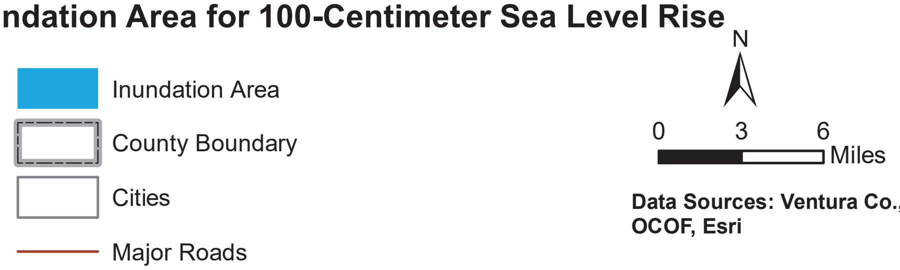
Figure 13-1. Estimated Inundation Area for 25-Centimeter Sea Level Rise

Inundation Area
County Boundary
Cities
Major Roads

N
0 3 6 Miles

Data Sources: Ventura Co., OCOF, Esri

Figure 13-2. Estimated Inundation Area for 100-Centimeter Sea Level Rise



Data Sources: Ventura Co., OCOF, Esri

13.2.3 Frequency

Coastal erosion results from storms and flooding, which typically occur in California in winter (November to April). Storm severity and frequency are influenced by climate patterns, most prominently the El Niño Southern Oscillation. Every two to seven years, the Southern Oscillation alternates between two phases—La Niña and El Niño. El Niño years generally result in persistently low air pressure, greater rainfall, and high winds. The water levels reached during these large, short-term events have exceeded mean sea levels projected for 2100, so understanding their additive effects is crucial for coastal planning. Individual erosion events are not regularly reported; however, according to the Ventura County General Plan 2040, many coastal areas experience annual beach erosion including:

- Faria Beach Park: 1.3 feet per year
- Emma Wood State Beach: 0.6 feet per year
- Point Mugu State Park, Sycamore Beach: 1.9 feet per year
- Point Mugu State Park, Solromar Beach: 0.9 feet per year

Sea-level rise is an ongoing phenomenon that will likely impact the frequency and severity of coastal storms. As sea-level rises, flooding from storms will become more frequent and potentially more hazardous.

13.2.4 Severity

Coastal erosion can destroy property and infrastructure and cause loss of human life. Erosion has the potential to destabilize the foundation of structures, which may result in monetary loss for residents. The collapse of coastal cliffs can be deadly, although it is unknown if any deaths have occurred in Ventura County as a result of coastal erosion.

The severity of sea-level rise to Ventura County will become greater over the next 30 to 80 years. The severity could be exacerbated by the following conditions:

- Daily tidal inundation—As sea-level rises, the amount of land and infrastructure subjected to daily inundation by high tides—also known as increases in mean higher high water—will increase. This would result in increased permanent future inundation of low-lying areas.
- Annual high tide inundation (King Tides)—King Tides are abnormally high, predictable astronomical tides that occur about twice per year. they are the highest tides that occur each year during the winter and summer when the Earth, moon and sun are aligned. Winter King Tides may be amplified by stormy weather, making them even more significant. King Tides result in temporary inundation associated with nuisance flooding, such as inundation of low-lying roads, boardwalks, and waterfront promenades.
- Extreme high tide inundation (storm surge)—When Pacific Ocean storms coincide with high tides, storm surge can elevate ocean levels and produce extreme high tides. Extreme high tides can cause severe inundation of low-lying roads, boardwalks, and promenades. They can exacerbate coastal and riverine flooding, cause upstream flooding, and interfere with stormwater outfalls.

13.2.5 Warning Time

Sea-level rise is not a hazard that requires near-term advance warning to support response and recovery operations. Programs such as the NOAA sea-level rise program are keeping an active watch on the sea-level rise phenomena to keep communities informed of its progression. This stream of information will feed programs to help the County to be prepared for and mitigate the long-term impacts from sea-level rise.

The timing of individual erosion events cannot be predicted, however general forecasting can be made about high surf conditions, which often result in advanced beach erosion. High surf warnings and high surf advisories are issued by the National Weather Service.

13.3 EXPOSURE

An analysis was performed using the 25-cm SLR and 100-cm SLR sea-level rise scenarios to estimate the potential exposure of resources within the planning area. Appendix D presents detailed exposure results for each coastal city in the planning area. County-wide summary results are presented in the sections below. Exposure analysis is not available for coastal erosion due to a lack of data.

13.3.1 Population

The planning team overlaid the sea-level rise projection data on the population and asset data developed for the hazard risk assessment for this plan. Results for the total planning area are presented in Table 13-2.

Table 13-2. Estimated Population Exposure for Sea-Level Rise

	25-cm SLR Scenario	100-cm SLR Scenario
Population Exposed	39	563
% of Total Planning Area Population	0.002%	0.07%

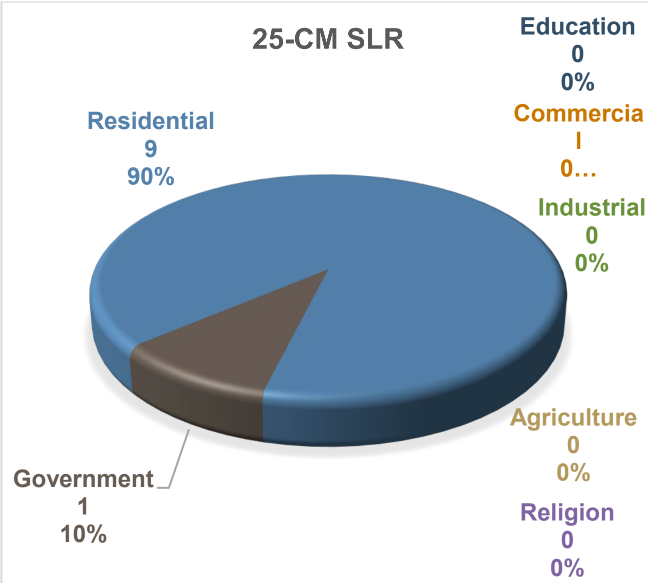
13.3.2 Property

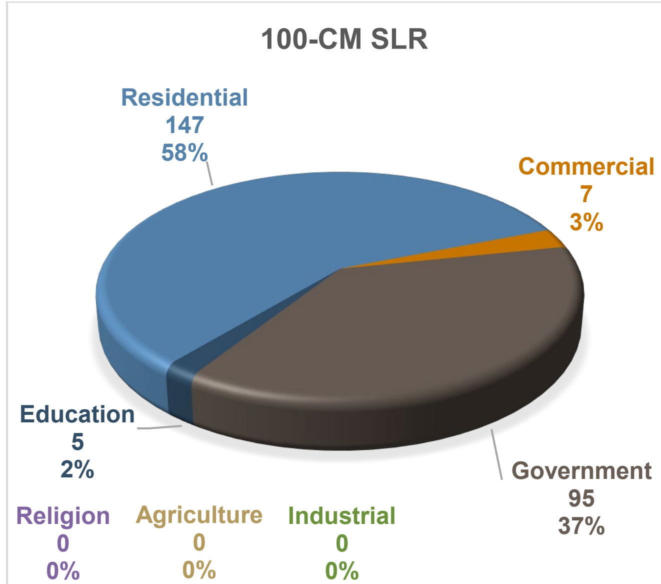
Results for property exposed to the sea-level rise hazard for the total planning area are presented in Table 13-3. Current land use distribution in the areas affected by sea-level rise, as represented by building occupancy class, is shown in Figure 13-3.

Table 13-3. Estimated Property Exposure for Sea-Level Rise

	25-cm SLR Scenario	100-cm SLR Scenario
Number of Buildings Exposed	10	249
Value of Exposed Structures	$15,774,103	$140,841,021
Value of Exposed Contents	$14,460,807	$121,450,187
Total Exposed Property Value	**$30,234,909**	**$262,291,208**
Total Exposed Value as % of Planning Area Total	***0.02%***	***0.15%***

Figure 13-3. Building Occupancy Classes in 25-cm and 100-cm Sea-Level Rise Exposure Areas





13.3.3 Critical Facilities

Hazus analysis identified only one critical facility within the mapped 25-cm sea-level rise inundation zone (a transportation facility) and only five within the mapped 100-cm sea-level rise inundation zone (four transportation facilities and one hazardous materials facility). A breakdown by municipality is provided in Appendix D.

13.3.4 Environment

All county beaches are vulnerable to the effects of sea-level rise and coastal erosion.

13.4 VULNERABILITY

No quantitative vulnerability analysis was performed for the sea-level rise and coastal erosion hazard. The following potential impacts were identified:

- Storm drainage systems may experience backups as a result of higher level of daily tidal flooding, especially if outfalls are located within sea-level rise inundation areas.
- Important coastal habitat may be lost as sea-level rise permanently inundates areas, or it may be damaged due to extreme tide and storm surge events.
- Saltwater intrusion into freshwater resources may occur, further altering habitat and ecosystems. Protective ecosystem services may be lost as land area and wetlands are permanently inundated.
- Residents of homes exposed to coastal erosion are vulnerable to this hazard.

Sea-level rise will have an impact on Ventura County's coastal ecosystems. Aquatic ecosystems located in creeks, streams, and estuaries along the coast, many containing a range of sensitive species of plants and animals, will need to adapt to changes in water quality from saltwater intrusion/incursion further upstream. The beneficial services that coastal ecosystems provide, such as flood protection, water filtration, and support for fisheries, will be threatened as rising sea levels expose beach, dune, estuarine, and freshwater habitats. Natural resources, such as cobble, sand, and dunes that have been overlooked for coastal planning will be increasingly necessary to hold and maintain the County's beaches for sea-level rise adaptation (Ventura County 2020).

Erosion and associated secondary hazards will likely have some of the most damaging effects on the environment. Coastal habitats are critical to the natural environment, society, and economy, and their loss has compounding effects on the vulnerability of the community at large.

13.5 SCENARIO

The worst-case scenario would be high wave events from winter storms coinciding with high tide. During a scenario of this magnitude, individuals and properties alike are potentially impacted by high surf, coastal flooding and erosion. The impacts of such an event will become greater with time if sea-level rise continues.

13.6 ISSUES

The following issues have been identified related to the sea-level rise and coastal erosion hazard:

- **Potential Impacts from Sea-Level Rise—**Rising sea levels are very likely to have significant impacts on the frequency and severity of coastal erosion. Areas not typically exposed to erosion events may become exposed, increasing vulnerability to this hazard of concern.
- **Future Development Impact Studies**—Erosion events are particularly destructive when natural processes are unable to replenish beaches due to development, causing erosion to impact infrastructure. Building on eroding coasts increases vulnerability to shoreline hazards. Local jurisdictions need to ensure that future development does not contribute to coastal erosion.

14. SEVERE STORMS

14.1 GENERAL BACKGROUND

The severe storms hazard for this plan refers specifically to winter storms and thunderstorms with the potential to cause damage, serious social disruption, or loss of human life. Other severe weather hazards are addressed in Chapter 15.

14.1.1 Winter Storms

California's southern coast features a Mediterranean climate, in which summers are hot and dry and winters are cool and damp. A dominating factor in the weather of California is the semi-permanent high-pressure area of the North Pacific Ocean, sometimes called the Pacific High. This pressure center moves northward in summer, holding storm tracks well to the north. As a result, California receives little or no precipitation during that period. The intensity of the Pacific High decreases in winter and it moves farther south, permitting storms to move into and across the state and producing high winds, widespread rain at low elevations, and snow at high elevations.

Occasionally the state's circulation pattern permits a series of storm centers to move into California from the southwest. This type of storm pattern is responsible for occasional heavy rains that can cause serious winter flooding. Winter storms may occur during the rainy season from mid-autumn to mid-spring. In addition to high winds and flooding, winter storms may bring extended periods of freezing temperatures to the county.

14.1.2 Thunderstorms

NOAA classifies a thunderstorm as a storm with lightning and thunder produced by cumulonimbus clouds, usually producing gusty winds, heavy rain, and sometimes hail. Thunderstorms are usually short in duration (seldom more than two hours), but they may deliver enough rainfall to cause urban or flash flooding. In addition to the hazards associated with heavy rainfall, thunderstorms present hazards associated with lightning and hail:

- Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a bolt. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000 ºF. The rapid heating and cooling of air near the lightning causes thunder.

- Hail occurs when updrafts in thunderstorms carry raindrops up into cold areas where they freeze. Eventually, the hailstones encounter downdraft air and fall to the ground. Hailstones can begin to melt and then re-freeze together, forming large and irregularly shaped hail.

14.1.3 El Niño Effects on Severe Storms

El Niño is a natural climatic event that impacts the frequency and intensity of severe storms. It is characterized by a warming of the ocean surface in the central and eastern tropical Pacific Ocean. Low-level surface winds, which normally blow from east to west along the equator, instead weaken or, in some cases, start blowing the other direction. El Niño recurs irregularly, from once every two years to once a decade. El Niño events can disrupt normal weather patterns in the United States and globally (U.S. Geological Survey 2021d). The most recent strong El Niño events were as follows:

- The 1997–1998 El Niño event gained national recognition for its contribution to hurricanes, floods, landslides, droughts, and fires that killed substantial numbers of people and caused billions of dollars in damage. Australia, Indonesia, and the Americas were particularly impacted.
- The 2015–2016 El Niño event affected California, since the state was already dealing at that time with the impacts of a long-term drought (Lee, et al. 2017).

14.1.4 Secondary Hazards

Major flooding can result from heavy rain (see Chapter 11 for more information on flooding). Rain falling on saturated soils on slopes or on areas recently burned by wildfire may lead to landslides (see Chapter 12 for more information on landslides). Lightning during thunderstorms presents a risk of starting a wildfire (see Chapter 17 for more information on wildfires). Storms can also increase the frequency of erosion along coastal cliffs (see Chapter 13 for more information on coastal erosion).

14.2 HAZARD PROFILE

14.2.1 Past Events

Ventura County was included in the federal disaster declarations for freezing/severe winter storms that occurred in December 1990-January 1991, December 1998, and January 2007. The 1998 freeze was particularly damaging to citrus crops. According to the NCEI Storm Events Database, 26 winter storms and thunderstorms causing snow and ice have occurred in Ventura County over the last 10 years. Some of the thunderstorms also caused hail. Two hailstorms were recorded in Ventura County in 2010, with hail of up to 1.5 inches in diameter reported. Table 14-1 summarizes recent severe storm events in Ventura County as recorded in the Storm Events Database.

Table 14-1. Recent Severe Storm Events in the Planning Area

Date	Type	Deaths or Injuries	Property Damage
January 27-29, 2021	Winter Storm	0	0
Snowfall totals around 12 inches were reported at 5,000 feet. The snow combined with southerly winds, gusting to 70 mph, to generate hazardous winter weather conditions.			
January 25, 2021	Winter Storm	0	0
Winter storm conditions impacted the mountains of Ventura County. Snowfall totals between 3 and 6 inches and southerly wind, gusting up to 65 mph, combined to produce hazardous winter weather conditions.			

Date	Type	Deaths or Injuries	Property Damage
December 28, 2020	Winter Storm	0	0
Above 5,000 feet, 6 to 12 inches of snowfall was reported. Additionally, southerly winds, gusting up to 45 mph, were reported.			
March 16, 2020	Winter Storm	0	0
At around 5,000 feet, snowfall totals of 4 to 8 inches were reported with likely heavier amounts above 7,000 feet. Additionally, southerly winds, gusting to 50 mph, were observed.			
December 26, 2019	Winter Storm/Thunderstorm	0	0
Snowfall totals ranged from 18 to 24 inches above 5,000 feet to 6 to 18 inches between 3,500 and 5,000 feet. Strong winds with gusts to 55 mph were reported. The winter storm conditions resulted in road closures, including Highway 33. Thunderstorms generated a waterspout over the coastal waters and a very weak tornado over Ventura Harbor.			
November 28-29, 2019	Winter Storm	0	0
Snow levels dropped to between 2,000 and 3,000 feet. Snowfall totals ranged between 12 and 24 inches above 5,000 feet with 6 to 12 inches down to around 3,000 feet. Additionally, gusty winds in excess of 50 mph were reported. These winter storm conditions resulted in significant travel issues, including closure of parts of Highway 33.			
January 9, 2018	Winter Storm	0	0
At around 7,000-foot elevation, 6 to 8 inches of snowfall was reported along with southerly winds, gusting to 50 mph.			
February 18, 2017	Winter Storm	0	0
In the mountains, 8 to 16 inches of snow accumulated. Additionally, southerly winds gusting to 70 mph were reported.			
March 7-8, 2016	Winter Storm/Thunderstorm	0	0
In the mountains, 5 to 10 inches of snow accumulated while winds gusted to 67 mph. Near the Solimar burn area, heavy rain produced a mud and debris flow across Highway 101. Elsewhere, strong thunderstorm gusts knocked down several trees.			
January 31, 2016	Winter Storm/Thunderstorm	0	0
Above 6,000 feet, between 6 and 12 inches of snow was reported. Some severe thunderstorms developed with strong thunderstorm winds (in excess of 60 mph) reported.			
January 6, 2016	Thunderstorm	0	0
A severe thunderstorm moved across the community of Fillmore, generating damaging wind gusts up to 60 mph. The thunderstorm winds knocked down a large tree across Highway 126.			
January 5-6, 2016	Winter Storm	0	0
Above 7,000 feet, Mount Pinos reported 12 to 18 inches of snowfall while locations around 5,000 feet reported 4 to 8 inches of snowfall. Along with the snow, south winds gusting between 45 and 60 mph were reported.			
March 1, 2014	Winter Storm/Thunderstorm	0	0
Snowfall amounts between 6 and 12 inches were reported above 6,000 feet along with southerly winds gusting to near 90 mph. This winter storm generated intense showers that produced flash flooding and debris flows as well as severe thunderstorms.			
February 20, 2013	Winter Storm	0	0
Along with northwest winds gusting in excess of 50 mph, snowfall amounts between 6 and 12 inches were observed, with the highest totals reported at Mount Pinos.			
January 10, 2013	Winter Storm	0	0
A band of heavy snowfall, combined with gusty north winds, brought critical winter storm conditions to the mountains of Ventura County. In 30 minutes, 2 to 3 inches of snowfall was reported across the Interstate 5 corridor near the Grapevine. This snowfall, combined with winds gusting in excess of 50 mph, shut down Interstate 5 for several hours, stranding hundreds of vehicles.			
March 25-26, 2012	Winter Storm	0	0
Above 5,000 feet, significant snowfall occurred. Some reports include: Mount Pinos (12 inches), Pine Mountain Club (8 inches), and Frazier Park (10 inches). The heavy snowfall combined with gusty south winds in excess of 60 mph to produce dangerous winter storm conditions.			
March 17-18, 2012	Winter Storm	0	0
Above 6,000 feet, significant snowfall (12 to 20 inches) was reported. Along with the heavy snowfall, gusty south winds in excess of 65 mph were reported.			

Date	Type	Deaths or Injuries	Property Damage
September 13, 2011	Lightning/Thunderstorm	3	0
At the Lockwood Valley Fire Station, three firefighters were injured when lightning struck within 50 feet of the station. All three firefighters reported disorientation and ringing in the ears.			
March 20-21, 2011	Winter Storm	0	0
Elevations above 4,500 feet received 1 to 4 feet of snow that, combined with gusty southerly winds, produced hazardous conditions.			
February 26, 2011	Winter Storm	0	0
Above 6,000 feet, snowfall totals ranged between 12 and 24 inches. Below 6,000 feet, snowfall amounts ranged between 3 and 8 inches. Along with the heavy snowfall, southerly winds gusting between 40 and 50 mph produced very hazardous winter storm conditions.			
February 19-20, 2011	Winter Storm/Thunderstorm	0	0
Snowfall between 12 and 24 inches was reported above 6,000 feet; 3 to 8 inches was reported between 3,500 and 6,000 feet. Strong winds with gusts between 60 and 70 mph were reported. Cold and unstable air generated some strong thunderstorms across the area.			
January 3, 2011	Winter Storm	0	0
Snowfall totals generally ranged between 4 and 8 inches. Southeast winds gusting between 45 and 55 mph accompanied the snowfall, producing reduced visibilities in blowing snow.			
December 30, 2010	Winter Storm	0	0
Significant winter storm conditions developed across the mountains of Ventura County. Dangerous winter storm conditions were reported across the Interstate 5 corridor with a snow and gusty winds. Snowfall totals ranged between 3 and 7 inches. Northerly winds gusting in excess of 60 mph generated near zero visibilities in blowing snow and wind chills below 0 ºF. Interstate 5 was shut down.			
December 22, 2010	Winter Storm	0	0
High elevation areas received over 12 inches of snowfall. Along with the snowfall, southeasterly winds gusted between 45 and 55 mph and produced dangerous winter storm conditions.			
October 19, 2010	Thunderstorm/Hail	0	0
A trained weather spotter reported one-inch hail in association with a severe thunderstorm.			
April 12, 2010	Winter Storm	0	0
Cuddy Valley reported 4 to 8 inches of snowfall. Along with the snowfall, strong southerly winds developed with gusts to 61 mph reported.			
February 9-10, 2010	Winter Storm	0	0
Over 10 inches of snowfall was reported above 6,000 feet with southerly winds gusting as high as 60 mph.			
January 21, 2010	Thunderstorm/Hail	0	0
A trained spotter in the Agoura Hills area reported large hail with a diameter of 1.50 inches.			
January 20-21, 2010	Winter Storm	0	0
Cuddy Valley received 15 inches of snowfall while Mount Pinos reported between 12 and 18 inches of snowfall. Along with the heavy snowfall, strong and gusty southerly winds were reported across the mountains.			

Source: NOAA 2021

14.2.2 Location

The entire county is susceptible to severe storms. Only higher elevation areas (typically at or above 4,000 feet) experience snowfall; lower elevation areas experience heavy rains. Thunderstorms affect relatively small, localized areas, rather than large regions like severe winter storms.

14.2.3 Frequency

Predicting the frequency of severe storm events in a constantly changing climate is a difficult task. Based on reports since 2010, Ventura County experiences more than two severe storms each year on average (Table 14-1). The planning area can expect to experience exposure to and adverse impacts from severe storm events at least annually.

14.2.4 Severity

The most common problems associated with severe storms are immobility and loss of utilities. Fatalities are uncommon, but can occur. Roads may become impassable due to snowfall, flooding, downed trees, or mudflows and landslides. Power lines may be downed due to high winds, and services such as water or phone may not be able to operate without power. Lightning can cause severe damage and injury. Physical damage to homes and facilities can be caused by wind or flooding.

Heavy rain can have significant impacts, including crop damage, soil erosion, and increased risk of flood. Stormwater runoff from heavy rains can also impair water quality by washing pollutants into local waterways (U.S. Environmental Protection Agency 2021). Soil erosion, particularly in areas affected by wildfire and along the coast, is a significant concern.

Lightning severity is typically based on both property damage and life safety (injuries and fatalities). The relationship of lighting to wildfire ignitions increases the significance of this hazard. There are no recorded instances of lightning appearing alone (without a storm) in Ventura County, and any lightning damage is likely to be compounded by other storm damage.

14.2.5 Warning Time

Meteorologists can often predict the likelihood of a severe storm event. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time. The Los Angeles/Oxnard Weather Forecast Office of the NWS monitors weather stations and issues watches and warnings to alert government agencies and the public of possible or impending weather events when appropriate. The watches and warnings are broadcast over NOAA weather radio, posted on the NWS website, and forwarded to the local media for retransmission using the Emergency Alert System.

14.3 EXPOSURE AND VULNERABILITY

All people and property and the entire environment of the planning area are exposed to some degree to the severe storm hazard.

14.3.1 Population

Thunderstorm-related deaths and injuries in the planning area are most likely to result from accompanying wind and flood events. There are no recorded fatalities from lightning within the planning area. Winter storm-related deaths and injuries are most likely to result from dangerous road conditions and accompanying wind, landslide and flood events.

The most common impacts on people associated with severe storm events are immobility and loss of utilities. All populations in the planning area are exposed to severe storm events, and some are especially vulnerable. The most vulnerable populations are generally those who lack adequate shelter during severe weather events, who are reliant on sustained sources of power in order to survive, and who live in isolated areas with limited ingress and egress options. Power outages can be life threatening to those dependent on electricity for life support. Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and black out, while populations in low-lying areas are at risk for possible flooding.

14.3.2 Property

All property is vulnerable during severe weather events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. The most common impacts of specific weather event types on property are as follows:

- **Thunderstorms**—Damage from thunderstorms in the planning area is most likely to be related to secondary hazards accompanying the event, such as flooding, landslides, or damaging winds. If lightning directly strikes a building, it may cause substantial damage and may even set the structure on fire.
- **Winter storms**—Damage from winter storms in the planning area is most likely to be related to secondary hazards accompanying the event, such as freezing, flooding, landslides or damaging winds. Freezing events can also cause pipes to burst in buildings leading to structural flooding.

No modeling is available for quantitative loss estimations for the severe weather hazard. Instead, loss estimates were developed representing 10 percent, 30 percent, and 50 percent of the replacement value of exposed structures:

- Loss of 10 percent of planning area replacement value—$18,075,696,763
- Loss of 30 percent of planning area replacement value—$54,227,090,289
- Loss of 50 percent of planning area replacement value—$90,378,483,815

14.3.3 Critical Facilities

All critical facilities are vulnerable during severe weather events, especially those that lack backup power generation capabilities. When facilities supplying power to planning area land-line telephone systems are frequently disrupted, significant issues arise with communication in the planning area. In addition, some facilities are particularly vulnerable to specific types of severe weather events:

- **Thunderstorm**—Facilities located in areas prone to localized or major flooding are vulnerable. Transportation systems are vulnerable to disruption from secondary hazards such as flooding or landslides.
- **Winter storms**—Facilities located in areas prone to freezing and snow accumulation are vulnerable. Transportation systems are vulnerable to disruption from secondary hazards such as road closures, flooding, or landslides.

14.3.4 Environment

The environment is highly vulnerable to severe storm events. Natural habitats such as streams and trees exposed to the elements during a severe storm risk major damage. Prolonged rains can saturate soils and lead to slope failure. Flood events caused by severe storms can produce river channel migration or damage riparian habitat. Storm surges can erode beachfront bluffs and redistribute sediment loads.

14.4 SCENARIO

Impacts of severe storms can be significant, particularly when secondary hazards of flood and landslide occur. A worst-case event would involve thunderstorms with prolonged high winds. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. In more rural areas, some subdivisions could experience limited ingress and egress. Prolonged rain could produce flooding, overtopped culverts with ponded water on roads, and landslides on steep slopes. Significant erosion and landslides along the coast may occur, further increasing the vulnerability of residents living right on the edge of coastal cliffs. Flooding and landslides could obstruct roads and bridges, isolating residents. Fog after the storm, resulting from the heavy moisture still in the area, could increase traffic accidents as visibility worsens.

14.5 ISSUES

Severe local storms are probably the most common widespread hazard. They affect large numbers of people in the planning area when they occur. Severe storms can quickly overwhelm city and county resources. Residents should be prepared for these types of storms: family plans should be developed, disaster kits should be put in homes, workplaces, schools, and cars, and every family member should be taught how to shut off household utilities. Initiating early dismissal from schools and business is an effective mitigation measure and should be encouraged.

Severe storms cannot be prevented, but measures can be taken to mitigate the effects. Critical infrastructure and utilities can be hardened to prevent damage during an event. The secondary effect of flooding can be addressed through decreasing runoff and water velocity. Important issues associated with severe storms in the Ventura County planning area include the following:

- Redundancy of power supply throughout the planning area must be evaluated to better understand what areas may be vulnerable.
- Although primarily thought of as an urban area, the County has a larger physical land mass containing rural communities and must also consider the needs of these residents (as well as their possible isolation during storm events).
- Public education on dealing with the impacts of severe storms needs to continue to be provided so that residents can be better informed and prepared for severe storm events.
- Debris management (downed trees, etc.) must be addressed, because debris can impact the severity of severe storm events, it requires coordination efforts, and may require additional funding.
- The effects of climate change may result in an increase of heavy rain or more intense storm events and will likely lead to changes in overall precipitation amounts.
- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe winter weather effects.
- Urban forest management programs should be evaluated to help reduce impacts from tree-related damage.

15. SEVERE WEATHER

15.1 GENERAL BACKGROUND

Severe weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. It includes thunderstorms, downbursts, tornadoes, waterspouts, snowstorms, ice storms, and dust storms, among other events. The most common severe weather events that impact the planning area are severe storms (as described in Chapter 14), damaging winds (including straight-line winds and tornadoes), and extreme temperatures (heat and cold). The frequency and intensity of severe weather events can be affected by El Niño conditions, as described in Section 14.1.3.

15.1.1 Damaging Winds

Straight-Line Winds

Straight-line wind is a general term used to describe winds that have no rotation (i.e., are not tornadoes). Damaging straight-line winds are those that exceed 50 to 60 mph. The Beaufort wind chart (Table 15-1) provides terminology and a description of potential impacts at different levels.

Table 15-1. Beaufort Wind Chart

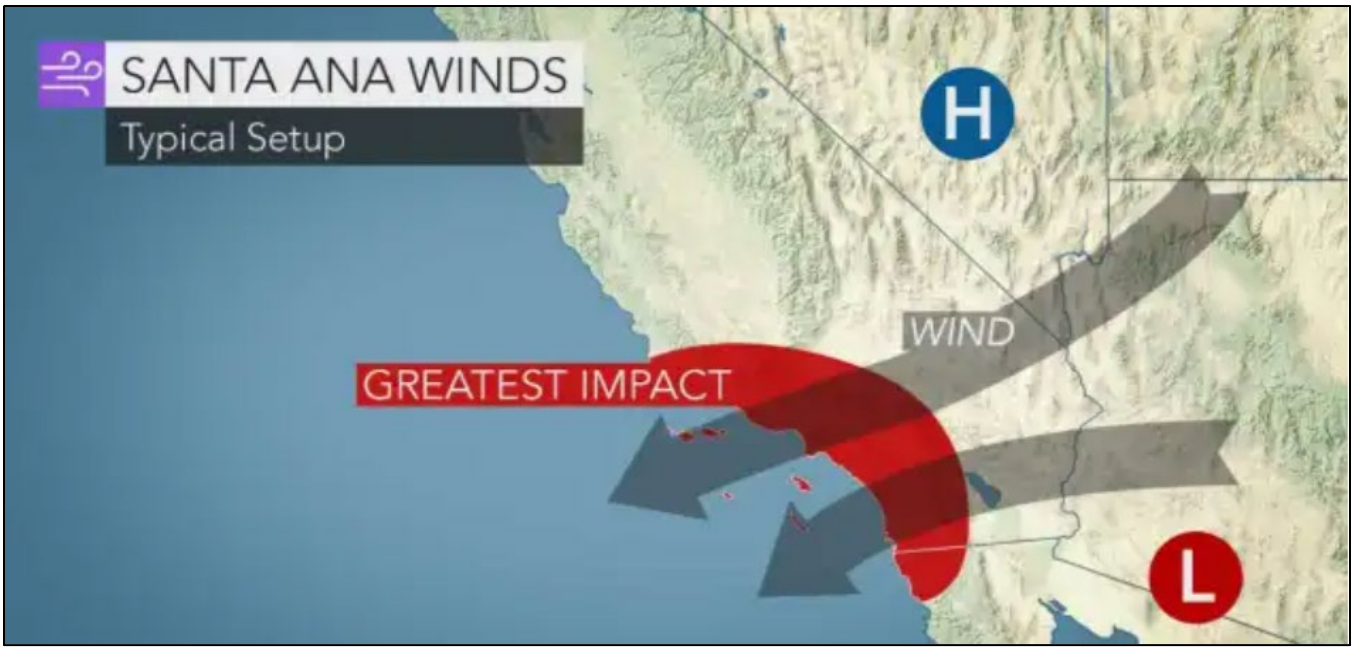
Beaufort Number	Range (mph)	Terminology	Description
0	0	Calm	Calm. Smoke rises vertically.
1	1-3	Light air	Wind motion visible in smoke.
2	4-7	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	Moderate breeze	Dust and loose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

Source: NWS, n.d.

Santa Ana Winds

In Southern California, strong, dry, gusty downslope winds known as Santa Ana winds form when air from a region of high pressure over the desert region of the southwestern U.S. flows westward toward low pressure areas off the California coast. As the wind flows over the Sierra Nevada and Santa Ana mountains, it drops from high elevation to sea level. The air becomes compressed and heats up as it sinks, and its relative humidity drops. Gaps in mountains form wind tunnels that strengthen these winds as they pour warm air east to west through the canyons (Figure 15-1). These winds play a major role in increasing wildfire risk in the Ventura region because of the dryness of the winds and the speed with which they can cause a fire to spread, complicating containment efforts.

Figure 15-1. Santa Ana Winds



Santa Ana winds may occur year-round, but are most common during the cooler months, typically from September through March. A Santa Ana wind event can yield sustained winds of 40 miles per hours; isolated wind gusts of over 80 miles per hour have been recorded. Most Santa Ana wind events peak for a 12- to 24-hour period but can persist for a few days.

Public Safety Power Shutoff Events

High winds can uproot trees, blow branches onto power lines or create sparks if power lines contact one another. When this occurs in combination with extreme heat and low humidity that dry out vegetation, it poses increased risks of wildfire. In 2012, the California Public Utilities Commission ruled that California Public Utilities Code gives electric utilities authority to shut off electric power to protect public safety by reducing the potential to ignite wildfires (California Public Utilities Commission 2021). Such shutoffs are referred to as public safety power shutoff events. Given the long, connected nature of power supply systems, a shutoff event targeted to a small at-risk area can affect a larger area outside the risk zone. The duration of a shutoff is tied directly to the severe weather that triggers it; the shutoff typically ends within 24 hours after the severe weather has passed (Pacific Gas & Electric n.d.).

Tornadoes

Although uncommon in the Ventura County area, a tornado is potentially the most dangerous of storms on a local scale (National Weather Service 2009b). Tornadoes are formed by the turbulent mixing of layers of air with contrasting temperature, moisture, density, and wind flow. Most of California's documented tornadoes have taken place primarily in winter or spring. Since 1950, NOAA has tracked six tornadoes touching down in Ventura County. All six were classified as F0, using the Fujita Tornado Damage Scale shown in Table 15-2.

Table 15-2. Operational Enhanced Fujita Scale

Enhanced Fujita Number	Wind, Damage
F0 (weak)	40-72 mph, light damage
F1 (weak)	73-112 mph, moderate damage
F2 (strong)	113-157 mph, considerable damage
F3 (strong)	158-206 mph, severe damage
F4 (violent)	207-260 mph, devastating damage
F5 (violent)	261-318 mph (rare), incredible damage

Source: (National Weather Service 2009b)

15.1.2 Extreme Temperatures

Extreme Heat

Extreme heat is defined as temperatures that hover 10 ºF or more above the average high temperatures for a region for several days or weeks. Extreme heat events can lead to an increase in heat-related illnesses and deaths, cause drought, and impact water supplies. Such events do not typically impact buildings; however, losses may be associated with the urban heat island effect and overheating of heating, ventilation, and air conditioning systems.

Extreme heat is the primary weather-related cause of death in the United States. Excessive heat claims over 100 lives each year in this country. In a 30-year record of weather fatalities across the nation (1990-2019), excessive heat claimed more lives each year than floods, lightning, tornadoes, and hurricanes (Erdman 2021). According to the *California Climate Adaptation Strategy*, heat waves have claimed more lives in California than all other declared disaster events combined. Despite this history, in a span of 60 years, only four heat emergencies (August 14, 2020; September 2, 2020; June 16, 2021; July 9, 2021) were proclaimed in California at the state level and none were proclaimed at a federal level. Heat waves do not strike victims immediately, but their cumulative effects slowly cause harm to vulnerable populations. Older adults, children, and sick or overweight individuals are at greater risk from extreme heat.

Extreme Cold

In areas that typically have mild winter weather, extreme cold is defined as near freezing temperatures. Frost or freeze warnings are issued when temperatures below freezing are expected. Whenever temperatures drop below normal and as wind speed increases, heat can leave the body more rapidly. These conditions are dangerous to those without shelter, those who are stranded, and those who live in homes that have no heat or are poorly insulated. Extreme cold can cause hypothermia and frostbite if a person is exposed for a long period of time.

In addition to direct risks to people, extreme cold can cause freezing rain, which can leave a coating of ice on roads and walkways. Rain that turns to ice pellets before reaching the ground, referred to as sleet, may become slippery.

15.1.3 Secondary Hazards

Strong Santa Ana winds can quickly cause or spread wildfires (see Chapter 17 for more information on wildfires). Erosion along coastal cliffs can be affected when high winds associated with winter storms increase the intensity of the surf (see Chapter 13 for more information on coastal erosion). Extreme heat can exacerbate drought conditions (see Chapter 9 for more information on drought).

15.2 HAZARD PROFILE

15.2.1 Past Events

Table 15-3 summarizes recent severe weather events in Ventura County as recorded in the NCEI Storm Events Database. Of 136 high wind events recorded, only those recorded at 70 knots or greater or that had a death, injury, or reported property damage are listed in this table. Ventura County was included in federal disaster declarations for extreme cold/freezing events that occurred in December 1990-January 1991, December 1998, and January 2007. The 1998 freeze was particularly damaging to citrus crops.

Table 15-3. Recent Severe Weather Events in the Planning Area

Date	Event Type[a]	Deaths or Injuries	Property Damage
January 19, 2021	High Wind	0	Gusty winds produced numerous reports of downed small trees and branches.
Very strong and gusty Santa Ana winds impacted many areas of Ventura and Los Angeles counties. Winds gusting up to 99 mph were reported across many areas.			
November 26, 2020	High Wind	0	0
Strong Santa Ana winds impacted the mountains of Ventura County. Sycamore Canyon reported wind gusts between 67 and 86 mph.			
December 25, 2019	Tornado	0	Only very minor damage was reported.
A strong thunderstorm generated a weak tornado over Ventura Harbor (in Ventura County).			
December 6, 2017	High Wind	0	0
Across the interior valleys of Ventura County, northeast wind gusts up to 85 mph were reported. This event coincided with Thomas Fire.			
December 25, 2014	High Wind	0	0
Strong north winds developed near the Interstate 5 corridor. Wind gusts in excess of 80 mph were reported at the higher elevations.			
April 7, 2013	High Wind	0	0
Strong northerly winds developed across the mountains of Ventura County. Gusts between 65 and 85 mph were reported in some areas.			
February 24, 2013	High Wind	0	0
Strong Santa Ana winds developed across Ventura County. Wind gusts in excess of 70 mph were reported.			
October 25, 2012	High Wind	0	0
Strong and gusty north to northeast winds were reported across the mountains of Ventura County. The strongest wind gusts occurred near the Interstate 5 corridor with gusts near 80 mph reported.			

Date	Event Type[a]	Deaths or Injuries	Property Damage
May 29, 2010	High Wind	0	0
Gusty northwest to north winds developed across the mountains of Ventura County through the Interstate 5 corridor. Sustained winds between 40 and 48 mph were reported along with wind gusts between 66 and 87 mph.			
January 21, 2010	Tornado	0	Several homes, a car and a farm outbuilding were damaged.
A small EF-0 tornado touched down in the City of San Buenaventura.			
January 13, 2010	High Wind	0	0
Strong and gusty north winds affected the mountains of Ventura County especially near the Interstate 5 corridor. Wind gusts between 60 and 83 mph affected the area.			
October 27, 2009	High Wind	0	0
Very strong and gusty winds were reported across the mountains of Ventura County through the Interstate 5 corridor. Wind gusts between 60 and 80 mph were reported.			
May 6, 2009	High Wind	0	0
Strong north winds were reported through the Interstate 5 corridor. Sustained winds between 40 and 50 mph with gusts as high as 85 mph were reported.			
October 13, 2008	High Wind	0	0
Gusty northeast winds to 84 mph were reported across eastern sections of the Ventura County mountains.			
June 20-21, 2008	Excessive Heat	0	0
An automated sensor at Newbury Park reported a high temperature of 108 ºF with a heat index of 106 ºF.			
January 24, 2008	Tornado	0	Tore the roof off a building, knocked over several trash cans.
A weak tornado moved onshore across Point Mugu Naval Air Station.			
August 31-September 1, 2007	Excessive Heat	0	0
The combination of above normal temperatures and relative humidity produced excessive heat across the interior valleys of Ventura County. Heat index values between 105 and 112 ºF were reported.			
April 12, 2007	High Wind	0	0
RAWS observations across the mountains measured very strong and gusty winds. At Whitaker Peak RAWS a peak northwest wind gust of 86 mph was reported. Other sensors, including Sandberg and Warm Springs, indicated sustained winds and gust that met warning criteria.			
January 13-15, 2007	Frost/Freeze	0	0
Widespread freezing conditions were reported across agricultural areas of Ventura County. Total crop damage in Ventura County was estimated to be around $280 million.			
July 22-26, 2006	Heat	0	0
The combination of high pressure aloft and above-normal relative humidity resulted in an extended period of excessive heat across San Luis Obispo, Santa Barbara, Ventura and Los Angeles counties. At times, heat index values ranged from 100 to 119 ºF.			
July 15, 2006	Heat	0	0
The combination of strong high pressure aloft and high relative humidity produced excessive heat conditions across the mountains of Ventura County. Heat index values ranged from 100 to 105 ºF in the mountains.			
January 10, 2005	Tornado	0	0
A California Highway Patrol officer reported a weak tornado in the community of El Rio.			
October 27, 2004	Funnel Cloud	0	0
An early-season storm brought rain, snow, and funnel clouds to Central and Southern California. Across Ventura and Santa Barbara counties, two funnel clouds were reported.			
February 24, 2003	Funnel Cloud	0	0
A weather observer at the Point Mugu Naval Base reported a funnel cloud offshore of the base.			
February 9, 2002	High Wind	1	Strong winds knocked down power lines and overturned a wooden bus stop structure in Moorpark.
Strong and gusty Santa Ana winds developed across the interior valleys of Ventura County. Reports from spotters indicated northeast winds gusting between 50 and 70 mph. In Simi Valley, a man was killed when a 45-foot tree was knocked down and pinned him.			

Sources: NOAA 2021

a. This list represents only high wind events recorded at 70 knots or greater, or that had a death, injury, or reported property damage.

The NCEI Storm Events Database lists 19 wildfire events in Ventura County from 2000 through 2021, and all but two of those events are directly attributed to wind events or occurred within one or two days of high wind events recorded in the database (National Centers for Environmental Information 2022).

15.2.2 Location

The entire county is susceptible to damage from wind. Wind events are most damaging to areas that are heavily wooded. The State of California has a low risk for serious tornados compared to other parts of the country (Croswell 1995). Tornadoes are usually localized and have historically formed in the southwest portion of Ventura County during the winter.

All of Ventura County is subject to extreme temperatures. The mountains are more likely to experience extreme cold. Extreme heat impacts may be exacerbated in inland areas more prone to urban heat island effects, such as Thousand Oaks and Simi Valley, than coastal regions (Oakley, et al. 2019).

15.2.3 Frequency

Based on reports since 2000, Ventura County experiences an average of more than seven severe weather event each year (Table 15-3). The planning area can expect to experience exposure to and adverse impacts from severe weather events at least annually.

15.2.4 Severity

Damaging Winds

Windstorms can be a frequent problem in the planning area and have been known to cause damage to utilities. The predicted wind speed given in wind warnings issued by the National Weather Service is for a one-minute average; gusts may be 25 to 30 percent higher. Lower wind speeds typical in the lower valleys are still high enough to knock down trees and power lines and cause other property damage. Higher elevations in the County can experience much higher winds under more varied conditions.

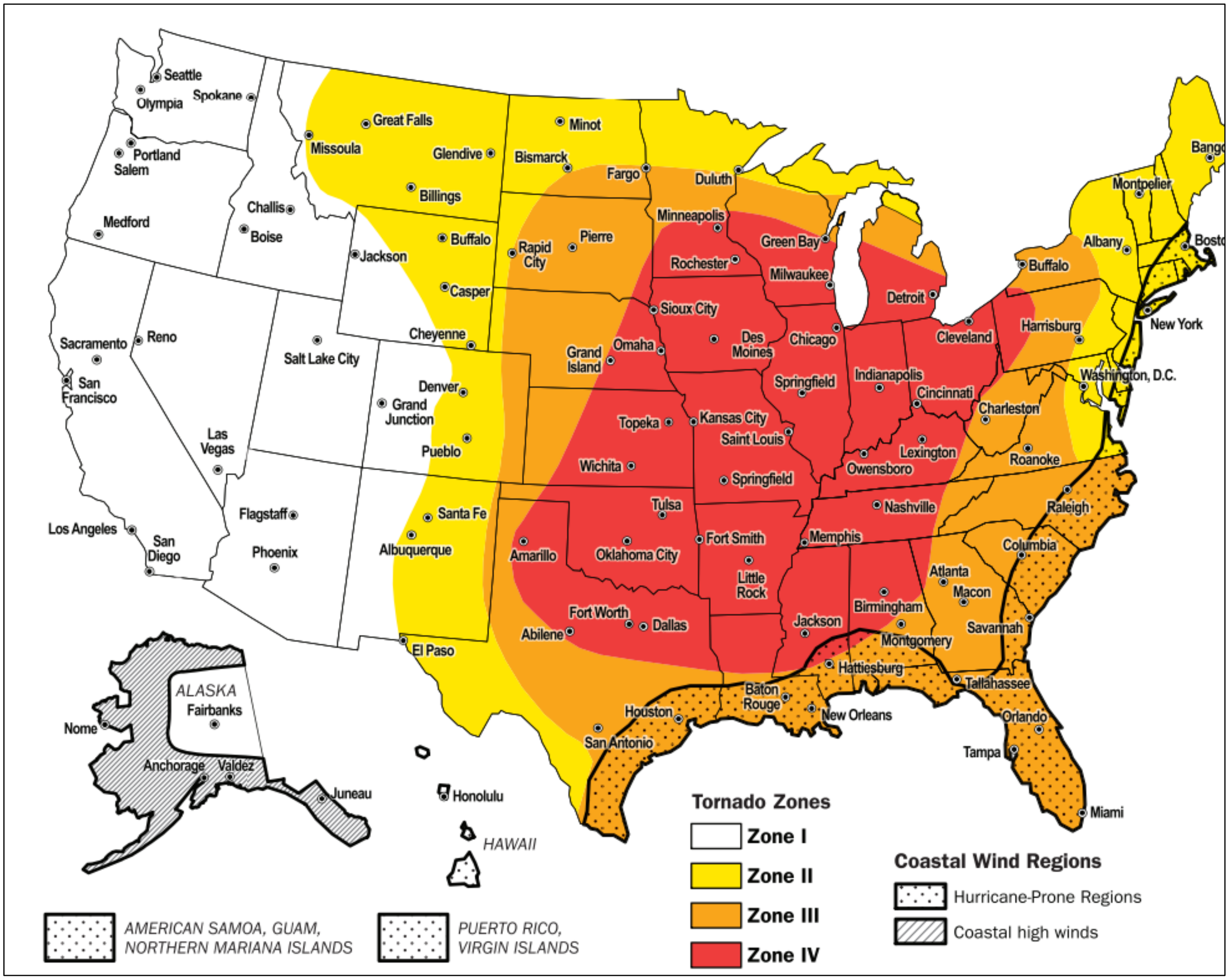
According to the FEMA Winds Zones of the United States map (Figure 15-2), Ventura County is in Wind Zone I, where wind speeds can reach up to 130 mph. The map indicates the strength of windstorms in the United States, and the general location of the most wind activity (Federal Emergency Management Agency 2021).

Tornadoes are potentially highly dangerous. If a major tornado were to strike within the populated areas of the County, damage could be widespread. Because the County has never experienced a tornado more severe than an F0, however, such severity is unlikely.

Extreme Temperatures

The record high temperature in the county (120 ºF) was set in Fillmore and Oak View in September 2020. The record low (25 ºF) was set in December 1998.

Figure 15-2. Wind Zones in the United States



Source: FEMA 2021

15.2.5 Warning Time

Meteorologists can often predict the likelihood of a severe weather event. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some weather events may come on more quickly and have only a few hours of warning time. The Los Angeles/Oxnard Weather Forecast Office of the NWS monitors weather stations and issues watches and warnings when appropriate to alert government agencies and the public of possible or impending weather events. The watches and warnings are broadcast over NOAA weather radio, posted on the NWS website, and are forwarded to the local media for retransmission using the Emergency Alert System.

15.3 EXPOSURE AND VULNERABILITY

15.3.1 Population

All people in the planning area are exposed to some degree to the severe weather hazard. The most common problems associated with severe weather events are immobility and loss of utilities. Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and black out. The most common impacts of specific weather event types on people are as follows:

- **Windstorms**—Damaging winds can cause injuries and fatalities in a number of ways. Downed trees may fall on homes or cars, killing or injuring those inside. Objects that are not secured can be picked up in wind events and become projectiles.
- **Tornado**—Structures that collapse or blow over during tornadoes may kill or injure those inside.
- **Excessive heat**—Heat exhaustion or heat stroke can cause illness or death. Toddlers are especially vulnerable if left or trapped in a parked vehicle. Seniors in residences without air conditioning are at more risk of heat illness and death during excessive heat waves.
- **Extreme cold**— Extreme cold can cause hypothermia and frostbite, especially among the population that does not have adequate shelter.

15.3.2 Property

All property in the planning area is exposed to some degree to the severe weather hazard. Properties in poor condition or in particularly vulnerable locations may risk the most damage. The most common impacts of specific weather event types on property are as follows:

- **Windstorm**—Mobile homes can be seriously damaged by wind gusts over 80 mph, even if they are anchored (National Severe Storms Laboratory 2018). Properties at higher elevations or on ridges may be more prone to wind damage. Falling trees can result in significant damage to structures.
- **Tornado**—A major tornado could cause widespread damage to property in the planning area, but such an event is unlikely.
- **Excessive heat**—Periods of high heat do not typically pose risks to structures, but when power fails during high heat events, air conditioning systems also fail and result in secondary shutdowns of heat-sensitive electronic or networking systems housed in those structures.
- **Extreme cold**—Infrastructure and building systems can be damaged by extreme cold when pipes freeze. Roofs can be damaged by ice buildup.

No modeling is available for quantitative loss estimations for the severe weather hazard. Instead, loss estimates were developed representing 1 percent, 3 percent, and 5 percent of the replacement value of exposed structures:

- Loss of 10 percent of planning area replacement value—$18,075,696,763
- Loss of 30 percent of planning area replacement value—$54,227,090,289

- Loss of 50 percent of planning area replacement value—$90,378,483,815

15.3.3 Critical Facilities

All critical facilities are exposed to some degree to the severe weather hazard. Those that lack backup power generation capabilities are especially vulnerable. When facilities supplying power to planning area land line telephone systems are disrupted, significant issues arise with communication. Some facilities are particularly vulnerable to specific types of severe weather events:

- **Windstorms**—Facilities located near trees or power lines that are likely to fall are vulnerable. Roads and other transportation infrastructure could be blocked by downed trees or other debris.
- **Tornado**—Critical facilities in the direct path of a tornado are particularly vulnerable.
- **Excessive heat**—Transportation systems can be impacted if extreme heat causes roads or railways to buckle.
- **Extreme cold**—Facilities that lack backup power are more likely to be impacted during extreme cold events. Pipes freeze more quickly in unheated buildings.

15.3.4 Environment

The entire environment of the planning area is exposed to some degree to the severe weather hazard. High winds can cause extensive damage to forested areas. Storm surges increased by high winds can erode beachfront bluffs and redistribute sediment loads. Periods of prolonged heat can increase pest and disease pressure on crops and increase the effects of drought.

15.4 SCENARIO

A worst-case severe weather event would involve prolonged high winds accompanied by thunderstorms. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. In more rural areas, some subdivisions could experience limited ingress and egress. If these events coincided with extreme heat or cold, the impacts on the population would be even greater.

15.5 ISSUES

Severe weather cannot be prevented, but measures can be taken to mitigate the effects. Critical infrastructure and utilities can be hardened to prevent damage during an event. Important issues associated with severe weather in the Ventura County planning area include the following:

- Redundancy of power supply throughout the planning area must be evaluated to better understand what areas may be vulnerable.
- Public education on dealing with the impacts of severe weather needs to continue to be provided so that residents can be better informed and prepared for severe weather events.
- Debris management (downed trees, etc.) must be addressed, because debris can impact the severity of severe weather events, requires coordination efforts, and may require additional funding.

- Climate change may result in more intense weather events and will likely lead to increased temperatures.
- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe wind.
- Urban forest management programs should be evaluated to help reduce impacts from forest-related wind damages.

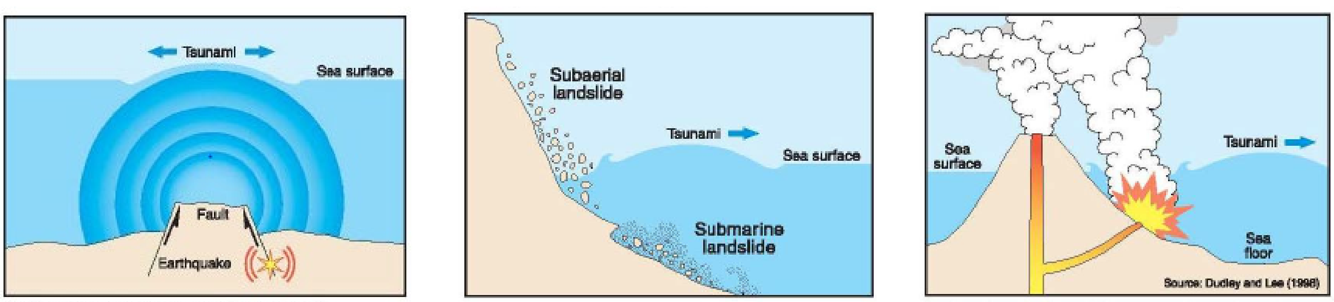
16. TSUNAMI

16.1 GENERAL BACKGROUND

A tsunami is a series of high-energy waves that radiate outward like pond ripples from an area where a generating event occurs, arriving at shorelines over an extended period. Tsunamis can be induced by earthquakes, landslides, and submarine volcanic explosions (see Figure 16-1). Tsunamis are typically classified as local or distant, depending on the location of their source in comparison to where waves occur:

- The waves nearest to the generating source represent a local tsunami. Such events have minimal warning time, leaving few options except to run to high ground after a strong, prolonged local earthquake. Damage from the tsunami adds to damage from the triggering earthquake due to ground shaking, surface faulting, liquefaction, and landslides.
- The waves far from the generating source represent a distant tsunami. Distant tsunamis may travel for hours before striking a coastline, giving a community a chance to implement evacuation plans if a warning is received.

Figure 16-1. Common Sources of Tsunamis



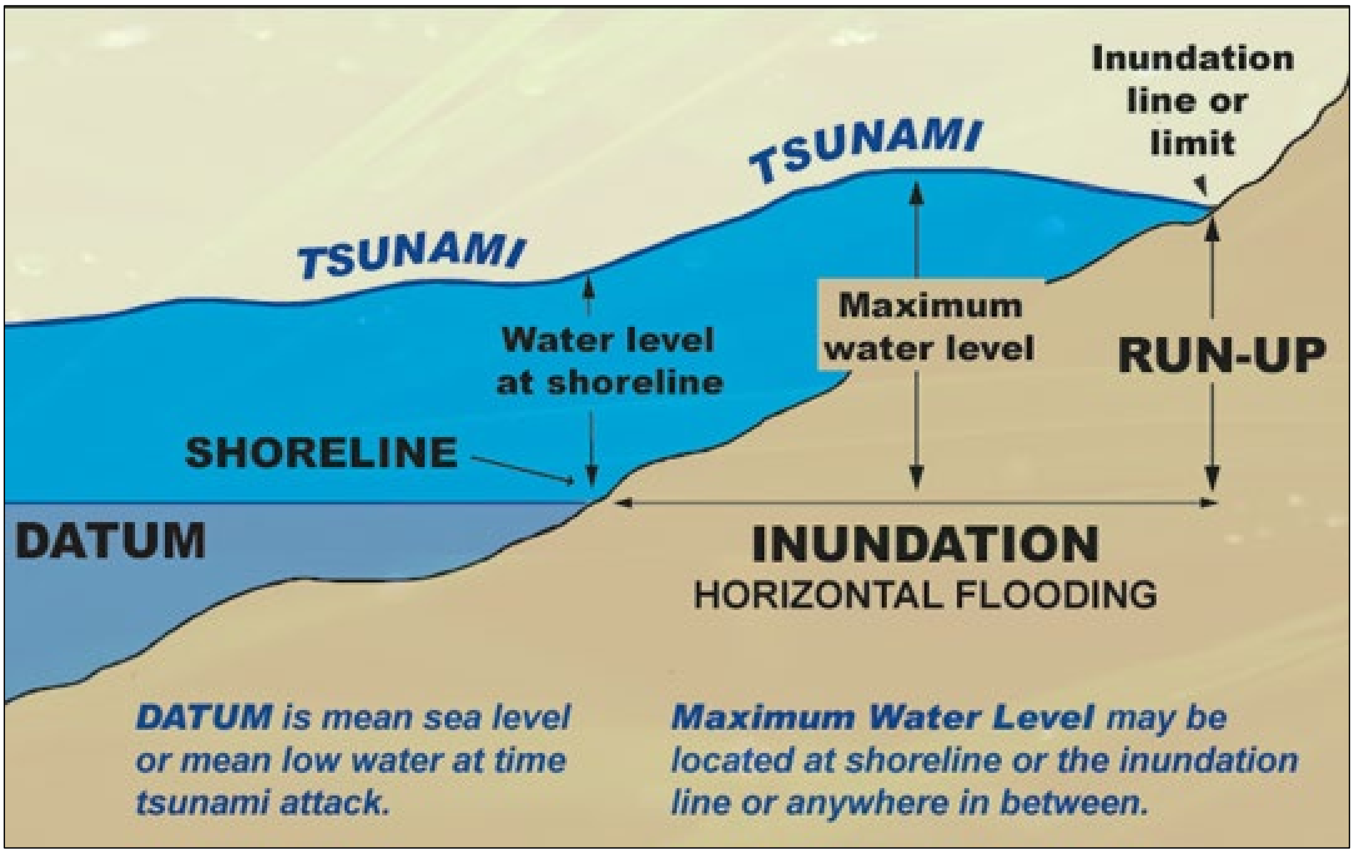
Faulting of the ocean floor may produce a tsunami.
Subaerial or submarine landslides may produce a tsunami.
A submarine volcanic explosion may produce a tsunami.

In the open ocean, a tsunami may be only a few inches or feet high, but it can travel with speeds approaching 600 miles per hour. As a tsunami enters the shoaling waters near a coastline, its speed diminishes, its wavelength decreases, and its height increases greatly. At the shoreline, tsunamis may take the form of a fast-rising tide, a cresting wave, or a bore (a large, turbulent wall-like wave). The bore phenomenon resembles a step-like change in the water level that advances rapidly (from 10 to 60 miles per hour). The first wave is usually followed by several larger and more destructive waves.

16.1.1 Factors Affecting Tsunami Impact

The configuration of the coastline, the shape of the ocean floor, and the characteristics of advancing waves play important roles in the destructiveness of the waves. Bays, sounds, inlets, rivers, streams, offshore canyons, islands, and flood control channels may alter the level of damage. Offshore canyons can focus tsunami wave energy, and islands can filter the energy. A tsunami wave entering a flood control channel could reach a mile or more inland, especially if it enters at high tide. The orientation of the coastline determines whether the waves strike head-on or are refracted from other parts of the coastline. A wave may be small at one point and much larger at others. The inundation area for a tsunami event is often described as runup as illustrated in Figure 16-2.

Figure 16-2. Runup Distance and Height in Relation to the Datum and Shoreline



Source: UNESCO, Retrieved from Different Directions: Tsunami, n.d.

16.1.2 Secondary Hazards

The secondary hazards most directly associated with tsunamis are flooding and coastal erosion, which are likely results of tsunami events.

16.2 HAZARD PROFILE

16.2.1 Past Events

More than 80 tsunamis have been recorded or observed in California, according to state records; however, many of these events were small and led to little or no damage. All tsunamis from the past century have been distant, not local. That is, they have all resulted from earthquakes far across the Pacific basin (as opposed to earthquakes near the American coastline). Ventura County has been affected by major statewide tsunamis as well as more local minor tsunamis. Table 16-1 lists known tsunami events that have struck the County or one of its jurisdictions since 1812.

Table 16-1. Tsunami Events in Ventura County

Date	Description
March 11, 2011	A 7.1 magnitude earthquake in Japan caused a run-up within Ventura Harbor. A federal disaster declaration was issued (DR-1968).
February 27, 2010	An 8.8 magnitude earthquake in Chile caused a 3-foot run-up in Ventura, as well as damage to 21 docks in Ventura Harbor.
September 29, 2009	An 8.2 magnitude earthquake in Samoa moved buoys within Ventura Harbor.
March 28, 1964	A 9.2 magnitude earthquake in Alaska caused the tide in Ventura to drop 8 feet and large swells were reported in Oxnard.
May 24, 1960	A 9.5 magnitude earthquake in Chile created a 4.4-foot run-up in Port Hueneme causing damage to docks and ships.
March 9, 1957	An 8.3 magnitude earthquake along the Aleutian Islands caused an approximate 2-foot run-up 6 hours after the first wave hit in Port Hueneme.
November 4, 1952	An 8.2 magnitude earthquake in Kamchatka caused a 2.3-foot run-up in Port Hueneme.
April 1, 1946	An 8.8 magnitude earthquake along the Aleutian Islands caused sand to sweep over the railroad tracks near Ormond Beach and minor ship berthing problems in Port Hueneme.
December 21, 1812	A 7.1 magnitude earthquake centered in the Santa Barbara or Ventura area caused a 6.5-foot run-up and damage to San Miguelito Chapel.

Source: Ventura County 2021

16.2.2 Location

The California Department of Conservation maintains detailed tsunami inundation maps for Ventura County and other parts of the state. These maps are generated through computer modeling of the areas most likely to be affected by a tsunami event and serve as an important preparedness tool. The tsunami hazard areas identified in the mapping are based on a suite of tsunami sources, both local and distant, and do not, therefore, represent risk from a single-source event. Tsunami risk areas are shown in Figure 16-3.

16.2.3 Frequency

Generally, four or five tsunamis occur every year in the Pacific Basin, and those that are most damaging are generated in the Pacific waters off South America rather than in the northern Pacific. Based on risk factors for the County and past occurrences, it is highly likely that tsunamis will continue to strike the coastline in Ventura County. Tsunami probabilities are tied to earthquake and other geologic events; however, not all earthquakes or submarine landslides will trigger a tsunami.

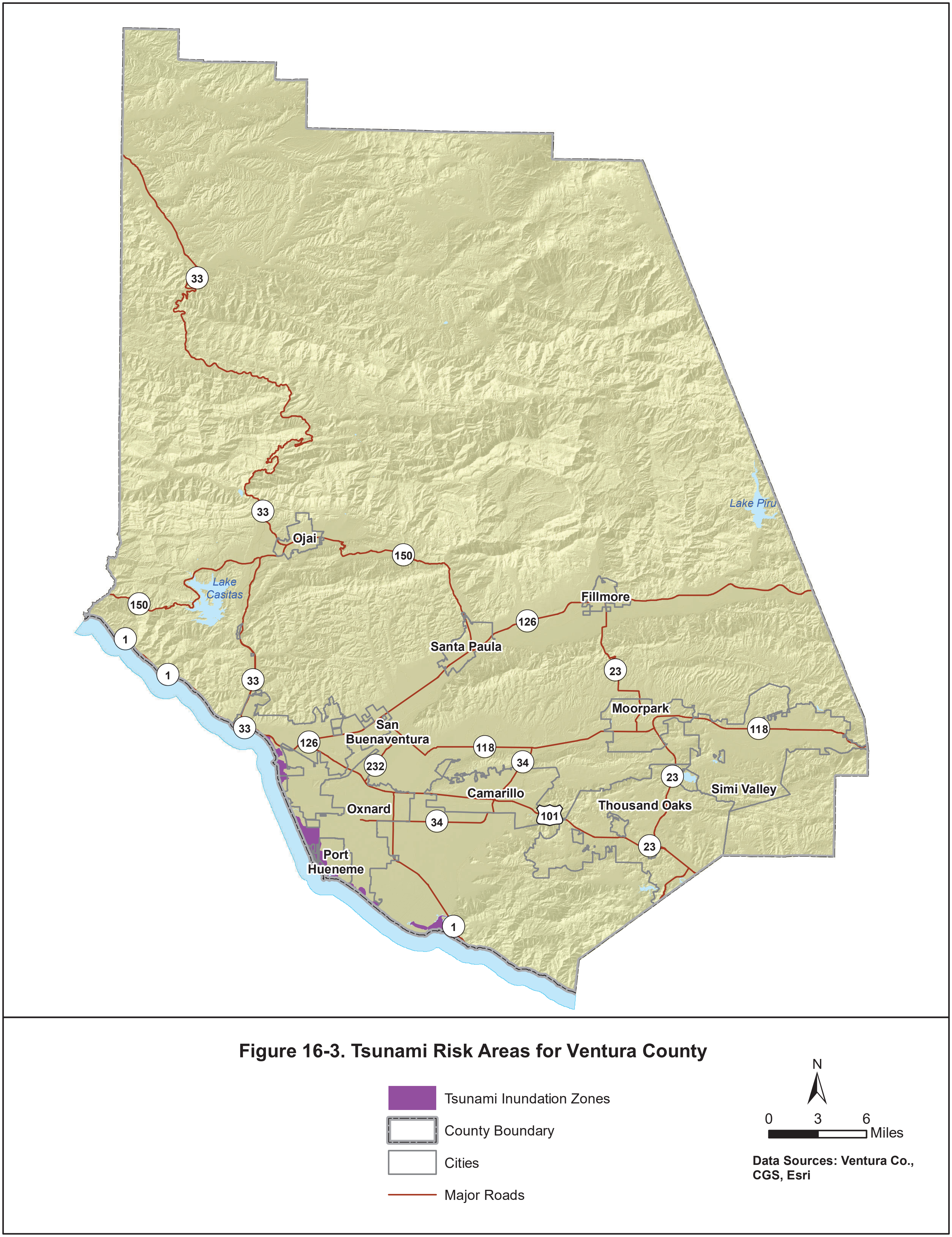


Figure 16-3. Tsunami Risk Areas for Ventura County

16.2.4 Severity

A tsunami's size and speed, as well as the coastal area's form and depth, affect the impact of the tsunami. At some locations, the advancing turbulent wave front will be the most destructive part of the tsunami wave. In other situations, the greatest damage will be caused by the outflow of water back to the sea between crests, sweeping away items on the surface and undermining roads, buildings, bulkheads, and other structures. This outflow action can carry enormous amounts of highly damaging debris, resulting in further destruction. Ships and boats, unless moved away from shore, may be forced against breakwaters, wharves, and other craft, or be washed ashore and left grounded after the withdrawal of the seawater (National Tsunami Warning Center 2021).

16.2.5 Warning Time

Visible Indications

Tsunamis are difficult to detect in the open ocean; with waves generally less than 3 feet high. The first visible indication of an approaching tsunami may be either a rise or drop in water surface levels (National Tsunami Warning Center 2021):

- A drop in water level (draw down) can be caused by the trough preceding the advancing, large inbound wave crest. Rapid draw down can create strong currents in harbor inlets and channels that can severely damage coastal structures due to erosive scour around piers and pilings. As the water's surface drops, piers can be damaged by boats or ships straining at or breaking their mooring lines. The vessels can overturn or sink due to strong currents, collisions with other objects, or impact with the harbor bottom.
- The advancing tsunami may initially arrive as a strong surge increasing the sea level. This can be similar to the rising tide, but the tsunami surge rises faster and does not stop at the shoreline. Even if the wave height appears to be small, 3 to 6 feet for example, the strength of the accompanying surge can be deadly. Waist-high surges can cause strong currents that float cars, small structures, other debris, and hazardous materials. Boats and debris are often carried inland by the surge and left stranded when the water recedes.

Warning System

The tsunami warning system for the Pacific Ocean evolved from a program initiated in 1946. It is a cooperative effort involving 26 countries along with numerous seismic stations, water level stations and information distribution centers. The National Weather Service operates two regional information distribution centers: The Pacific Tsunami Warning Center in Ewa Beach, Hawaii; and the National Tsunami Warning Center covering the California coast in Palmer, Alaska. The warning centers issue tsunami watches, warnings, and advisories. A watch is issued when a large earthquake has occurred far away from the region and the threat is still being determined.

A warning is issued when damaging tsunami waves inundating dry land are expected. An advisory is issued when tsunami waves less than 1 meter high and dangerous strong currents will occur in harbors. The warning system is activated when a Pacific basin earthquake of magnitude 6.5 occurs or an earthquake is widely felt along the North American coast. When this occurs, the following sequence of actions occurs:

- Data is interpolated to determine epicenter and magnitude of the event.

- If the earthquake is of the right type, depth, magnitude, and is far away from California coast, a TSUNAMI WATCH is typically issued for the California coastline.
- A TSUNAMI WATCH is upgraded to a TSUNAMI WARNING if tsunami wave heights are forecast to be 1 meter or larger. A TSUNAMI ADVISORY is issued if tsunami wave heights are forecast to be 0.3 meters to less than 1 meter.
- Tsunami travel times are calculated, and the warning is transmitted to disseminating agencies who relay it to the public.
- The National Tsunami Warning Center will cancel/expire watches, warnings, or advisories if tide gauges and buoys indicate no significant tsunami was generated or if tsunami waves no longer meet the criteria for at least 3 hours.

This system is not considered to be effective for communities close to the tsunami source, because the first wave would arrive before the data can be processed and analyzed, and communications systems may be impacted by the precipitating event. In this case, strong ground shaking would provide the first warning of a potential tsunami and evacuations should begin immediately.

Estimated Travel Times

The NOAA National Center for Environmental Information website provides maps that show estimated travel times to coastal locations for various tsunami-generating events. Figure 16-4 shows one example of the travel time for a tsunami generated in Aburatsu, Japan to reach the planning area—approximately 13 hours.

16.3 EXPOSURE

Exposure and vulnerability estimates are based on tsunami inundation maps. The value of exposed buildings in the tsunami inundation zone was generated by overlaying the inundation areas on the general building stock. The population living in tsunami hazard zones was estimated using the percent of buildings within the tsunami inundation areas and applying this percent to the estimated planning area population. Detailed results by jurisdiction are included in Appendix D; results for the total planning area are presented below.

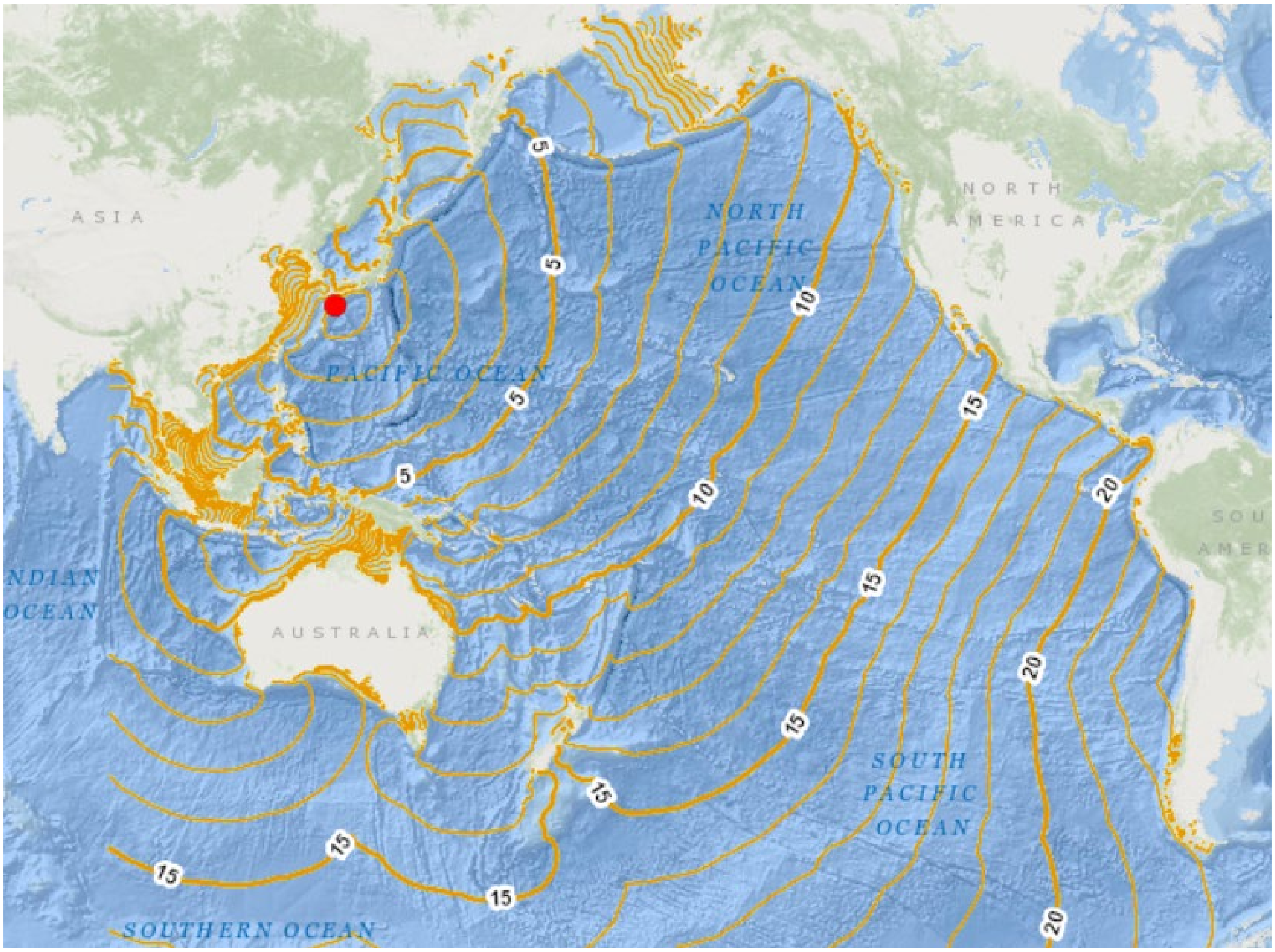
16.3.1 Population

The estimated total population living in the evaluated tsunami inundation zone is 27,626 (3.3 percent of the total planning area population). People recreating along beaches, low-lying coastal areas, tidal flats, and stream deltas that empty into ocean-going waters also would be exposed.

16.3.2 Property

Table 16-2 summarizes the estimated property exposure in the evaluated tsunami inundation areas. Figure 16-5 shows the Hazus-defined occupancy class of all buildings in the tsunami inundation areas. These occupancy classes provide an indication of land use within the mapped hazard area. Some land uses are more vulnerable to inundation, such as single-family homes, while others are less vulnerable, such as agricultural land or parks.

Figure 16-4. Potential Tsunami Travel Times in the Pacific Ocean, in Hours

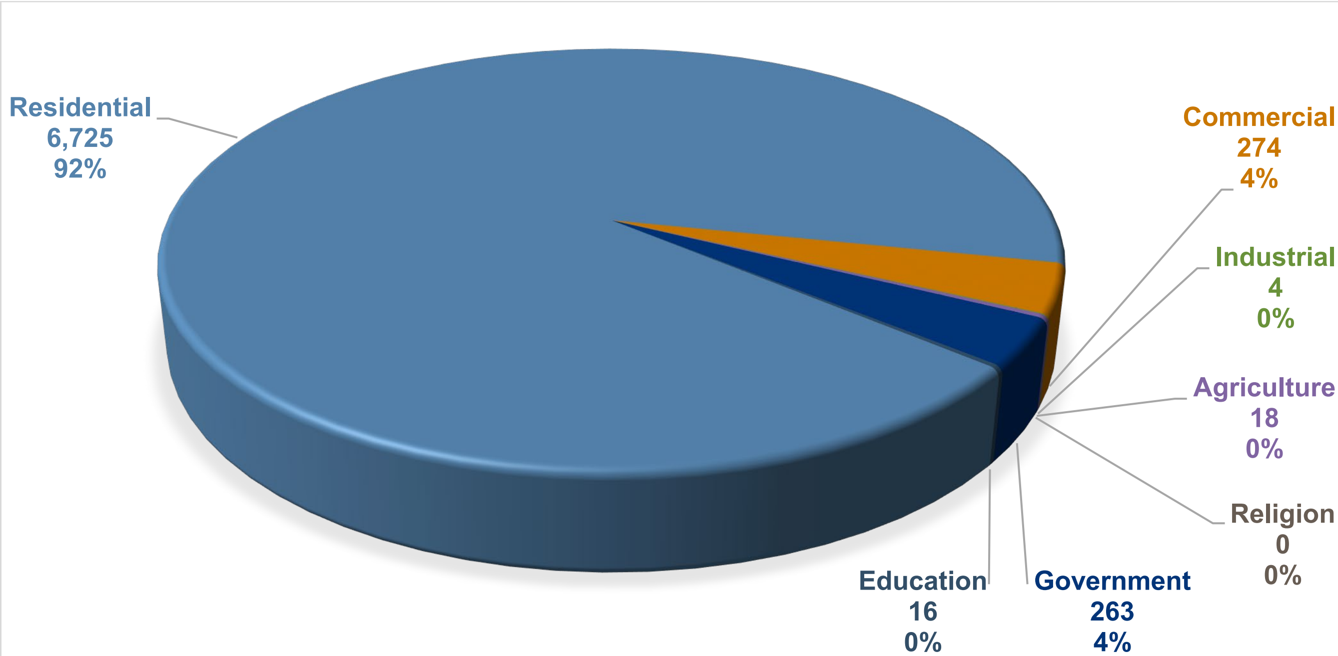


Source: National Centers for Environmental Information, 2021

Table 16-2. Exposed Property in the Tsunami Inundation Zone

Acres of Inundation Area	4,690
Number of Buildings Exposed	7,300
Value of Exposed Structures	$2,703,527,102
Value of Exposed Contents	$1,659,832,511
Total Exposed Property Value	**$4,363,359,613**
Total Exposed Value as % of Planning Area Total	***2.4%***

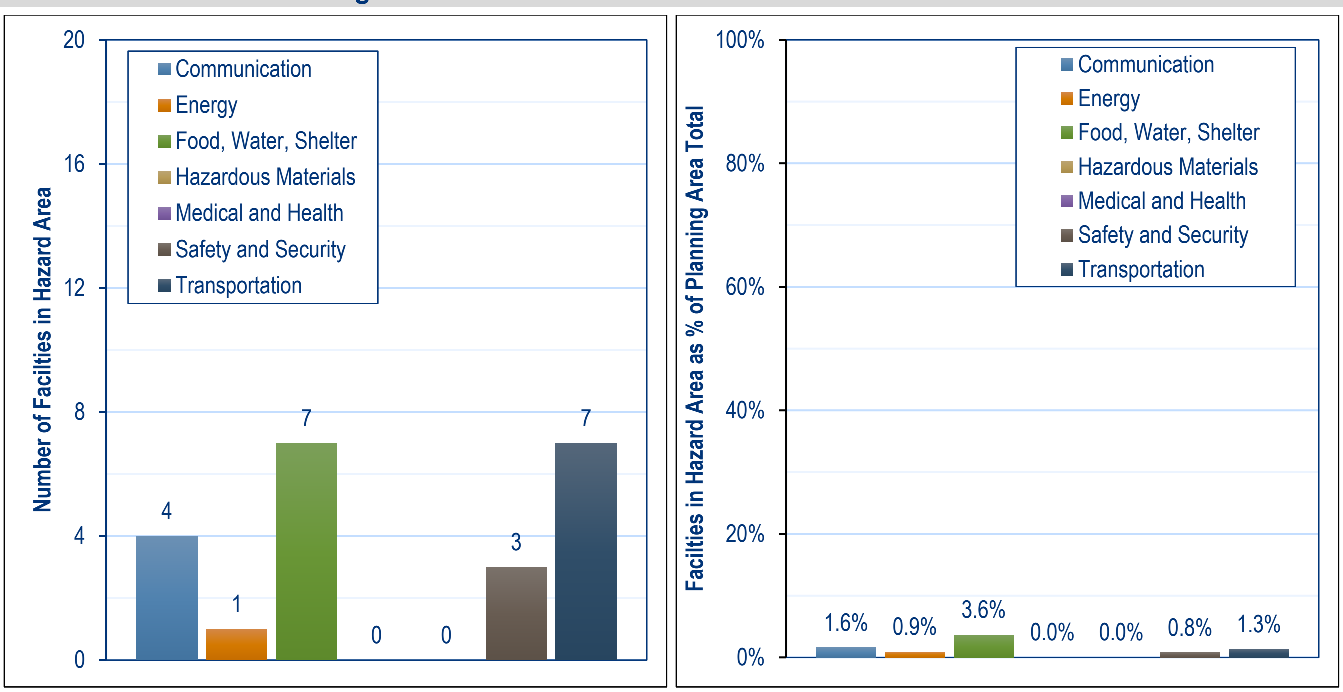
Figure 16-5. Structures in the Tsunami Inundation Zone, by Building Occupancy Class



16.3.3 Critical Facilities

Figure 16-6 shows critical facilities located in the tsunami inundation zone by facility type. The total count of critical facilities in the tsunami inundation zone (22) represents 1.4 percent of the planning area total of 1,559.

Figure 16-6. Critical Facilities in Tsunami Inundation Area



16.3.4 Environment

All waterways and beaches would be exposed to the effects of a tsunami; inundation of water and introduction of foreign debris could be hazardous to the environment. All wildlife inhabiting the area also is exposed.

16.4 VULNERABILITY

The vulnerability of people, property, and critical facilities was evaluated for the mapped tsunami inundation areas. Appendix D shows results by jurisdiction; countywide summaries are provided below.

16.4.1 Population

The populations most vulnerable to the tsunami hazard are the elderly, disabled, and very young who reside or recreate near beaches, low-lying coastal areas, tidal flats, and stream or river deltas that empty into ocean-going waters. Visitors recreating in or around inundation areas also would be vulnerable, as they may not be as familiar as residents with appropriate responses to a tsunami or ways to reach higher ground.

Impacts on persons and households in the mapped tsunami inundation area were estimated through the Level 2 Hazus analysis. Countywide results are as follows:

- Number of Displaced Population = 21,957
- Number of Residents Requiring Short-Term Shelter= 1,584

16.4.2 Property

Property Impacted

The impact of tsunami waves and the scouring associated with debris that may be carried in the water could be damaging to all structures along beaches, low-lying coastal areas, tidal flats, and river deltas. The most vulnerable are those in the front line of tsunami impact and those that are structurally unsound. The Hazus analysis indicated that 17.8 percent of the exposed structures (1,297 structures) would be impacted by the modeled scenario event.

Damage Estimates

Table 16-3 summarizes Hazus estimates of tsunami damage in the planning area. The estimated damage value is associated with the tsunami wave only; it does not include additional damage that may occur as a result of debris battering structures as the tsunami wave rushes in and out of the inundation area or fires caused by an earthquake and tsunami event. The debris estimate includes only structural debris and building finishes; it does not include additional debris that may result from a tsunami event, such as from boats, trees, sediment, building contents, bridges, or utility lines. Structures that were built to current floodplain regulations in the tsunami inundation area may have some level of protection, particularly if they were built to withstand wave action.

Table 16-3. Estimated Impact of a Tsunami Event in the Planning Area

Structure Debris (tons)	1,755,480
Buildings Impacted	1,297
Structure Value Damaged	$125,195,566
Content Value Damaged	$198,643,647
Total Value Damaged	**4323,839,203**
Damage as % of Total Value	***0.2%***

16.4.3 Critical Facilities

Significant facilities predicted by Hazus to be affected by the modeled tsunami event include one fire station, one school, and five road bridges

Damage Estimates

Hazus was used to estimate the number of critical facilities affected by tsunami and the resulting percent of damage to the building and contents. Figure 16-7 compares the predicted number of affected facilities to the number of exposed facilities. Figure 16-8 shows the estimated damage to critical facilities from a tsunami event. Depending on critical facility category, the average amount of damage to structures, measured as a percentage of total value, ranges from 1.3 to 13.0 percent of total value, and average damage to contents ranges from 0 to 47.4 percent.

Figure 16-7. Critical Facilities Exposed to and Affected by Mapped Tsunami Inundation Area

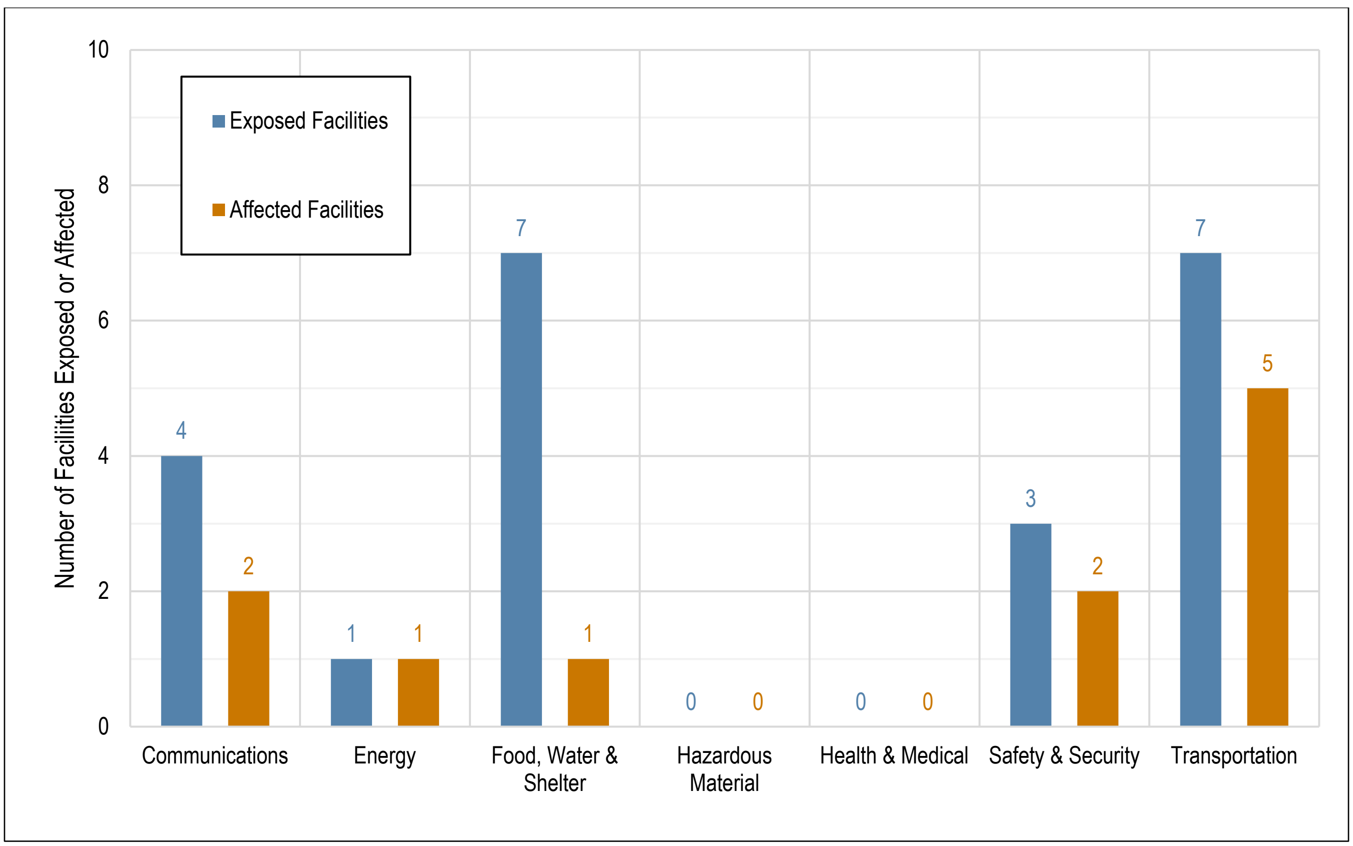
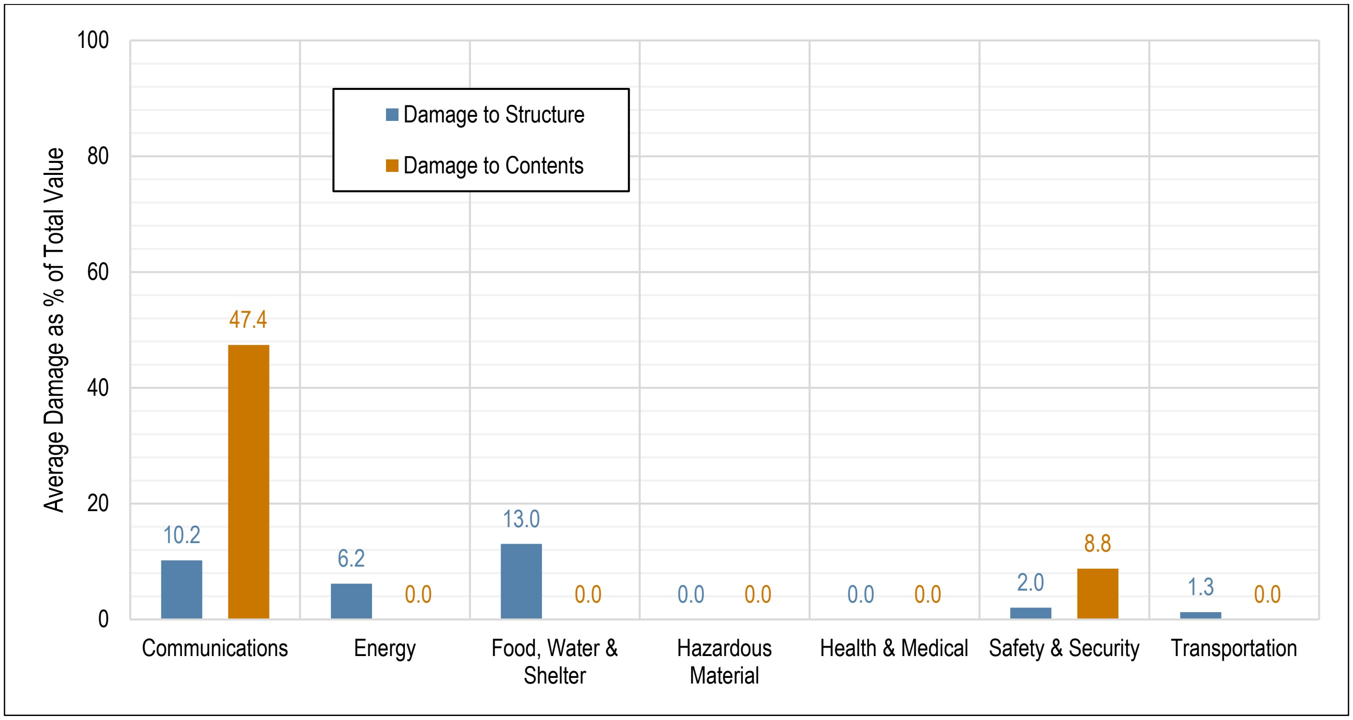


Figure 16-8. Average % of Damage to Critical Facilities Caused by Modeled Tsunami



Vulnerable Infrastructure

In addition to the vulnerable critical facilities identified by the Hazus analysis, the following infrastructure is also generally vulnerable to damage:

- **Water Proximate Infrastructure**—Breakwaters and piers collapse, sometimes because of scouring actions that sweep away their foundation material and sometimes because of the sheer impact of the tsunami waves.
- **Flood Control Systems**—Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from tsunami events, also causing localized urban flooding.
- **Utility Systems—**Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing waste to spill into homes, neighborhoods, rivers, and streams. Tsunami waves can knock down power lines and radio/cellular communication towers. Power generation facilities can be severely impacted by wave action and by inundation from floodwater.

16.4.4 Environment

Environmental impacts on local waterways and wildlife would be most significant in areas closest to the point of impact. Areas near gas stations, industrial areas and facilities storing hazardous materials are vulnerable. The vulnerability of aquatic habit and associated ecosystems in low-lying areas close to the coastline is high. Tsunami waves can carry destructive debris and pollutants that can have devastating impacts on all facets of the environment. A tsunami event has the potential to alter the shoreline, depending on the force of the run-up.

Most environmental and ecological impacts from tsunamis derive from direct damage from the waves, which can physically remove vegetation and wildlife, increase sediment load, and smother vegetation that is not physically carried away. Other environmental impacts from tsunamis include chemical changes from saltwater intruding into freshwater sources; eutrophication (enrichment) of water from increased runoff; and decomposition of vegetation, wildlife, rotting property (boats or buildings) and unrecovered remains. Non-biodegradable waste, such as plastics, can lead to a buildup in marine debris, and toxic wastes, if inadequately stored, may be released into the environment. Lastly, exotic wildlife may be introduced or may escape into the local ecosystem.

16.5 SCENARIO

The presentation *Tsunami Hazards and Preparedness in Ventura County* shows that local tsunamis may cause serious impact. A worst-case-scenario for the Ventura coastline would be a nearshore tsunami caused by a significant off-shore seismic event. While history has shown that these type events are not likely, should one occur, damage for this type of event would exceed what is estimated in the risk assessment for this hazard mitigation plan.

16.6 ISSUES

The planning team has identified the following issues related to the tsunami hazard for the planning area:

- **Hazard Identification**—To truly measure and evaluate the probable impacts of tsunamis on planning, hazard mapping based on probabilistic scenarios must continue to be updated regularly. The science and technology in this field are emerging. Accurate probabilistic tsunami mapping will need to be a key component for tsunami hazard mitigation programs to be effective.
- **Building Code Revisions**—Present building codes and guidelines may not adequately address the impacts of tsunamis on structures. Planning partners, in the cities of Ventura, Oxnard, and Port Hueneme, should review their building code for requirements for tsunami-resistant construction standards in vulnerable areas.
- **Enhancement of Current Capabilities**—As tsunami warning technologies evolve, the tsunami warning capability within the planning area will need to be enhanced to provide the highest degree of warning.
- **Vulnerable Populations Planning**—Special attention will need to be focused on the vulnerable communities in the tsunami zone and on hazard mitigation through public education, outreach, and warning capabilities. This issue may be especially important for visitors to Ventura County.

17. WILDFIRE

17.1 GENERAL BACKGROUND

A wildfire is any uncontrolled fire on undeveloped land that requires fire suppression. Although wildfires can occur naturally and are important to many ecosystem processes, most are started by human activity.

17.1.1 CAL FIRE Wildfire Mapping

Fire Hazard Severity Zones

CAL FIRE has modeled and mapped wildfire hazard zones using a computer model that designates moderate, high or very high fire hazard severity zones (FHSZ). FHSZ ratings are derived from a combination of fire frequency (how often an area burns) and expected fire behavior under severe weather conditions. CAL FIRE's model derives fire frequency from 50 years of fire history data. Fire behavior is based on factors such as the following (CAL FIRE 2021):

- **Fuel**—Fuel may include living and dead vegetation on the ground, along the surface as brush and small trees, and above the ground in tree canopies. Lighter fuels such as grasses, leaves and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite. Trees killed or defoliated by forest insects and diseases are more susceptible to wildfire.
- **Weather**—Relevant weather conditions include temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere. When the temperature is high, relative humidity is low, wind speed is increasing and coming from the east (offshore flow), and there has been little or no precipitation, so vegetation is dry, conditions are very favorable for extensive and severe wildfires. These conditions occur more frequently inland where temperatures are higher and fog is less prevalent.
- **Terrain**—Topography includes slope and elevation. The topography of a region influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind;

FIRE HAZARD SEVERITY AS DETERMINED BY CAL FIRE

CAL FIRE classifies areas of the state as having a moderate, high, or very high fire hazard, based on how a fire would behave in a given area and the probability of flames and embers threatening buildings.

For wildland areas, the FHSZ model uses burn probability and expected fire behavior based on weather, fuel (the vegetation in the area), and terrain. For urban areas, hazard levels are based on vegetation density, distance from wildlands, and the levels assigned to surrounding zones.

Each area gets a score for flame length, embers, and the likelihood of the area burning. Scores of smaller areas are then averaged over larger zones that encompass them.

potential barriers to fire spread, such as highways and lakes; and elevation and slope of landforms (fire spreads more easily uphill than downhill).

The model also is based on frequency of fire weather, ignition patterns, and expected rate-of spread. It accounts for flying ember production, which is the principal driver of the wildfire hazard in densely developed areas. A related concern in built-out areas is the relative density of vegetative fuels that can serve as sites for new spot fires within the urban core and spread to adjacent structures. The model refines the zones to characterize fire exposure mechanisms that cause ignitions to structures. Significant land-use changes need to be accounted for through periodic model updates.

Wildfire Protection Responsibility Areas

Hundreds of agencies have fire protection responsibility for wildland and wildland/urban interface fires in California. Local, state, tribal, and federal organizations have primary legal (and financial) responsibility for wildfire protection. In many instances, two fire organizations have dual primary responsibility on the same parcel of land —one for wildfire protection, and the other for structural or "improvement" fire protection. According to the *2018 California State Hazard Mitigation Plan*, this layering of responsibility and resulting dual policies, rules, practices, and legal ordinances can cause conflict or confusion. To address wildfire jurisdictional responsibilities, the California state legislature in 1981 adopted Public Resource Code Section 4291.5 and Health and Safety Code Section 13108.5 establishing the following responsibility areas:

- **Federal Responsibility Areas (FRAs)—**FRAs are fire-prone wildland areas that are owned or managed by a federal agency such as the U.S. Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, or U.S. Department of Defense. Primary financial and rule-making jurisdictional authority rests with the federal land agency. In many instances, FRAs are interspersed with private land ownership or leases. Fire protection for developed private property is usually not the responsibility of the federal land management agency; structural protection responsibility is that of a local government agency.
- **State Responsibility Areas (SRAs)**—SRAs are lands in California where CAL FIRE has legal and financial responsibility for wildfire protection and where CAL FIRE administers fire hazard classifications and building standard regulations. SRAs are defined as lands that meet the following criteria:
  - Are county unincorporated areas
  - Are not federally owned
  - Have wildland vegetation cover rather than agricultural or ornamental plants
  - Have watershed or range/forage value
  - Have housing densities not exceeding three units per acre.
  - Where SRAs contain built environment or development, the responsibility for fire protection of those improvements (non-wildland) is that of a local government agency.
- **Local Responsibility Areas (LRAs)—**LRAs include land in cities, cultivated agriculture lands, and non-flammable areas in unincorporated areas, and lands that do not meet the criteria for SRA or FRA. LRA fire protection is typically provided by city fire departments, fire protection districts, and counties, or by CAL FIRE under contract to local governments. LRAs may include flammable vegetation and wildland/urban interface areas where the financial and jurisdictional responsibility for improvement and wildfire protection is that of a local government agency.

17.1.2 State Codes and Policies for Mitigating the Fire Hazard

Urbanization tends to alter the natural fire regime and can lead to expansion of urbanized areas into wildland areas. State and local policies and regulations require landowners to carry out activities such as maintaining defensible space and reducing vulnerability to damage or loss from wildfire. The most important policies and regulations related to residential wildfire safety in California are as follows:

- **General Plan Safety Element Review: Government Code 65302.5**—The Board of Forestry and Fire Protection (BOF) must provide recommendations to a local jurisdiction's general plan safety element at the time that the general plan is being amended. BOF recommendations include goals and policies that provide for contemporary fire-prevention standards for the jurisdiction. This is not a direct and binding fire-prevention requirement for individuals.
- **Sprinkler Systems: California Residential Code, Chapter 3, Section R313—**All new dwellings, dwelling units, and one- and two-family townhomes must be equipped with an automatic fire-sprinkler system that can protect the entirety of the dwelling. Dwellings and homes constructed prior to January 1, 2011, that do not have a sprinkler system may be retrofitted, but it is not required.
- **Fire Safety Standards: California Public Resources Code 4290 and 14 California Code of Regulations (CCR) 1270—**These regulations govern roads, driveway width, clearance, turnarounds, signing, and water related to fire safety throughout California. Public Resources Code 4290 is typically enacted through regulation at the county level, as described below.
- **Wildland-Urban Interface Building Standards: California Government Code 51189**—The Office of the State Fire Marshal is required to create building standards for wildfire resistance. Construction of buildings in the wildland-urban interface must use fire-resistant materials to save life and property. As of 2011, the standards relevant to fire-safe construction for all new structures in the SRA are the California Building Code, Chapter 7A (for commercial construction) and the California Residential Code, Chapter 3, Section R327 (for residential construction).
- **State Responsibility Area: Public Resources Code 4102, 4125-4229 and 14 CCR 1220**—These statutes and regulations establish the locations where CAL FIRE has the financial responsibility for preventing and suppressing fires. These designations define financial arrangements for fire protection services and establish the locations where fire safe and defensible space laws or regulations apply.
- **Hazardous Fire Areas: Public Resources Code 4251-4255 and 14 CCR 1200—**These laws and regulations allow petitioners to the BOF or CAL FIRE to establish hazardous fire areas, providing for area closures and other restrictions for fire prevention.
- **Defensible Vegetation Clearing Around Structures: Public Resources Code 4291/14 CCR 1299**— Public Resources Code 4291 regulates fuel management around a property. It states that a person who owns or controls a building or structure in or adjoining to forest, brush, or grass covered lands shall follow certain guidelines outlined in the code. At least 100 feet of defensible space is required. The owner of the property is liable for making these changes to protect habitable structures. The 100 feet is separated into two zones, with the closer zone, 30 feet out from the structure, being managed more intensively.

17.1.3 Secondary Hazards

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

17.2 HAZARD PROFILE

17.2.1 Past Events

Ventura County has a prolific fire history, including 11 events since 2000 that have triggered federal disaster declarations, as listed in Table 17-1. Most of these fires coincided with strong Santa Ana wind events.

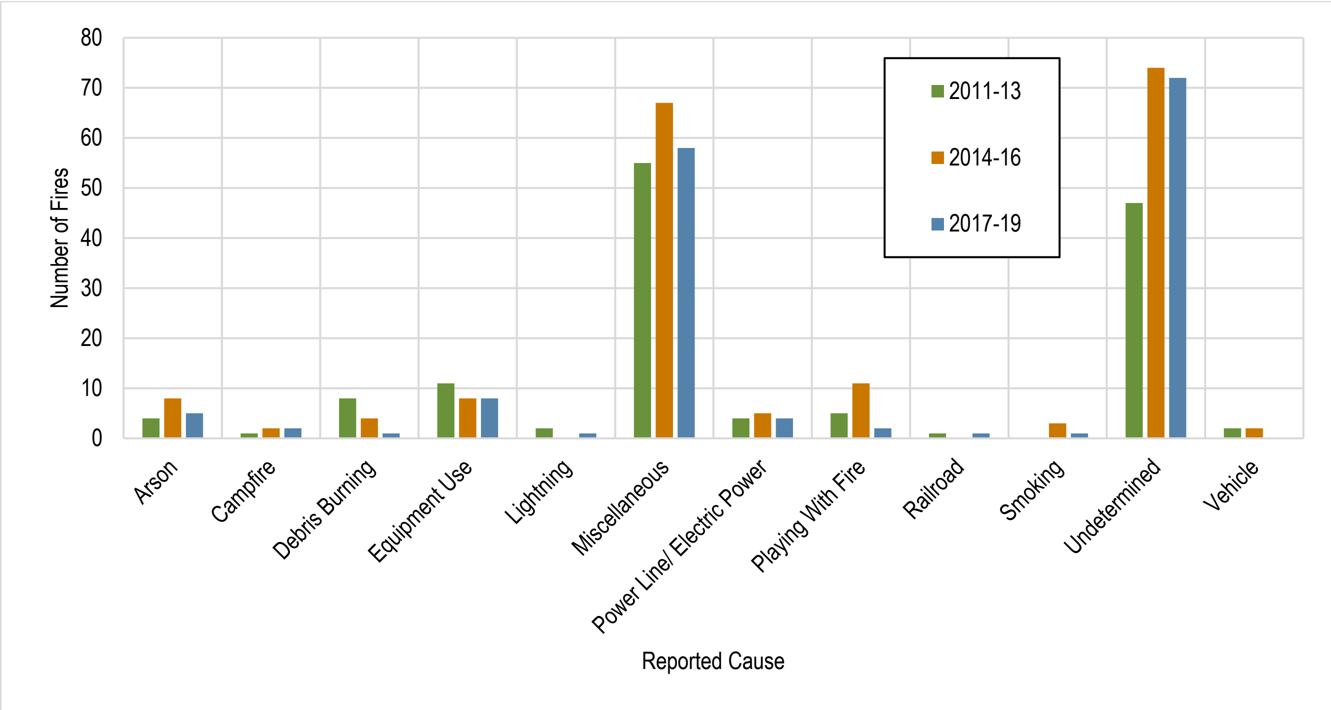
Table 17-1. Federally Declared Wildfire Events in Ventura County

Date Started	FEMA Declaration #	Description
October 31, 2019	FM-5302	Maria Fire 9,999 acres burned, 4 structures destroyed
October 30, 2019	FM-5298	Easy Fire 2,375 acres burned, 1 structure damaged, 1 structure destroyed
November 8, 2018	DR-4407	Woolsey Fire 96,949 acres, 1,643 structures destroyed, 3 fatalities
December 4, 2017	FM-5224 DR-4353	Thomas Fire[a] 281,893 acres burned, 280 structures damaged, 1,063 structures destroyed, 2 fatalities
May 2, 2013	FM-5024	Springs Fire 24,251 acres burned, 12 structures damaged, 10 structures destroyed
September 22, 2009	FM-2839	Guiberson Fire 17,500 acres burned
December 3, 2006	FM-2681	Shekell Fire 13,600 acres burned, 7 structures burned
September 4, 2006	FM-2677	Day Fire 162,702 acres burned
November 17, 2005	FM-2586	School Fire 3,891 acres burned
September 28, 2005	FM-2583	Topanga Fire 24, 175 acres burned, 6 structures burned
October 25, 2003	DR-1498	Simi Fire 107,560 acres burned, 48 structures lost

Source: FEMA 2021, CAL FIRE 2021
a. Statistics include Ventura and Santa Barbara Counties

CAL FIRE maintains statistics on historical wildfire activity through its annual reporting (Redbooks). Wildfire statistics include state and county information, cause and size, acres burned, and dollar damage, among other details. Figure 17-1 shows the wildfire activity for Ventura County between 2011 and 2019, the most recent annual report available. CAL FIRE has Redbooks available for every year back through 1942.

Figure 17-1. CAL FIRE Wildfire Activity Statistics for Ventura County 2011-2019



17.2.2 Location

Figure 17-2 shows the moderate, high, and very high FHSZs for Ventura County. These maps are the basis for the wildfire risk assessment.

17.2.3 Frequency

The wildfire season in coastal Southern California displays a distinct seasonality. Unlike the rest of western North America, which is mainly susceptible to wildfires during the summer, Southern California's fire season historically peaks in the fall. This is the result of two factors: the long dry summer defining the local Mediterranean climate regime; and the dry, gusty downslope Santa Ana winds, whose season starts in the fall when vegetation is at its driest.

Based on its history of past events, Ventura County has a high chance of a wildfire in any given year. The most common causes of wildfires, based on recent past events, will be "undetermined," miscellaneous, equipment use, playing with fire, and arson.

17.2.4 Severity

The Thomas Fire in 2017 had greater impact on Ventura County than any other wildfire to date. This fire started near Santa Paula and spread quickly, aided by strong Santa Ana winds. It burned for 38 days, covering 282,000 acres in Ventura and Santa Barbara counties and destroying or damaging more than 1,300 structures. Two people lost their lives. The agriculture industry in Ventura County suffered losses of at least $171 million.

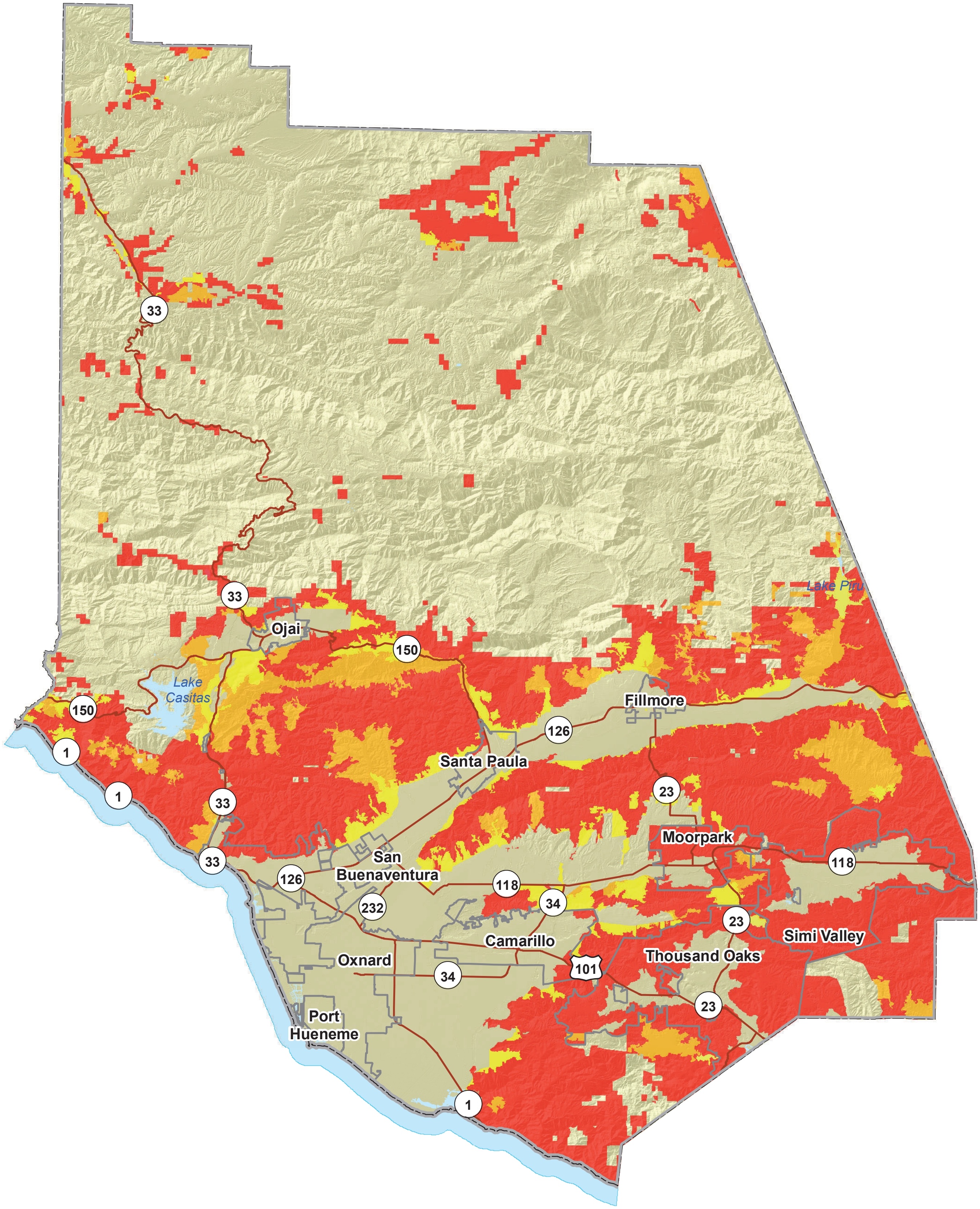


Figure 17-2. Wildfire Hazard Severity Zones in Ventura County

Data Sources: Ventura Co., CAL FIRE, Esri

In CAL FIRE's July 2021 list of the deadliest, largest, and most destructive wildfires that have occurred in the state, the Thomas Fire ranks as the 8th largest and 15th most destructive. The 2018 Woolsey Fire ranks as the 8th most destructive. Both these fires were exacerbated by strong Santa Ana wind conditions. Although no Ventura County fires are listed among the top 20 deadliest events, four of the deadliest fires recorded were in neighboring Los Angeles County.

17.2.5 Warning Time

Whether intentionally or accidentally, most wildfires are caused by humans. There is no way to predict when one might break out. Dry seasons, prolonged droughts, and Santa Ana wind events are factors that greatly increase fire likelihood. Severe weather can be predicted, so special attention can be paid during weather events that may increase wildfire risk. Since fireworks often cause brush fires, extra diligence also is warranted around holidays, such as Fourth of July, when the use of fireworks is highest.

If a fire does break out and spread rapidly, residents may need to evacuate within days or hours. According to the U.S. Forest Service, a fire's peak burning period generally is between 10 a.m. and sundown. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to significant improvements in warning time.

17.3 EXPOSURE

A quantitative assessment of exposure to the wildfire hazard was conducted using the hazard mapping shown in Figure 17-2 and the asset inventory developed for this plan. Detailed results by municipality are provided in Appendix D; results for the total planning area are presented below.

17.3.1 Population

Population exposure was estimated by calculating the number of buildings in each hazard area as a percent of total planning area buildings and applying this percentage to the planning area population. Table 17-2 summarizes the estimated countywide population living in the mapped risk areas. In addition to populations who reside in risk areas where fires may occur, visitors, hikers and campers may be exposed to wildfires. The entire population of the planning area has the potential to be exposed to smoke from nearby wildfires.

Table 17-2. Exposed Population in Mapped Relative Fire Hazard Zones

	Moderate FHSZ	High FHSZ	Very High FHSZ
Population Exposed	6,101	4,188	175,759
% of Total Planning Area Population	0.7%	0.5%	20.8%

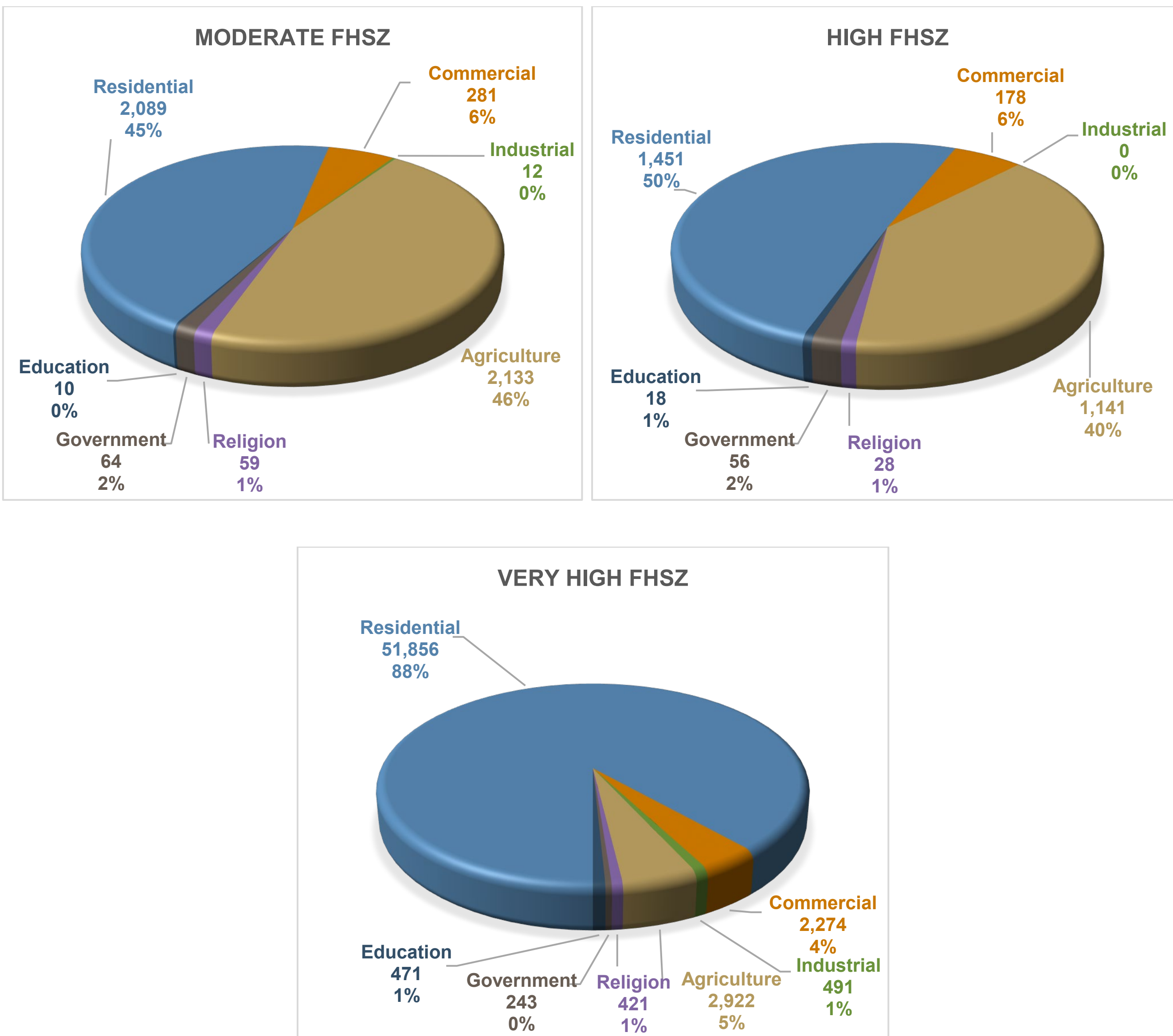
17.3.2 Property

Table 17-3 summarizes the estimated countywide property exposure in the mapped wildfire risk areas. Figure 17-3 shows the occupancy class for all buildings in the mapped fire hazard areas. These occupancy classes provide an indication of land use within the mapped hazard area. Some land uses are more vulnerable to fire, such as single-family homes, while others are less vulnerable, such as agricultural land or parks.

Table 17-3. Exposed Property in Mapped Relative Fire Hazard Zones

	Moderate FHSZ	High FHSZ	Very High FHSZ
Number of Buildings Exposed	4,648	2,872	58,678
Value of Exposed Structures	$1,444,900,462	$955,204,682	$24,250,894,229
Value of Exposed Contents	$1,099,162,715	$725,563,443	$15,324,915,299
Total Exposed Property Value	**$2,544,063,177**	**$1,680,768,126**	**$39,575,809,528**
Total Exposed Value as % of Planning Area Total	***1.4%***	***0.9%***	***21.9%***

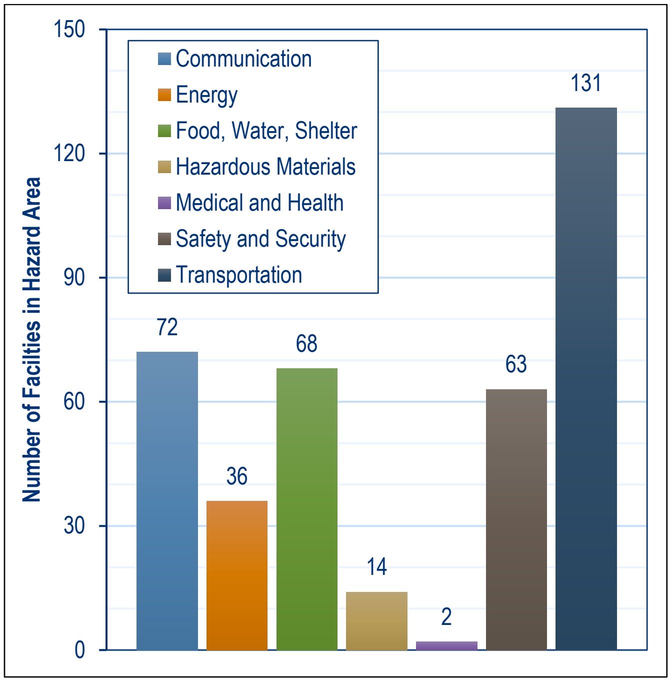
Figure 17-3. Structures in the Moderate, High or Very High FHSZs, by Occupancy Class

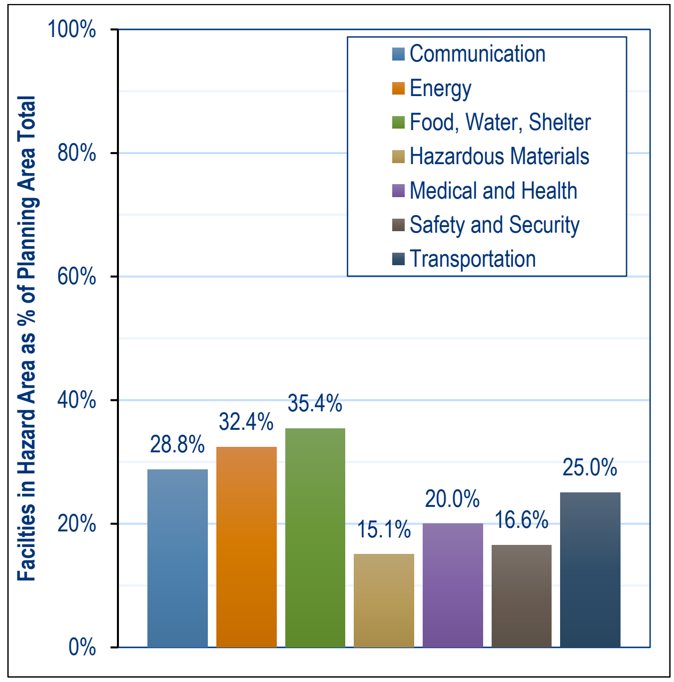


17.3.3 Critical Facilities

Figure 17-4 shows critical facilities located in the high or very high fire hazard severity zones, by facility type. The total count of critical facilities in these risk areas (386) represents 25 percent of the planning area total of 1,559. A breakdown by municipality is provided in Appendix D.

Figure 17-4. Critical Facilities in High or Very High Severity Zones





17.3.4 Environment

All natural resources and habitats in mapped fire hazard severity zones are exposed to the risk of wildfire.

17.4 VULNERABILITY

17.4.1 Population

All people exposed to the wildfire hazard are potentially vulnerable to wildfire impacts. Persons with access and functional needs, the elderly and very young may be especially vulnerable to a wildfire if there is not adequate warning time for them to evacuate if needed. In addition, people outside the mapped risk areas are susceptible to health hazards associated with smoke and air pollution from wildfires, especially sensitive populations including children, the elderly, and those with respiratory and cardiovascular diseases. In addition, wildfires threaten the health and safety of those fighting the fires.

17.4.2 Property

All property exposed to the wildfire hazard is vulnerable. Structures that were not constructed to standards designed to protect a building from a wildfire may be especially vulnerable. As of 2008, California State Building code requires minimum standards be met for new buildings in fire hazard severity zones. According the 2019 American Community Survey estimates, most of the housing in the planning area—96.8 percent—was built prior to this code requirement. It is unknown how many of these structures are located in fire hazard zones.

Estimates were developed to indicate the loss that would occur if wildfire damage were equal to 1, 10, 30 or 50 percent of the exposed property value, as summarized in Table 17-4. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure.

Table 17-4. Loss Estimates for Fire Hazard Severity Zones

	Exposed Value	Loss Value	Loss as % of Total Planning Area Replacement Value
Moderate FHSZ			
Loss = 1% of Exposed Value	$2,544,063,177	$25,440,632	0.01%
Loss = 10% of Exposed Value		$254,406,318	0.14%
Loss = 30% of Exposed Value		$763,218,953	0.42%
Loss = 50% of Exposed Value		$1,272,031,589	0.70%
High FHSZ			
Loss = 1% of Exposed Value	$1,680,768,126	$16,807,681	0.01%
Loss = 10% of Exposed Value		$168,076,813	0.09%
Loss = 30% of Exposed Value		$504,230,438	0.27%
Loss = 50% of Exposed Value		$840,384,063	0.45%
Very FHSZ			
Loss = 1% of Exposed Value	$39,575,809,528	$395,758,095	0.22%
Loss = 10% of Exposed Value		$3,957,580,953	2.19%
Loss = 30% of Exposed Value		$11,872,742,858	6.57%
Loss = 50% of Exposed Value		$19,787,904,764	10.95%

17.4.3 Critical Facilities

Currently there are 14 hazardous material containment sites identified in wildfire risk zones. During a wildfire event, containers with these materials could rupture because of the excessive heat and act as fuel for the fire, causing rapid spreading and escalating the fire to unmanageable levels. In addition, they could leak into surrounding areas, saturating soils and seeping into surface waters, and have a disastrous effect on the environment.

In the event of wildfire, there would likely be little damage to most infrastructure. Most roads would not be damaged except in the worst scenarios, although roads and bridges can be blocked by debris or fire-related conditions and become impassable. Power poles are the most at risk to wildfire because most are made of wood and susceptible to burning. In the event of a wildfire, pipelines could provide a source of fuel and lead to a catastrophic explosion.

17.4.4 Environment

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, affecting the types, structure, and spatial extent of native vegetation. However, in some circumstances it can also cause severe environmental impacts, such as the following:

- **Soil Erosion**—The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- **Reduced Agricultural Resources**—Wildfire can have disastrous consequences on agricultural resources, removing them from production and necessitating lengthy restoration programs.
- **Spread of Invasive Plant Species**—Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.
- **Disease and Insect Infestations**—Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- **Destroyed Endangered Species Habitat—**Wildfire can have negative consequences for endangered species by degrading their habitat.
- **Soil Sterilization**—Some wildfires burn so hot that they can sterilize the soil. Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost.
- **Damaged Fisheries—**Fisheries can suffer from increased water temperatures, sedimentation, and changes in water quality.
- **Damaged Cultural and Historical Resources**—The destruction of cultural and historic resources may occur, scenic vistas can be damaged, and access to recreational areas can be reduced.

17.5 SCENARIO

With Ventura County’s Mediterranean climate, high moisture levels during the winter rainy season can significantly increase the growth of plants, followed by that vegetation becoming dried during the long, hot summers, decreasing plant moisture content and increasing the ratio of dead fuel to living fuel. As a result, fire susceptibility increases dramatically, particularly in late summer and early autumn.

The worst conditions for local wildfires also depend on how long it has been since the last fire. For several years after a fire has occurred, easily flammable herbaceous species predominate and increase the likelihood of new fires. When woody species become re-established, they contribute to a lower overall level of fire susceptibility for approximately 10 years. However, after this period, the slow aging plant community becomes ever more likely to burn because of increased levels of dead plant material and lowered plant moisture levels.

Santa Ana winds contribute to the likeliness of wildfires in Ventura County, bringing extremely dry air and high wind speeds that further desiccate plant communities during the period of the year when the constituent species have very low moisture content. The effect of these winds on existing fires is particularly dangerous; the winds can greatly increase the rate at which fires spread.

A worst-case scenario would include an active fire season throughout the American west, spreading resources thin. Firefighting teams would be exhausted or unavailable. Many federal assets would be responding to other fires that started earlier in the season.

To further complicate the problem, heavy rains could follow, causing flooding and landslides in areas where vegetation has been removed by the fire.

17.6 ISSUES

The major issues for wildfire are the following:

- Public education and outreach to people living in or near the fire hazard zones should include information about and assistance with mitigation actions such as defensible space and advance identification of evacuation routes and safe zones.
- Wildfires could cause landslides as a secondary natural hazard.
- Wildfire preparedness and response planning should emphasize being alert to any predictions of Santa Ana winds, which are significant contributors to wildfire in Ventura County.
- Climate change could exacerbate the wildfire hazard.
- Future growth into interface areas should continue to be managed.
- Area fire districts need to continue to train on wildland-urban interface events.
- Vegetation management activities—This issue would include enhancement through expansion of the target areas as well as additional resources.
- Regional consistency of higher building code standards such as residential sprinkler requirements and prohibitive combustible roof standards.
- Firefighters in remote and rural areas are faced with limited water supply and lack of hydrant taps.
- Expand certifications and qualifications for fire department personnel.
- Ensure that all firefighters are trained in basic wildfire behavior, basic fire weather, and that all company officers and chief level officers are trained to the wildland command and strike team leader level.

18. CLIMATE CHANGE

18.1 GENERAL BACKGROUND

18.1.1 What is Climate Change?

"Climate change" refers to alterations in the long-term patterns of temperature, precipitation, humidity, wind and seasons that play a fundamental role in shaping natural ecosystems and the human economies and cultures that depend on them. These shifts may result from natural processes (e.g., cyclical ocean patterns like El Niño, La Niña and the Pacific Decadal Oscillation, volcanic activity, changes in the sun's energy output, variations in Earth's orbit), but they can also be driven by human activity. Many of the changes observed in Earth's climate since the early 20th century have been attributed to human activity.

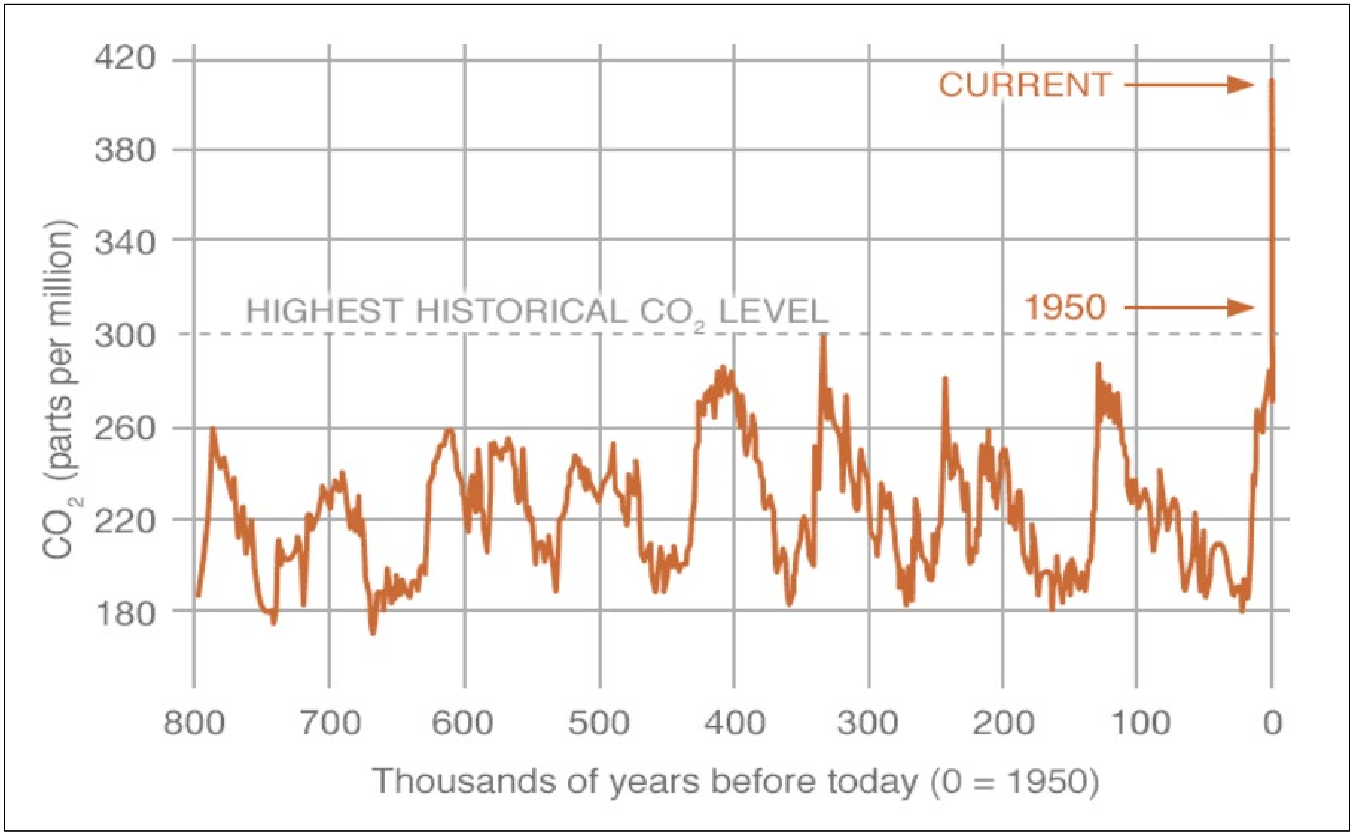
The well-established worldwide warming trend of recent decades and its related impacts are caused by increasing concentrations of carbon dioxide and other greenhouse gases in the earth's atmosphere. Greenhouse gases are gases that trap heat in the atmosphere, resulting in a warming effect. Carbon dioxide is the most commonly known greenhouse gas; however, methane, nitrous oxide and fluorinated gases also contribute to warming. Emissions of these gases come from a variety of sources, such as the combustion of fossil fuels, agricultural production, and changes in land use. According to the National Aeronautics and Space Administration (NASA), carbon dioxide concentrations measured about 280 parts per million (ppm) before the industrial era began in the late 1700s and have risen dramatically since then, surpassing 400 ppm in 2013 for the first time in recorded history (see Figure 18-1).

18.1.2 How Climate Change Affects Hazard Mitigation

Climate change will affect the people, property, economy, and ecosystems of the planning area in a variety of ways. Consequences of climate change include increased periods of prolonged drought, potential for heat-related illnesses, detrimental impacts on agricultural productivity, and increased flood vulnerability. The most important effect for the development of this hazard mitigation plan is that climate change will have a measurable impact on the occurrence and severity of many natural hazards.

An essential aspect of hazard mitigation is predicting the likelihood of future hazard events. Typically, predictions are based on statistical projections from records of past events. This approach assumes that the likelihood of hazard events remains essentially unchanged over time. Thus, averages based on the past frequencies of, for example, floods are used to estimate future frequencies: if a river has flooded an average of once every 5 years for the past 100 years, then it can be expected to continue to flood an average of once every 5 years.

Figure 18-1. Global Carbon Dioxide Concentrations Over Time



Source: NASA 2021

For hazards that are affected by climate conditions though, the assumption that future behavior will be equivalent to past behavior is not valid. For example, flooding is generally associated with precipitation frequency and quantity. However, the frequency of flooding will not remain constant if broad precipitation patterns change over time. Specifically, as hydrology changes, storms currently considered to be the 100-year flood might strike more often, leaving many communities at greater risk.

The risks of landslide, severe storms, severe weather, and wildfire are all affected by climate patterns as well. For this reason, an understanding of climate change is pertinent to efforts to mitigate natural hazards. Information about how climate patterns are changing provides insight on the reliability of future hazard projections used in mitigation analysis.

18.1.3 Current Indicators of Climate Change

Global Indicators

The major scientific agencies of the United States—including NASA and the National Oceanic and Atmospheric Administration (NOAA)—have presented evidence that climate change is occurring. NASA summarizes key evidence as follows (National Aeronautics and Space Administration 2021):

- **Global Temperature Rise**—The planet's average surface temperature has risen about 2.12 ºF since the late 19th century, a change driven largely by increased carbon dioxide emissions into the atmosphere and other human activities. Most of the warming occurred in the past 40 years, with the seven most recent years being the warmest. The years 2016 and 2020 are tied for the warmest year on record. The ocean has absorbed much of this increased heat, with the top 100 meters (about 328 feet) of ocean showing warming of more than 0.6 ºF since 1969. Earth stores 90 percent of its extra energy in the ocean.

- **Shrinking Ice Sheets**—The Greenland and Antarctic ice sheets have decreased in mass. Data from NASA's Gravity Recovery and Climate Experiment show Greenland lost an average of 279 billion tons of ice per year between 1993 and 2019, while Antarctica lost about 148 billion tons of ice per year.
- **Glacial Retreat**—Glaciers are retreating almost everywhere around the world—including in the Alps, Himalayas, Andes, Rockies, Alaska and Africa.
- **Decreased Snow Cover**—Satellite observations reveal that the amount of spring snow cover in the Northern Hemisphere has decreased over the past five decades and that the snow is melting earlier
- **Sea-Level Rise**—Global sea levels rose about 8 inches in the last century. The rate in the last two decades is nearly double that of the last century and is accelerating slightly every year.
- **Declining Arctic Sea Ice**—Both the extent and thickness of Arctic sea ice has declined rapidly over the last several decades
- **Extreme Events**—The number of record high temperature events in the United States has been increasing, while the number of record low temperature events has been decreasing, since 1950. The U.S. has also witnessed an increasing number of intense rainfall events.
- **Ocean Acidification**—Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30 percent. The amount of carbon dioxide absorbed by the upper layer of the oceans is increasing to about 7 to 10 billion metric tons per year.

California Indicators

Monitoring and research efforts across California have generated data that describe changes already underway in the state. Notable examples across the state include the following (California Office of Environmental Health Hazard Assessment 2018):

- Dissolved oxygen in coastal waters is declining throughout the south coast survey region
- Since 1950, the northern Sierra Nevada showed an overall snowpack decline of 7.4 inches.
- Unusually warm waters occurred in the Pacific Ocean in 2014-2015, leading to widespread impacts on marine life. This marine heat wave first appeared as a large area of exceptionally high sea surface temperatures in the Gulf of Alaska in November 2013 and later extended along the entire west coast of North America.
- The surface area of seven Sierra Nevada glaciers has decreased dramatically since the beginning of the 20th century. In 2014, the size of these glaciers ranged from 14 to 52 percent of their 1903 area.
- Sea level has risen by about 7 inches since 1900 at San Francisco and by about 6 inches since 1924 at La Jolla.
- Since 1906, the fraction of annual snowmelt runoff that flows into the Sacramento River between April and July has decreased by about 9 percent.

- Compared to the 1930s, forests across much of California today have lower densities of large trees, and higher densities of small trees. Water stress, which increases in a warming climate, poses a greater risk to large trees than to small trees.
- Annual tree mortality in California forests increased in 2014, and steep increases in mortality followed in subsequent years; the highest number, 62 million tree deaths, was recorded in 2016.
- Future droughts may be hotter, as warm temperatures coincide with periodic dry years; 2016 and 2020 were the warmest years on record.
- Heat-related deaths and illnesses in California increased dramatically in 2006 following a record-breaking heat wave. At least 140 deaths occurred between July 15 and August 1. Deaths related to this heat wave were largely attributed to elevated nighttime temperatures.
- The number of acres burned by wildfires statewide has been increasing since 1950. Large fires affecting 1,000 acres or more account for most of the area burned each year.

18.1.4 Projected Future Impacts

Climate change projections contain inherent uncertainty, largely derived from the fact that they depend on future greenhouse gas emission scenarios. Generally, the uncertainty in greenhouse gas emissions is addressed by the presentation of differing scenarios: low-emissions or high-emissions scenarios. In low-emissions scenarios, greenhouse gas emissions are reduced substantially from current levels. In high-emissions scenarios, greenhouse gas emissions generally increase or continue at current levels. Uncertainty in outcomes is generally addressed by averaging a variety of model outcomes. Despite this uncertainty, climate change projections present valuable information to help guide decision-making for possible future conditions.

Global and National Projections

The Intergovernmental Panel on Climate Change, which includes more than 1,300 scientists from the United States and other countries, project that Earth's average temperatures will raise 2.5 to 10 ºF over the next century (National Aeronautics and Space Administration 2021). The Third and Fourth *National Climate Assessment Reports* indicate the following:

- **Change Will Continue Through This Century and Beyond**—Global climate is projected to continue to change over this century and beyond. The magnitude of climate change beyond the next few decades depends primarily on the amount of heat-trapping gases emitted globally, and how sensitive the Earth's climate is to those emissions.
- **Temperatures Will Continue to Rise**—Because human-induced warming is superimposed on a naturally varying climate, the temperature rise has not been, and will not be, uniform or smooth across the country or over time.
- **Frost-Free Season and Growing Season will Lengthen—**The length of the frost-free season and the corresponding growing season has been increasing nationally since the 1980s, with the largest increases occurring in the western United States, affecting ecosystems and agriculture. Across the United States, the growing season is projected to continue to lengthen.

  In a future in which heat-trapping gas emissions continue to grow, increases of a month or more in the lengths of the frost-free and growing seasons are projected across most of the United States by the end of the century, with slightly smaller increases in the northern Great Plains. The largest increases in the frost-free season (more than eight weeks) are projected for the western United States, particularly in high elevation and coastal areas. The increases will be smaller if heat-trapping gas emissions are reduced.

- **Changes in Precipitation Patterns**—Average U.S. precipitation has increased since 1900, but some areas have had increases greater than the national average, and some areas have had decreases. More winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.

  Projections of future climate over the United States suggest that the recent trend toward increased heavy precipitation events will continue. This trend is projected to occur even in regions where total precipitation is expected to decrease, such as the Southwest.

- **More Droughts and Heat Waves**—Droughts in the Southwest and heat waves everywhere are projected to become more intense, and cold waves less intense everywhere. Summer temperatures are projected to continue rising, and a reduction of soil moisture, which exacerbates heat waves, is projected for much of the western and central United States in summer. By the end of this century, what have been once-in-20-year extreme heat days (one-day events) are projected to occur every two or three years over most of the nation.

- **Hurricanes Will Become Stronger and More Intense**—The intensity, frequency, and duration of North Atlantic hurricanes, as well as the frequency of the strongest (Category 4 and 5) hurricanes, have all increased since the early 1980s. The relative contributions of human and natural causes to these increases are still uncertain. Hurricane-associated storm intensity and rainfall rates are projected to increase as the climate continues to warm.

- **Arctic Likely to Become Ice-Free in Summer**—The Arctic Ocean is currently expected to become essentially ice free in summer before 2050.

- **Sea Level Will Rise 1 to 8 feet by 2100**—Global sea level has risen by about 8 inches since reliable record keeping began in 1880. It is projected to rise another 1 to 8 feet by 2100. This is the result of added water from melting land ice and the expansion of seawater as it warms.

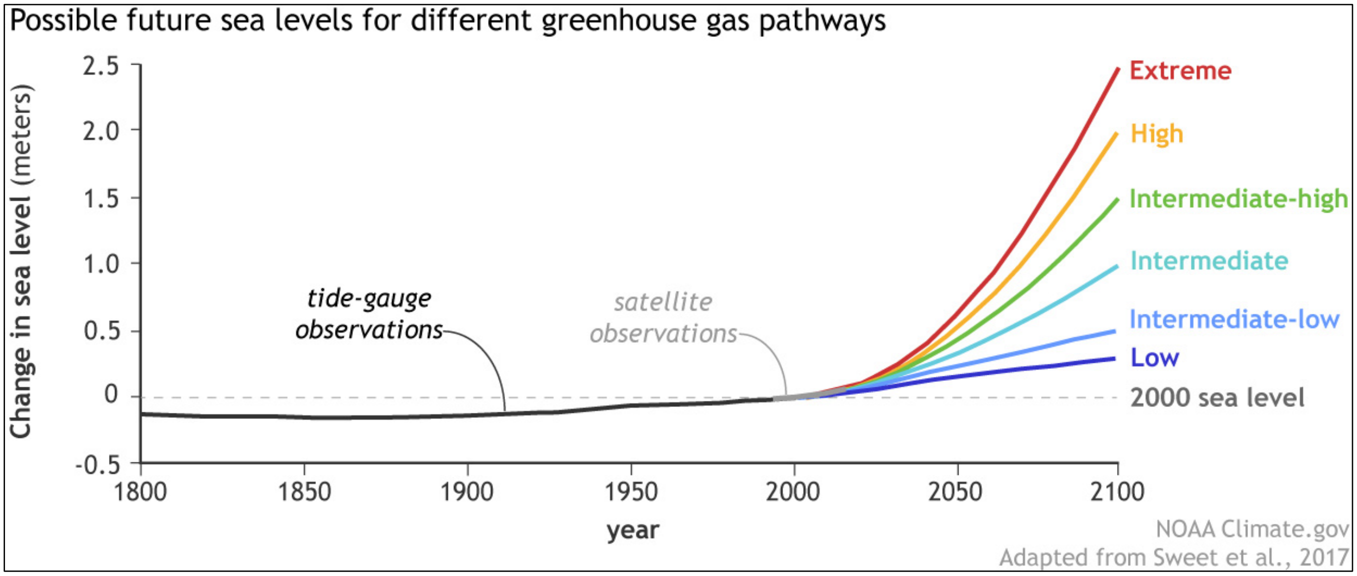
  In the next several decades, storm surges and high tides could combine with sea-level rise and land subsidence, resulting in increased flooding in many regions. Sea-level rise will continue past 2100 because the oceans take a very long time to respond to warmer conditions at the Earth's surface. Ocean waters will therefore continue to warm and sea level will continue to rise for many centuries at rates equal to or higher than those of the current century. Figure 18-2 shows the projected rate of global sea-level rise under different greenhouse gas scenarios (National Oceanic and Atmospheric Administration 2021).

Projections for California

According to *California's Fourth Climate Change Assessment*, the state can expect the following climate change impacts (State of California 2021):

- By 2100, the average annual maximum daily temperature is projected to increase by 5.6 to 8.8 ºF
- By 2100, the water supply from snowpack is projected to decline by two-thirds
- By 2050, a study estimates California's agricultural production could face climate-related water shortages of up to 16 percent in certain regions
- By 2100, the frequency of extreme wildfires will increase, and the average area burned statewide would increase by 77 percent

Figure 18-2. Possible Future Sea Levels for Different Greenhouse Gas Pathways



Source: NOAA, 2021

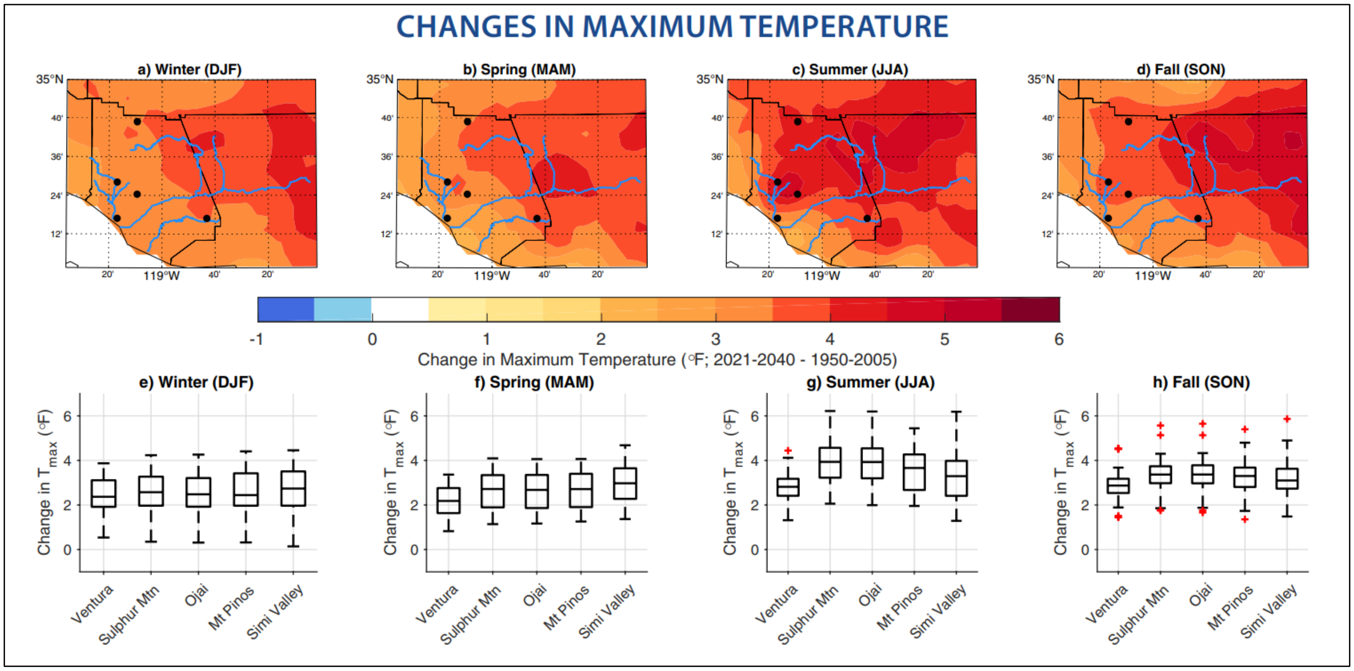
- By 2100, 13 to 67 percent of Southern California beaches may completely erode due to sea-level rise
- By 2100, the miles of highways susceptible to coastal flooding in a 100-year storm event will triple
- By 2050, heat waves in cities could cause 2 to 3 times more heat-related deaths

Projections for Ventura County

The 2019 report, *Projected Changes in Ventura County Climate*, lists the following local projections (Oakley, et al. 2019):

- **Changes in temperature**—Both annual average temperatures and the frequency of extreme temperatures will increase across Ventura County. Inland areas are likely to see an increase of at least 3 to 5 ºF. Coastal areas are likely to see an increase of at least 2 to 3 ºF. Figure 18-3 shows the projected maximum temperature changes from the average temperature for 1950 – 2005, to the average temperature for 2021 – 2040. Increases in maximum temperatures and overnight minimum temperatures as well as frequency of extreme temperatures will likely have negative impacts on human health and ecosystems, disproportionately affecting disadvantaged communities and impacting species extent and abundance.
- **Changes in Precipitation**—Precipitation is likely to intensify, meaning that the same amount of precipitation will fall in fewer days. Projections suggest a 7 percent decrease in winter precipitation days, an 11 percent decrease in spring precipitation days, and a 20 percent decrease in fall precipitation days with little overall projected change in seasonal precipitation totals. Changes in precipitation characteristics (intensification and concentration into winter season) may have implications for groundwater recharge and how surface water is conveyed, captured, and stored. There may be increased potential for post-fire flash flooding and/or debris flows due to more frequent short-duration, high intensity rainfall.

Figure 18-3. Changes in Projected Maximum Temperatures in Ventura County



- **Changes in evaporative demand**—The greatest changes are likely in inland terrain, particularly in the headwaters of the Santa Clara River (Los Angeles County). Seasonally, the greatest total evaporation changes in demand will be in the spring, followed by summer and fall, with modest changes during the winter. The fall season demonstrates the largest percentage increases in evaporative demand over the largest area while the greatest percentage increases during spring and summer occur in the Topatopa Mountains. Increased evaporative demand may affect what crops can be grown economically, alter ecosystem function, and increase drought susceptibility.

18.1.5 Responses to Climate Change

Communities and governments worldwide are working to address, evaluate and prepare for climate changes that are likely to impact communities in coming decades. Generally, climate change discussions encompass two separate but inter-related considerations: mitigation and adaptation.

The term "mitigation" has multiple meanings across disciplines. Mitigation in emergency management, as generally addressed in this hazard mitigation plan, is typically defined as the effort to reduce loss of life and property by lessening the impact of disasters. Mitigation in climate change discussions is defined as a human intervention to reduce impacts on the climate system. It includes strategies to reduce greenhouse gas sources and emissions and enhance greenhouse gas sinks. In this chapter, mitigation is used as defined by the climate change community. In the other chapters of this plan, mitigation is primarily used in an emergency management context.

Adaptation refers to adjustments in natural or human systems in response to the actual or anticipated effects of climate change and associated impacts. These adjustments may moderate harm or exploit beneficial opportunities. Mitigation and adaptation are related, as the world's ability to reduce greenhouse gas emissions will affect the degree of adaptation that will be necessary. Some initiatives and actions can both reduce greenhouse gas emissions and support adaptation to likely future conditions.

Societies across the world are facing the need to adapt to changing conditions associated with natural disasters and climate change. Farmers are altering crops and agricultural methods to deal with changing rainfall and rising temperature; architects and engineers are redesigning buildings; planners are looking at managing water supplies to deal with droughts or flooding.

Adaptive capacity goes beyond human systems, as some ecosystems are able to adapt to change and to buffer surrounding areas from the impacts of change. Forests can bind soils and hold large volumes of water during times of plenty, releasing it through the year; floodplains can absorb vast volumes of water during peak flows; coastal ecosystems can hold out against storms, attenuating waves and reducing erosion. Other ecosystem services—such as food provision, timber, materials, medicines, and recreation—can provide a buffer to societies in the face of changing conditions. Ecosystem-based adaptation is the use of biodiversity and ecosystem services as part of an overall strategy to help people adapt to the adverse effects of climate change. This includes the sustainable management, conservation and restoration of specific ecosystems that provide key services.

Assessment of the current efforts and adaptive capacity of the planning partners participating in this hazard mitigation plan are included in the jurisdiction-specific annexes in Volume 2.

18.2 IMPACT OF CLIMATE CHANGE ON HAZARDS OF CONCERN

18.2.1 Dam Failure

On average, changes in California's annual precipitation levels are not expected to be dramatic; however, small changes may have significant impacts for water resource systems, including dams. Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hygrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard.

If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream. According to the California Department of Water Resources, flood flows on many California rivers have been record-setting since the 1950s. This means that water infrastructure, such as dams, have been forced to manage flows for which they were not designed. The California Division of Dam Safety has indicated that climate change may result in the need for increased safety precautions to address higher winter runoff, frequent fluctuations of water levels, and increased potential for sedimentation and debris accumulation from changing erosion patterns and increases in wildfires. According to the Division, climate change also will impact the ability of dam operators to estimate extreme flood events (California Department of Water Resources 2021b).

A strategy called Forecast Informed Reservoir Operations (FIRO) is being developed and tested in California as a way to inform decisions to retain or release water by allowing flexibility in operation policies and rules with enhanced monitoring and improved weather and water forecasts (Center for Western Weather and Water Extremes 2021).

Dams are constructed with safety features known as “spillways.” Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events, often referred to as “design failures,” result in increased discharges downstream and increased flooding potential. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

The following summarizes changes in exposure and vulnerability to the dam failure hazard resulting from climate change:

- **Population**—Population exposure and vulnerability to the dam failure hazard are unlikely to change as a result of climate change.
- **Property**—Property exposure and vulnerability to the dam failure hazard are unlikely to change as a result of climate change.
- **Critical facilities—**The exposure and vulnerability of critical facilities are unlikely to change as result of climate change. Dam owners and operators are sensitive to the risk and may need to alter maintenance and operations to account for changes in the hydrograph and increased sedimentation.
- **Environment**—The exposure and vulnerability of the environment to dam and levee failure are unlikely to change as a result of climate change. Ecosystem services may be used to mitigate some factors that could increase the risk of design failures, such as increasing the natural water storage capacity in watersheds above dams.

18.2.2 Drought

The long-term effects of climate change on regional water resources are unknown, but global water resources are already experiencing the following stresses without climate change:

- Growing populations
- Increased competition for available water
- Poor water quality
- Environmental claims
- Uncertain reserved water rights
- Groundwater overdraft
- Aging urban water infrastructure.

With a warmer climate, droughts could become more frequent, more severe, and longer-lasting. According to the National Climate Assessment, “higher surface temperatures brought about by global warming increase the potential for drought. Evaporation and the higher rate at which plants lose moisture through their leaves both increase with temperature. Unless higher evapotranspiration rates are matched by increases in precipitation, environments will tend to dry, promoting drought conditions” (U.S. Climate Resilience Toolkit 2021).

Because changes in precipitation patterns are still uncertain, the potential impacts and likelihood of drought are uncertain. DWR has noted impacts of climate change on statewide water resources by charting changes in snowpack, sea level, and river flow. As temperatures rise and more precipitation comes in the form of rain instead of snow, these changes will likely continue or grow even more significant. DWR estimates that the Sierra Nevada snowpack, which provides a large amount of the water supply for other parts of the state, will experience a 48- to 65-percent loss by the end of the century compared to the historical April 1 average (California Department of Water Resources 2021a). Projections for the planning area show a significant decline in projected snow water equivalent in April snowpack. Increasing temperatures may also increase net evaporation from reservoirs, which would reduce water availability for ecosystems and human use (Mount, Escriva-Bou and Sencan 2021).

By addressing current stresses on water supplies and by building a flexible, robust program, the County will be able to more adeptly respond to changing conditions and to survive dry years.

The following summarizes changes in exposure and vulnerability to the drought hazard resulting from climate change:

- **Population**—Population exposure and vulnerability to drought are unlikely to increase as a result of climate change. While greater numbers of people may need to engage in behavior change, such as water saving efforts, significant life or health impacts are unlikely.
- **Property**—Property exposure and vulnerability may increase as a result of increased drought resulting from climate change, although this would most likely occur in non-structural property such as crops and landscaping. It is unlikely that structure exposure and vulnerability would increase as a direct result of drought, although secondary impacts of drought, such as wildfire, may increase and threaten structures.
- **Critical facilities**—Critical facility exposure and vulnerability are unlikely to increase as a result of increased drought resulting from climate change; however, critical facility operators may be sensitive to changes and need to alter standard management practices and actively manage resources, particularly in water-related service sectors
- **Environment**—The vulnerability of the environment may increase as a result of increased drought resulting from climate change. Prolonged or more frequent drought resulting from climate change may stress ecosystems in the region, which include many special-status species.

18.2.3 Earthquake

The impacts of global climate change on earthquake probability are unknown, although scientists have identified tiny earthquakes triggered by the change of fault stress loads from rain and snow. Similarly, long-term drought can result in a significant change in the stress load on earth's crust.

Pumping of groundwater from underground aquifers by humans, which is exacerbated during times of drought, has also been shown to impact patterns of stress loads by "unweighting" Earth's crust. A 2014 study looked at the effects of groundwater extraction in California's Central Valley on seismicity on the adjacent San Andreas Fault. The researchers found that such extractions can promote lateral changes in stress to the two sides of the San Andreas, which move horizontally against each other along the boundary of two major tectonic plates. This could potentially cause them to unclamp and slip, resulting in an earthquake (National Aeronautics and Space Administration 2019).

Because impacts on the earthquake hazard are not well understood, increases in exposure and vulnerability of local resources are not able to be determined.

18.2.4 Flood

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

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

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

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain areas to contribute to peak storm runoff. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

The following summarizes changes in exposure and vulnerability to the flood hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability may increase as a result of climate change impacts on the flood hazard. Runoff patterns may change, resulting in flooding in areas where it has not previously occurred.
- **Critical facilities**—Critical facility exposure and vulnerability may increase as a result of climate change impacts on the flood hazard. Runoff patterns may change, resulting in risk to facilities that have not historically been at risk from flooding. Changes in the management and design of flood protection critical facilities may be needed as additional stress is placed on these systems. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, bypass channels and levees, as well as the design of local sewers and storm drains.
- **Environment**—The exposure and vulnerability of the environment may increase as a result of climate change impacts on the flood hazard. Changes in the timing and frequency of flood

events may have broader ecosystem impacts that alter the ability of already stressed species to survive.

18.2.5 Landslide

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature is likely to affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. Each these factors would increase the probability of landslides.

The following summarizes changes in exposure and vulnerability to the landslide hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability would be unlikely to increase because of climate change impacts on the landslide hazard. These events may occur more frequently, but the extent and location should be contained within mapped hazard areas or recently burned areas.
- **Critical facilities**—Critical facility exposure and vulnerability would be unlikely to increase due to climate change impacts on the landslide hazard; however, critical facility owners and operators may experience more frequent disruption to service provision resulting from landslide hazards. For example, transportation systems may experience more frequent delays if movements blocking these systems occur more frequently.
- **Environment**—Exposure and vulnerability of the environment would be unlikely to increase because of climate change, but more frequent movements in river systems may impact water quality and have negative impacts on stressed species.

18.2.6 Sea-Level Rise and Coastal Erosion

Coastal areas are sensitive to sea-level rise, changes in precipitation and the frequency and intensity of storms, and warmer ocean temperatures. According to NASA, warmer temperatures may lead to an increase in the intensity of storms, leading to weather events that can have increase impacts on coastal erosion. A study on increased storm wave heights from climate change indicated that coastal erosion and flooding may occur twice as fast from sea-level rise alone and up to four times as fast as a doubling of the frequency of major El Niño events. Should all these potential events from climate change occur simultaneously, there could be up to an order of magnitude increase in coastal erosion compared to current rates (National Aeronautics and Space Administration 2010).

Climate change-related sea-level rise could exacerbate sea water intrusion issues under the agricultural lands of the Oxnard coastal plain, which were first observed in the 1930s and became a serious problem in the 1950s. This could result in diminishing returns or even render existing, valuable crop lands completely unusable.

18.2.7 Severe Storms

Climate change presents a challenge for risk management associated with severe storms. The science for linking the severity of specific severe storm events to climate change is still evolving; however, a number or trends provide some indication of how climate change may be impacting these events. According to the *Fourth National Climate Change Assessment*, heavy rainfall events are becoming more severe (U.S. Global Change Research Program 2018). Climate change impacts on other severe storm events such as thunderstorms are still not well understood. The following summarizes changes in exposure and vulnerability to the severe weather hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability would be unlikely to increase as a direct result of climate change impacts on the severe storm hazard. Severe winter storms and thunderstorms may occur more frequently, but exposure and vulnerability will remain the same. Secondary impacts, such as the extent of localized flooding, may increase, impacting greater numbers of people and structures.
- **Critical facilities**—Critical facility exposure and vulnerability would be unlikely to increase as a result of climate change impacts on the severe storm hazard; however, critical facility owners and operators may experience more frequent disruption to service provision. For example, more frequent and intense storms may cause more frequent disruptions in power service.
- **Environment**—Exposure and vulnerability of the environment would be unlikely to increase; however, more frequent storms and more intense rainfall may place additional stress on already stressed systems.

18.2.8 Severe Weather

According to the *Fourth National Climate Change Assessment*, over the past two decades, the number of high temperature records in the United States far exceed the number of low temperature records (U.S. Global Change Research Program 2018). The increase in average surface temperatures can lead to more intense heat waves. Evidence suggests that heat waves are already increasing, especially in western states.

Climate change impacts on winds are still not well understood. Until recently, scientists had predicted rapid inland warming would weaken one of the primary drivers for Santa Ana winds and reduce their frequency. But a 2021 study found that bouts of hot Santa Ana winds are not declining and could even be increasing (Science 2021).

The following summarizes changes in exposure and vulnerability to the severe weather hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability would be unlikely to increase as a direct result of climate change impacts on the severe weather hazard. Severe weather events may occur more frequently, but exposure and vulnerability will remain the same.
- **Critical facilities**—Critical facility exposure and vulnerability would be unlikely to increase as a result of climate change impacts on the severe weather hazard; however, critical facility owners and operators may experience more frequent disruption to service provision. For example, more frequent and intense windstorms may cause more frequent disruptions in power service.
- **Environment**—Exposure and vulnerability of the environment would be unlikely to increase; however, more frequent wind and heat events may place additional stress on already stressed systems.

18.2.9 Tsunami

The impacts of global climate change on tsunami probability are unknown. However, even if climate change does not increase the frequency with which tsunamis occur, it may result in more destructive waves. As sea levels continue to rise, tsunami inundation areas would likely extend further inland.

The following summarizes changes in exposure and vulnerability to the tsunami hazard resulting from climate change:

- **Population, Property, and Critical Facility—**Population, property, and critical facility exposure and vulnerability to the tsunami hazard may increase as a result of climate change-related sea-level rise. As sea levels rise, tsunami impact areas may reach into parts of the community that were previously outside the tsunami risk area. The extent of this change will depend on the size of the tsunami, the local topography, and the extent of sea-level rise in the area.
- **Environment—**Exposure and vulnerability of the environment to tsunamis may be impacted by the effects of climate change. In particular, sea-level rise could alter the shape of the existing shoreline, placing different structures and ecosystems at risk from potential tsunami impacts. Additionally, ice crust melt could lead to a rise of the earth's crust, especially at higher latitudes, causing more submarine landslides and a greater vulnerability to tsunamis.

18.2.10 Wildfire

Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation.

Climate change may increase winds or change the timing/seasonality of winds that spread fires. Most of California's worst wildfires occur in the fall, when vegetation is driest and the Santa Ana winds start to pick up. Some research indicates a shift in the annual pattern of Santa Ana winds that would move the wildfire season later in the year (AGU 2019).

Changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel). When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes.

The following summarizes changes in exposure and vulnerability to the wildfire hazard resulting from climate change:

- **Population**, **Property and Critical facilities**—According to *Projected Changes in Ventura County Climate,* wildfire risk in Ventura County is expected to increase, with wildfire season starting earlier and extending later in the year due to drought, increased temperatures, and greater evaporative demand. While the future frequency, size and intensity of wildfires is uncertain, it is likely that exposure and vulnerability to the wildfire hazard would increase.
- **Environment**—It is likely that the exposure and vulnerability of the environment will be impacted by changes in wildfire risk due to climate change. Natural fire regimes may change, resulting in more frequent or higher intensity burns. These impacts may alter the composition of the ecosystems in areas in and surrounding planning area. Whether areas burn more frequently, or more acreage is burned in each fire, wildlife has the potential to become more stressed as suitable habitat is lost.

18.2.11 Other Hazards of Interest

Agricultural and Biological Hazards

The impacts of global climate change on agricultural and biological hazards are still being studied, however climate change is known to be influencing the spread of many invasive species. Increased temperatures, and both intense rainfall and drought can facilitate the spread and establishment of non-native species, creating new opportunities for them to become invasive (U.S. Department of Agriculture 2021b). Prolonged drought stresses trees and can result in higher susceptibility to detrimental pests.

Pandemic

Climate change will likely have significant indirect impacts on disease outbreaks. In California, injuries and premature deaths related to extreme weather events, changes in the prevalence and geographical distribution of food- and water-borne illnesses and other infectious diseases should be anticipated. The fourth Intergovernmental Panel on Climate Change report states that climate change has altered the distribution of some infectious disease vectors.

19. OTHER HAZARDS OF INTEREST

After reviewing the previous plan and considering options for other hazards of interest to address, the Steering Committee selected a limited number of hazards of interest to include in this update of the Ventura County Multi-Jurisdictional Hazard Mitigation Plan. The sections below provide short profiles of each hazard of interest, including a qualitative discussion of their potential impact in Ventura County. No formal risk assessment was performed, no mitigation actions have been developed to address them, and the hazards are not included in the risk ranking. However, all planning partners for this plan should be aware of these hazards and take steps to reduce the risks they present whenever it is practical to do so.

19.1 AGRICULTURAL AND BIOLOGICAL

19.1.1 Overview

Agricultural infestation generally involves the artificial introduction of an insect, disease, vertebrate, or weed pest. These pests are particularly destructive to local agricultural crops because they have no natural enemies to keep them under control. The type and severity of an agricultural infestation will vary based on many factors, including weather, crop diversity, and proximity to urban areas.

The onset for an agricultural infestation can be rapid. Controlling its spread is critical to limiting the impacts of the infestation. Methods for detecting, limiting, and eradicating exotic pests include delimitation trapping, quarantining the area and preventing the shipment of products from the designated area, aerial and ground application of pesticides, and in extreme cases, premature harvest and/or crop destruction. Duration is largely affected by the degree to which the infestation is aggressively controlled but is commonly more than a week. The warning time needed to control infestation is typically more than 24 hours. Maximizing warning time is also critical for reducing damage from this hazard.

Ventura County's agriculture industry provides a significant base to the County's economy. The agricultural output of Ventura County in 2020 reached almost $2 billion and encompassed more than 96,500 acres of irrigated cropland (Ventura County Agricultural Commissioner 2020). Ventura County is one of the top 10 agricultural counties in California. The impact of infestation by a pest or disease can include economic losses due to crop losses from pest damage, limitations on the ability to export products from the area, and increased costs for pest control.

Many pests not only damage the agricultural economy but also affect residential areas and open space. Damage to landscape plants and vegetable gardens can be significant.

19.1.2 Identified Agricultural and Biological Hazards

The Ventura County Agricultural Commissioner and the USDA have identified agricultural and biological hazards that currently affect the County or have the potential to do so in the future. Many of these are listed in Table 19-1.

Table 19-1. Agricultural and Biological Hazards That Threaten Ventura County

Type	Description
Invertebrates	
Quagga Mussels	A mollusk that covers hard surfaces in waterways. It clogs water infrastructure, covers boats, disrupts the food chain for native species, and releases toxins that affect other species.
Insects	
Asian Citrus Psyllid	An insect that causes damage to citrus plants and is a carrier of Huanglongbing disease.
Glassy Winged Sharpshooter	An insect that transmits a bacterial disease (Pierce's Disease) that can seriously damage grapevines
Light Brown Apple Moth	A tortricid leafroller that affects over 2,000 types of plants.
Mediterranean Fruit Fly	An insect that infests more than 300 varieties of fruits, vegetables, and nuts by laying eggs in the produce. The larvae feed on the produce, ruining it for human consumption.
Shot Hole Borer	An invasive beetle that attacks over 110 kinds of trees. These tiny beetles tunnel into host trees and spread Fusarium Dieback.
Invasive Weeds	
Artichoke Thistle	An invasive weed with an aggressive root system.
Arundo Grass	Tall perennial grass that forms dense growth, choking out other plants.
Dalmation Todflax	Displaces native plants and may increase soil erosion and surface runoff.
Distaff Thistle	Crowds out grasses and native species.
Geraldton Carnation Spurge	Produces a toxic sap and has allelopathic properties that reduce germination of native plants.
Russian Knapweed	Aggressive plant with allelopathic effects (releases a substance that does not allow other plants to grow).
Scotch Thistle	Dense growths of the spiny plants interrupt grazing lands for livestock and wildlife.
Silverleaf Nightshade	Noxious weed competes with crops, interferes with livestock, acts as a host for insects and plant diseases, and spreads by forming dense colonies from its extensive root system as well as by propagation of seeds.
Skeletonweed	Deep rooted noxious weed with minimal feed value that crowds out native grasses and forage for livestock and wildlife.
Spotted Knapweed	A highly invasive weed that can reduce the availability of desirable forage for livestock operations, degrade wildlife habitats, and hinder reforestation and landscape restoration efforts.
Stinkweed	Rapidly spreading invasive weed.
Tree Spurge	Small invasive shrub that has an economic impact on crop production in the County.
Diseases	
Charcoal Rot	A fungal disease that affects strawberries.
Fusarium Dieback	A fungal disease that disrupts the transport of water and nutrients inside the tree, leading to branch dieback and overall decline
Huanglongbing	A disease spread by the Asian citrus psyllid that kills citrus trees. It has no known cure.
Pierce's Disease	A bacteria-caused disease spread by the Glassy Winged Sharpshooter. Pierce's Disease blocks the water-conducting system in grapevines.
Sudden Oak Death	A tree disease caused by the fungus-like plant pathogen *Phytophthora ramorum*. It kills oaks, rhododendrons, camellias, and other common horticulture plants.

19.1.3 Location, Extent and Magnitude

Ventura County's agricultural areas are most susceptible to insect pests, agriculture biological diseases, and invasive weeds. Range land, open spaces, and areas affected by wildfire are also susceptible to many of the invasive weeds. Quagga mussels are found in Lake Piru and the Santa Clara River.

Injurious pests commonly enter Ventura County in a number of ways. They may, for example, be inadvertently shipped by a private individual in an infested plant, fruit, or vegetable. When the package is received and the article is found to contain pests, the recipient throws it out and the pests multiply and infest nearby agricultural crops, waterways, or urban properties. Pests can also travel easily on plants and plant parts shipped from uncertified and unlicensed nurseries; on plants offered for sale at swap meets and other open air markets; or in vehicles or luggage. Inspectors from the Agricultural Commissioner's office inspect incoming plants at nurseries, farmer's markets, and swap meets to check for the presence of pests not occurring in this area.

Future agricultural and waterway infestations in Ventura County are likely based on past occurrences. Based on previous history, infestations causing widespread damage have occurred about once every 10 to 20 years. Another factor increasing the likelihood of future infestations is the mild climate in Ventura County, which increases the ability of pests to proliferate.

The extent of a devastating event would depend on many factors, including the specific pest introduced, climatic conditions at the time of introduction, fluctuations in funding for pest detection and eradication, and public pressure regarding aerial and ground applications of pesticides proximate to urban areas.

19.2 PANDEMIC

19.2.1 Overview

According to the World Health Organization, a pandemic involves the international spread of a new disease. While an epidemic remains limited to one city, region, or country, a pandemic spreads beyond national borders and possibly worldwide. Authorities consider a disease to be an epidemic when the number of people with the infection is higher than the forecast number within a specific region. A pandemic is an epidemic that becomes widespread in several countries at the same time. A pandemic affects a higher number of people and can be more deadly than an epidemic.

A new virus strain or subtype that easily transmits between humans can cause a pandemic. Bacteria that become resistant to antibiotic treatment may also be behind the rapid spread. Sometimes, pandemics occur when new diseases develop the ability to spread rapidly, such as COVID-19. Humans may have little or no immunity against a new virus. Often, a new virus cannot spread between animals and people. However, if the disease changes or mutates, it may start to spread easily, and a pandemic may result. Seasonal flu epidemics generally occur because of a viral subtype that is already circulating among people. Novel subtypes, such as COVID-19, generally cause pandemics. These subtypes will not previously have circulated among humans. A pandemic can lead to social disruption, economic loss, and general hardship on a wide scale (Felman 2020).

19.2.2 Identified Health Hazards

The California Department of Public Health has identified the conditions described in Table 19-2 as reportable human communicable diseases that could contribute to a serious epidemic in the state.

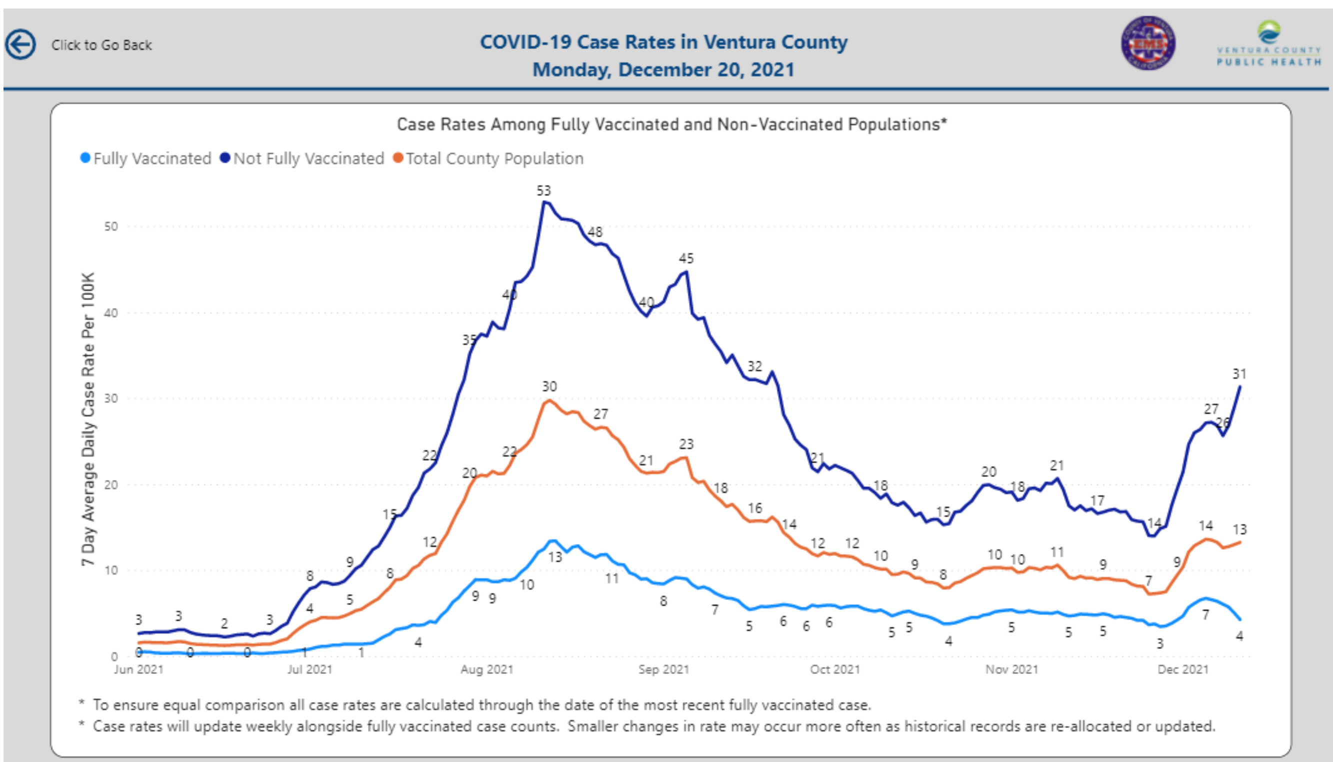
Table 19-2. Naturally Spread Diseases Seen in California

Description	Examples	
Animal Transmitted		
These are diseases that are transmitted to humans by domestic or non-domestic animals.	• Brucellosis (undulant fever) • Campylobacteriosis • Escherichia coli (E. coli) • Giardiasis • Middle Eastern Respiratory Syndrome (MERS) • Plague	• Psittacosis (ornithosis, parrot fever) • Q Fever • Rabies • Salmonellosis • Tularemia
Bloodborne		
Viruses, bacteria and parasites that can be carried in blood and cause disease are known as bloodborne pathogens. Transmission of these diseases may be from direct blood contact, needle sticks, intravenous drug use, sexual behavior, insects or other vectors.	• Hepatitis C • Malaria	
Community-Acquired Infections		
Community-acquired infections are infections that are contracted outside of a hospital (or are diagnosed within 48 hours of admission) without any previous health care encounter.	• Campylobacteriosis • Influenza due to novel strains • Legionellosis • Meningitis (viral, bacterial, fungal, parasitic)	• Respiratory syncytial virus • Smallpox • Tularemia
Foodborne		
Foodborne diseases can be spread when food becomes contaminated with fecal matter containing bacteria, viruses, or parasites. This contamination can happen at a farm, manufacturing plant, restaurant, or home. Foodborne diseases usually result in gastrointestinal illness, which can include symptoms such as diarrhea, vomiting, nausea, stomachache, and fever. People who are ill with a foodborne disease can give the infection to others, so proper hygiene and hand washing practices are essential to limit the spread of disease.	• Brucellosis • Campylobacteriosis • Cholera • Ciguatera fish poisoning • Cryptosporidiosis • Cyclosporiasis • Escherichia coli (E. coli) • Giardiasis	• Listeriosis • Salmonellosis • Scombroid fish poisoning • Shigellosis • Tularemia • Typhoid Fever • Vibriosis • Yersinia enterocolitica
Mosquito-Transmitted		
In addition to causing severe annoyance and allergic reaction, mosquitoes found in California are capable of spreading many diseases to humans.	• Chikungunya • Dengue • Malaria	• West Nile • Yellow Fever • Zika
Respiratory Viruses		
Respiratory viruses are responsible for influenza-like illness. They can also cause the common cold. The virus that caused the COVID-19 pandemic is a respiratory virus. People at high risk (those with certain underlying conditions, the elderly, the very young, and pregnant women) can develop severe illness that results in hospitalization or death.	• Coronaviruses (including SARS and MERS CoV) • Influenza • Respiratory Syncytial Virus	• Measles • Pertussis (whooping cough)
Waterborne Diseases		
Diseases caused by micro-organisms transmitted in water can be spread while bathing, washing, drinking water, or eating food exposed to contaminated water.	• Cholera • Giardiasis • Legionellosis	• Leptospirosis • Typhoid Fever • Vibriosis

Description	Examples
Sexually Transmitted Disease	
The Centers for Disease Control and Prevention uses community engagement methods in their Community Approaches to Reducing Sexually Transmitted Diseases (CARS). California has state-mandated HIV/AIDS prevention education in middle and high schools. In 2019, 154 of every 100,000 people in Ventura County were living with HIV.	• Hepatitis A, B, and C • Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) • Syphilis • Zika

As this plan is being prepared, Ventura County, the State of California, and the rest of the world are still dealing with impacts of the global COVID-19 pandemic. In March 2020, Ventura County was included in the FEMA Major Disaster Declaration for the COVID-19 pandemic. As of December 2021, about 107,000 people, or 7.86 percent of the Ventura County population, have had the disease. More than 1,200 people, or 0.14 percent of the population, have died from the disease. Over 572,000 residents are fully vaccinated. Figure 19-1 shows the COVID-19 case rates among the fully vaccinated and unvaccinated populations for the last half of 2021.

Figure 19-1. Ventura County COVID-19 Case Rate June – December 20, 2021



Throughout the cycle of the COVID-19 pandemic, safety precautions have changed or been adapted to current infection rates and circumstances. Ventura County has provided public service outreach through numerous channels, including the Ventura County Recovers website, which provides regular updates regarding:

- Vaccine information
- Business information

- Booster shots
- COVID-19 testing
- School/childcare and sports information
- Quarantine guidance
- Monoclonal antibody treatment
- Outreach activities.

19.2.3 Location, Extent and Magnitude

Health hazards that affect the residents of Ventura County may arise in a variety of situations, such as during a communicable disease outbreak or after a natural disaster. All populations in Ventura County are susceptible to pandemic events. Populations who are young or elderly or have compromised immune systems are likely to be more vulnerable. The relative ease of world-wide travel ensures that all countries are vulnerable to pandemic events at any time.

20. PLANNING AREA RISK RANKING

A risk ranking was performed for the hazards of concern described in this plan. This risk ranking assesses the probability of each hazard's occurrence as well as its likely impact on the people, property, and economy of the planning area. The risk ranking was conducted via facilitated brainstorming sessions with the Steering Committee. Estimates of risk were generated with data from Hazus using methodologies promoted by FEMA. The results are used in establishing mitigation priorities. This chapter presents results for all of Ventura County. Results for individual municipalities are provided in Appendix D and in the Volume 2 annexes for individual planning partners.

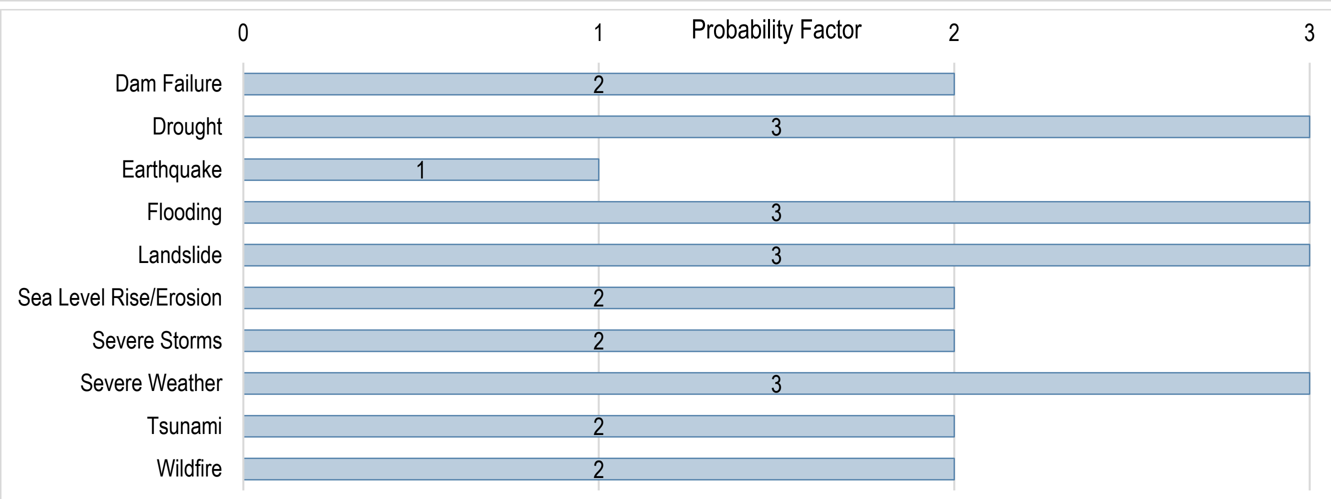
20.1 PROBABILITY OF OCCURRENCE

The probability of occurrence of a hazard is indicated by a probability factor based on likelihood of annual occurrence:

- High—Hazard event is likely to occur within 25 years (Probability Factor = 3)
- Medium—Hazard event is likely to occur within 100 years (Probability Factor =2)
- Low—Hazard event is not likely to occur within 100 years (Probability Factor =1)
- No exposure—There is no probability of occurrence (Probability Factor = 0)

The assessment of hazard frequency is generally based on past hazard events in the area. Figure 20-1 summarizes the probability assessment for each hazard of concern for this plan.

Figure 20-1. Probability Factors for Hazards of Concern



20.2 IMPACT

Hazard impacts were assessed in three categories: impacts on people, impacts on property and impacts on the local economy. Numerical impact factors were assigned as follows:

- **People**—Values were assigned based on the percentage of the total ***population exposed*** to the hazard event. The degree of impact on individuals will vary and is not measurable, so the calculation assumes for simplicity and consistency that all people exposed to a hazard because they live in a hazard zone will be equally impacted when a hazard event occurs. It should be noted that planners can use an element of subjectivity when assigning values for impacts on people. Impact factors were assigned as follows:
  - High—50 percent or more of the population is exposed to a hazard (Impact Factor = 3)
  - Medium—25 percent to 49 percent of the population is exposed to a hazard (Impact Factor = 2)
  - Low—25 percent or less of the population is exposed to the hazard (Impact Factor = 1)
  - No impact—None of the population is exposed to a hazard (Impact Factor = 0)
- **Property**—Values were assigned based on the percentage of the total ***property value exposed*** to the hazard event:
  - High—30 percent or more of the total assessed property value is exposed to a hazard (Impact Factor = 3)
  - Medium—15 percent to 29 percent of the total assessed property value is exposed to a hazard (Impact Factor = 2)
  - Low—14 percent or less of the total assessed property value is exposed to the hazard (Impact Factor = 1)
  - No impact—None of the total assessed property value is exposed to a hazard (Impact Factor = 0)
- **Economy**—Values were assigned based on the percentage of the total ***property value vulnerable*** to the hazard event. Values represent estimates of the loss from a major event of each hazard in comparison to the total assessed value of the property exposed to the hazard. For some hazards, such as wildfire, landslide and severe weather, vulnerability was considered to be the same as exposure due to the lack of loss estimation tools specific to those hazards. Loss estimates separate from the exposure estimates were generated for the earthquake and flood hazards using Hazus.
  - High—Estimated loss from the hazard is 20 percent or more of the total assessed property value (Impact Factor = 3)
  - Medium—Estimated loss from the hazard is 10 percent to 19 percent of the total assessed property value (Impact Factor = 2)
  - Low—Estimated loss from the hazard is 9 percent or less of the total assessed property value (Impact Factor = 1)
  - No impact—No loss is estimated from the hazard (Impact Factor = 0)

The impacts of each hazard category were assigned a weighting factor to reflect the significance of the impact. These weighting factors are consistent with those typically used for measuring the benefits of hazard mitigation actions: impact on people was given a weighting factor of 3; impact on property was given a weighting factor of 2; and impact on the operations was given a weighting factor of 1. Figure 20-2 and Figure 20-3 summarize the unweighted and weighted impact factors, respectively, for each hazard.

Figure 20-2. Impact Factors for Hazards of Concern

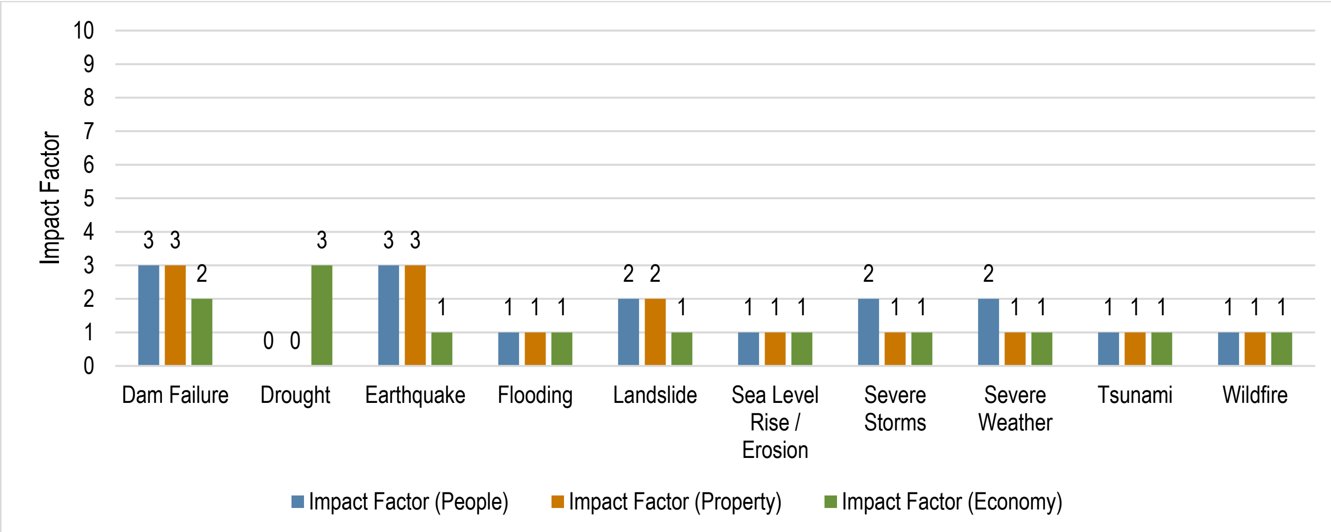
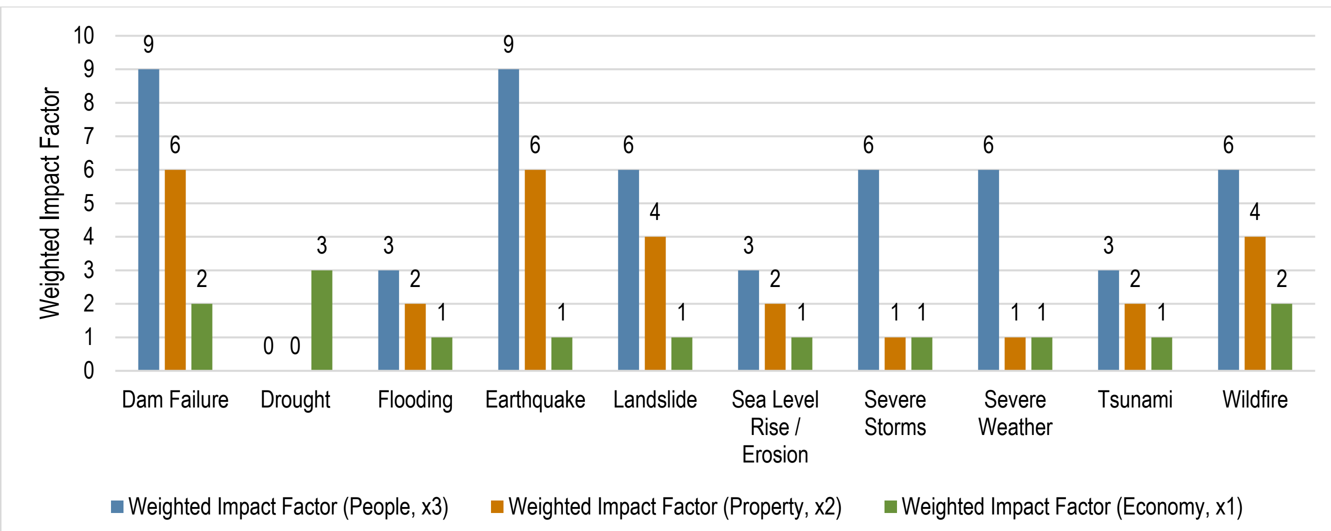


Figure 20-3. Weighted Impact Factors for Hazards of Concern



20.3 RISK RATING AND RANKING

The risk rating for each hazard was determined by multiplying the probability factor by the sum of the weighted impact factors for people, property, and operations, as summarized in Figure 20-4.

Based on these ratings, a priority of high, medium, or low was assigned to each hazard. The hazards ranked as being of highest concern are dam failure, landslide, and earthquake. Hazards ranked as being of medium concern are flood, severe storms, severe weather, and wildfire. The hazards ranked as being of lowest concern are drought, sea-level rise/coastal erosion, and tsunami. Figure 20-5 shows the hazard risk ranking.

Figure 20-4. Total Risk Rating for Hazards of Concern

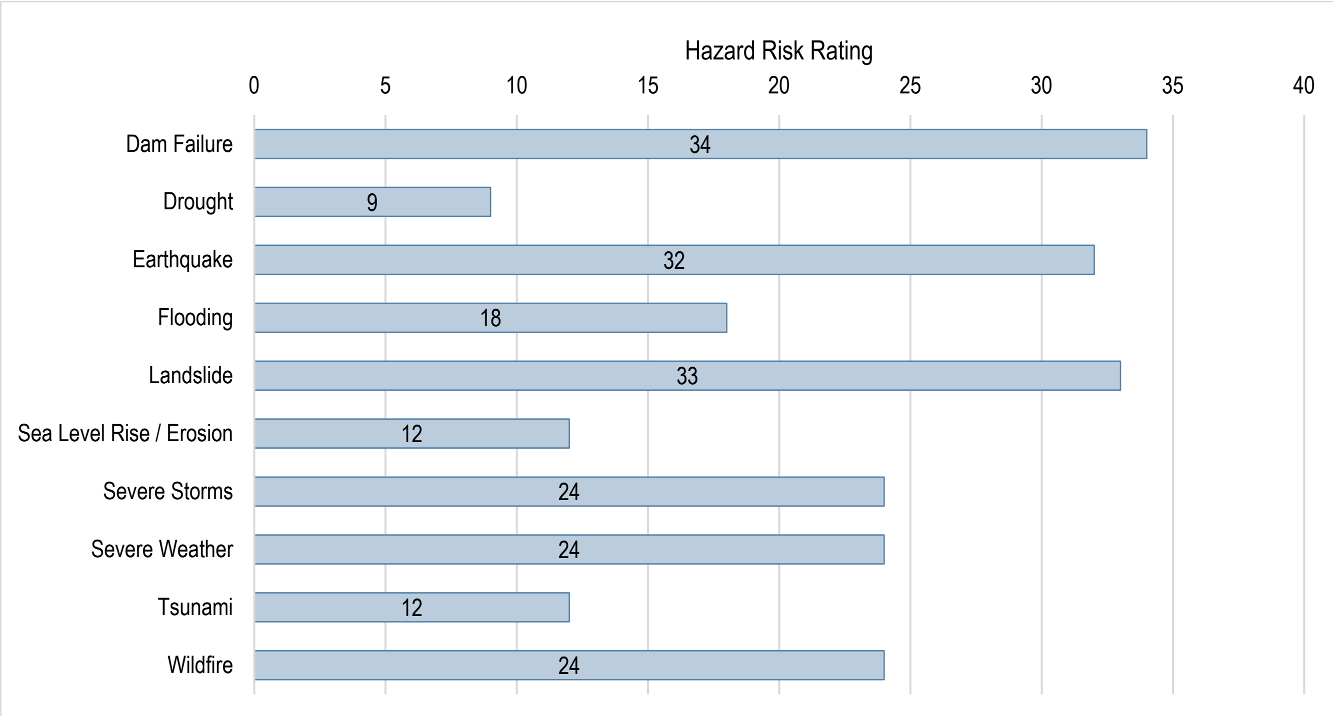
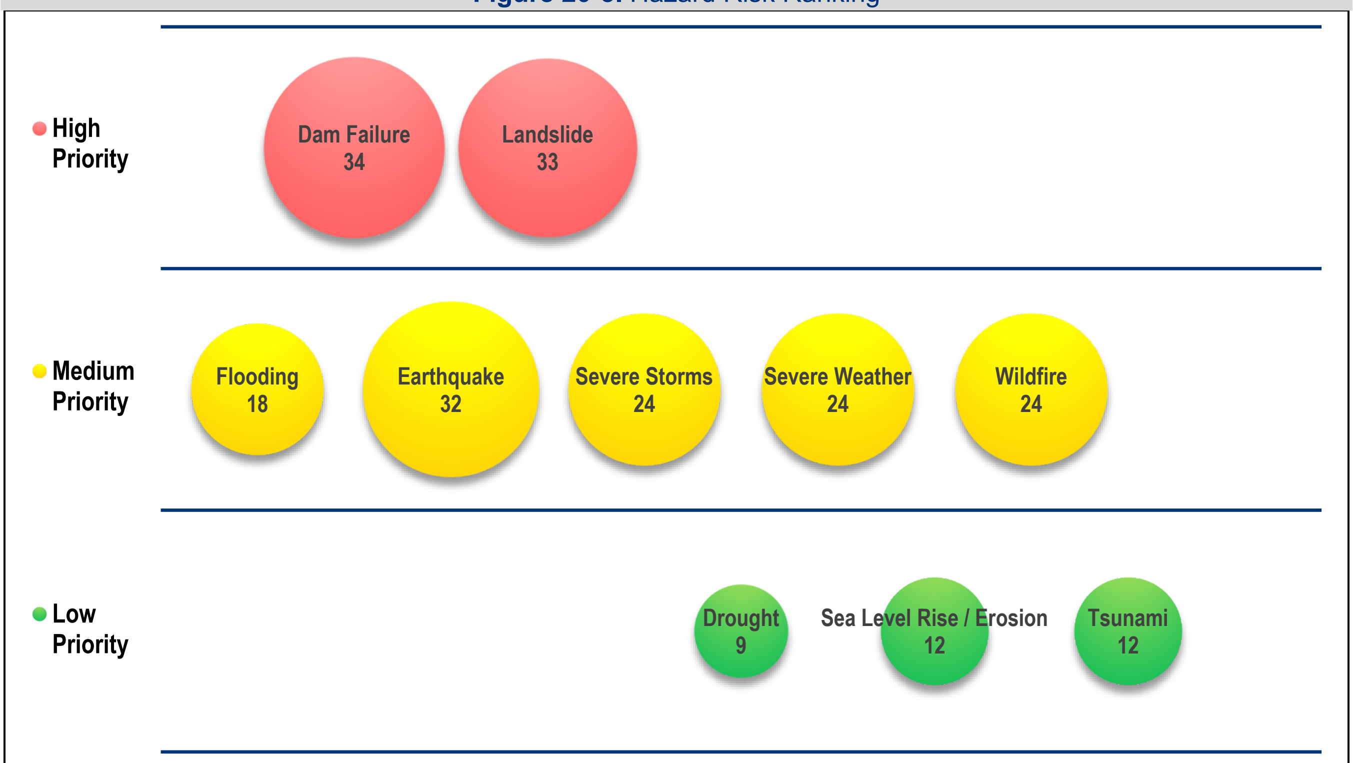


Figure 20-5. Hazard Risk Ranking



Values shown are risk ratings. Larger circles indicate higher rating.

Part 3—MITIGATION PLAN

21. VISION STATEMENT, GOALS AND OBJECTIVES

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6(c)(3)(i)). The Steering Committee reviewed the previous plan and noted that neither a vision statement nor a list of objectives was part of the plan. The goals in the previous plan needed to be expanded to better reflect the purpose of this plan update.

The vision statement, goals, objectives, and actions in this plan all support each other. Goals were selected to support the vision statement. Objectives were selected that meet multiple goals. Actions (presented in Chapter 23) were prioritized based on their ability to meet multiple objectives.

21.1 VISION STATEMENT

A vision statement focuses the range of objectives and actions to be considered. A vision statement is not a goal because it does not describe a hazard mitigation outcome and it is broader than a hazard-specific objective. The vision statement for this hazard mitigation plan is as follows:

> *The Ventura County Multi-Jurisdictional Hazard Mitigation Plan will establish and promote a comprehensive mitigation strategy and efforts to equitably reduce risk and increase the resiliency of the community and environment from natural hazards.*

21.2 GOALS

The following are the mitigation goals for this plan:

1. Protect life, property, and the environment, and minimize displacement due to natural hazards events.
2. Effectively communicate natural hazard risks and mitigation strategies to the whole community.
3. Pursue development and implementation of feasible, cost-effective, and environmentally sound hazard mitigation measures.
4. Prioritize multi-objective hazard mitigation actions and those that reduce risk to vulnerable communities.
5. Coordinate with other plans and programs that can support or enhance hazard mitigation.
6. Enhance the County’s capability and capacity to prepare for, respond to, and recover from the impacts of natural hazards.
7. Proactively anticipate the risks of future impacts from hazards.
8. Increase the County’s adaptive capacity to reduce risk from hazard impacts.

9. Promote proactive, self-sufficient mitigation and response abilities.
10. Reduce risk to and increase the resilience of critical infrastructure and community lifelines.

21.3 OBJECTIVES

Each selected objective meets multiple goals, serving as a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset of a goal. The objectives also are used to help establish priorities. The objectives are as follows:

1. Utilize the best available data, science, and technology to identify and communicate the risk exposure to hazards to state, regional, and local agencies, as well as the private sector and non-profit groups.
2. Support efforts to improve the resilience of community lifelines in socially vulnerable communities.
3. Enhance supply chain diversity and improved resilience by supporting local food and energy production and increased multi-modal transportation.
4. Research, develop, promote, adopt, and enforce codes and standards to preserve life and property that are affordable and feasible to implement.
5. Promote and implement measures to mitigate the risk of wildfires, such as greenbelts and fire breaks around communities and along roadways.
6. Support the protection of vital records, and strengthen or replace buildings, infrastructure, and lifelines to minimize post-disaster disruption and facilitate short-term and long-term recovery.
7. Improve and expand systems that provide warning and emergency communications to the whole community.
8. Continue developing and strengthening inter-jurisdictional coordination and cooperation in the area of emergency services.
9. Promote and implement the retrofit or replacement of at-risk structures and lifelines to increase community resilience.
10. Incentivize mitigation measures for high-risk and repetitive loss areas to address repairs, major alterations, development plans, and practices to increase community resilience.
11. Reduce repetitive property losses due to hazard impacts through acquisition, retrofitting, design, and updated construction and land use regulations.
12. Encourage and support leadership within the private sector, non-profit agencies, and community-based organizations to promote and implement local hazard mitigation activities.
13. Proactively manage and care for natural resources, including grasslands, forests, oak woodlands, riparian forests, stream channels, coastal wetlands, and beaches, to enhance their ability to withstand and recover from natural disasters and minimize public safety risks.
14. Support hazard mitigation measures that promote and enhance natural processes.
15. Support hazard mitigation measures, where feasible, that utilize nature-based practices and solutions (e.g., holistic watershed management and green belts) and support and enhance natural processes.

16. Encourage the creation of financial and regulatory incentives to motivate stakeholders such as homeowners, private sector businesses, and non-profit community organizations to mitigate hazards and risks.
17. Conduct public outreach activities that increase community awareness and understanding of hazard risk, mitigation options, and preparedness strategies.
18. Minimize impacts of hazard events on the economic drivers for the County.
19. Align the hazard mitigation plan with state mitigation plans; city and county general, community, capital improvement plans; special-purpose district plans; and climate action, resilience, and adaptation plans.

22. MITIGATION BEST PRACTICES

22.1 MITIGATION BEST PRACTICES

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use by the planning partners, in compliance with 44 CFR (Section 201.6(c)(3)(ii)). One catalog was developed for each hazard of concern evaluated in this plan. The catalogs present alternatives that are categorized in two ways:

- By who would have responsibility for implementation:
  - Individuals (personal scale)
  - Businesses (corporate scale)
  - Government (government scale).
- By what the alternative would do:
  - Manipulate the hazard
  - Reduce exposure to the hazard
  - Reduce vulnerability to the hazard
  - Build local capacity to respond to or prepare for the hazard.

Hazard mitigation actions recommended in this plan were selected from an analysis of the alternatives presented in the catalogs. The catalogs provide a baseline of mitigation alternatives that are backed by a planning process, are consistent with the established goals and objectives, and are generally within the capabilities of the planning partners to implement. They provide a list of what could be considered to reduce risk from natural hazards. Not all actions listed are feasible for this plan. Planning partners selected actions based their ability to implement the action. Actions in the catalog that are not included in partners' action plans were not selected for one or more of the following reasons:

- The action is not feasible.
- The action is already being implemented.
- The planning partner does not have the capability to implement the action.
- There is an apparently more cost-effective alternative.
- The action does not have public or political support.

The catalogs for each hazard are presented in Table 22-1 through Table 22-9.

Table 22-1. Alternatives to Mitigate the Dam Failure Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Relocate out of dam failure inundation areas • **Reduce vulnerability:** ❖ Elevate home to appropriate levels • **Build local capacity:** ❖ Learn about risk reduction for the dam failure hazard ❖ Learn the evacuation routes for a dam failure event ❖ Educate yourself on early warning systems and the dissemination of warnings	• **Manipulate the hazard:** ❖ Remove dams ❖ Harden dams • **Reduce exposure:** ❖ Replace earthen dams with hardened structures • **Reduce vulnerability:** ❖ Flood-proof facilities within dam failure inundation areas • **Build local capacity:** ❖ Educate employees on the probable impacts of a dam failure ❖ Develop a continuity of operations plan	• **Manipulate the hazard:** ❖ Remove dams ❖ Harden dams • **Reduce exposure:** ❖ Replace earthen dams with hardened structures ❖ Relocate critical facilities out of dam failure inundation areas ❖ Consider open space land use in designated dam failure inundation areas • **Reduce vulnerability:** ❖ Adopt higher floodplain standards in mapped dam failure inundation areas ❖ Retrofit critical facilities within dam failure inundation areas • **Build local capacity:** ❖ Map dam failure inundation areas ❖ Enhance emergency operations plan to include a dam failure component ❖ Institute monthly communications checks with dam operators ❖ Inform the public on risk reduction techniques ❖ Adopt real-estate disclosure requirements for the re-sale of property located within dam failure inundation areas ❖ Consider the probable impacts of climate change in assessing the risk associated with the dam failure hazard ❖ Establish early warning capability downstream of listed high hazard dams ❖ Consider the residual risk associated with protection provided by dams in future land use decisions

Table 22-2. Alternatives to Mitigate the Drought Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ None • **Reduce vulnerability:** ❖ Drought-resistant landscapes ❖ Reduce water system losses ❖ Modify plumbing systems (through water saving kits) ❖ For homes with on-site water systems: increase storage, utilize rainwater catchment • **Build local capacity:** ❖ Practice active water conservation	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ None • **Reduce vulnerability:** ❖ Drought-resistant landscapes ❖ Reduce private water system losses ❖ Support alternative irrigation techniques to reduce water use and encourage use of climate-sensitive water supplies ❖ For businesses with on-site water systems: increase storage, utilize rainwater catchment • **Build local capacity:** ❖ Practice active water conservation	• **Manipulate the hazard:** ❖ Groundwater recharge through stormwater management ❖ Develop a water recycling program ❖ Increase “above-the-dam” regional natural water storage systems • **Reduce exposure:** ❖ Identify and create groundwater backup sources • **Reduce vulnerability:** ❖ Water use conflict regulations ❖ Reduce water system losses ❖ Distribute water saving kits ❖ increase conventional storage that is filled during high-flow periods • **Build local capacity:** ❖ Public education on drought resistance ❖ Identify alternative water supplies for times of drought; mutual aid agreements with alternative suppliers ❖ Develop drought contingency plan ❖ Develop criteria “triggers” for drought-related actions ❖ Improve accuracy of water supply forecasts ❖ Modify rate structure to influence active water conservation techniques ❖ Consider the probable impacts of climate change on the risk associated with the drought hazard

Table 22-3. Alternatives to Mitigate the Earthquake Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Locate outside of hazard area (off soft soils) • **Reduce vulnerability:** ❖ Retrofit structure (anchor house structure to foundation) ❖ Secure household items that can cause injury or damage (such as water heaters, bookcases, and other appliances) ❖ Build to higher design • **Build local capacity:** ❖ Practice "drop, cover, and hold" ❖ Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 72-hour self-sufficiency during an event ❖ Keep cash reserves for reconstruction ❖ Become informed on the hazard and risk reduction alternatives available. ❖ Develop a post-disaster action plan for your household	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Locate or relocate mission-critical functions outside hazard area where possible • **Reduce vulnerability:** ❖ Build redundancy for critical functions and facilities ❖ Retrofit critical buildings and areas housing mission-critical functions • **Build local capacity:** ❖ Adopt higher standard for new construction; consider "performance-based design" when building new structures ❖ Keep cash reserves for reconstruction ❖ Inform your employees on the possible impacts of earthquake and how to deal with them at your work facility. ❖ Develop a continuity of operations plan	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Locate critical facilities or functions outside hazard area where possible • **Reduce vulnerability:** ❖ Harden infrastructure ❖ Provide redundancy for critical functions ❖ Adopt higher regulatory standards • **Build local capacity:** ❖ Provide better hazard maps ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas (e.g., tax incentives, information) ❖ Include retrofitting and replacement of critical system elements in capital improvement plan ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components such as pipe, power line, and road repair materials ❖ Develop and adopt a continuity of operations plan ❖ Initiate triggers guiding improvements (such as <50% substantial damage or improvements) ❖ Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities. ❖ Develop a post-disaster action plan that includes grant funding and debris removal components.

Table 22-4. Alternatives to Mitigate the Flood Hazard

Personal-Scale	Corporate-Scale	Government-Scale	
• **Manipulate the hazard:** ❖ Clear storm drains and culverts ❖ Use low-impact development techniques • **Reduce exposure:** ❖ Locate outside of hazard area ❖ Elevate utilities above base flood elevation ❖ Use low-impact development techniques • **Reduce vulnerability:** ❖ Raise structures above base flood elevation ❖ Elevate items within house above base flood elevation ❖ Build new homes above base flood elevation ❖ Flood-proof structures • **Build local capacity:** ❖ Buy flood insurance ❖ Develop household plan, such as retrofit savings, communication with outside, 72-hour self-sufficiency during and after an event	• **Manipulate the hazard:** ❖ Clear storm drains and culverts ❖ Use low-impact development techniques • **Reduce exposure:** ❖ Locate critical facilities or functions outside hazard area ❖ Use low-impact development techniques • **Reduce vulnerability:** ❖ Build redundancy for critical functions or retrofit critical buildings ❖ Provide flood-proofing when new critical infrastructure must be located in floodplains • **Build local capacity:** ❖ Keep cash reserves for reconstruction ❖ Support and implement hazard disclosure for sale of property in risk zones. ❖ Solicit cost-sharing through partnerships with others on projects with multiple benefits.	• **Manipulate the hazard:** ❖ Maintain drainage system ❖ Institute low-impact development techniques on property ❖ Dredging, levee construction, and providing regional retention areas ❖ Structural flood control, levees, channelization, or revetments. ❖ Stormwater management regulations and master planning ❖ Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff • **Reduce exposure:** ❖ Locate or relocate critical facilities outside of hazard area ❖ Acquire or relocate identified repetitive loss properties ❖ Promote open space uses in identified high hazard areas via techniques such as: planned unit developments, easements, setbacks, greenways, sensitive area tracks. ❖ Adopt land development criteria such as planned unit developments, density transfers, clustering ❖ Institute low impact development techniques on property ❖ Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff ❖ Preserve undeveloped and vulnerable shoreline ❖ Restore existing flood control and riparian corridors • **Reduce vulnerability:** ❖ Harden infrastructure, bridge replacement program ❖ Provide redundancy for critical functions and infrastructure ❖ Adopt regulatory standards such as freeboard standards, cumulative substantial improvement or damage, lower substantial damage threshold; compensatory storage, non-conversion deed restrictions. ❖ Stormwater management regulations and master planning. ❖ Adopt “no-adverse impact” floodplain management policies that strive to not increase the flood risk on downstream communities	❖ Facilitate managed retreat from, or upgrade of, the most at-risk areas ❖ Require accounting of sea-level rise in all applications for new development in shoreline areas ❖ Implement Assembly Bill 162 (2007) requiring flood hazard information in local general plans • **Build local capacity:** ❖ Produce better hazard maps ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) ❖ Incorporate retrofitting or replacement of critical system elements in capital improvement plan ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components ❖ Develop and adopt a continuity of operations plan ❖ Consider participation in the Community Rating System ❖ Maintain and collect data to define risks and vulnerability ❖ Train emergency responders ❖ Create an elevation inventory of structures in the floodplain ❖ Develop and implement a public information strategy ❖ Charge a hazard mitigation fee ❖ Integrate floodplain management policies into other planning mechanisms within the planning area. ❖ Consider the probable impacts of climate change on the risk associated with the flood hazard ❖ Consider the residual risk associated with structural flood control in future land use decisions ❖ Enforce National Flood Insurance Program requirements ❖ Adopt a Stormwater Management Master Plan ❖ Develop an adaptive management plan to address the long-term impacts of sea-level rise

Table 22-5. Alternatives to Mitigate the Landslide Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope ❖ Minimize vegetation removal and the addition of impervious surfaces. • **Reduce exposure:** ❖ Locate structures outside of hazard area (off unstable land and away from slide-run out area) • **Reduce vulnerability:** ❖ Retrofit home • **Build local capacity:** ❖ Institute warning system, and develop evacuation plan ❖ Keep cash reserves for reconstruction ❖ Educate yourself on risk reduction techniques for landslide hazards	• **Manipulate the hazard:** ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope • **Reduce exposure:** ❖ Locate structures outside of hazard area (off unstable land and away from slide-run out area) • **Reduce vulnerability:** ❖ Retrofit at-risk facilities • **Build local capacity:** ❖ Institute warning system, and develop evacuation plan ❖ Keep cash reserves for reconstruction ❖ Develop a continuity of operations plan ❖ Educate employees on the potential exposure to landslide hazards and emergency response protocol.	• **Manipulate the hazard:** ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope • **Reduce exposure:** ❖ Acquire properties in high-risk landslide areas. ❖ Adopt land use policies that prohibit the placement of habitable structures in high-risk landslide areas. • **Reduce vulnerability:** ❖ Adopt higher regulatory standards for new development within unstable slope areas. ❖ Armor/retrofit critical infrastructure against the impact of landslides. • **Build local capacity:** ❖ Produce better hazard maps ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas: better land controls, tax incentives, information ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components ❖ Develop and adopt a continuity of operations plan ❖ Educate the public on the landslide hazard and appropriate risk reduction alternatives. ❖ Consider the probable impacts of climate change on the risk associated with the landslide hazard

Table 22-6. Alternatives to Mitigate Sea-Level Rise and Coastal Erosion

Personal-Scale	Corporate-Scale	Government-Scale
Manipulate the hazard: ❖ Barriers (Sea Wall) ❖ Pump Stations ❖ Protect, preserve, and restore beaches and dunes **Reduce exposure to the hazard:** ❖ Voluntary retreat ❖ Elevate on fill above sea-level rise elevation ❖ Elevate utilities above base flood elevation ❖ Use low-impact development techniques **Reduce vulnerability to the hazard:** ❖ Elevate ❖ Floodproof **Build local capacity to respond to or prepare for the hazard:** ❖ Buy flood insurance ❖ Develop household plan, such as retrofit savings, communication with outside, 72-hour self-sufficiency during and after an event	**Manipulate the hazard:** ❖ Barriers (sea wall) ❖ Pump Stations ❖ Protect, preserve, and restore wetlands ❖ Protect, preserve, and restore beaches and dunes **Reduce exposure to the hazard:** ❖ Relocate out hazard zone ❖ Elevate on fill above sea-level rise elevation ❖ Locate critical facilities or functions outside hazard area ❖ Use low-impact development techniques **Reduce vulnerability to the hazard:** ❖ Build redundancy for critical functions or retrofit critical buildings ❖ Maintain drainage facilities that service your property. ❖ Provide flood-proofing when new critical infrastructure must be located in floodplains **Build local capacity to respond to or prepare for the hazard:** ❖ Be informed and understand future impacts of sea-level rise on your business ❖ Develop a Continuity of Operations Plan	**Manipulate the hazard:** ❖ Barriers (Sea wall) ❖ Pump Stations ❖ Protect, preserve, and restore wetlands ❖ Protect, preserve, and restore beaches and dunes **Reduce exposure to the hazard:** ❖ Buyout/Relocation Program ❖ Promote open space uses in identified high hazard areas via techniques such as: planned unit developments, easements, setbacks, greenways, sensitive area tracks. ❖ Adopt land development criteria such as planned unit developments, density transfers, clustering ❖ Institute low impact development techniques on property ❖ Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff **Reduce vulnerability to the hazard:** ❖ Harden infrastructure ❖ Provide redundancy for critical functions and infrastructure ❖ Adopt higher regulatory standards in sea-level rise zones ❖ Facilitate managed retreat from, or upgrade of, the most at-risk areas ❖ Implement tree management programs. ❖ Elevate roads that are vital/critical to evacuation and local community operations. ❖ Design or enhance existing drainage systems for higher design storms to provide increased capacity of the drainage system. ❖ Maintain the drainage infrastructure to levels that equal or exceed their design specifications. ❖ Require accounting of sea-level rise in all applications for new development in shoreline areas **Build local capacity to respond to or prepare for the hazard:** ❖ Provide technical information and guidance ❖ Promote the purchase of flood insurance ❖ Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) ❖ Incorporate retrofitting or replacement of critical system elements in capital improvement plan ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Provide incentives to guide development away from hazard areas or to retrofit in place ❖ Provide residents with sea-level rise inundation maps

Table 22-7. Alternatives to Mitigate the Severe Storm and Severe Weather Hazards

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ None • **Reduce vulnerability:** ❖ Insulate house ❖ Provide redundant heat and power ❖ Insulate structure ❖ Plant appropriate trees near home and power lines ("Right tree, right place" National Arbor Day Foundation Program) • **Build local capacity:** ❖ Trim or remove trees that could affect power lines ❖ Promote 72-hour self-sufficiency ❖ Obtain a NOAA weather radio. ❖ Obtain an emergency generator.	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ None • **Reduce vulnerability:** ❖ Relocate critical infrastructure (such as power lines) underground ❖ Reinforce or relocate critical infrastructure such as power lines to meet performance expectations ❖ Install tree wire • **Build local capacity:** ❖ Trim or remove trees that could affect power lines ❖ Create redundancy ❖ Equip facilities with a NOAA weather radio ❖ Equip vital facilities with emergency power sources.	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Develop an urban heat island reduction program that includes an urban forest program or plan • **Reduce vulnerability:** ❖ Harden infrastructure such as locating utilities underground ❖ Trim trees back from power lines ❖ Designate snow routes and strengthen critical road sections and bridges • **Build local capacity:** ❖ Support programs such as "Tree Watch" that proactively manage problem areas through use of selective removal of hazardous trees, tree replacement, etc. ❖ Establish and enforce building codes that require all roofs to withstand snow loads ❖ Increase communication alternatives ❖ Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. ❖ Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines ❖ Provide NOAA weather radios to the public ❖ Consider the probable impacts of climate change on the risk associated with the severe weather hazard ❖ Review and update heat response plan in light of climate change (heat events) projections

Table 22-8. Alternatives to Mitigate the Tsunami Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Locate outside of hazard area • **Reduce vulnerability:** ❖ Apply personal property mitigation techniques to your home such as anchoring your foundation and foundation openings to allow flow though. • **Build local capacity:** ❖ Develop and practice a household evacuation plan ❖ Educate yourself on the risk exposure from the tsunami hazard and ways to minimize that risk ❖ Understand tsunami warning signs and signals	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Locate structure or mission critical functions outside of hazard area whenever possible • **Reduce vulnerability:** ❖ Mitigate personal property for the impacts of tsunami • **Build local capacity:** ❖ Develop and practice a corporate evacuation plan ❖ Educate employees on the risk exposure from the tsunami hazard and ways to minimize that risk	• **Manipulate the hazard:** ❖ Build wave abatement structures (e.g. the “Jacks” looking structure designed by the Japanese) • **Reduce exposure:** ❖ Locate structure or functions outside of hazard area whenever possible ❖ Harden infrastructure for tsunami impacts ❖ Relocate identified critical facilities located in tsunami high hazard areas • **Reduce vulnerability:** ❖ Adopt higher regulatory standards that will provide higher levels of protection to structures built in a tsunami inundation area ❖ Utilize tsunami mapping to guide development away from high risk areas through land use planning • **Build local capacity:** ❖ Use probabilistic tsunami mapping and land use guidance from the state when published ❖ Provide incentives to guide development away from hazard areas ❖ Improve the tsunami warning and response system ❖ Provide residents with tsunami inundation maps ❖ Join NOAA’s Tsunami Ready program ❖ Develop and communicate evacuation routes ❖ Enhance the public information program to include risk reduction options for the tsunami hazard

Table 22-9. Alternatives to Mitigate the Wildfire Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ Clear potential fuels on property such as dry overgrown underbrush and diseased trees • **Reduce exposure:** ❖ Create and maintain defensible space around structures ❖ Locate outside of hazard area ❖ Mow regularly • **Reduce vulnerability:** ❖ Create and maintain defensible space around structures and provide water on site ❖ Use fire-resistant building materials ❖ Create defensible spaces around home • **Build local capacity:** ❖ Employ techniques from the National Fire Protection Association's Firewise USA program to safeguard home ❖ Identify alternative water supplies for fire fighting ❖ Install/replace roofing material with non-combustible roofing materials and implement other strategies to harden homes from embers and flame impingement	• **Manipulate the hazard:** ❖ Clear potential fuels on property such as dry underbrush and diseased trees • **Reduce exposure:** ❖ Create and maintain defensible space around structures and infrastructure ❖ Locate outside of hazard area • **Reduce vulnerability:** ❖ Create and maintain defensible space around structures and infrastructure and provide water on site ❖ Use fire-resistant building materials ❖ Use fire-resistant plantings in buffer areas of high wildfire threat. • **Build local capacity:** ❖ Support Firewise USA community initiatives. ❖ Create /establish stored water supplies to be utilized for firefighting.	• **Manipulate the hazard:** ❖ Clear potential fuels on property such as dry underbrush and diseased trees ❖ Implement best management practices on public lands • **Reduce exposure:** ❖ Create and maintain defensible space around structures and infrastructure ❖ Locate outside of hazard area ❖ Enhance building code to include use of fire resistant materials in high hazard area. • **Reduce vulnerability:** ❖ Create and maintain defensible space around structures and infrastructure ❖ Use fire-resistant building materials ❖ Use fire-resistant plantings in buffer areas of high wildfire threat. ❖ Consider higher regulatory standards (such as Class A roofing) ❖ Establish biomass reclamation initiatives ❖ Reintroduce fire (controlled or prescribed burns) to fire-prone ecosystems ❖ Manage fuel load through thinning and brush removal ❖ Establish integrated performance standards for new development to harden homes. • **Build local capacity:** ❖ More public outreach and education efforts, including an active Firewise USA program ❖ Possible weapons of mass destruction funds available to enhance fire capability in high-risk areas ❖ Identify fire response and alternative evacuation routes and establish where needed ❖ Seek alternative water supplies ❖ Become a Firewise USA community ❖ Use academia to study impacts/solutions to wildfire risk ❖ Establish/maintain mutual aid agreements between fire service agencies ❖ Develop, adopt, and implement integrated plans for mitigating wildfire impacts in wildland areas bordering on development ❖ Consider the probable impacts of climate change on the risk associated with the wildfire hazard in future land use decisions ❖ Establish a management program to track forest and rangeland health ❖ Provide incentives to for existing structures to be hardened against wildfire.

22.2 ADAPTIVE CAPACITY

Adaptive capacity is defined as “the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences” (Intergovernmental Panel on Climate Change 2021). In addition to hazard-specific capacity building, the following list provides general alternatives that planning partners considered to build capacity for adapting to both current and future risks (Cal OES 2020).

- Incorporate climate change adaptation into relevant local and regional plans and projects.
- Establish a climate change adaptation and hazard mitigation public outreach and education program.
- Build collaborative relationships between regional entities and neighboring communities to promote complementary adaptation and mitigation strategy development and regional approaches.
- Establish an ongoing monitoring program to track local and regional climate impacts and adaptation strategy effectiveness.
- Increase participation of low-income, immigrant, non-English-speaking, racially and ethnically diverse, and special-needs residents in planning and implementation.
- Ask local employers and business associations to participate in local efforts to address climate change and natural hazard risk reduction.
- Conduct a communitywide assessment and develop a program to address health, socioeconomic, and equity vulnerabilities.
- Focus planning and intervention programs on neighborhoods that currently experience social or environmental injustice or bear a disproportionate burden of potential public health impacts.
- Use performance metrics and data to evaluate and monitor the impacts of climate change and natural hazard risk reduction strategies on public health and social equity.
- Develop coordinated plans for mitigating future flood, landslide, and related impacts through concurrent adoption of updated general plan safety elements and local hazard mitigation plans.
- Update safety elements to reflect existing hazards and projected climate change impacts on hazards.
- Implement general plan safety elements through zoning and subdivision practices that restrict development in floodplains, landslide, and other natural hazard areas.
- Identify and protect locations where native species may shift or lose habitat due to climate change impacts (sea-level rise, loss of wetlands, warmer temperatures, drought).
- Collaborate with agencies managing public lands to identify, develop, or maintain corridors and linkages between undeveloped areas.
- Promote economic diversity.
- Incorporate consideration of climate change impacts as part of infrastructure planning and operations.
- Conduct a climate impact assessment on community infrastructure.

- Identify gaps in legal and regulatory capabilities and develop ordinances or guidelines to address them.
- Identify and pursue new sources of funding for mitigation and adaptation activities.
- Hire new staff or provide training to current staff to ensure an adequate level of administrative and technical capability to pursue mitigation and adaptation activities.

23. RECOMMENDED PLANNING-AREA-WIDE ACTIONS

23.1 RECOMMENDED MITIGATION ACTIONS FOR ALL PARTNERS

The Steering Committee reviewed the catalogs of hazard mitigation alternatives and selected planning-area-wide actions to be included in a hazard mitigation action plan for all planning partners. The selection of area-wide actions was based on the risk assessment of identified hazards of concern and the defined hazard mitigation goals and objectives. Table-23-1 lists the recommended hazard mitigation actions that make up the action plan. The timeframe indicated in the table is defined as follows:

- Short Term = to be completed in 1 to 5 years
- Long Term = to be completed in greater than 5 years
- Ongoing = currently being funded and implemented under existing programs.

Additional jurisdiction-specific action plans for each planning partner are included in the partner annexes in Volume 2 of this hazard mitigation plan.

Table-23-1. Action Plan—Countywide Mitigation Initiatives

Hazards Addressed	Lead Agency	Possible Funding Sources or Resources	Time Line	Objectives
CW-1— Continue to maintain a website that will house the multi-jurisdictional hazard mitigation plan and any amendments to it adopted during the next 5-year period to provide the planning partners and the public with ongoing access to the plan and its implementation.				
All Hazards	Ventura County	General Funds	Short term, Ongoing	1, 2, 7, 17
CW-2— Continue to leverage/support/enhance ongoing, regional public education and awareness programs, such as VCAlert, CERT (Community Emergency Response Team), DART (Disaster Assistance Response Team), TsunamiReady, and StormReady, as methods to educate the public on risk, risk reduction, and community resilience.				
All Hazards	Planning Partners	Cost sharing from the partnership General fund allocations Cost sharing with stakeholders	Short term, Ongoing	1, 2, 7, 12, 17
CW-3— Continue to provide a virtual hub for sharing information on hazard mitigation resources on the readyventuracounty.org website that will support mitigation efforts and awareness of grant funding opportunities to the planning partnership.				
All Hazards	Ventura County	General funds	Short term, Ongoing	1, 2, 17

23.2 AREA-WIDE ACTION PLAN PRIORITIZATION

The actions recommended in the action plan were prioritized based on the following factors:

- Cost and availability of funding
- Benefit, based on likely risk reduction to be achieved

- Number of plan objectives achieved
- Timeframe for project implementation
- Eligibility for grand funding programs

Two priorities were assigned for each action:

- A high, medium, or low priority for implementing the action
- A high, medium, or low priority for pursuing grant funding for the action.

The sections below describe the analysis of benefits and costs and the assignment of the two priority ratings.

23.2.1 Benefit and Cost

The action plan must be prioritized according to a benefit/cost analysis of the proposed actions (44 CFR, Section 201.6(c)(3)(iii)). For this hazard mitigation plan, a qualitative benefit-cost review was performed for each action by assigning ratings for benefit and cost as follows:

- Cost:
  - **High**—Existing funding will not cover the cost of the action; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).
  - **Medium—**The action could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the action would have to be spread over multiple years.
  - **Low**—The action could be funded under the existing budget. The action is part of or can be part of an ongoing existing program.
- Benefit:
  - **High—**Action will provide an immediate reduction of risk exposure for life and property.
  - **Medium—**Action will have a long-term impact on the reduction of risk exposure for life and property, or action will provide an immediate reduction in the risk exposure for property.
  - **Low—**Long-term benefits of the action are difficult to quantify in the short term.

To assign priorities, each action with a benefit rating equal to or higher than its cost rating (such as high benefit/medium cost, medium benefit/medium cost, medium benefit/low cost, etc.) was considered to be cost-beneficial. This is not the detailed level of benefit/cost analysis required for some FEMA hazard-related grant programs. Such analysis would be performed at the time a given action is being submitted for grant funding.

23.2.2 Implementation Priority

Implementation priority ratings were assigned as follows:

- **High Priority**—An action that meets multiple objectives, has benefits that exceed costs, and has a secured source of funding. Action can be completed in the short term (1 to 5 years).
- **Medium Priority**—An action that meets multiple objectives, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can be completed in

the short term (1 to 5 years), once funding is secured. Medium-priority actions become high-priority actions once funding is secured.

- **Low Priority**—An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

23.2.3 Grant Pursuit Priority

Grant pursuit priority ratings were assigned as follows:

- **High Priority**—An action that meets identified grant eligibility requirements, has high benefits, and is listed as high or medium implementation priority; local funding options are unavailable or available local funds could be used instead for actions that are not eligible for grant funding.
- **Medium Priority**—An action that meets identified grant eligibility requirements, has medium or low benefits, and is listed as medium or low implementation priority; local funding options are unavailable.
- **Low Priority**—An action that has not been identified as meeting any grant eligibility requirements.

23.2.4 Prioritization Summary for Countywide Actions

Table 23-2 lists the priority of each action.

Table 23-2. Mitigation Action Priority

Action #	# of Objectives Met	Benefit	Cost	Do Benefits Equal or Exceed Costs?	Is Action Grant Eligible?	Can Action be Funded Under Existing Programs/ Budgets?	Implementation Priority	Grant Pursuit Priority
CW-1	4	Medium	Low	Yes	No	Yes	High	Low
CW-2	5	Medium	Low	Yes	No	Yes	High	Low
CW-3	3	Low	Low	Yes	No	Yes	High	Low

23.3 CLASSIFICATION OF AREA-WIDE MITIGATION ACTIONS

Each recommended action was classified based on the hazard it addresses and the type of mitigation it involves. Table 23-3 shows these classifications. Mitigation types used for this categorization are as follows:

- **Prevention**—Government, administrative or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. Includes planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**—Modification of buildings or structures to protect them from a hazard or removal of structures from a hazard area. Includes acquisition, elevation, relocation, structural retrofit, storm shutters, and shatter-resistant glass.

- **Public Education and Awareness**—Actions to inform residents and elected officials about hazards and ways to mitigate them. Includes outreach projects, real estate disclosure, hazard information centers, and school-age and adult education.
- **Natural Resource Protection**—Actions that minimize hazard loss and preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, wetland restoration and preservation, and green infrastructure.

Table 23-3. Analysis of Mitigation Actions

Hazard	Actions That Address the Hazard, by Mitigation Type							
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Climate Resiliency	Community Capacity Building
HIGH-PRIORITY HAZARDS								
Dam Failure			CW-1, 2					CW-2, 3
Landslide			CW-1, 2					CW-2, 3
MEDIUM-PRIORITY HAZARDS								
Earthquake			CW-1, 2					CW-2, 3
Flooding			CW-1, 2					CW-2, 3
Severe Storms			CW-1, 2					CW-2, 3
Severe Weather			CW-1, 2					CW-2, 3
Wildfire			CW-1, 2					CW-2, 3
LOW-PRIORITY HAZARDS								
Drought			CW-1, 2					CW-2, 3
Sea-Level Rise			CW-1, 2					CW-2, 3
Tsunami			CW-1, 2					CW-2, 3

- **Emergency Services**—Actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, and the protection of essential facilities.
- **Structural Projects**—Actions that involve the construction of structures to reduce the impact of a hazard. Includes dams, setback levees, floodwalls, retaining walls, and safe rooms.
- **Climate Resiliency**—Actions that incorporate methods to mitigate and/or adapt to the impacts of climate change. Includes aquifer storage and recovery activities, incorporating future conditions projections in project design or planning, or actions that specifically address jurisdiction-specific climate change risks, such as sea-level rise or urban heat island effect.
- **Community Capacity Building**—Actions that increase or enhance local capabilities to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. Includes staff training, memorandums of understanding, development of plans and studies, and monitoring programs.

24. PLAN ADOPTION AND MAINTENANCE

24.1 PLAN ADOPTION

A hazard mitigation plan must document formal adoption by the governing body of the jurisdiction requesting federal approval of the plan (44 CFR, Section 201.6.c.5). For multi-jurisdictional plans, each jurisdiction requesting approval must document that is has been formally adopted. This plan will be submitted for a pre-adoption review to Cal OES and FEMA Region IX prior to adoption. Once pre-adoption approval has been provided, all planning partners will formally adopt the plan. DMA compliance and its benefits cannot be achieved until the plan is adopted. Copies of the FEMA approval and planning partner resolutions adopting this plan can be found in Appendix F of this volume.

24.2 PLAN MAINTENANCE STRATEGY

This section describes a formal plan maintenance process to ensure that the hazard mitigation plan remains an active and relevant document. It includes an explanation of the responsibilities of a hazard mitigation plan Project Management Team and the planning partners. It outlines steps to ensure that the plan remains an active and relevant document and that any improvements and revisions to the hazard mitigation plan occur in a well-managed, efficient, and coordinated manner. Requirements for monitoring, evaluating, and updating the hazard mitigation plan include the following:

- 44 CFR 201.6, Local Mitigation Plans (Element A)—Inclusion of a description of the method and schedule for keeping the plan current (monitoring, evaluating, and updating the mitigation plan within a 5-year cycle. (Requirement § 201.6(c)(4)(1))
- CRS 510 Floodplain Management Planning, CRS Step 10:
  - A. Procedures to monitor and recommend revisions.
  - B. Same planning committee or successor committee that qualifies under Section 511.a.2 (a) does the evaluation.

A Project Management Team, composed of Ventura County staff members, will take the lead on monitoring, evaluating, and updating the hazard mitigation plan over the 5-year performance period. Table 24-1 summarizes the plan maintenance strategy over the 5-year performance period of the plan. The sections below further describe each element.

Table 24-1. Plan Maintenance Matrix

Approach	Timeline	Lead Responsibility[a]
Plan Monitoring		
Track the implementation of plan actions	Continuous	All planning partners will report annually to Ventura County Sheriff's OES on action implementation. Points of contact are listed in Volume 2.
Plan Evaluation		
Review the status of previous actions; assess changes in risk; evaluate success of integration	Upon initiation of hazard mitigation plan update, comprehensive General Plan update, or major disaster	All planning partners
Grant Monitoring and Coordination		
The County will consider options to pursue grants to fund actions identified in this plan.	Continuous, as grants become available	Ventura County Sheriff's OES
Plan Update		
Initiate the process to comprehensively update the plan at least every 5 years.	At the end of year 3 (mid-2025), coordinate with the planning partners, and work to identify grant funding opportunity for update. Obtain grant funding by the end of year 4 (mid 2026).	Ventura County Sheriff's OES will lead the plan update. All planning partners will support the effort.
Integration into Other Planning Mechanisms		
Create a linkage between the hazard mitigation plan and individual jurisdictions' general plans or similar plans identified in the core capability assessments	Continuous	All planning partners
Continuing Public Involvement		
Maintain and update the www.readyventuracounty.org website with relevant hazard mitigation information and public participation opportunities.	Continuous	Ventura County Sheriff's OES will lead continuing public participation. All planning partners will support the effort.

a. Responsible lead party may designate an alternate. Jurisdictional points of contact identified in Volume 2 have support responsibility.

24.2.1 Plan Monitoring

Ventura County Sheriff's OES will be the lead agency responsible for oversight and the Project Management Team will support plan monitoring, evaluation, and the plan update schedule. Each planning partner will monitor plan implementation by tracking the status of mitigation actions in its action plan. Staff or departments with primary responsibility are identified in each jurisdictional annex (see Volume 2).

24.2.2 Plan Evaluation

Plan evaluation will be a shared responsibility among all planning partners identified as lead agencies in the area-wide and jurisdiction-specific action plans. The plan will be analyzed for which goals and objectives were achieved. Additionally, a review of any changes in risk over the performance period will be analyzed by the degree to which those changes may impact and require revision to the mitigation goals and objectives and how they are incorporated into jurisdictional plans, policies and programs. Review of the hazard mitigation plan can include the following:

- Discussion of hazard events that occurred during the prior year and their impact on the planning area
- Impact of potential grant opportunities on the implementation of mitigation actions
- Re-evaluation of the action plans to determine if the timeline for identified actions needs to be amended (such as changing a long-term action to a short-term action because of funding availability)
- Recommendations for new actions
- Impact of any other planning programs or initiatives that involve hazard mitigation

24.2.3 Grant Monitoring and Coordination

Ventura County Sheriff's OES, in consultation with the planning partners, will identify hazard mitigation grant funding opportunities and assume lead responsibility for planning and facilitating grant opportunity calls or meetings. The Project Management Team will communicate and coordinate with the planning partners to review the hazard mitigation plan and pursue a strategy to capture grant funding.

24.2.4 Plan Update

FEMA requires the hazard mitigation plan to be revised and resubmitted for review and approval by Cal OES and FEMA prior to the five-year anniversary date of the plan's adoption in order to remain eligible for benefits under the DMA (44 CFR, Section 201.6(d)(3)). To meet this timeline, at the end of year 3 (2025), Ventura County Sheriff's OES, with support from the Project Management Team, will coordinate with the planning partners to identify a grant funding opportunity for the update. Grant funding for the update will be obtained by the end of year 4 (2026). This cycle may be accelerated to less than five years based on the following triggers:

- A federal disaster declaration that impacts Ventura County
- A hazard event that causes loss of life
- A comprehensive update of the Ventura County General Plan

The revision process may include the following elements, as required by FEMA at the time of the next update:

- The revision process will be convened through a new steering committee
- The hazard risk assessment will be reviewed and, if necessary, revised using best available information and technologies
- The action plan will be reviewed for any actions completed, ongoing, or withdrawn, and will be reconciled to account for changes in the risk assessment or new policies identified under other plans (such as the General Plan)
- The draft plan revision will be sent to appropriate agency departments and divisions for comment
- The public will be given an opportunity to comment on the revised plan prior to adoption
- The Ventura County Board of Supervisors will adopt the updated plan once the reviews by Cal OES and FEMA have been conducted

24.2.5 Integration with Other Planning Mechanisms

The information on hazard, risk, vulnerability, and mitigation contained in this plan is based on the best science and technology available at the time this plan was prepared. The planning partners, through adoption of General Plans and zoning ordinances, have planned for the impact of natural hazards. The hazard mitigation plan development process provided them with an opportunity to review and expand on policies contained within these planning mechanisms. The planning partners used their general plans and the hazard mitigation plan as complementary documents that work together to achieve the goal of reducing risk exposure to the citizens of the planning area. An update to a General Plan may trigger an update to the hazard mitigation plan.

All municipal planning partners have committed to creating a linkage between the hazard mitigation plan and their individual General Plans within one of their identified mitigation actions. Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan may include:

- Climate action plans
- Emergency operations plans
- Resilience plans
- Recovery plan
- Emergency response plans
- Training and exercise of emergency response plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Stormwater management programs
- Debris management plans
- Water-efficient landscape design guidelines
- Water system vulnerability assessments
- Community wildfire protection plans
- Comprehensive flood hazard management plans
- Community development block grant-disaster recovery action plans
- Public information/education plans.

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation. As information becomes available from other planning mechanisms that can enhance this plan, that information can be incorporated via the next hazard mitigation plan update.

For the special purpose district planning partners to this plan, identified planning capabilities include capital facility plans, emergency operations plan, continuity of operations plans, and community wildfire protection plans. Special purpose districts do not have land use authority, so integration with land use plans is not a capability for districts. However, for the planning capabilities that the districts do possess, they will integrate where appropriate relevant sections of this plan when those plans are scheduled for updates. This has already occurred for most of the district planning partners as indicated in Volume 2 of this plan.

24.2.6 Continuing Public Involvement

The public will continue to be apprised of the plan's progress through the www.readyventuracounty.org website. The website will house the final plan and the StoryMap and will provide information regarding the plan, plan implementation, and plan update process. The website will continue to be updated as additional information becomes available. This may include examples of local mitigation in action, planning partner updates, resources, and public participation opportunities.

Upon initiation of future update processes, a new public involvement strategy will be developed. This strategy will be based on the needs and capabilities of Ventura County and its planning partners at the time of the update and will include web, social media, and the use of other local media outlets in the planning area.

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Ventura County Multi-Jurisdictional Hazard Mitigation Plan

Appendix A. Public Involvement Materials

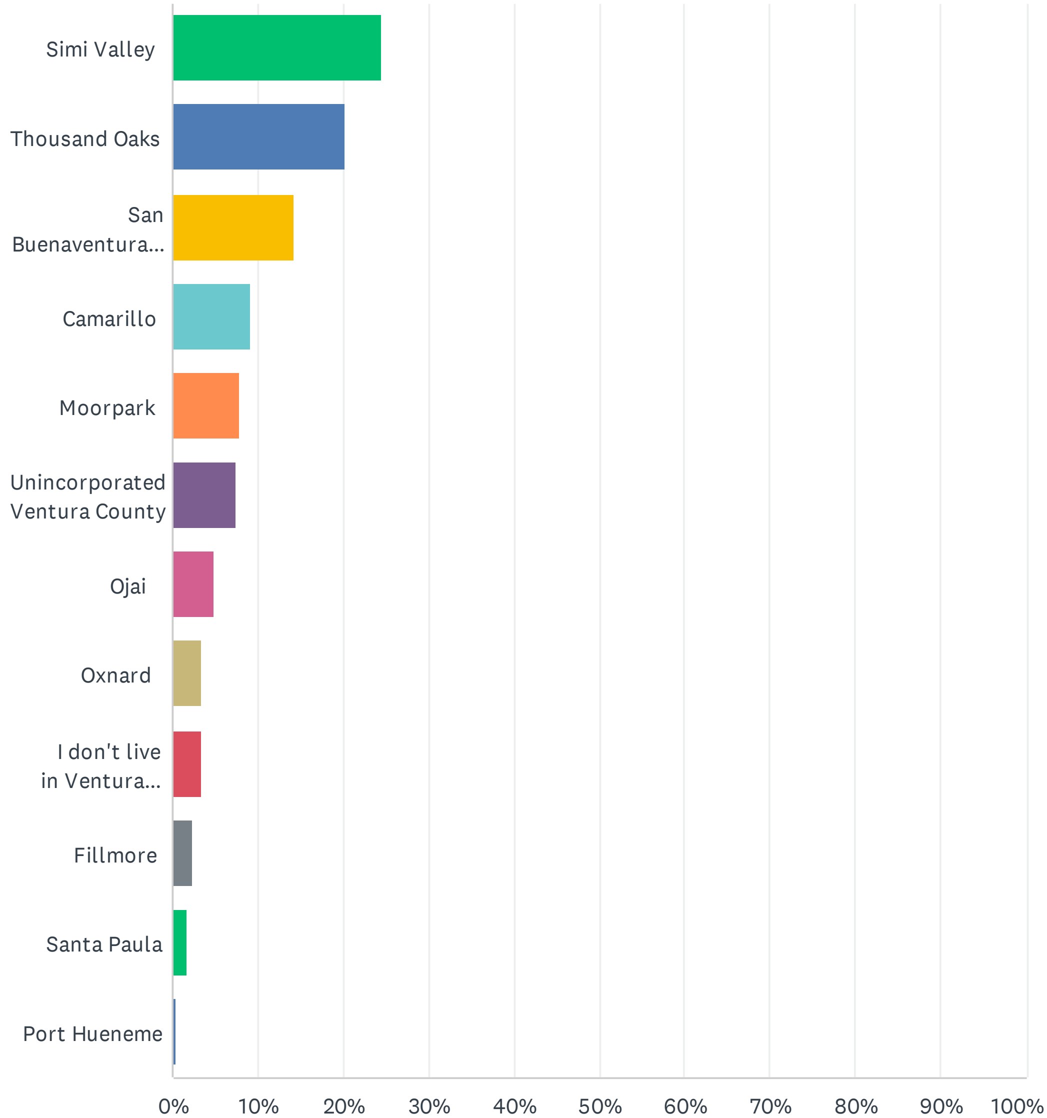
A. Public Involvement Materials

Steering Committee meeting agendas and notes are available online at https://www.readyventuracounty.org/calendar-of-events/

Survey results are provided on the following pages.

Q1 Where in Ventura County do you live?

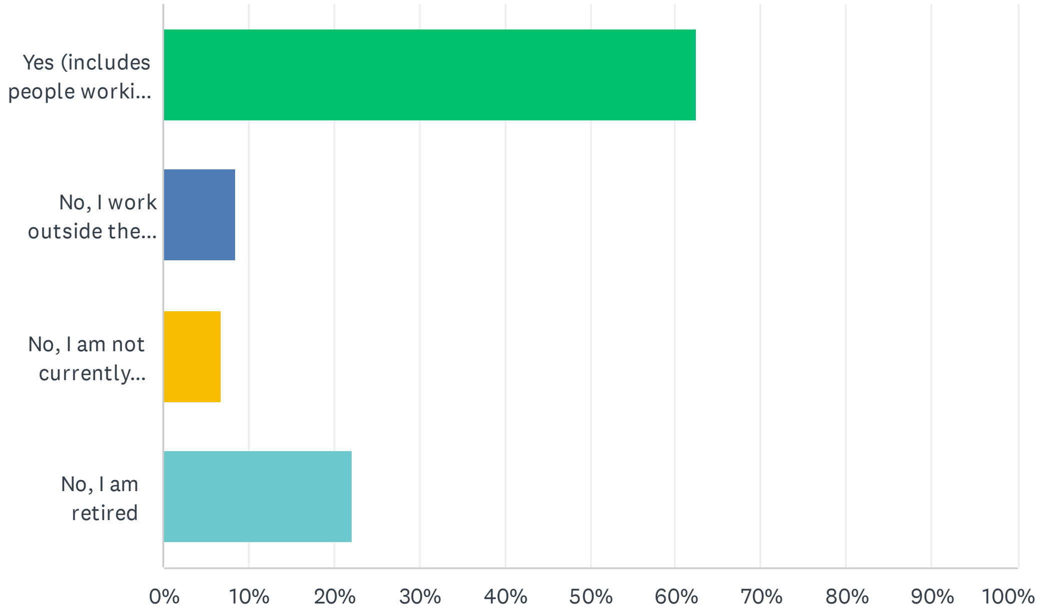
Answered: 831 Skipped: 1



ANSWER CHOICES	RESPONSES	
Simi Valley	24.55%	204
Thousand Oaks	20.22%	168
San Buenaventura (Ventura)	14.20%	118
Camarillo	9.27%	77
Moorpark	7.82%	65
Unincorporated Ventura County	7.46%	62
Ojai	4.93%	41
Oxnard	3.49%	29
I don't live in Ventura County	3.49%	29
Fillmore	2.29%	19
Santa Paula	1.81%	15
Port Hueneme	0.48%	4
TOTAL		831

Q2 Do you work in Ventura County?

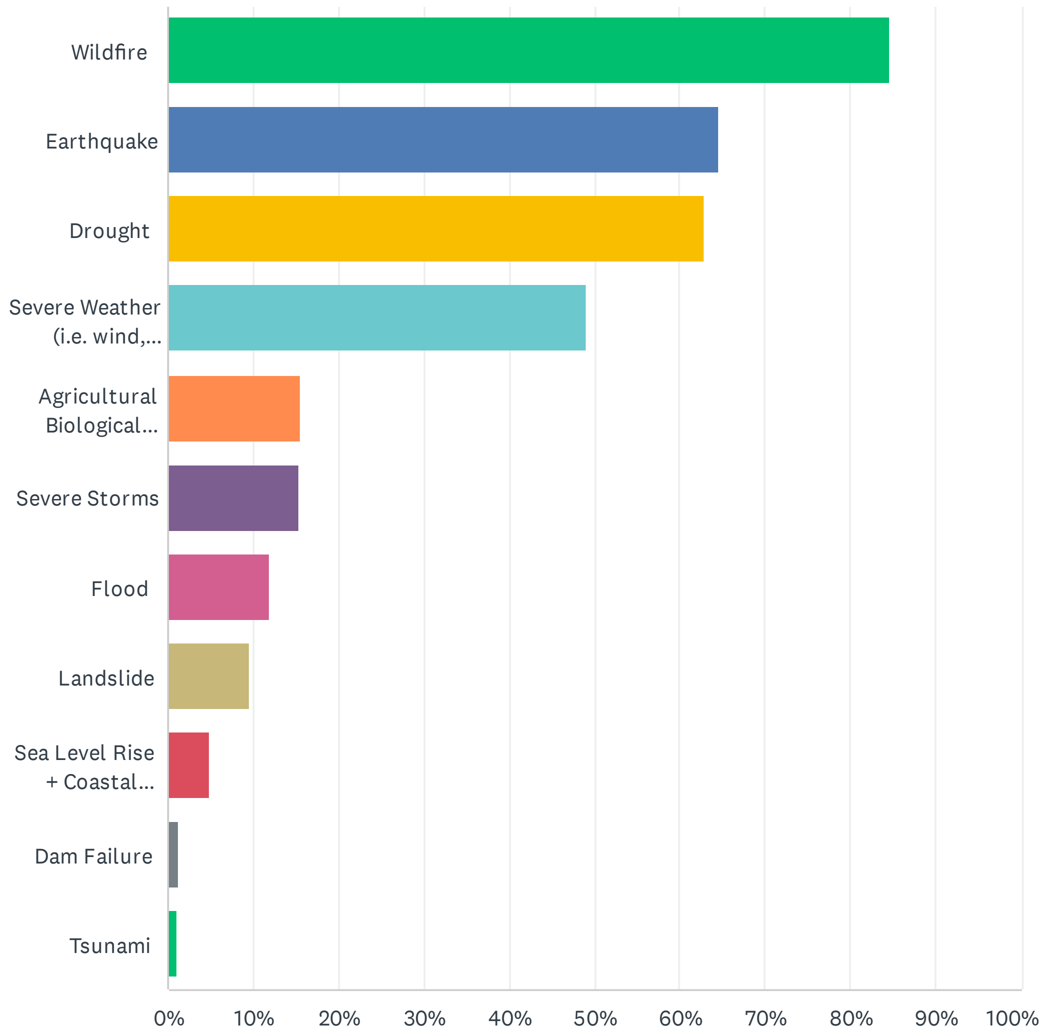
Answered: 831 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes (includes people working remotely from home)	62.58%	520
No, I work outside the County	8.42%	70
No, I am not currently employed	6.86%	57
No, I am retired	22.14%	184
TOTAL		831

Q3 Which of the following natural hazard events have you experienced or been affected by within Ventura County? (Check all that apply)

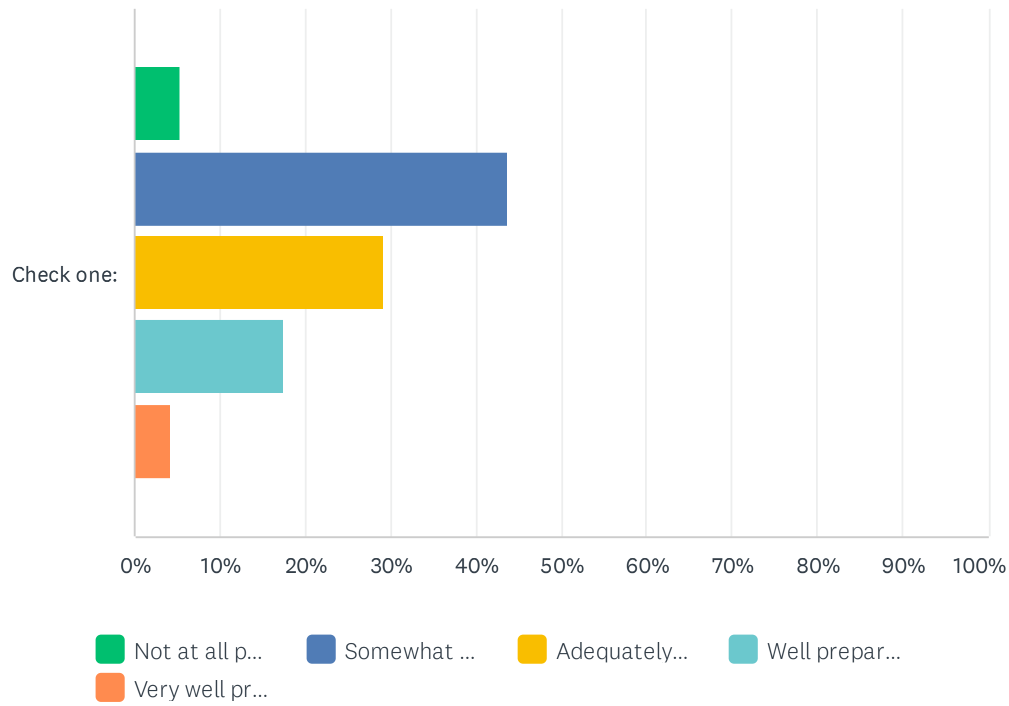
Answered: 831 Skipped: 1



ANSWER CHOICES	RESPONSES	
Wildfire	84.60%	703
Earthquake	64.50%	536
Drought	62.94%	523
Severe Weather (i.e. wind, cold, heat)	49.10%	408
Agricultural Biological (e.g. west nile, epidemic diseases)	15.64%	130
Severe Storms	15.40%	128
Flood	12.03%	100
Landslide	9.51%	79
Sea Level Rise + Coastal Erosion	4.93%	41
Dam Failure	1.20%	10
Tsunami	0.96%	8
Total Respondents: 831		

Q4 How prepared is your household to deal with a hazard event?

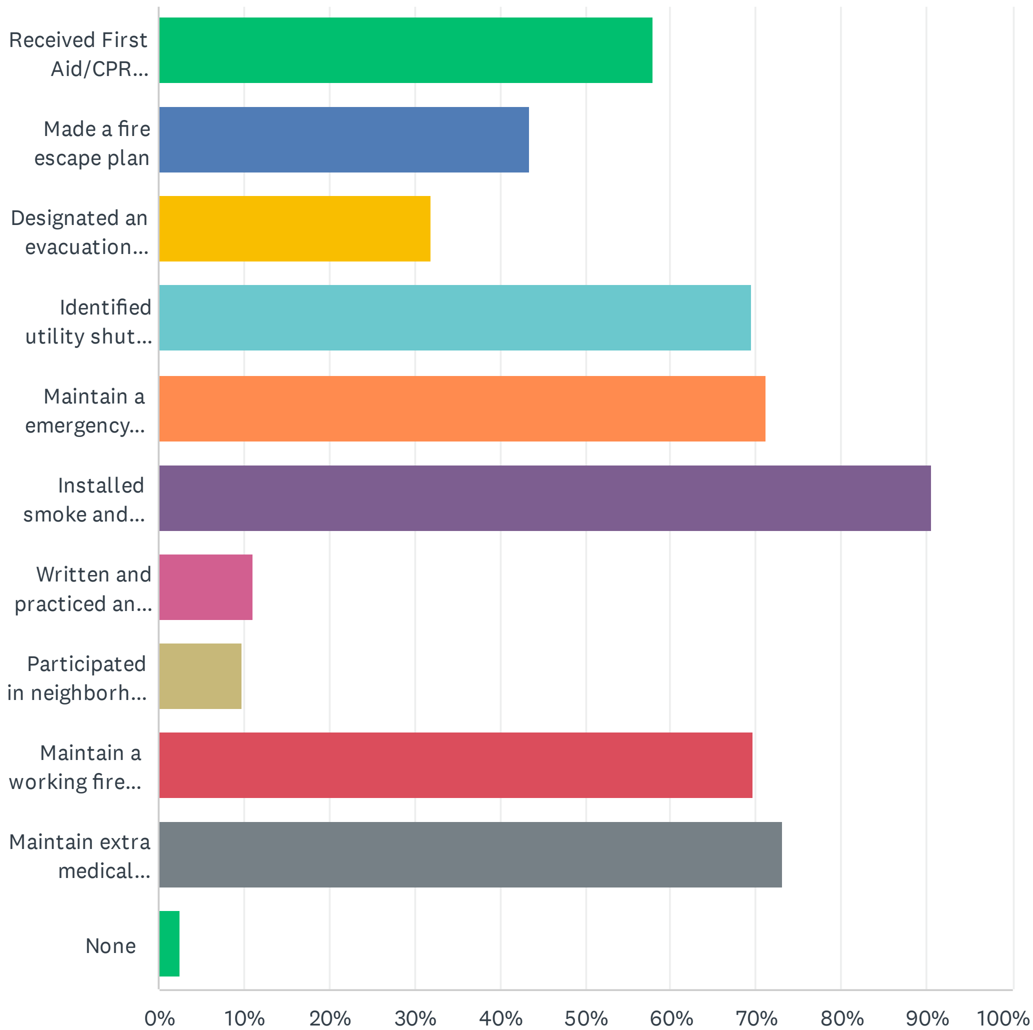
Answered: 792   Skipped: 40



	NOT AT ALL PREPARED	SOMEWHAT PREPARED	ADEQUATELY PREPARED	WELL PREPARED	VERY WELL PREPARED	TOTAL	WEIGHTED AVERAGE
Check one:	5.30% 42	43.69% 346	29.17% 231	17.55% 139	4.29% 34	792	2.72

Q5 What steps has your household taken to prepare for a disaster? (Check all that apply)

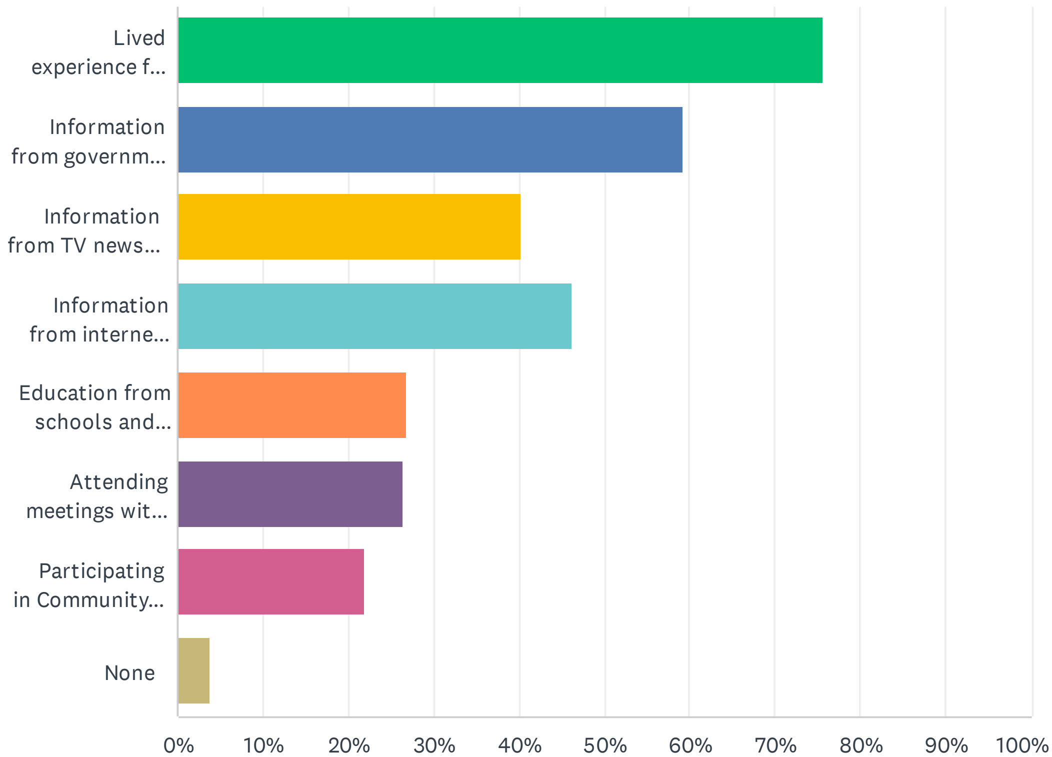
Answered: 791 Skipped: 41



ANSWER CHOICES	RESPONSES	
Received First Aid/CPR training	57.90%	458
Made a fire escape plan	43.49%	344
Designated an evacuation meeting place	31.98%	253
Identified utility shutoff locations	69.53%	550
Maintain a emergency supply kit (e.g. batteries, flashlights, battery-powered radio, food/water)	71.30%	564
Installed smoke and carbon monoxide detectors	90.52%	716
Written and practiced an individual or family disaster plan	11.00%	87
Participated in neighborhood preparedness and planning	9.86%	78
Maintain a working fire extinguisher at home	69.79%	552
Maintain extra medical supplies (e.g. first aid kit, medications)	73.07%	578
None	2.53%	20
Total Respondents: 791		

Q6 What resources/experiences have helped you to become more prepared? (Check all that apply)

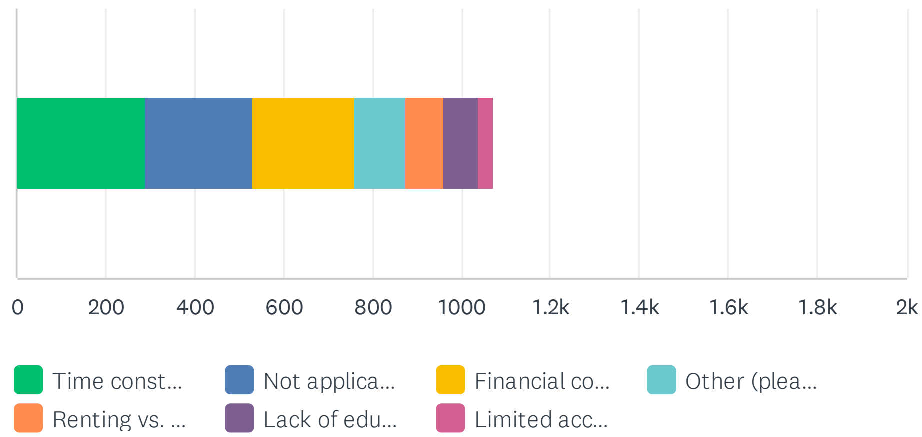
Answered: 792 Skipped: 40



ANSWER CHOICES	RESPONSES	
Lived experience from one or more hazards or disasters	75.76%	600
Information from government sources (e.g. federal, state, or local)	59.22%	469
Information from TV news, radio news	40.28%	319
Information from internet or social media	46.21%	366
Education from schools and other academic institutions	26.89%	213
Attending meetings with information on disaster preparedness	26.39%	209
Participating in Community Emergency Response Training (CERT) or other disaster training program (e.g. DART)	21.97%	174
None	3.91%	31
Total Respondents: 792		

Q7 What are the hurdles preventing you from being more prepared?

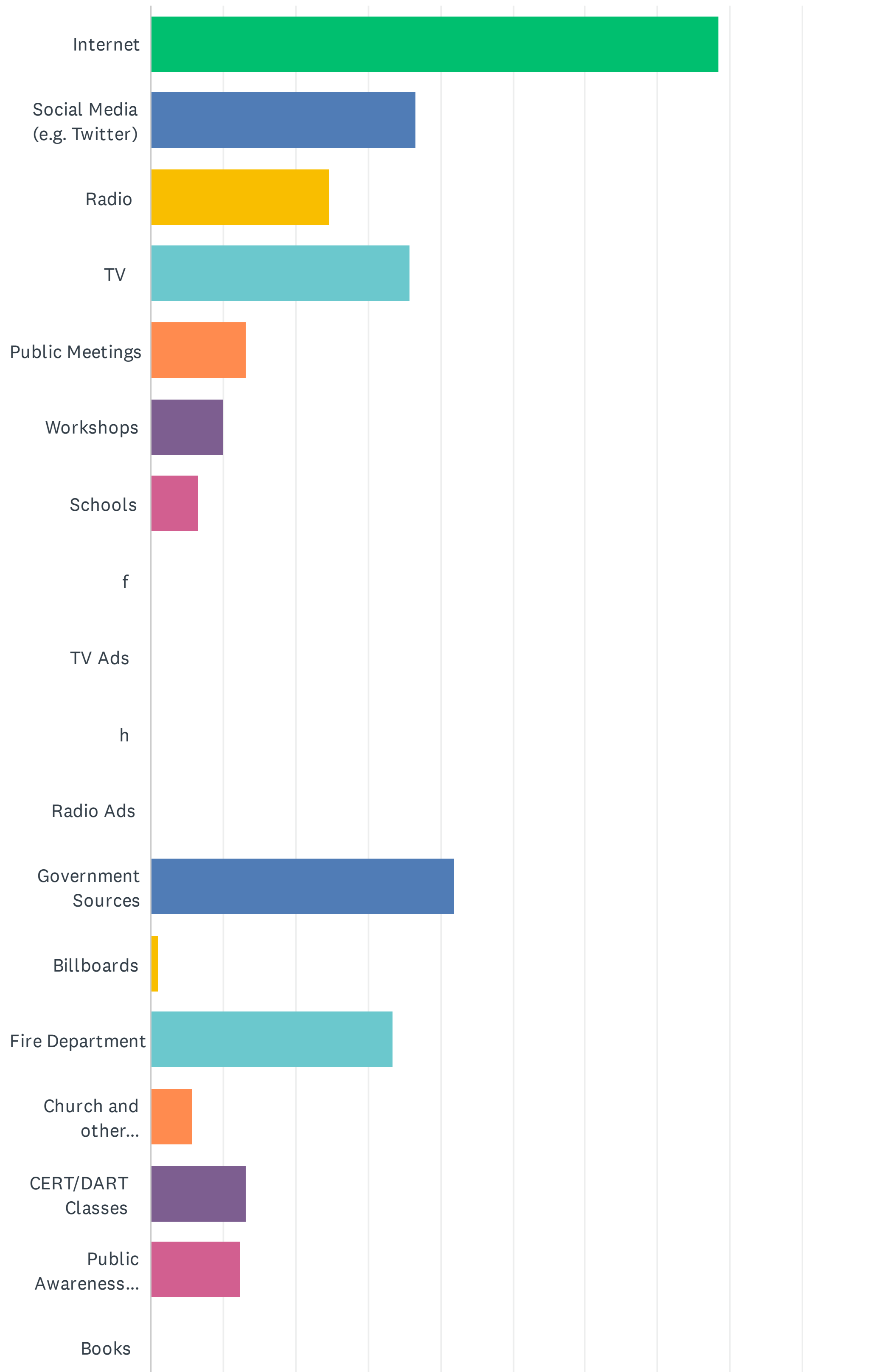
Answered: 789 Skipped: 43

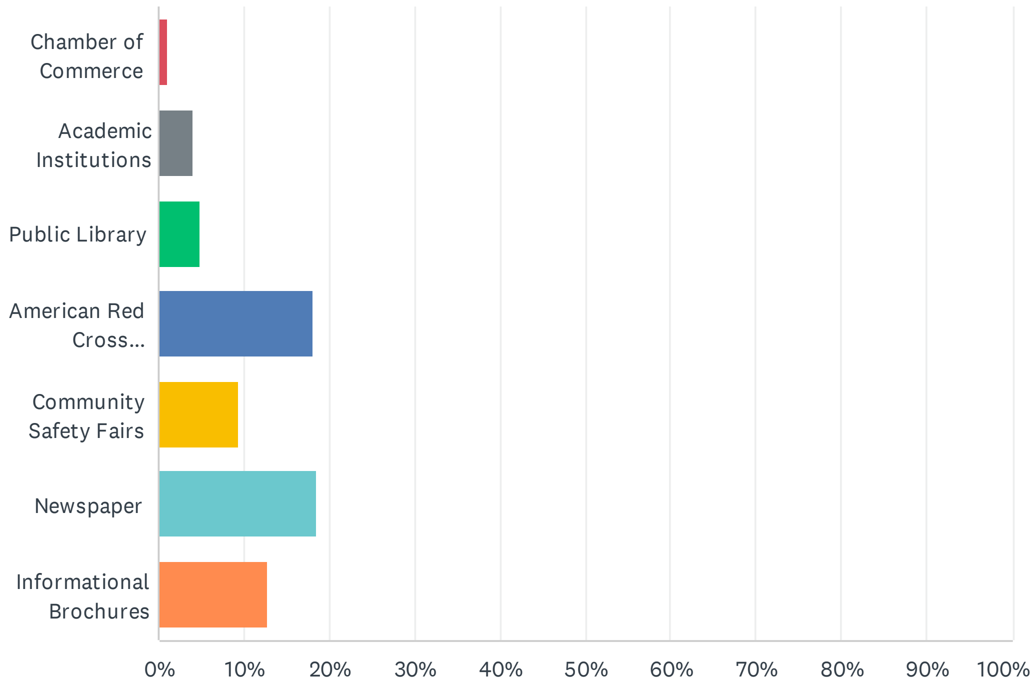


ANSWER CHOICES	RESPONSES	
Time constraints	36.76%	290
Not applicable, I feel adequately prepared already	30.80%	243
Financial constraints	29.02%	229
Other (please specify below)	14.58%	115
Renting vs. owning home or business	10.77%	85
Lack of education about disasters	9.76%	77
Limited access to information resources	4.18%	33
Total Respondents: 789		

Q8 Which information sources on emergency preparedness do you use most? (Check all that apply)

Answered: 792   Skipped: 40

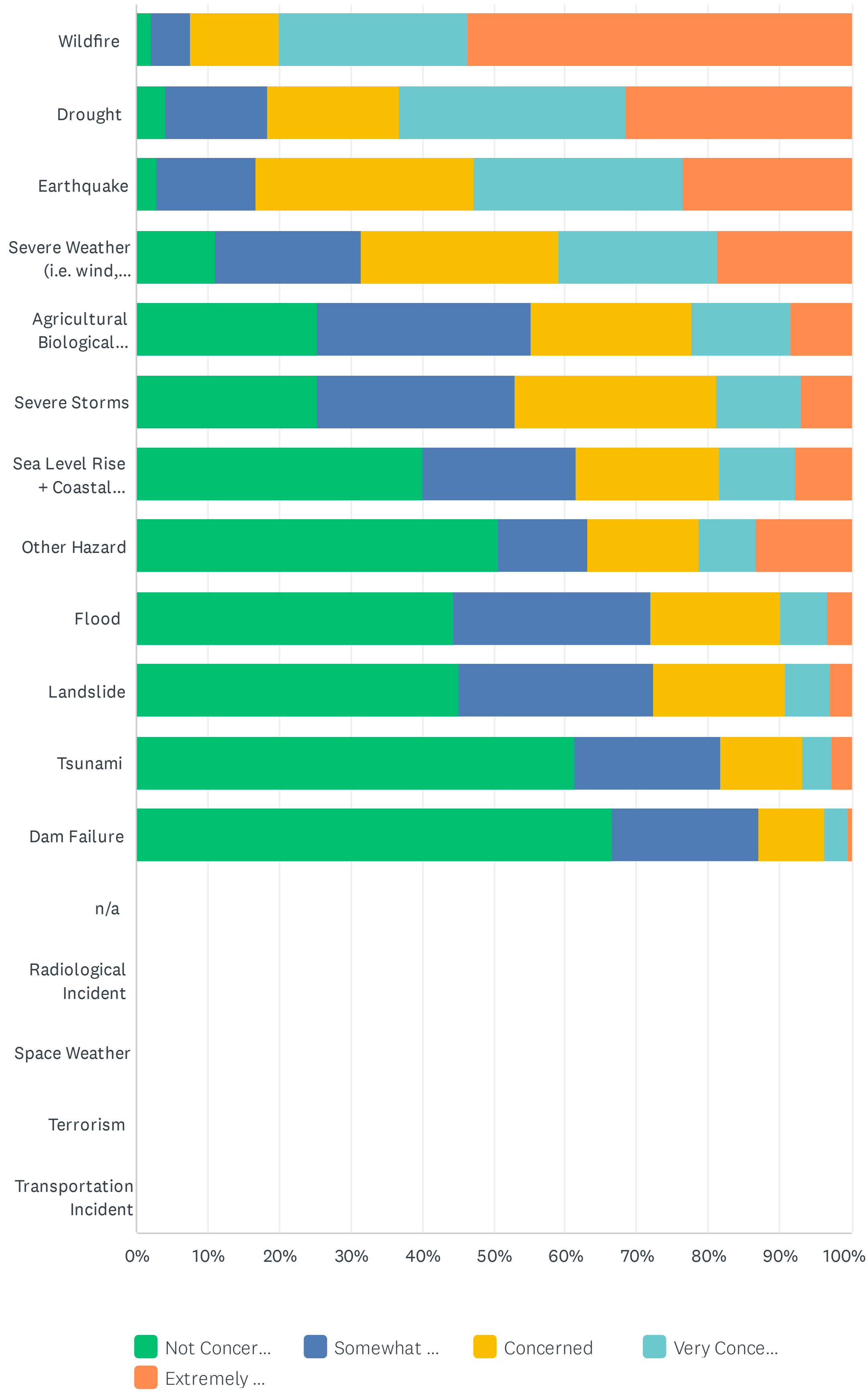



Chamber of Commerce
Academic Institutions
Public Library
American Red Cross...
Community Safety Fairs
Newspaper
Informational Brochures
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

ANSWER CHOICES	RESPONSES	
Internet	78.54%	622
Social Media (e.g. Twitter)	36.74%	291
Radio	24.75%	196
TV	35.73%	283
Public Meetings	13.26%	105
Workshops	10.10%	80
Schools	6.57%	52
f	0.00%	0
TV Ads	0.00%	0
h	0.00%	0
Radio Ads	0.00%	0
Government Sources	41.92%	332
Billboards	1.14%	9
Fire Department	33.46%	265
Church and other faith-based groups	5.68%	45
CERT/DART Classes	13.13%	104
Public Awareness Campaign (e.g. Flood Awareness Week)	12.37%	98
Books	0.00%	0
Chamber of Commerce	1.01%	8
Academic Institutions	4.04%	32
Public Library	4.80%	38
American Red Cross Information	18.18%	144
Community Safety Fairs	9.47%	75
Newspaper	18.56%	147
Informational Brochures	12.88%	102
Total Respondents: 792		

Q9 How concerned are you about the following hazards? (Check one response for each hazard)

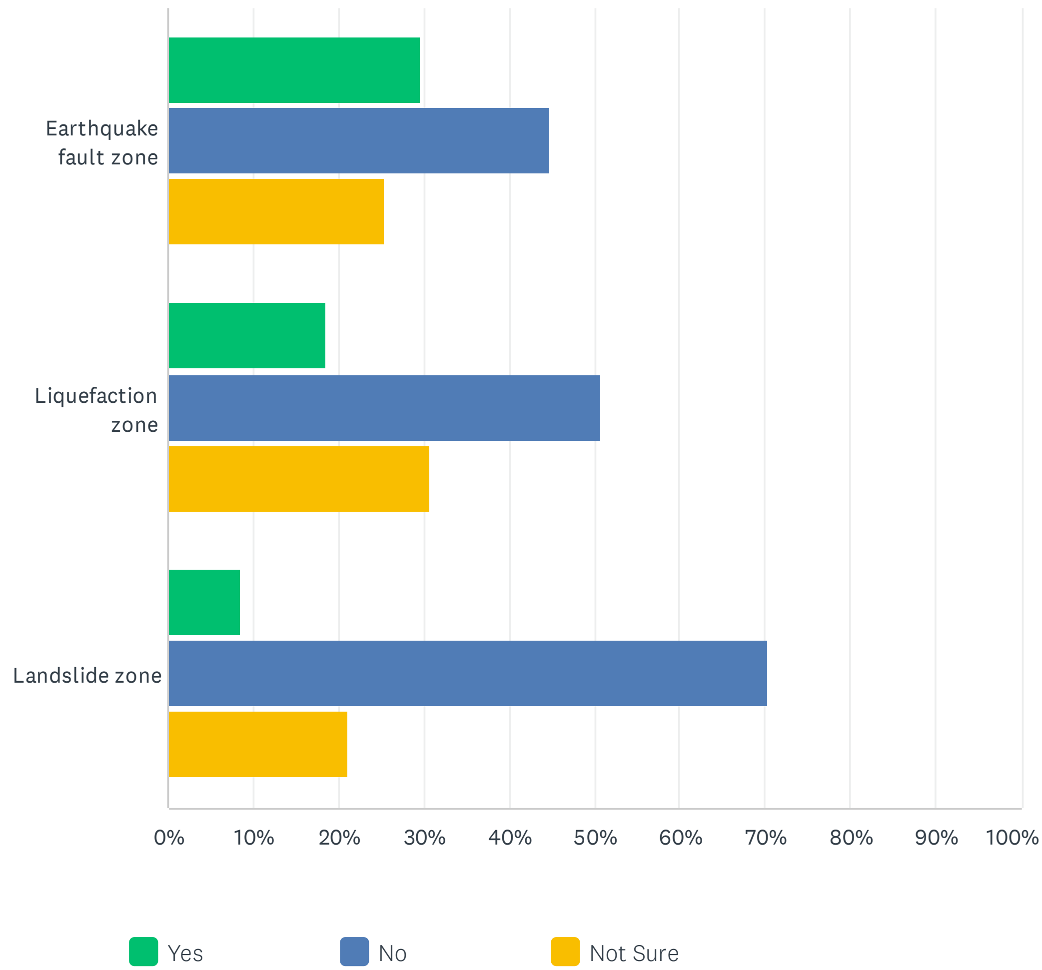
Answered: 679 Skipped: 153


Wildfire
Drought
Earthquake
Severe Weather (i.e. wind,...
Agricultural Biological...
Severe Storms
Sea Level Rise + Coastal...
Other Hazard
Flood
Landslide
Tsunami
Dam Failure
n/a
Radiological Incident
Space Weather
Terrorism
Transportation Incident
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Not Concer...
Somewhat ...
Concerned
Very Conce...
Extremely ...

	NOT CONCERNED	SOMEWHAT CONCERNED	CONCERNED	VERY CONCERNED	EXTREMELY CONCERNED	TOTAL	WEIGHTED AVERAGE
Wildfire	1.95% 13	5.55% 37	12.44% 83	26.39% 176	53.67% 358	667	4.24
Drought	4.17% 28	14.29% 96	18.30% 123	31.85% 214	31.40% 211	672	3.72
Earthquake	2.84% 19	13.88% 93	30.60% 205	29.25% 196	23.43% 157	670	3.57
Severe Weather (i.e. wind, cold, heat)	10.96% 73	20.57% 137	27.48% 183	22.37% 149	18.62% 124	666	3.17
Agricultural Biological (e.g. west nile, epidemic diseases)	25.37% 170	29.85% 200	22.39% 150	14.03% 94	8.36% 56	670	2.50
Severe Storms	25.46% 167	27.59% 181	28.05% 184	11.89% 78	7.01% 46	656	2.47
Sea Level Rise + Coastal Erosion	40.03% 265	21.60% 143	19.94% 132	10.57% 70	7.85% 52	662	2.25
Other Hazard	50.65% 157	12.58% 39	15.48% 48	8.06% 25	13.23% 41	310	2.21
Flood	44.29% 287	27.62% 179	18.21% 118	6.64% 43	3.24% 21	648	1.97
Landslide	45.14% 297	27.20% 179	18.54% 122	6.23% 41	2.89% 19	658	1.95
Tsunami	61.31% 404	20.49% 135	11.53% 76	4.10% 27	2.58% 17	659	1.66
Dam Failure	66.62% 439	20.49% 135	9.26% 61	3.19% 21	0.46% 3	659	1.50
n/a	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0	0.00
Radiological Incident	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0	0.00
Space Weather	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0	0.00
Terrorism	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0	0.00
Transportation Incident	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0	0.00

Q10 Is your current residence located within a known earthquake fault zone, liquefaction zone, or landslide zone? (Check all that apply) Need help answering? Add your address to this tool: https://maps.conservation.ca.gov/cgs/EQZApp/app/

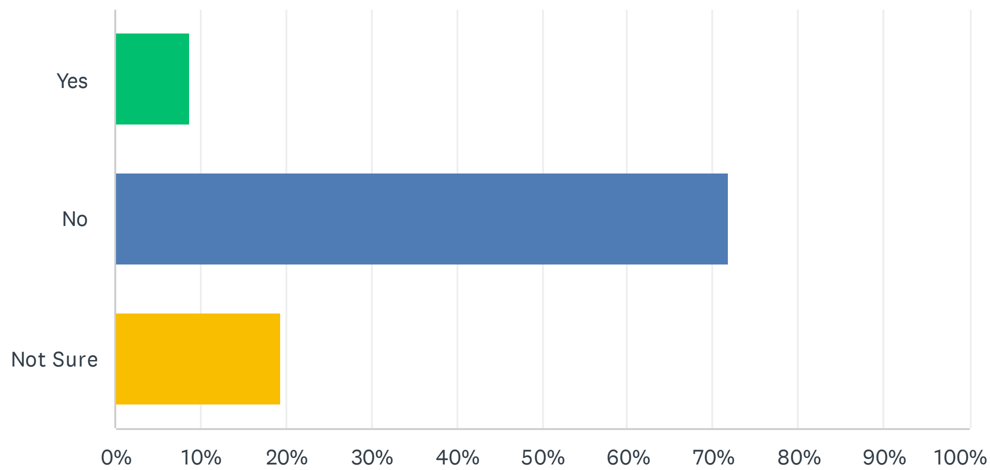
Answered: 679   Skipped: 153



	YES	NO	NOT SURE	TOTAL
Earthquake fault zone	29.72% 200	44.87% 302	25.41% 171	673
Liquefaction zone	18.55% 123	50.68% 336	30.77% 204	663
Landslide zone	8.47% 56	70.35% 465	21.18% 140	661

Q11 Is your current residence located in a FEMA designated floodplain? Need help answering? Add your address to this tool: https://msc.fema.gov/portal/search

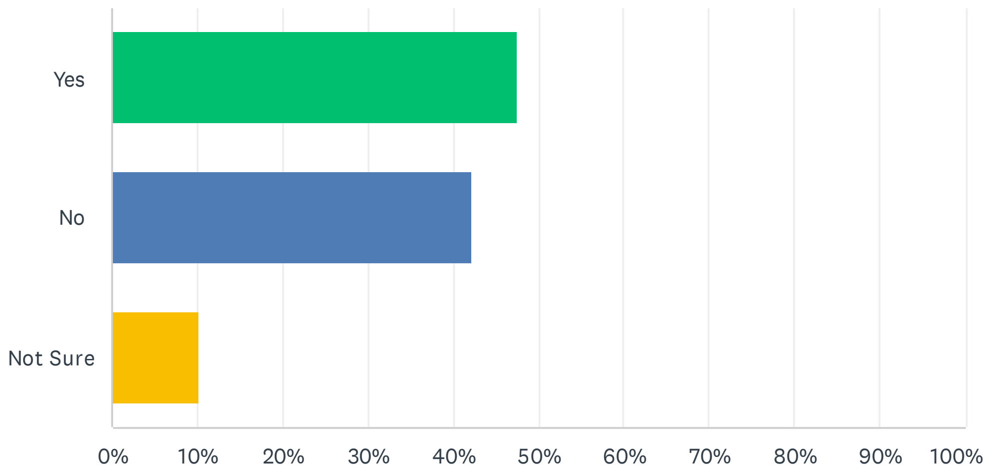
Answered: 679 Skipped: 153



ANSWER CHOICES	RESPONSES	
Yes	8.69%	59
No	71.87%	488
Not Sure	19.44%	132
TOTAL		679

Q12 Is your current residence in a high-risk area for wildfire? Need help answering? Add your address to this tool: https://www.arcgis.com/apps/Styler/index.html?appid=5e96315793d445419b6c96f89ce5d153

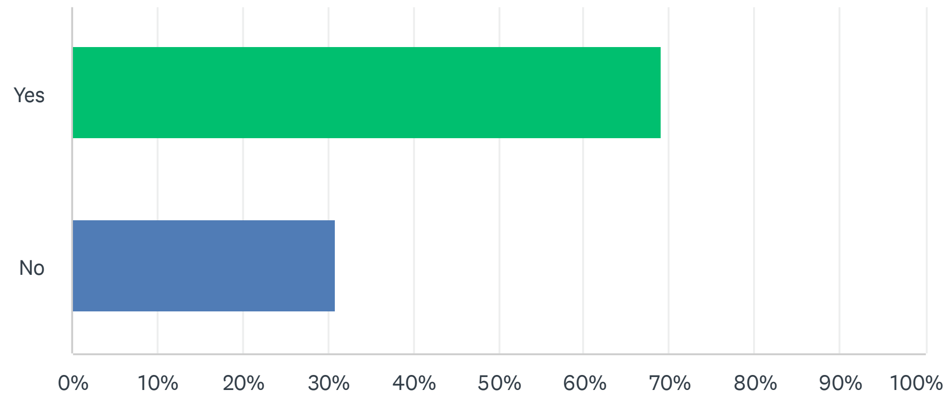
Answered: 679 Skipped: 153



ANSWER CHOICES	RESPONSES	
Yes	47.57%	323
No	42.27%	287
Not Sure	10.16%	69
TOTAL		679

Q13 Are you aware that California law requires the disclosure of a natural hazard risk zone (e.g. earthquake fault zone, dam failure zone, or high fire risk area) before you purchase or move into a home?

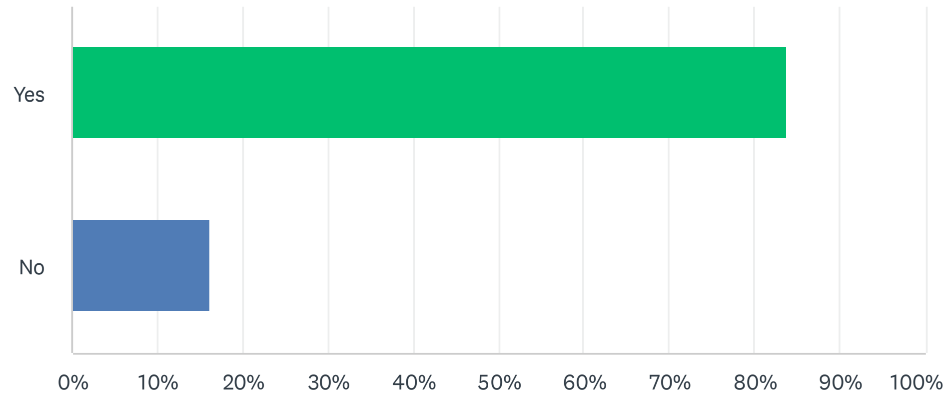
Answered: 679 Skipped: 153



ANSWER CHOICES	RESPONSES	
Yes	69.07%	469
No	30.93%	210
TOTAL		679

Q14 Would the disclosure of natural hazard information influence your decision to purchase or move into a home today?

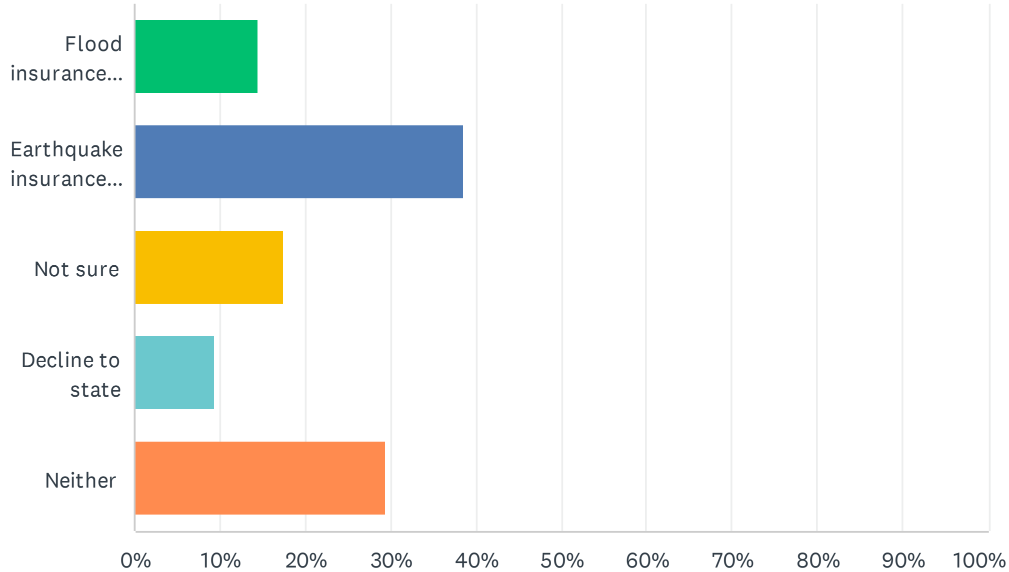
Answered: 679 Skipped: 153



ANSWER CHOICES	RESPONSES	
Yes	83.80%	569
No	16.20%	110
TOTAL		679

Q15 To the best of your knowledge, does the home in which you live have:

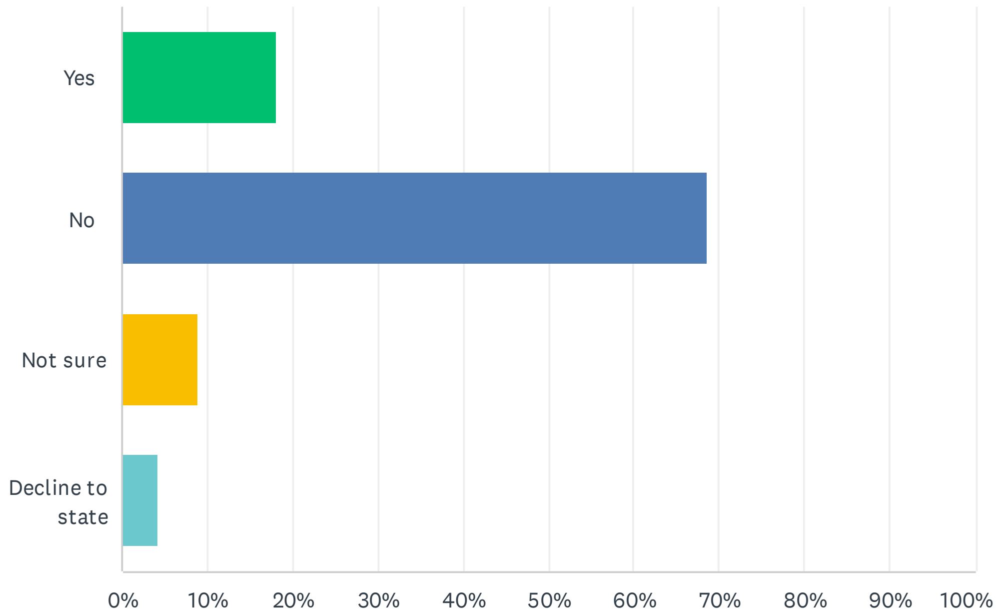
Answered: 678   Skipped: 154



ANSWER CHOICES	RESPONSES	
Flood insurance policy	14.60%	99
Earthquake insurance policy	38.64%	262
Not sure	17.55%	119
Decline to state	9.29%	63
Neither	29.50%	200
Total Respondents: 678		

Q16 Have you ever had difficulty obtaining homeowners or renters insurance due to risks from natural hazards?

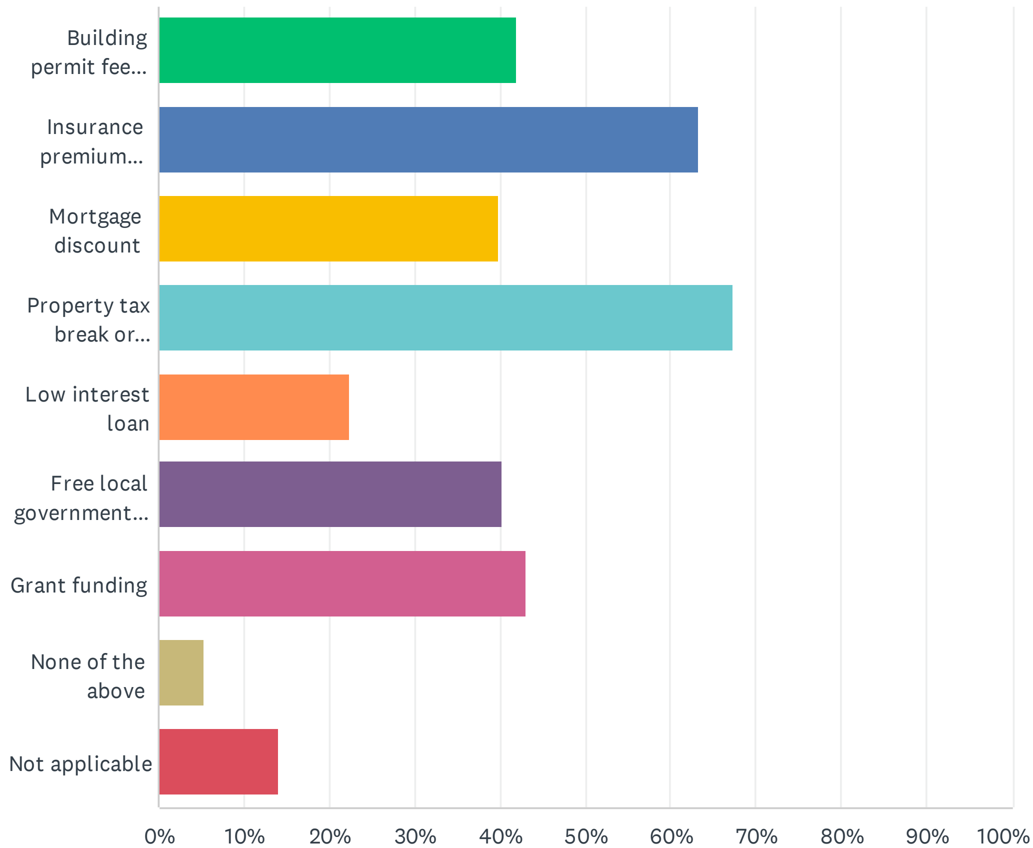
Answered: 678   Skipped: 154



ANSWER CHOICES	RESPONSES	
Yes	18.14%	123
No	68.73%	466
Not sure	8.85%	60
Decline to state	4.28%	29
TOTAL		678

Q17 Which incentives would encourage you to retrofit your home to protect against natural disasters? (Check all that apply)

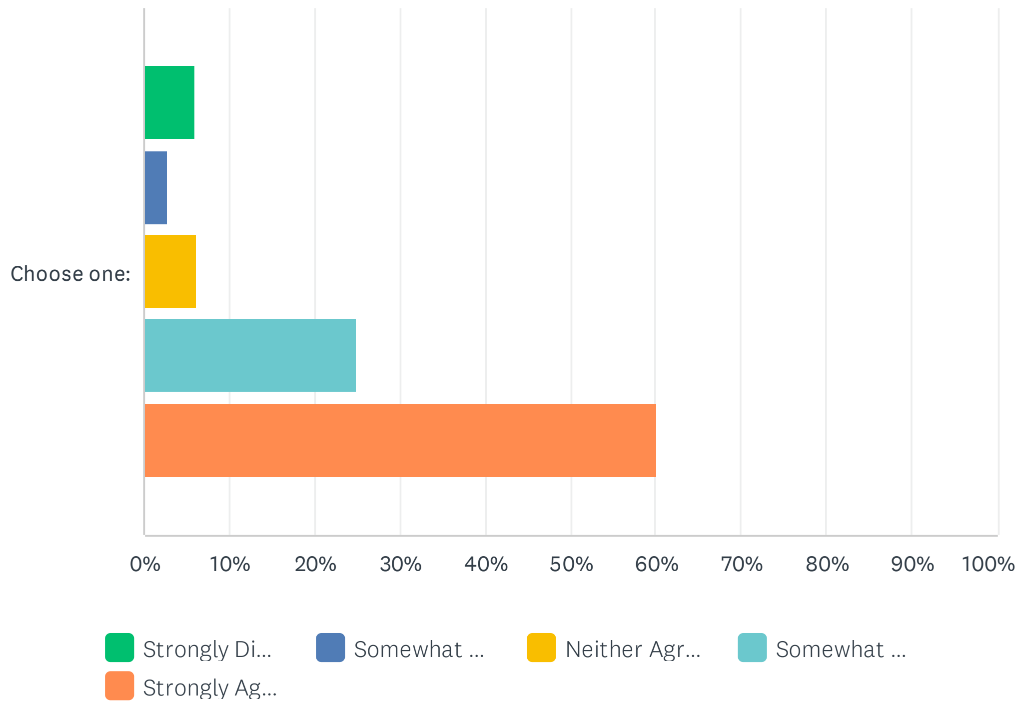
Answered: 679 Skipped: 153



ANSWER CHOICES	RESPONSES	
Building permit fee waiver	41.97%	285
Insurance premium discount	63.33%	430
Mortgage discount	39.91%	271
Property tax break or incentive	67.30%	457
Low interest loan	22.39%	152
Free local government technical assistance	40.35%	274
Grant funding	43.15%	293
None of the above	5.30%	36
Not applicable	13.99%	95
Total Respondents: 679		

Q18 Please indicate how you feel about the following statement:"I think it is important to provide education and programs that promote community members to take action to reduce their exposure and risks to natural hazards."

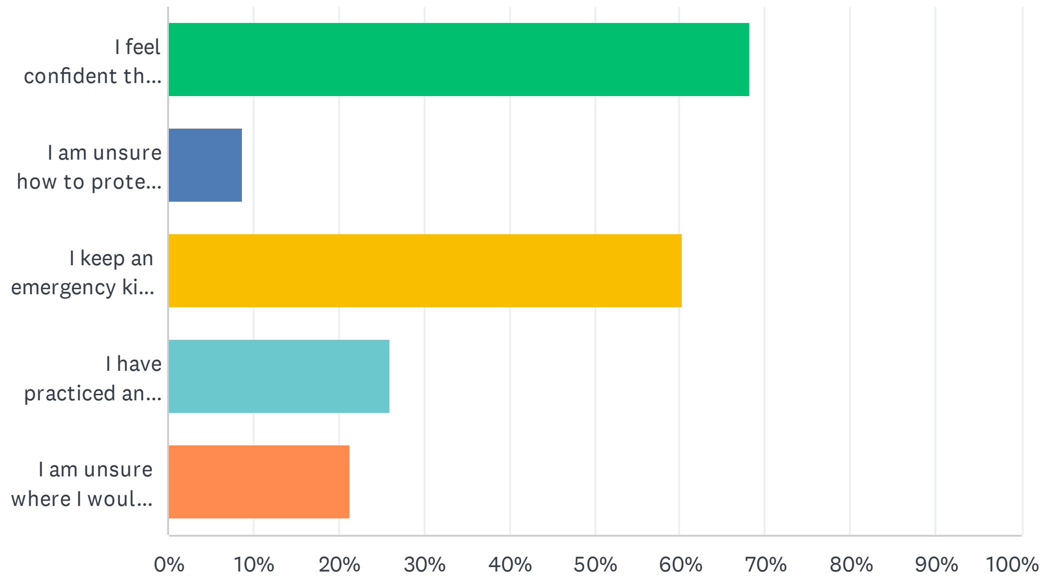
Answered: 678   Skipped: 154



	STRONGLY DISAGREE	SOMEWHAT DISAGREE	NEITHER AGREE NOR DISAGREE	SOMEWHAT AGREE	STRONGLY AGREE	TOTAL	WEIGHTED AVERAGE
Choose one:	6.05% 41	2.80% 19	6.19% 42	24.93% 169	60.03% 407	678	4.30

Q19 If a natural disaster such as a large earthquake were to strike tomorrow... (Check all that apply)

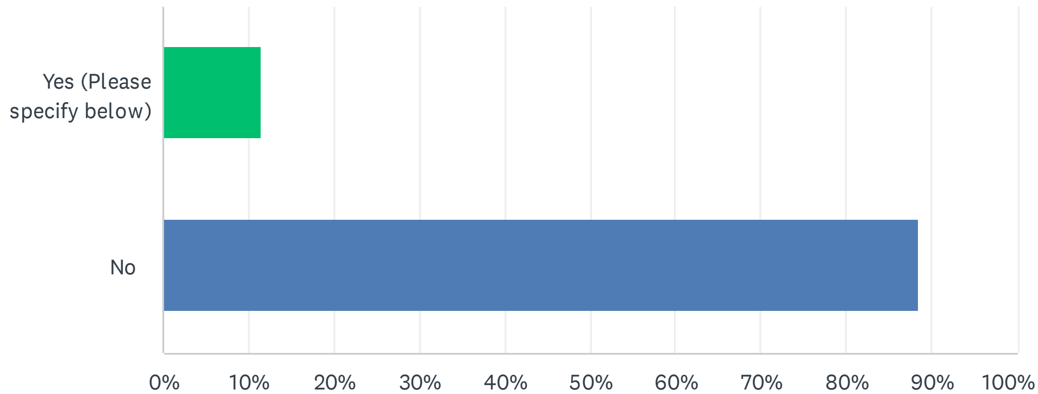
Answered: 679 Skipped: 153



ANSWER CHOICES	RESPONSES	
I feel confident that I know how to protect myself during an earthquake	68.34%	464
I am unsure how to protect myself during an earthquake	8.69%	59
I keep an emergency kit with spare food and water for myself and my family	60.24%	409
I have practiced an evacuation plan and/or know where I and my family would go if we needed to evacuate our home	26.07%	177
I am unsure where I would go if I needed to evacuate my home	21.35%	145
Total Respondents: 679		

Q20 Does your street (or another street that you know of) typically flood during rain events?

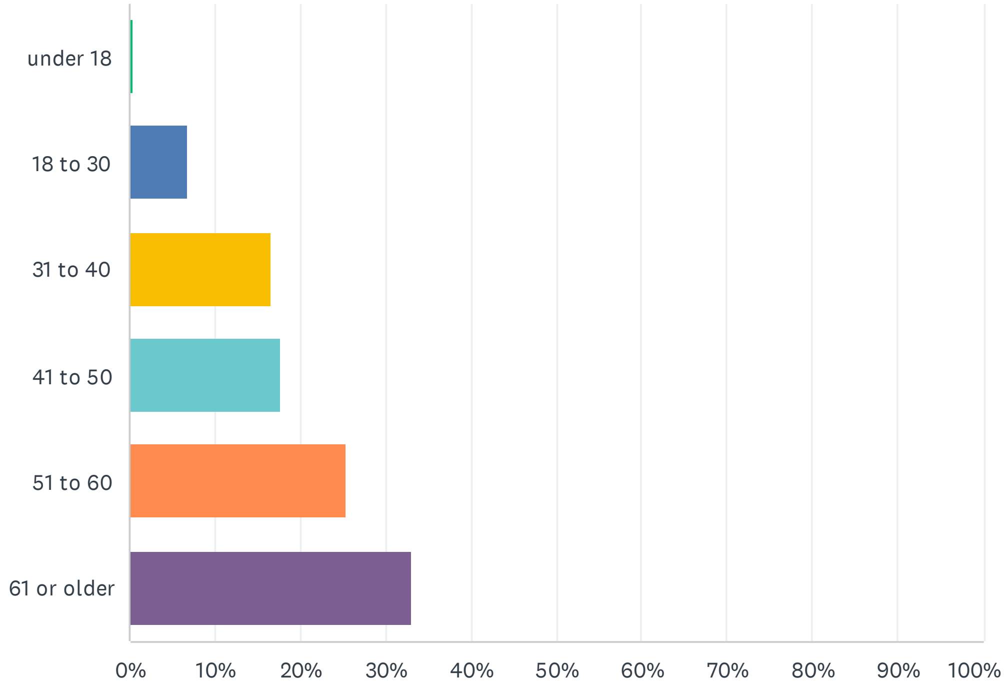
Answered: 678 Skipped: 154



ANSWER CHOICES	RESPONSES	
Yes (Please specify below)	11.50%	78
No	88.50%	600
TOTAL		678

Q21 Please indicate your age range:

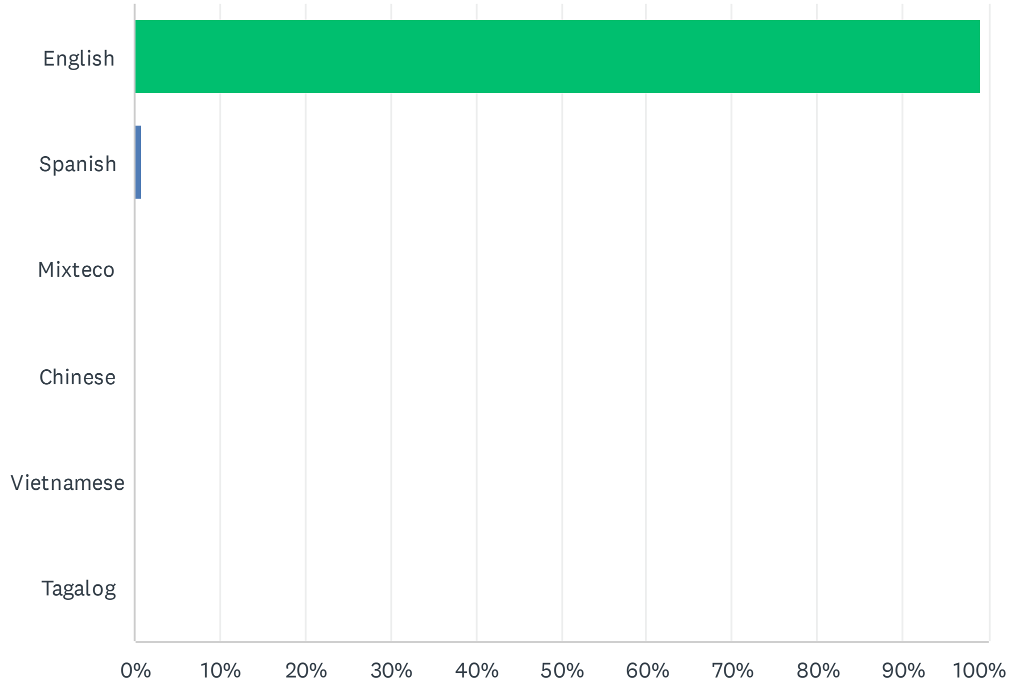
Answered: 665 Skipped: 167



ANSWER CHOICES	RESPONSES	
under 18	0.45%	3
18 to 30	6.77%	45
31 to 40	16.69%	111
41 to 50	17.59%	117
51 to 60	25.41%	169
61 or older	33.08%	220
TOTAL		665

Q22 Please indicate the primary language spoken in your household.

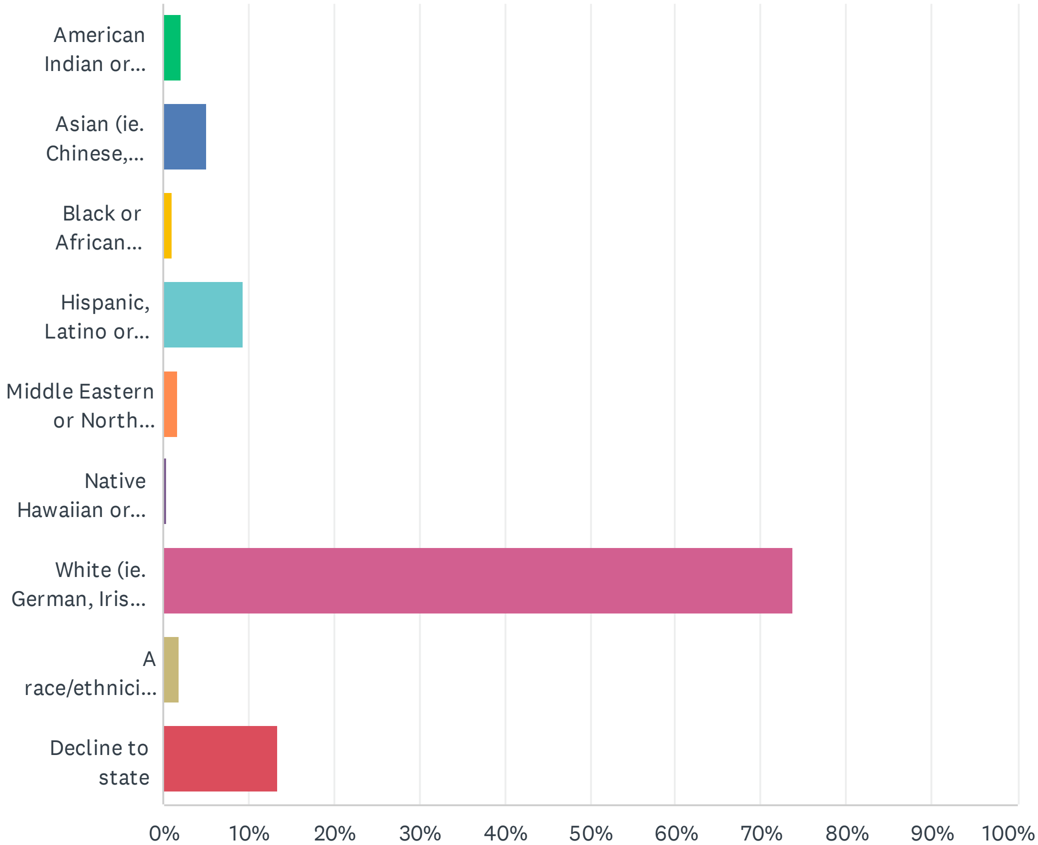
Answered: 665 Skipped: 167



ANSWER CHOICES	RESPONSES	
English	99.25%	660
Spanish	0.75%	5
Mixteco	0.00%	0
Chinese	0.00%	0
Vietnamese	0.00%	0
Tagalog	0.00%	0
TOTAL		665

Q23 Which category best describes you? (Check all that apply)

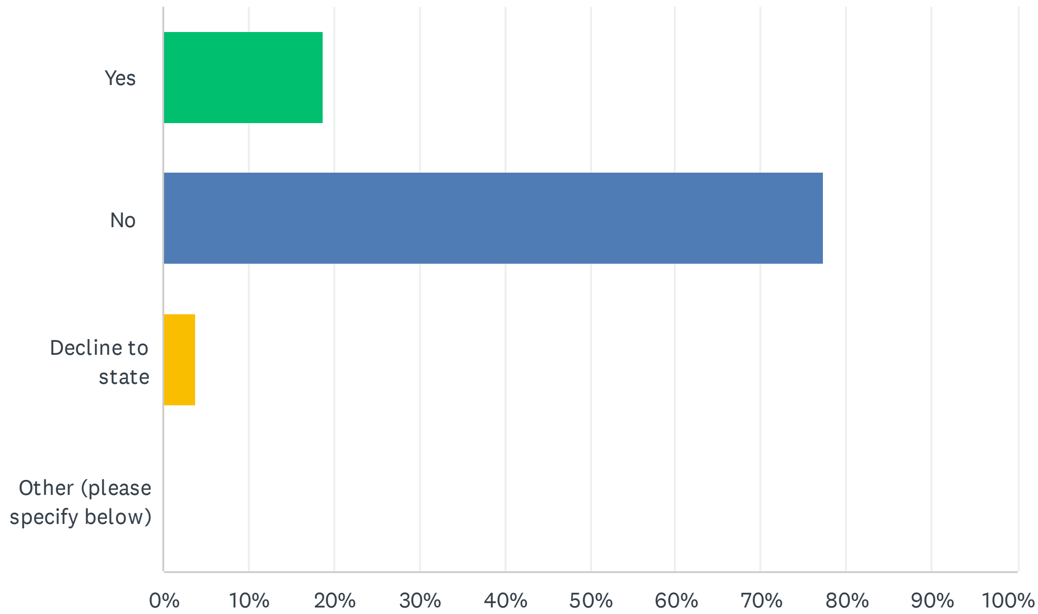
Answered: 665   Skipped: 167



ANSWER CHOICES	RESPONSES	
American Indian or Alaska Native (ie. Navajo nation, Blackfeet tribe, Mayan, Aztec, Nome Eskimo Community, etc)	2.11%	14
Asian (ie. Chinese, Filipino, Asian Indian, Vietnamese, Korean, Japanese, etc)	5.11%	34
Black or African American (ie. African American, Jamaican, Haitian, Nigerian, Ethiopian, Somalian, etc)	1.05%	7
Hispanic, Latino or Spanish origin (ie. Spanish, Mexican or Mexican American, Puerto Rican, Cuban, Salvadoran, Dominican, Colombian, etc.)	9.47%	63
Middle Eastern or North African (ie. Lebanese, Iranian, Egyptian, Syrian, Moroccan, Algerian, etc)	1.65%	11
Native Hawaiian or Other Pacific Islander (ie. Native Hawaiian, Samoan, Chamorro, Tongan, Fijian, etc)	0.45%	3
White (ie. German, Irish, English, Italian, Polish, French, etc)	73.68%	490
A race/ethnicity not listed here	1.95%	13
Decline to state	13.53%	90
Total Respondents: 665		

Q24 Do you, or anyone in your household, identify as a person with a disability (e.g. mobility, hard of hearing/deaf, low vision/blind, intellectual)?

Answered: 664 Skipped: 168



ANSWER CHOICES	RESPONSES	
Yes	18.67%	124
No	77.41%	514
Decline to state	3.77%	25
Other (please specify below)	0.15%	1
TOTAL		664

Q25 What is your annual (gross) household income?

Answered: 665 Skipped: 167

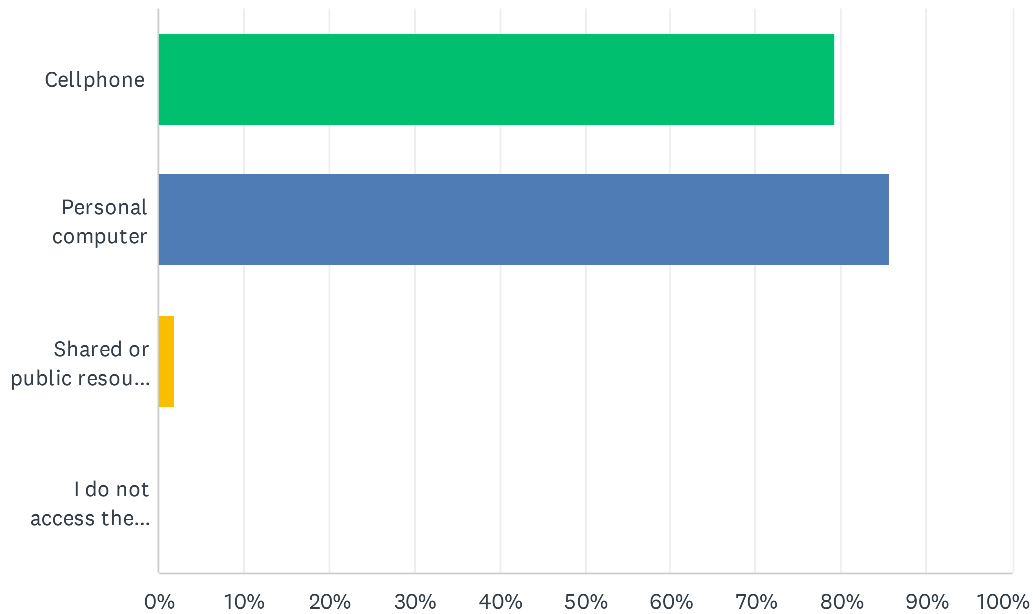
ANSWER CHOICES	RESPONSES	
<$10,000	0.60%	4
$10,000 - $30,000	2.11%	14
$30,001 - $50,000	4.96%	33
$50,001 - $70,000	5.26%	35
$70,001 - $90,000	7.97%	53
$90,001 - $110,000	7.82%	52
$110,001 - $130,000	8.72%	58
$130,001 - $150,000	7.67%	51
$150,001 - $170,000	3.46%	23
$170,001 - $190,000	2.86%	19
$190,001 - $210,000	4.21%	28
$210,001 - $230,000	4.06%	27
>$230,001	7.97%	53
Decline to state	32.33%	215
TOTAL		665

Q26 What is your zipcode?

Answered: 612 Skipped: 220

Q27 How do you typically access the internet? (Check all that apply)

Answered: 665 Skipped: 167



ANSWER CHOICES	RESPONSES	
Cellphone	79.25%	527
Personal computer	85.71%	570
Shared or public resource computer (e.g. library)	1.95%	13
I do not access the internet	0.30%	2
Total Respondents: 665		

Ventura County Multi-Jurisdictional Hazard Mitigation Plan

Appendix B. Federal and State Agencies, Programs and Regulations

B. FEDERAL AND STATE AGENCIES, PROGRAMS AND REGULATIONS

Existing laws, ordinances, plans and programs at the federal and state level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). The following federal and state programs have been identified as programs that may interface with the actions identified in this plan. Each program enhances capabilities to implement mitigation actions or has a nexus with a mitigation action in this plan. Information presented in this section can be used to review local capabilities to implement the actions found in the jurisdictional annexes of Volume 2. Each planning partner has individually reviewed existing local plans, studies, reports, and technical information in its jurisdictional annex, presented in Volume 2.

FEDERAL

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) seeks to prevent discrimination against people with disabilities in employment, transportation, public accommodation, communications, and government activities. Title II of the ADA deals with compliance with the Act in emergency management and disaster-related programs, services, and activities. It applies to state and local governments as well as third parties, including religious entities and private nonprofit organizations.

The ADA has implications for sheltering requirements and public notifications. During an emergency alert, officials must use a combination of warning methods to ensure that all residents have all necessary information. Those with hearing impairments may not hear radio, television, sirens, or other audible alerts, while those with visual impairments may not see flashing lights or other visual alerts. Two technical documents for shelter operators address physical accessibility needs of people with disabilities, as well as medical needs and service animals.

The ADA intersects with disaster preparedness programs in regards to transportation, social services, temporary housing, and rebuilding. Persons with disabilities may require additional assistance in evacuation and transit (e.g., vehicles with wheelchair lifts or paratransit buses). Evacuation and other response plans should address the unique needs of residents. Local governments may be interested in implementing a special-needs registry to identify the home addresses, contact information, and needs for residents who may require more assistance.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Bureau of Land Management

The U.S. Bureau of Land Management (BLM) funds and coordinates wildfire management programs and structural fire management and prevention on BLM lands. BLM works closely with the Forest Service and state and local governments to coordinate fire safety activities. The Interagency Fire Coordination Center in Boise, Idaho serves as the center for this effort.

Civil Rights Act

The Civil Rights Act of 1964 prohibits discrimination based on race, color, religion, sex or nation origin and requires equal access to public places and employment. The Act is relevant to emergency management and hazard mitigation in that it prohibits local governments from favoring the needs of one population group over another. Local government and emergency response must ensure the continued safety and well-being of all residents equally, to the extent possible. FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation’s surface waters so that they can support “the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water.”

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, and pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. Numerous issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

The CWA is important to hazard mitigation in several ways. There are often permitting requirements for any construction within 200 feet of water of the United States, which may have implications for mitigation projects identified by a local jurisdiction. Additionally, CWA requirements apply to wetlands, which serve important functions related to preserving and protecting the natural and beneficial functions of floodplains and are linked with a community’s floodplain management program. Finally, the National Pollutant Discharge Elimination System is part of the CWA and addresses local stormwater management programs. Stormwater management plays a critical role in hazard mitigation by addressing urban drainage or localized flooding issues within jurisdictions.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Community Development Block Grant Disaster Resilience Program

In response to disasters, Congress may appropriate additional funding for the U.S. Department of Housing and Urban Development Community Development Block Grant programs to be distributed as Disaster Recovery grants (CDBG-DR). These grants can be used to rebuild affected areas and provide seed money to start the recovery process. CDBG-DR assistance may fund a broad range of recovery activities, helping communities and neighborhoods that otherwise might not recover due to limited resources. CDBG-DR grants often supplement disaster programs of FEMA, the Small Business Administration, and the U.S. Army Corps of Engineers. Housing and Urban Development generally awards noncompetitive, nonrecurring CDBG-DR grants by a formula that considers disaster recovery needs unmet by other federal disaster assistance programs. To be eligible for CDBG-DR funds, projects must meet the following criteria:

- Address a disaster-related impact (direct or indirect) in a presidentially declared county for the covered disaster
- Be a CDBG-eligible activity (according to regulations and waivers)
- Meet a national objective.

Incorporating preparedness and mitigation into these actions is encouraged, as the goal is to rebuild in ways that are safer and stronger. CDBG-DR funding is a potential alternative source of funding for actions identified in this plan.

Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The discount partially depends on location of the property. Properties outside the special flood hazard area receive smaller discounts: a 10-percent discount if the community is at Class 1 to 6 and a 5-percent discount if the community is at Class 7 to 9. The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Disaster Mitigation Act

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

Emergency Relief for Federally Owned Roads Program

The U.S. Forest Service's Emergency Relief for Federally Owned Roads Program was established to assist federal agencies with repair or reconstruction of tribal transportation facilities, federal lands transportation facilities, and other federally owned roads that are open to public travel and have suffered serious damage by a natural disaster over a wide area or by a catastrophic failure. The program funds both emergency and permanent repairs. Eligible activities under this program meet some of the goals and objectives for this plan and the program is a possible funding source for actions identified in this plan.

Emergency Watershed Program

The USDA Natural Resources Conservation Service (NRCS) administers the Emergency Watershed Protection (EWP) Program, which responds to emergencies created by natural disasters. Eligibility for assistance is not dependent on a national emergency declaration. The program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. EWP is an emergency recovery program. Financial and technical assistance are available for the following activities:

- Remove debris from stream channels, road culverts, and bridges
- Reshape and protect eroded banks
- Correct damaged drainage facilities
- Establish cover on critically eroding lands
- Repair levees and structures
- Repair conservation practices.

This federal program could be a possible funding source for actions identified in this plan.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- Endangered means that a species of fish, animal or plant is "in danger of extinction throughout all or a significant portion of its range." (For salmon and other vertebrate species, this may include subspecies and distinct population segments.)
- Threatened means that a species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- Critical habitat means "specific geographical areas that are…essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding it:

- Section 4: Listing of a Species—The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) is responsible for listing marine species; the U.S. Fish and Wildlife Service is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or residents may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.
- Section 7: Consultation—Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat. This includes private and public actions that require a federal permit. Once a final listing is made, non-federal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a species, it must propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.
- Section 9: Prohibition of Take—It is unlawful to "take" an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding or sheltering.
- Section 10: Permitted Take—Through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit a take that

would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a "Habitat Conservation Plan."

- Section 11: Citizen Lawsuits—Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

Every five years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters), or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors seismic research and applies it in performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication Engineering Guidelines for the Evaluation of Hydropower Projects guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

Federal Wildfire Management Policy and Healthy Forests Restoration Act

Federal Wildfire Management Policy and Healthy Forests Restoration Act (2003). These documents call for a single comprehensive federal fire policy for the Interior and Agriculture Departments (the agencies using federal fire management resources). They mandate community-based collaboration to reduce risks from wildfire.

National Dam Safety Act

Potential for catastrophic flooding due to dam failures led to passage of the National Dam Inspection Act in 1972, creation of the National Dam Safety Program in 1996, and reauthorization of the program through the Dam Safety Act in 2006. National Dam Safety Program, administered by FEMA requires a periodic engineering analysis of the majority of dams in the country; exceptions include the following:

- Dams under jurisdiction of the Bureau of Reclamation, Tennessee Valley Authority, or International Boundary and Water Commission
- Dams constructed pursuant to licenses issued under the Federal Power Act
- Dams that the Secretary of the Army determines do not pose any threat to human life or property.

The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect lives and property of the public. The National Dam Safety Program is a partnership among the states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under FEMA's leadership, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchases of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most of the dams in the United States.

National Environmental Policy Act

The National Environmental Policy Act requires federal agencies to consider the environmental impacts of proposed actions and reasonable alternatives to those actions, alongside technical and economic considerations. The National Environmental Policy Act established the Council on Environmental Quality, whose regulations (40 CFR Parts 1500-1508) set standards for compliance. Consideration and decision-making regarding environmental impacts must be documented in an environmental impact statement or environmental assessment. Environmental impact assessment requires the evaluation of reasonable alternatives to a proposed action, solicitation of input from organizations and individuals that could be affected, and an unbiased presentation of direct, indirect, and cumulative environmental impacts. FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

National Fire Plan

The 2001 National Fire Plan was developed based on the National Fire Policy. A major aspect of the National Fire Plan is joint risk reduction planning and implementation carried out by federal, state and local agencies and communities. The National Fire Plan presented a comprehensive strategy in five key initiatives:

- Firefighting—Be adequately prepared to fight fires each fire season.
- Rehabilitation and Restoration—Restore landscapes and rebuild communities damaged by wildfires.
- Hazardous Fuel Reduction—Invest in projects to reduce fire risk.
- Community Assistance—Work directly with communities to ensure adequate protection.
- Accountability—Be accountable and establish adequate oversight, coordination, program development, and monitoring for performance.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities that enact floodplain regulations. Participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act.

For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent-annual-chance flood and the 0.2-percent-annual-chance flood. Base flood elevations and the boundaries of the flood hazard areas are shown on Flood Insurance Rate Maps, which are the principle tool for identifying the extent and location of the flood hazard. Flood Insurance Rate Maps are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under the local floodplain management program. In recent years, Flood Insurance Rate Maps have been digitized as Digital Flood Insurance Rate Maps, which are more accessible to residents, local governments and stakeholders.

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

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 1-percent-annual-chance flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

NFIP participation is limited to local governments that possess permit authority and have the ability to adopt and enforce regulations that govern land use. This does not typically apply to special purpose districts. None of the special purpose district planning partners covered by this plan are eligible to participate in the NFIP, so their action plans do not address NFIP participation.

National Incident Management System

The National Incident Management System (NIMS) is a systematic approach for government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards. The NIMS provides a flexible but standardized set of incident management practices. Incidents typically begin and end locally, and they are managed at the lowest possible geographical, organizational, and jurisdictional level. In some cases, success depends on the involvement of multiple jurisdictions, levels of government, functional agencies, and emergency responder disciplines. These cases necessitate coordination across a spectrum of organizations. Communities using NIMS follow a comprehensive national approach that improves the effectiveness of emergency management and response personnel across the full spectrum of potential hazards (including natural hazards, technological hazards, and human-caused hazards) regardless of size or complexity.

Although participation is voluntary, federal departments and agencies are required to make adoption of NIMS by local and state jurisdictions a condition to receive federal preparedness grants and awards. The content of this plan is considered to be a viable support tool for any phase of emergency management. The NIMS program is considered as a response function, and information in this hazard mitigation plan can support the implementation and update of all NIMS-compliant plans within the planning area.

National Landslide Preparedness Act

The 2021 National Landslide Preparedness Act authorized a national landslide hazards reduction program and a 3D elevation program within the USGS. This broadened the existing Landslide Hazards Program (under the Natural Hazards Mission Area) and the 3D Elevation Program (under the National Geospatial Program). The act required coordination among federal agencies through an Interagency Coordinating Committee on Landslide Hazards representing USGS and other agencies. The act calls for development of a national strategy for landslide loss reduction and a publicly accessible national landslide database of landslide hazard and risk.

Presidential Executive Order 11988, Floodplain Management

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. It requires federal agencies to provide leadership and take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values of floodplains. The requirements apply to the following activities:

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing.

Presidential Executive Order 11990, Protection of Wetlands

Executive Order 11990 requires federal agencies to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. The requirements apply to the following activities:

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing.

All actions identified in this plan will seek full compliance with all applicable presidential executive orders.

Rural Development Program

The mission of the U.S. Department of Agriculture (USDA) Rural Development Program is to help improve the economy and quality of life in rural America. The program provides project financing and technical assistance to help rural communities provide the infrastructure needed by rural businesses, community facilities, and households. The program addresses rural America’s need for basic services, such as clean running water, sewage and waste disposal, electricity, and modern telecommunications and broadband. Loans and competitive grants are offered for various community and economic development projects and programs, such as the development of essential community facilities including fire stations. This program is a potential source of funding for actions identified in this plan.

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers operates and maintains approximately 700 dams nationwide. It is also responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency’s capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety. The Corps maintains the National Inventory of Dams, which contains information about a dam’s location, size, purpose, type, last inspection and regulatory status.

U.S. Army Corps of Engineers Flood Hazard Management

The following U.S. Army Corps of Engineers authorities and programs related to flood hazard management:

- The Floodplain Management Services program offers 100-percent federally funded technical services such as development and interpretation of site-specific data related to the extent, duration and frequency of flooding. Special studies may be conducted to help a community understand and respond to flood risk. These may include flood hazard evaluation, flood warning and preparedness, or flood modeling.

- For more extensive studies, the Corps of Engineers offers a cost-shared program called Planning Assistance to States and Tribes. Studies under this program generally range from $25,000 to $100,000 with the local jurisdiction providing 50 percent of the cost.
- The Corps of Engineers has several cost-shared programs (typically 65 percent federal and 35 percent non-federal) aimed at developing, evaluating and implementing structural and non-structural capital projects to address flood risks at specific locations or within a specific watershed:
  - The Continuing Authorities Program for smaller-scale projects includes Section 205 for Flood Control, with a $7 million federal limit and Section 14 for Emergency Streambank Protection with a $1.5 million federal limit. These can be implemented without specific authorization from Congress.
  - Larger scale studies, referred to as General Investigations, and projects for flood risk management, for ecosystem restoration or to address other water resource issues, can be pursued through a specific authorization from Congress and are cost-shared, typically at 65 percent federal and 35 percent non-federal.
  - Watershed management planning studies can be specifically authorized and are cost-shared at 50 percent federal and 50 percent non-federal.
- The Corps of Engineers provides emergency response assistance during and following natural disasters. Public Law 84-99 enables the Corps to assist state and local authorities in flood fight activities and cost share in the repair of flood protective structures. Assistance is provided in the flowing categories:
  - Preparedness—The Flood Control and Coastal Emergency Act establishes an emergency fund for preparedness for emergency response to natural disasters; for flood fighting and rescue operations; for rehabilitation of flood control and hurricane protection structures. Funding for Corps of Engineers emergency response under this authority is provided by Congress through the annual Energy and Water Development Appropriation Act. Disaster preparedness activities include coordination, planning, training and conduct of response exercises with local, state and federal agencies.
  - Response Activities—Public Law 84-99 allows the Corps of Engineers to supplement state and local entities in flood fighting urban and other non-agricultural areas under certain conditions (Engineering Regulation 500-1-1 provides specific details). All flood fight efforts require a project cooperation agreement signed by the public sponsor and the sponsor must remove all flood fight material after the flood has receded. Public Law 84-99 also authorizes emergency water support and drought assistance in certain situations and allows for "advance measures" assistance to prevent or reduce flood damage conditions of imminent threat of unusual flooding.
  - Rehabilitation—Under Public Law 84-99, an eligible flood protection system can be rehabilitated if damaged by a flood event. The flood system would be restored to its pre-disaster status at no cost to the federal system owner, and at 20-percent cost to the eligible non-federal system owner. All systems considered eligible for Public Law 84-99 rehabilitation assistance have to be in the Rehabilitation and Inspection Program prior to the flood event. Acceptable operation and maintenance by the public levee sponsor are verified by levee inspections conducted by the Corps on a regular basis. The Corps has the responsibility to coordinate levee repair issues with interested federal, state, and local agencies following natural disaster events where flood control works are damaged.

These authorities and programs are all available to the planning partners to support any related mitigation actions.

U.S. Bureau of Reclamation Safety Evaluation of Existing Dams Program

The U.S. Bureau of Reclamation's Safety Evaluation of Existing Dams Program was officially implemented in 1978 with passage of the Reclamation Safety of Dams Act (Public Law 95-578). This act was amended in 1984 under Public Law 98-404, in 2000 under Public Law 106-377, in 2002 under Public Law 107-117, and in 2004 under Public Law 108-439. Program development and administration of dam safety activities is the responsibility of the Bureau of Reclamation's Dam Safety Office located in Denver, Colorado.

Dams must be operated and maintained in a safe manner, ensured through inspections for safety deficiencies, analyses utilizing current technologies and designs, and corrective actions if needed based on current engineering practices. In addition, future evaluations should include assessments of benefits foregone with the loss of a dam. For example, a failed dam can no longer provide needed fish and wildlife benefits.

The primary emphasis of the Safety Evaluation of Existing Dams program is to perform site evaluations and to identify potential safety deficiencies on Bureau of Reclamation and other Interior Department dams. The basic objective is to quickly identify dams which pose an increased threat to the public, and to quickly complete the related analyses in order to expedite corrective action decisions and safeguard the public and associated resources. The selected course of action relies on assessments of risks and liabilities with environmental and public involvement input to the decision-making process.

U.S. Fire Administration

There are federal agencies that provide technical support to fire agencies/organizations. For example, the U.S. Fire Administration, which is a part of FEMA, provides leadership, advocacy, coordination, and support for fire agencies and organizations.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service fire management strategy uses prescribed fire to maintain early successional fire-adapted grasslands and other ecological communities throughout the National Wildlife Refuge system.

STATE

AB 9: Fire safety: wildfires: fire adapted communities.

Establishes the Regional Forest and Fire Capacity Program to support regional leadership, build local and regional capacity, and develop, prioritize, and implement strategies and projects that create fire-adapted communities by improving watershed health, forest health, community wildfire preparedness, and fire resilience.

AB 32: The California Global Warming Solutions Act

This bill identifies the following potential adverse impacts of global warming:

> "… the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems."

AB 32 establishes a state goal of reducing greenhouse gas emissions to 1990 levels by 2020 (a reduction of approximately 25 percent from forecast emission levels), with further reductions to follow. The law requires the state Air Resources Board to do the following:

- Establish a program to track and report greenhouse gas emissions.
- Approve a scoping plan for achieving the maximum technologically feasible and cost-effective reductions from sources of greenhouse gas emissions.
- Adopt early reduction measures to begin moving forward.
- Adopt, implement, and enforce regulations—including market mechanisms such as "cap and-trade" programs—to ensure that the required reductions occur.

The Air Resources Board has adopted a statewide greenhouse gas emissions limit and an emissions inventory, along with requirements to measure, track, and report greenhouse gas emissions by the industries it determined to be significant sources of greenhouse gas emissions.

AB 38: Fire safety: Low-Cost Retrofits: Regional Capacity Review: Wildfire Mitigation

Requires the seller of any real property located in a high or very fire hazard severity zone to provide a disclosure notice, as specified, to the buyer with information relating to fire hardening improvements on the property.

Requires the California Natural Resources Agency, in consultation with the State Fire Marshal and the Forest Management Task Force, to review the regional capacity of each county that contains a very high fire hazard severity zone to improve forest health, fire resilience, and safety.

Requires the California Office of Emergency Services to enter into a joint powers agreement with the Department of Forestry and Fire Protection to administer a comprehensive wildfire mitigation and assistance program to encourage cost-effective structure hardening and facilitate vegetation management, contingent upon appropriation by the Legislature.

AB 70: Flood Liability

This bill provides that a city or county may be required to contribute a fair and reasonable share to compensate for property damage caused by a flood to the extent that it has increased the state's exposure to liability for property damage by unreasonably approving new development in a previously undeveloped area that is protected by a state flood control project, unless the city or county meets specified requirements.

AB 162: Flood Planning

This California State Assembly Bill passed in 2007 requires cities and counties to address flood-related matters in the land use, conservation, and safety and housing elements of their general plans. The land use element must identify and annually review the areas covered by the general plan that are subject to flooding as identified in floodplain mapping by either FEMA or the state Department of Water Resources (DWR). During the next revision of the housing element on or after January 1, 2009, the conservation element of the general plan must identify rivers, creeks, streams, flood corridors, riparian habitat, and land that may accommodate floodwater for the purpose of groundwater recharge and stormwater management. The safety element must identify information regarding flood hazards, including:

- Flood hazard zones
- Maps published by FEMA, DWR, the U.S. Army Corps of Engineers, the Central Valley Flood Protection Board, and the Governor's Office of Emergency Services (Cal OES)
- Historical data on flooding
- Existing and planned development in flood hazard zones.

The general plan must establish goals, policies and objectives related to flooding risks, including:

- Avoiding or minimizing the risks of flooding new development
- Evaluating whether new development should be located in flood hazard zones
- Identifying construction methods to minimize damage.

AB 162 establishes goals, policies and objectives related to flooding risks. It establishes procedures for the determination of available land suitable for urban development, which may exclude lands where FEMA or DWR has concluded that the flood management infrastructure is not adequate to avoid the risk of flooding.

AB 267: California Environmental Quality Act: Exemption: Prescribed Fire, Thinning, and Fuel Reduction Projects

Current law, until January 1, 2023, exempts from the requirements of CEQA prescribed fire, thinning, or fuel reduction projects undertaken on federal lands to reduce the risk of high-severity wildfire that have been reviewed under the federal National Environmental Policy Act of 1969. Current law requires the Department of Forestry and Fire Protection, beginning December 31, 2019, and annually thereafter until January 1, 2023, to report to the relevant policy committees of the Legislature the number of times the exemption was used. This extends the exemption from CEQA and the requirement on the department to report to the relevant policy committees of the Legislature to January 1, 2026.

AB 380: Forestry: Priority Fuel Reduction Projects

On March 22, 2019, the Governor issued a proclamation of a state of emergency directing the Department of Forestry and Fire Protection to implement fuel reduction projects for communities at greatest risk of wildfire to reduce the risk of catastrophic wildfire. The proclamation of a state of emergency exempts the identified fuel reduction projects from various legal requirements, including, among others, requirements regarding public contracting for those projects, requirements for environmental review under the California Environmental Quality Act for those projects, and licensure requirements for individuals conducting certain activities for those projects.

This bill requires the department, before December 31, 2022, and before December 31 of each year thereafter, to identify priority fuel reduction projects, as provided. The bill exempts the identified priority fuel reduction projects from legal requirements in a similar manner as provided in the proclamation of a state of emergency described above.

AB 431: Forestry: Timber Harvesting Plans: Defensible Space: Exemptions

The Z'berg-Nejedly Forest Practice Act of 1973 prohibits a person from conducting timber operations, as defined, unless a timber harvesting plan prepared by a registered professional forester has been submitted to, and approved by, the Department of Forestry and Fire Protection. The act authorizes the State Board of Forestry and Fire Protection to exempt from some or all of those provisions of the act a person engaging in specified forest management activities, as prescribed, including, only until January 1, 2022, the cutting or removal of trees on the person's property in compliance with specified defensible space requirements. This bill extends to January 1, 2026, the board's authorization to exempt a person engaging in the cutting or removal of trees on the person's property in compliance with the specified defensible space requirements.

AB 497: Forestry and Fire Protection: Local Assistance Grant Program: Fire Prevention Activities: Street and Road Vegetation Management

Under existing law, the Department of Forestry and Fire Protection is required to develop, implement, and administer forest improvement and fire prevention programs in the state. Existing law requires the department to establish a local assistance grant program for fire prevention activities in California. Existing law requires the department to prioritize, to the extent feasible, projects that are multiyear efforts and to prioritize grant applications from specified local agencies.

This bill appropriated $25,000,000 to provide the local assistance grants. It requires the department to prioritize projects that manage vegetation along streets and roads to prevent the ignition of wildfire and that require the funds for purposes of purchasing equipment necessary for the project.

AB 575: Civil Liability: Prescribed Burning Activities: Gross Negligence

This bill provides that a private entity engaging in a prescribed burning activity that is supervised by a person certified as burn boss is liable for damages to a third party only if the prescribed burning activity was carried out in a grossly negligent manner.

AB 642: Wildfires

This omnibus fire prevention bill makes changes to support cultural and prescribed fire, including the creation of a Cultural Burning Liaison at the Department of Forestry and Fire Protection, and requires a proposal for creating a prescribed fire training center in California. The Act requires the Director of Forestry and Fire Protection to identify areas in the state as moderate and high fire hazard severity zones and to classify areas into fire hazard severity zones based on additional factors including possible lightning caused ignition. The bill requires a local agency, within 30 days of receiving a transmittal from the director that identifies fire hazard severity zones, to make the information available for public comment.

AB 747: Required Information for General Plan Safety Elements

This bill requires California communities with general plans to address evacuation routes in the safety element of the general plan. Information on the evacuation routes and their capacity, safety and viability under a range of emergency scenarios must be provided. For communities that have not adopted a local hazard mitigation plan, the safety element must be updated with this information by January 1, 2022. For those with a local hazard mitigation plan, the requirement applies upon the next revision of the hazard mitigation plan on or after January 1, 2022. Communities that have adopted a local hazard mitigation plan, emergency operations plan, or other document that fulfills the goals and objectives of this law may comply with this requirement by summarizing and incorporating by reference the other plan or document in the safety element.

In subsequent revisions to the safety element, communities also will be required to identify new information relating to flood and fire hazards and climate adaptation and resiliency strategies applicable to the city or county that was not available during the previous revision of the safety element. These subsequent updates must occur upon each revision of the general plan housing element or local hazard mitigation plan and not less than once every eight years.

AB 800: Wildfires: Local General Plans: Safety Elements: Fire Hazard Severity Zones

Existing law requires the Director of Forestry and Fire Protection to identify areas of the state as very high fire hazard severity zones, and requires each planning agency to prepare, and the legislative body of each county and city to adopt, a comprehensive, long-term general plan, including a safety element, for the physical development of the county or city. Existing law requires each city or county that contains a very high fire hazard severity zone to submit the draft element of, or draft amendment to the safety element its general plan to the State Board of Forestry and Fire Protection and to every local agency that provides fire protection to territory in the city or county at least 90 days before adoption or amendment.

This requires the director to also identify areas of the state as moderate and high fire hazard severity zones. It requires the draft element of, or draft amendment to, the safety element of a county or city's general plan to be submitted to the state board and to every local agency that provides fire protection to territory in the city or county at least 90 days before the adoption or amendment to the safety element of its general plan for each city or county that contains a moderate or high fire hazard severity zone.

Existing law requires the state board and authorizes a local agency to review the draft or an existing safety element and recommend changes to the planning agency regarding uses of land and policies in state responsibility areas and very high fire hazard severity zones and regarding methods and strategies for wildland fire risk reduction and prevention within state responsibility areas and very high fire hazard severity zones.

This bill also requires the state board and authorizes a local agency to review the draft or an existing safety element and recommend changes to the planning agency regarding uses of land and policies in moderate and high fire hazard severity zones and regarding methods and strategies for wildland fire risk reduction and prevention within moderate and high fire hazard severity zones.

The existing Subdivision Map Act vests the authority to regulate and control the design and improvement of subdivisions in the legislative body of a local agency, and sets forth procedures governing the local agency's processing, approval, conditional approval, or disapproval, and filing of tentative, final, and parcel maps, and the modification thereof. The act generally requires a subdivider to file a tentative map or vesting tentative map with the local agency, and requires the local agency to approve, conditionally approve, or disapprove the map within a specified time period. Before approving a tentative map, or a parcel map for which a tentative map was not required, for an area located in a state responsibility area or a very high fire hazard severity zone, existing law requires a legislative body of a county to make specified findings. Existing law requires a legislative body of a county to transmit these findings to the State Board of Forestry and Fire Protection.

This requires a legislative body of a county to make specified findings before approving a tentative map, or a parcel map for which a tentative map was not required, for areas located in moderate and high fire hazard severity zones, and requires these findings to be transmitted to the state board.

By requiring new duties on a county, the bill imposes a state-mandated local program. The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement. This bill provides that, if the Commission on State Mandates determines that the bill contains costs mandated by the state, reimbursement for those costs shall be made pursuant to statutory provisions.

AB 1255: Fire Prevention: Fire Risk Reduction Guidance: Local Assistance Grants

This bill requires the Department of Forestry and Fire Protection, in coordination with the Secretary of the Natural Resources Agency, to facilitate regional, habitat-specific, and area-specific approaches to fire risk reduction, prevention, and restoration of projects that improve community safety, protect sites and structures, restore burned habitat, reduce catastrophic wildfires, and protect natural resources. It requires the department to develop policies, funding programs for which the funding shall be contingent upon subsequent appropriation in the annual Budget Act or a similar statute for this purpose, and relevant program guidelines that promote specified objectives. The bill requires various state entities to establish grant programs, for which funding shall be contingent upon subsequent appropriation, to fulfill the specified objectives.

AB 1295: Residential Development Agreements: Very High Fire Risk Areas

Current law requires the Director of Forestry and Fire Protection to identify areas in the state as very high fire hazard severity zones based on the severity of fire hazard that is expected to prevail in those areas and requires each local agency to designate, by ordinance, the very high fire hazard severity zones in its jurisdiction. Current law additionally requires the director to classify lands within state responsibility areas into fire hazard severity zones. This bill, prohibits the legislative body of a city or county from entering into a residential development agreement for property in a very high fire risk area.

The bill defines "very high fire risk area" for these purposes to mean a very high fire hazard severity zone designated by a local agency or a fire hazard severity zone classified by the director.

AB 1439: Property Insurance Discounts

This bill requires a residential property insurance policy to include a discount if a local government of the jurisdiction where the insured property is located funds a local wildfire protection or mitigation program. Because the bill mandates discounts for specified residential property insurance policies, thus affecting the Insurance Commissioner's consideration of a rate, the bill would amend Proposition 103.

AB 1500: Safe Drinking Water, Wildfire Prevention, Drought Preparation, Flood Protection, Extreme Heat Mitigation, and Workforce Development Bond Act of 2022

If approved by the voters, this bill would authorize the issuance of bonds in the amount of $6,700,000,000 pursuant to the State General Obligation Bond Law to finance projects for safe drinking water, wildfire prevention, drought preparation, flood protection, extreme heat mitigation, and workforce development programs.

AB 2140: General Plans—Safety Element

This bill provides that the state may allow for more than 75 percent of public assistance funding under the California Disaster Assistance Act only if the local agency is in a jurisdiction that has adopted a local hazard mitigation plan as part of the safety element of its general plan. The local hazard mitigation plan needs to include elements specified in this legislation. In addition, this bill requires Cal OES to give preference for federal mitigation funding to cities and counties that have adopted local hazard mitigation plans. The intent of the bill is to encourage cities and counties to create and adopt hazard mitigation plans.

AB 2800: Climate Change—Infrastructure Planning

This California State Assembly bill passed in 2016 and until July 1, 2020, requires state agencies to take into account the current and future impacts of climate change when planning, designing, building, operating, maintaining, and investing in state infrastructure. The bill, by July 1, 2017, and until July 1, 2020, requires an agency to establish a Climate-Safe Infrastructure Working Group to examine how to integrate scientific data concerning projected climate change impacts into state infrastructure engineering.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was enacted in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent construction of buildings used for human occupancy on the surface trace of active faults. Before a new project is permitted, cities and counties require a geologic investigation to demonstrate that proposed buildings will not be constructed on active faults. The act addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards, such as liquefaction or seismically induced landslides. The law requires the State of California Geologist to establish regulatory zones around the surface traces of active faults and to issue appropriate maps. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local agencies must regulate most development projects within the zones. Projects include all land divisions and most structures for human occupancy. All seismic hazard mitigation actions identified in this plan will seek full compliance with the Alquist-Priolo Earthquake Fault Zoning Act.

Board of Forestry and Fire Protection Fire Safe Regulations

California's Board of Forestry and Fire Protection is authorized to adopt regulations to implement specified programs. To become effective, the Office of Administrative Law must approve these regulations. Once adopted, Board regulations are placed in Title 14 of the California Code of Regulations. The Department of Forestry and Fire Protection then implements the regulations.

Since 1991, the Board's Fire Safe Regulations have set the floor for fire safety standards for perimeters and access to all residential, commercial, and industrial building construction in state responsibility areas. They address road standards for fire equipment access, standards for road and building signs, minimum private water supplies for emergency fire use, and fuel breaks and greenbelts. Starting on July 1, 2021, these requirements will also apply in the local responsibility areas and will address construction on ridgelines.

California Coastal Management Program

The California Coastal Management Program under the California Coastal Act requires each city or county lying wholly or partly within the coastal zone to prepare a local coastal plan. The specific contents of such plans are not specified by state law, but they must be certified by the Coastal Commission as consistent with policies of the Coastal Act (Public Resources Code, Division 20). The Coastal Act has provisions relating to geologic hazards, but does not mention tsunamis specifically. Section 30253(1) of the Coastal Act states that new development shall minimize risks to life and property in areas of high geologic, flood, and fire hazard. Development should be prevented or limited in high hazard areas whenever possible. However, where development cannot be prevented or limited, land use density, building value, and occupancy should be kept at a minimum. Any mitigation project identified in this plan that intersects the mapped coastal zone will be consistent with the recommendations of the local coastal plan.

California Department of Forestry and Fire Protection

CAL FIRE has responsibility for wildfires in areas of the county that are not under the jurisdiction of the Forest Service or a local fire organization, including lands designated as State Responsibility Areas. CAL FIRE also has fire protection responsibilities by contract and mutual aid agreements. For example, CAL FIRE provides year-round fire protection under Amador Plan agreements with certain local government agencies (Public Resources Code §4144). Through these agreements, CAL FIRE provides local structural and wildfire protection or dispatch services to a community and maintains a staffing level that otherwise would be available only during the fire season. The local entity pays the additional cost of the service.

California Department of Parks and Recreation

State Parks manages portions of the California coastline including coastal wetlands, estuaries, beaches, and dune systems. The State Parks Resources Management Division has limited wildfire protection resources available to suppress fires on State Park lands.

California Department of Water Resources

In California, the DWR is the coordinating agency for floodplain management. The DWR works with FEMA and local governments by providing grants and technical assistance, evaluating community floodplain management programs, reviewing local floodplain ordinances, participating in statewide flood hazard mitigation planning, and facilitating annual statewide workshops. Compliance is monitored by FEMA regional staff and by the DWR.

California Division of Safety of Dams

California's Division of Safety of Dams (a division of the DWR) monitors the dam safety program at the state level and maintains a working list of dams in the state. When a new dam is proposed, Division engineers and geologists inspect the site and the subsurface. Upon submittal of an application, the Division reviews the plans and specifications prepared by the owner to ensure that the dam is designed to meet minimum requirements and that the design is appropriate for the known geologic conditions. After approval of the application, the Division inspects all aspects of the construction to ensure that the work is done in accordance with the approved plans and specifications. After construction, the Division inspects each dam to ensure that it is performing as intended and is not developing problems. The Division periodically reviews the stability of dams and their major appurtenances in light of improved design approaches and requirements, as well as new findings regarding earthquake hazards and hydrologic estimates in California. Over 1,200 dams are inspected by Division engineers on a yearly schedule to ensure performance and maintenance of dams.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) was passed in 1970, shortly after the federal government enacted the National Environmental Policy Act, to institute a statewide policy of environmental protection. CEQA requires state and local agencies in California to follow a protocol of analysis and public disclosure of the potential environmental impacts of development projects. CEQA makes environmental protection a mandatory part of every California state and local agency's decision-making process.

CEQA establishes a statewide environmental policy and mandates actions all state and local agencies must take to advance the policy. Jurisdictions conduct analysis of the project to determine if there are potentially significant environmental impacts, identify mitigation measures, and possible project alternatives by preparing environmental reports for projects that requires CEQA review. This environmental review is required before an agency takes action on any policy, program, or project. Any project action identified in this plan will seek full CEQA compliance upon implementation.

California Fire Alliance

The California Fire Alliance (CFA) was established in response to directives from the 2001 National Fire Plan. The CFA pursues four strategies to deal with the National Fire Plan's community assistance initiative:

- Work with communities at risk from wildfires to develop community-based planning leadership and facilitate the development of community fire loss mitigation plans, which transcend jurisdiction and ownership boundaries.
- Assist communities in development of fire loss mitigation planning, education and projects to reduce the threat of wildfire losses on public and private lands.
- Develop an information and education outreach plan to increase awareness of wildfire protection program opportunities available to communities at risk.
- Work collaboratively to develop, modify and maintain a comprehensive list of communities at risk.

California Fire Plan

The State Board of Forestry and CAL FIRE have prepared a comprehensive update of the California Fire Plan for wildfire protection. The planning process included defining a level of service measurement; considering assets at risk; incorporating the cooperative interdependent relationships of wildfire protection providers; providing for public stakeholder involvement; and creating a fiscal framework for policy analysis. The California Fire Plan's overall goal is to reduce costs and losses from wildfire in the state by protecting assets at risk through pre-fire management and by reducing the spread of fire through more successful initial response.

California Fire Safe Council

In 1993, the statewide Fire Safe Council, consisting of private and public membership, was formed to educate and encourage Californians to plan and prepare for wildfires by reducing the risk of fire to property, communities, and natural/structural resources. In 2002, this group created a nonprofit organization and board of directors, called the California Fire Safe Council. The Council works with the California Fire Alliance to facilitate the distribution of National Fire Plan grants for wildfire risk reduction and education (www.grants.firesafecouncil.org). The Council also provides assistance to local Fire Safe Councils through its website (www.firesafecouncil.org), the distribution of educational materials, and technical assistance, primarily through regional representatives. More than 130 local Fire Safe Councils have formed in California to plan, coordinate, and implement fire prevention activities.

California Fire Service and Rescue Emergency Mutual Aid Plan

The Governor's Office of Emergency Services Fire and Rescue Branch administers the California Fire Service and Rescue Emergency Mutual Aid Plan. The agency provides guidance and procedures for agencies developing emergency operations plans, as well as training and technical support, primarily to overall emergency service organizations and urban search and rescue teams.

California General Planning Law

California state law requires that every county and city prepare and adopt a comprehensive long-range plan to serve as a guide for community development. The general plan expresses the community's goals, visions, and policies relative to future land uses, both public and private. The general plan is mandated and prescribed by state law (Cal. Gov. Code §65300 et seq.), and forms the basis for most local government land use decision-making.

The plan must consist of an integrated, internally consistent set of goals, policies, and implementation measures. In addition, the plan must focus on issues of the greatest concern to the community and be written in a clear and concise manner. City and county actions, such as those relating to land use allocations, annexations, zoning, subdivision and design review, redevelopment, and capital improvements, must be consistent with the plan.

California Multi-Hazard Mitigation Plan

Under the DMA, California must adopt a federally approved state multi-hazard mitigation plan to be eligible for certain disaster assistance and mitigation funding. The intent of the State of California Multi-Hazard Mitigation Plan is to reduce or prevent injury and damage from hazards in the state through the following:

- Documenting statewide hazard mitigation planning in California
- Describing strategies and priorities for future mitigation activities
- Facilitating the integration of local and tribal hazard mitigation planning activities into statewide efforts
- Meeting state and federal statutory and regulatory requirements.

The plan is an annex to the State Emergency Plan, and it identifies past and present mitigation activities, current policies and programs, and mitigation strategies for the future. It also establishes hazard mitigation goals and objectives. The plan will be reviewed and updated annually to reflect changing conditions and new information, especially information on local planning activities.

Under 44 CFR Section 201.6, local hazard mitigation plans must be consistent with their state's hazard mitigation plan. In updating this plan, the Steering Committee reviewed the California State Hazard Mitigation Plan to identify key relevant state plan elements (see Section 3.7).

California Residential Mitigation Program

The California Residential Mitigation Program was established in 2011 to help Californians strengthen their homes against damage from earthquakes. The program is a joint powers authority created by Cal OES and the California Earthquake Authority, which is a not-for-profit, publicly managed, privately funded provider of home earthquake insurance to California homeowners and renters.

Earthquake Brace + Bolt was developed to help homeowners lessen the potential for damage to their houses during an earthquake. A residential seismic retrofit strengthens an existing older house, making it more resistant to earthquake activity such as ground shaking and soil failure. The seismic retrofitting involves bolting the house to its foundation and adding bracing around the perimeter of the crawl space.

Most homeowners hire a contractor to do the retrofit work, and owners of houses in ZIP Codes with house characteristics suitable for this type of retrofit are eligible for up to $3,000 toward the cost. A typical retrofit by a contractor may cost between $3,000 and $7,000, depending on the location and size of the house, contractor fees, and the amount of materials and work involved. If the homeowner is an experienced do-it-yourselfer, a retrofit can cost less than $3,000.

California State Building Code

California Code of Regulations Title 24 (CCR Title 24), also known as the California Building Standards Code, is a compilation of building standards from three sources:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions
- Building standards authorized by the California legislature that constitute extensive additions not covered by the model codes adopted to address particular California concerns.

The state Building Standards Commission is authorized by California Building Standards Law (Health and Safety Code Sections 18901 through 18949.6) to administer the processes related to the adoption, approval, publication, and implementation of California's building codes. These building codes serve as the basis for the design and construction of buildings in California. The national model code standards adopted into Title 24 apply to all occupancies in California, except for modifications adopted by state agencies and local governing bodies. Since 1989, the Building Standards Commission has published new editions of Title 24 every three years.

On January 1, 2014, California Building Code Accessibility Standards found in Chapter 11B incorporated the 2010 Americans with Disabilities Act (ADA) Standards as the model accessibility code for California. The purpose was to ensure consistency with federal guidelines. As a result of this incorporation, the California standards will fully implement and include 2010 ADA Standards within the California Building Code while maintaining enhanced levels of accessibility already provided by existing California accessibility regulations.

Disadvantaged and Low-income Communities Investments

Senate Bill (SB) 535 directs state and local agencies to make investments that benefit California's disadvantaged communities. It also directs the California Environmental Protection Agency to identify disadvantaged communities for the purposes of these investments based on geographic, socio-economic, public health, and environmental hazard criteria. Assembly Bill (AB) 1550 increased the percent of funds for projects located in disadvantaged communities from 10 to 25 percent and added a focus on investments in low-income communities and households. This program is a potential alternative source of funding for actions identified in this plan.

Division of the State Architect's AB 300 List of Seismically At-Risk Schools

In 2002, California's Division of the State Architect completed an inventory of public school buildings built before 1978 that identifies buildings with characteristics that might make them unsafe in future earthquakes. This inventory provides a list of potentially at-risk schools known as the AB 300 list (the inventory was authorized by Assembly Bill 300 in 1999). Using available information on school buildings' dates of construction, seismic retrofits, and structural systems (wood-frame, concrete shear wall, or steel moment frame, etc.), the inventory categorized California public school buildings into one of two categories: those expected to perform well in future earthquakes; and those that are not expected to perform well and require more detailed seismic evaluation.

The Division of the State Architect recommends that public schools on this list undergo detailed seismic evaluations to determine if they pose life safety risks, but the state has neither required nor funded school districts to do this.

Governor's Executive Order S-13-08

Governor's Executive Order S-13-08 enhances the state's management of climate impacts from sea-level rise, increased temperatures, shifting precipitation and extreme weather events. There are four key actions in the executive order:

- Initiate California's first statewide climate change adaptation strategy to assess expected climate change impacts, identify where California is most vulnerable, and recommend adaptation policies. This effort will improve coordination within state government so that better planning can more effectively address climate impacts on human health, the environment, the state's water supply and the economy.
- Request that the National Academy of Science establish an expert panel to report on sea-level rise impacts in California, to inform state planning and development efforts.
- Issue interim guidance to state agencies for how to plan for sea-level rise in designated coastal and floodplain areas for new projects.
- Initiate a report on critical infrastructure projects vulnerable to sea-level rise.

Office of the State Fire Marshal

The Office of the State Fire Marshal is a division of CAL FIRE that has a wide variety of fire safety and training responsibilities and provides technical support to fire agencies/organizations.

Senate Bill 12: Local Government: Planning and Zoning: Wildfires

This bill imposes new planning requirements on local governments, as follows:

- Defines "very high fire risk areas" to be the VHFHSZ in both the SRA and the Local Responsibility Area.
- Requires each city or county, upon the next revision of the housing element or local hazard mitigation plan on or after July 1, 2024, whichever occurs first, to review and update its safety element to include a comprehensive retrofit strategy that includes specified contents.
- Requires a city or county with VHFHSZ within its jurisdiction to amend the land use element of its general plan upon the next revision of the housing element on or after July 1, 2024. This amendment of the land use element must include the locations of all VHFHSZ within the city or county, the data and analysis described in the Office of Planning and Research's publication

Fire Hazard Planning–General Plan Technical Advice Series, and other specified goals, objectives, and implementation measures.

- Requires, after the initial amendment to the land use element, that a city or county review upon each revision of the housing element the implementation of the wildfire risk reduction standards within the jurisdiction and the designation of VHFHSZ.
- Provides for review and comment on draft findings by the Board and local fire agencies on whether the city or county has implemented the standards or made adequate progress, as defined.
- Requires, on or before January 1, 2023, to develop and post on its web site a clearinghouse of local ordinances, policies, and best practices relating to land use planning in VHFHSZ, wildfire risk reduction, and wildfire preparedness. The Office of Planning and Research must also regularly update the clearinghouse.

Senate Bill 92: Public Resources Portion of Biennial Budget Bill

The State of California updated its requirements regarding emergency action plans (EAPs) via Senate Bill 92, which became effective in June 2017 as part of the state Legislature's biennial budget process. The bill required dam owners to submit EAPs to Cal OES and the Department of Water Resources for approval by January 1, 2018 (for extremely high hazard dams), January 1, 2019 (for high-hazard dams), and January 1, 2021 (for significant hazard dams). The EAPs were to include the following (California Government Code Section 8589.5):

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

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

SB 92 also requires dams other than low-risk dams to have current inundation mapping, which must be updated every 10 years, or sooner if specific circumstances change. EAPs also must be updated every 10 years. It provides DWR with enforcement tools, including fines and operational restrictions for failure to comply. Cal OES is required by the law to work with state and federal agencies, dam owners, planners, and the public to make dam failure inundation maps available to citizens interested in learning their dam failure inundation risk.

Senate Bill 97: Guidelines for Greenhouse Gas Emissions

Senate Bill 97, enacted in 2007, amends CEQA to clearly establish that greenhouse gas emissions and the effects of greenhouse gas emissions are appropriate subjects for CEQA analysis. It directs the

Governor's Office of Planning and Research to develop draft CEQA guidelines for the mitigation of greenhouse gas emissions or their effects by July 1, 2009 and directs the California Natural Resources Agency to certify and adopt the CEQA Guidelines by January 1, 2010.

Senate Bill 99: Evacuation Route Planning

Senate Bill 99, enacted in 2019, requires that cities' and counties' general plans address evacuation routes from any hazard area identified in the safety element. Under this law, the safety element must include information to identify residential developments in hazard areas that do not have at least two emergency evacuation routes. Each city or county must update its safety element with the new information upon the next revision of its housing element on or after January 1, 2020.

Senate Bill 182 Local Government: Planning and Zoning: Wildfires

California Senate Bill 182 made a number of changes to state law regarding planning for and permitting development in areas designated as very high fire risk areas. The bill requires a local jurisdiction to do the following:

- Include a comprehensive retrofit strategy in its safety element to reduce the risk of property loss and damage during wildfires.
- Amend its land use element to identify all very high fire risk areas and to establish measures to protect lives and property from unreasonable risk of wildfire.
- Adopt a very high fire risk overlay zone for its zoning ordinance.
- Allocate a lower portion of projected future housing to very high fire hazard severity zones

This bill prohibits local governments from entering into a development agreement for property in a very high fire risk area, approving a permit for a project in a very high fire risk area, or approving a tentative map for a subdivision in a very high fire risk area, unless the jurisdiction makes specified findings based on substantial evidence.

Senate Bill 379: General Plans: Safety Element—Climate Adaptation

Senate Bill 379 builds upon the flood planning inclusions into the safety and housing elements and the hazard mitigation planning safety element inclusions in general plans outlined in AB 162 and AB 2140, respectively. SB 379 focuses on a new requirement that cities and counties include climate adaptation and resiliency strategies in the safety element of their general plans beginning January 1, 2017. In addition, this bill requires general plans to include a set of goals, policies and objectives, and specified implementation measures based on the conclusions drawn from climate adaptation research and recommendations.

Senate Bill 1000: General Plan Amendments—Safety and Environmental Justice Elements

In 2016, Senate Bill 1000 amended California's Planning and Zoning Law in two ways:

- The original law established requirements for initial revisions of general plan safety elements to address flooding, fire, and climate adaptation and resilience. It also required subsequent review and revision as necessary based on new information. Senate Bill 1000 specifies that the subsequent reviews and revision based on new information are required to address only flooding and fires (not climate adaptation and resilience).

- Senate Bill 1000 adds a requirement that, upon adoption or revision of any two other general plan elements on or after January 1, 2018, an environmental justice element be adopted for the general plan or environmental justice goals, policies and objectives be incorporated into other elements of the plan.

Senate Bill 1035: Fire, Flood, and Adaptation Safety Element Updates

Senate Bill 1035 clarifies that revisions to a community's General Plan Safety Element—to address fire hazards, flood hazards, and climate adaptation and resilience strategies—must occur upon each revision to a Housing Element or Local Hazard Mitigation Program.

Senate Bill 1241: General Plans: Safety Element—Fire Hazard Impacts

In 2012, Senate Bill 1241 passed requiring that the safety elements of all future general plans address fire risk in state responsibility areas and very high fire hazard severity zones. The bill requires cities and counties to make findings regarding available fire protection and suppression services before approving a tentative map or parcel map.

Standardized Emergency Management System

CCR Title 19 establishes the Standardized Emergency Management System (SEMS) to standardize the response to emergencies involving multiple jurisdictions. SEMS is intended to be flexible and adaptable to the needs of all emergency responders in California. It requires emergency response agencies to use basic principles and components of emergency management. Local governments must use SEMS by December 1, 1996, to be eligible for state funding of response-related personnel costs under CCR Title 19 (Sections 2920, 2925 and 2930). The roles and responsibilities of Individual agencies contained in existing laws or the state emergency plan are not superseded by these regulations. This hazard mitigation plan is considered to be a support document for all phases of emergency management, including those associated with SEMS.

Western Governors Association Ten-Year Comprehensive Strategy

The *Western Governors Association Ten-Year Comprehensive Strategy: A Collaborative Approach for Reducing Wildfire Risks to Communities and the Environment* (August 2001) is strategy implementation plan prepared by federal and Western state agencies that outlines measures to restore fire-adapted ecosystems and reduce hazardous fuels.

Ventura County Multi-Jurisdictional Hazard Mitigation Plan

Appendix C. Mapping Methods & Data Sources

C. MAPPING METHODS & DATA SOURCES

DAM FAILURE INUNDATION MAPPING

Dam breach inundation maps, including inundation boundaries and depth grids, were downloaded from the California Department of Water Resources' (DWR) website (https://fmds.water.ca.gov/maps/damim/). As required by California Water Code section 6161, the Division of Safety of Dams (DSOD) at DWR reviews and approves inundation maps prepared by licensed civil engineers and submitted by dam owners for extremely high, high, and significant hazard dams and their critical appurtenant structures. Inundation maps are based on a hypothetical failure of a dam or critical appurtenant structure, and the information depicted on the maps is approximate. The dams and failure scenarios are as follows:

- Arundel Barranca (National Dam ID CA01412)—Scenarios show inundation extents for sunny day failures of Main Dam and Spillway. Files downloaded from DSOD website generated on 5/13/2020.
- Bouquet Canyon (National Dam ID CA00088)—Scenarios show inundation extents for sunny day failures of Main Dam and Saddle Dam 1 (Dam No. 2). Files downloaded from DSOD website generated on 7/22/2019.
- Castaic (National Dam ID CA00044)—Scenarios show inundation extents for sunny day failures of Main Dam, Low Level Outlet, and Spillway. Files downloaded from DSOD website generated on 4/9/2019.
- Lake Eleanor (National Dam ID CA00737)—Scenario shows an inundation extent for a sunny day failure of Main Dam. File downloaded from DSOD website generated on 12/24/2018.
- Lake Sherwood (National Dam ID CA00736)—Scenarios show inundation extents for sunny day failures of Main Dam and Spillway 1. Files downloaded from DSOD website generated on 10/10/2019.
- Lang Creek Detention Basin (National Dam ID CA01368)—Scenarios show inundation extents for sunny day failures of Main Dam and Spillway 1. Files downloaded from DSOD website generated on 8/12/2020.
- Las Llajas (National Dam ID CA01217)—Scenario shows an inundation extent for a sunny day failure of Main Dam. File downloaded from DSOD website generated on 8/12/2020.
- Matilija (National Dam ID CA00312)—Scenario shows an inundation extent for a sunny day failure of Main Dam. File downloaded from DSOD website generated on 12/24/2019.
- Pyramid (National Dam ID CA00052)—Scenarios show inundation extents for sunny day failures of Main Dam, Low Level Outlet, and Spillway 1 (Gated Spillway). Files downloaded from DSOD website generated on 4/10/2019.

- Runkle (National Dam ID CA00313)—Scenario shows an inundation extent for a sunny day failure of Main Dam. File downloaded from DSOD website generated on 3/27/2020.
- Santa Felicia (National Dam ID CA00805)—Scenarios show inundation extents for sunny day failures of Main Dam and Spillway 1. Files downloaded from DSOD website generated on 9/20/2019.
- Senior Canyon (National Dam ID CA01019)—Scenarios show inundation extents for sunny day failures of Main Dam, Dam No. 2 and Dam No. 3. Files downloaded from DSOD website generated on 12/4/2019.
- Sinaloa Lake (National Dam ID CA01018)—Scenario shows an inundation extent for a sunny day failure of Main Dam. File downloaded from DSOD website generated on 10/13/2019.
- Stewart Canyon Debris Basin (National Dam ID CA01159)—Scenario shows an inundation extent for a sunny day failure of Main Dam. File downloaded from DSOD website generated on 5/14/2020.
- Sycamore Canyon (National Dam ID CA01266)—Scenario shows an inundation extent for a sunny day failure of Main Dam. File downloaded from DSOD website generated on 4/8/2020.
- Westlake Reservoir (National Dam ID CA00904)—Scenarios show inundation extents for sunny day failures of Main Dam and West Dam. Files downloaded from DSOD website generated on 11/1/2018.
- Wood Ranch (National Dam ID CA00850)—Scenarios show inundation extents for storm-induced failures of Main Dam, Dike 1, Dike 2, Dike 3, Dike 4, Dike 5 and Dike 6. Files downloaded from DSOD website generated on 12/19/2019.

EARTHQUAKE MAPPING

Liquefaction Zones

Seismic Hazard Zone Maps for Liquefaction dataset downloaded from the California Geological Survey's geologic hazards data website (https://maps.conservation.ca.gov/geologichazards/). The seismic hazards zones datasets include areas where liquefaction may occur during a strong earthquake. Developers of properties falling within the zones may be required to investigate the potential hazard and mitigate its threat during the local permitting process. The data is used by cities and counties to regulate development and by property owners selling property within areas where seismic hazard zones have been identified. Local governments can withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into development plans. Sellers of property use the data to check the location of their specific site and, if applicable, disclose to the buyer that the property lies within a seismic hazard zone as required by the Seismic Hazards Mapping Act of 1990 (Public Resources Code, Division 2, Chapter 7.8). This data may not show all areas that have potential for liquefaction. Also, a single earthquake capable of causing liquefaction will not uniformly affect the entire zone. The identification and location of liquefaction zones are based on the best available data. However, the quality of data used is varied. Zone boundaries have been drawn as accurately as possible at the map scale (1:24,000).

National Earthquake Hazard Reduction Program (NEHRP) Soils

NEHRP soils information is derived from a shear wave velocity (Vs30) data produced by the California Geological Survey in 2015. The Vs30 data represents simplified geologic units that have been correlated to the time-averaged shear-wave velocity in the upper 30 meters of the earth's surface. The geologic units were compiled from published maps that range in scale from 1:250,000 to 1:24,000. (Wills, et al., 2015)

Probabilistic Peak Ground Acceleration Maps

Probabilistic peak ground acceleration data, by Census tract, are generated by Hazus 4.2 SP03. In Hazus' probabilistic analysis procedure, the ground shaking demand is characterized by spectral contour maps developed by the U.S. Geological Survey (USGS) as part of a 2018 update of the National Seismic Hazard Maps. USGS probabilistic seismic hazard maps are revised about every six years to reflect newly published or thoroughly reviewed earthquake science and to keep pace with regular updates of the building code. Hazus includes maps for eight probabilistic hazard levels: ranging from ground shaking with a 39 percent probability of being exceeded in 50 years (100-year return period) to the ground shaking with a 2 percent probability of being exceeded in 50 years (2,500-year return period).

Shake Maps

A shake map is designed as a rapid response tool to portray the extent and variation of ground shaking throughout the affected region immediately following significant earthquakes. Ground motion and intensity maps are derived from peak ground motion amplitudes recorded on seismic sensors (accelerometers), with interpolation based on estimated amplitudes where data are lacking, and site amplification corrections. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. For this plan, shake maps were prepared by the USGS for four earthquake scenarios:

- An earthquake on the Oak Ridge (Onshore) fault with the following characteristics:
  - Magnitude: 7.16
  - Epicenter: N 34.31 W 118.96
  - Depth: 12.8 km
- An earthquake on the San Cayetano fault with the following characteristics:
  - Magnitude: 7.16
  - Epicenter: N 34.54 W 118.95
  - Depth: 10.2 km
- An earthquake on the S. San Andreas fault with the following characteristics:
  - Magnitude: 8.03
  - Epicenter: N 34.80 W 118.85
  - Depth: 9.1 km
- An earthquake on the Ventura-Pitas Point fault with the following characteristics:
  - Magnitude: 7.12
  - Epicenter: N 34.32 W 119.28

- Depth: 10.0 km

FLOOD MAPPING

Flood hazard areas are from the countywide effective FEMA Digital Flood Insurance Rate Map (DFIRM) dated January 29, 2021 with the latest incorporated Letter of Map Revision (LOMR) dated June 18, 2021.

LANDSLIDE MAPPING

Susceptibility to Deep-Seated Landslides data provided by the California Geological Survey. The map, and associated data, show the relative likelihood of deep-seated landsliding based on regional estimates of rock strength and steepness of slopes. On the most basic level, weak rocks and steep slopes are most likely to generate landslides. The map uses detailed information on the location of past landslides, the location and relative strength of rock units, and steepness of slope to estimate susceptibility to deep-seated landsliding (0 to X, low to high). The USGS 2009 National Elevation Dataset (NED) with 10-m grid size was used as the base map. This landslide susceptibility map is intended to provide infrastructure owners, emergency planners and the public with a general overview of where landslides are more likely to occur. (Wills, et al., 2011)

SEA-LEVEL RISE MAPPING

Projected sea level rise data are from the USGS Coastal Storm Modeling System (CoSMoS), accessed via the Our Coast Our Future web platform (Point Blue Conservation Science and USGS). The projections were generated using the latest downscaled climate projections and calibrated hydrodynamic models by the CoSMoS project team led by Patrick Barnard, at the USGS Pacific Coastal and Marine Science Center.

TSUNAMI MAPPING

Initial tsunami modeling was performed by the University of Southern California Tsunami Research Center funded through the California Emergency Management Agency by the National Tsunami Hazard Mitigation Program. The tsunami modeling process utilized the MOST (Method of Splitting Tsunamis) computational program (Version 0), which allows for wave evolution over a variable bathymetry and topography used for the inundation mapping (Titov and Gonzalez, 1997; Titov and Synolakis, 1998).

The bathymetric/topographic data that were used in the tsunami models consist of a series of nested grids. Near-shore grids with a 3 arc-second (75- to 90-meters) resolution or higher were adjusted to “mean high water” sea-level conditions, representing a conservative sea level for the intended use of the tsunami modeling and mapping. A suite of tsunami source events was selected for modeling, representing realistic local and distant earthquakes and hypothetical extreme undersea, near-shore landslides. Local tsunami sources that were considered include offshore reverse-thrust faults, restraining bends on strike-slip fault zones and large submarine landslides capable of significant seafloor displacement and tsunami generation. Distant tsunami sources that were considered include great subduction zone events that are known to have occurred historically (1960 Chile and 1964 Alaska earthquakes) and others that can occur around the Pacific Ocean “Ring of Fire.”

In order to enhance the result from the 75- to 90-meter inundation grid data, a method was developed utilizing higher-resolution digital topographic data (3- to 10-meters resolution) that better defines the location of the maximum inundation line. The location of the enhanced inundation line was determined by using digital imagery and terrain data on a GIS platform with consideration given to historical inundation information (Lander, et al., 1993). This information was verified, where possible, by field work coordinated with local county personnel.

The accuracy of the inundation line shown on these maps is subject to limitations in the accuracy and completeness of available terrain and tsunami source information, and the current understanding of tsunami generation and propagation phenomena as expressed in the models. Thus, although an attempt has been made to identify a credible upper bound to inundation at any location along the coastline, it remains possible that actual inundation could be greater in a major tsunami event. This map does not represent inundation from a single scenario event. It was created by combining inundation results for an ensemble of source events affecting a given region. For this reason, all of the inundation region in a particular area will not likely be inundated during a single tsunami event. (State of California, 2009)

WILDFIRE MAPPING

PRC 4201 – 4204 and Govt. Code 51175-89 directed the California Department of Forestry and Fire Protection, Fire and Resource Assessment Program (CALFIRE - FRAP) to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as Fire Hazard Severity Zones (FHSZ), define the application of various mitigation strategies to reduce risk associated with wildland fires. CAL FIRE remapped Fire Hazard Severity Zones (FHSZ) for State Responsibility Areas (SRA) and Very High Fire Hazard Severity Zones (VHFHSZ) recommendations in Local Responsibility Areas (LRA) in 2005 – 2008 to provide updated map zones, based on new data, science, and technology.

Mapping of the areas referred to as Very High Fire Hazard Severity Zones (VHFHSZ) was based on data and models of potential fuels over a 30- to 50-year time horizon and their associated expected fire behavior, and expected burn probabilities to quantify the likelihood and nature of vegetation fire exposure (including firebrands) to buildings. The goal of the mapping effort was to create more accurate fire hazard zone designations such that mitigation strategies would be implemented in areas where hazards warrant these investments. The fire hazard zones provide specific designation for application of defensible space and building standards consistent with known mechanisms of fire risk to people, property, and natural resources.

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Ventura County Multi-Jurisdictional Hazard Mitigation Plan

Appendix D. Detailed Risk Assessment Results

Appendix D.1

Exposure and Vulnerability of People and Property

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
Port Hueneme	21,954	6,413	5,583	$4,655,956,714
San Buenaventura	110,763	35,310	30,694	$23,838,143,638
Santa Paula	30,657	8,527	7,211	$4,571,072,937
Simi Valley	126,356	37,802	35,640	$24,328,139,279
Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
Unincorporated	94,003	49,022	32,568	$29,161,232,550
Total	**843,843**	**262,657**	**225,169**	**$180,756,967,629**

(1)2020 population from State of California, Department of Finance. Table C1 - Summary Population and Housing Data: 2020, California, Counties, Incorporated Cities/Towns, and Census Designated Places (CDP). Summary from 2020 Census, Redistricting Data (Public Law 94-171) Summary File, generated August 2021.

(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) Percent of residential buildings exposed multiplied by the Estimated Population.

(4) Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.2 SP03.

(5) Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.2 SP03, and adjusted to reflect the estimated population.

(6) Calculated using a user-defined (UDF) analysis in Hazus 4.2 SP03.

Jurisdiction	Estimated Building Exposure						
	Buildings Exposed (2)	Population Exposed (3)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value Exposed
Camarillo	3,193	10,113	14.3%	$1,825,655,234	$1,714,652,312	$3,540,307,546	20.0%
Fillmore	2,230	7,882	48.0%	$647,367,412	$389,746,474	$1,037,113,886	42.0%
Moorpark	2,410	7,440	20.5%	$1,342,208,186	$1,285,066,640	$2,627,274,826	32.0%
Ojai	315	730	9.6%	$106,146,197	$60,372,872	$166,519,069	7.1%
Oxnard	38,418	168,971	83.6%	$14,966,842,858	$11,247,144,546	$26,213,987,404	79.7%
Port Hueneme	5,610	19,370	88.2%	$2,153,487,223	$1,633,337,353	$3,786,824,576	81.3%
San Buenaventura	1,643	4,929	4.5%	$856,674,472	$760,613,648	$1,617,288,120	6.8%
Santa Paula	3,755	12,312	40.2%	$1,386,519,268	$1,184,477,947	$2,570,997,214	56.2%
Simi Valley	4,606	14,993	11.9%	$1,747,376,403	$1,359,059,306	$3,106,435,709	12.8%
Thousand Oaks	1,105	3,626	2.9%	$481,014,948	$283,093,686	$764,108,634	2.5%
Unincorporated	9,163	16,770	17.8%	$3,308,551,348	$2,712,590,423	$6,021,141,770	20.6%
Total	**72,448**	**267,136**	**31.7%**	**$28,821,843,548**	**$22,630,155,206**	**$51,451,998,753**	**28.5%**

Jurisdiction	Economic Impact							
	Structure Debris (Tons) (4)	Displaced Population (5)	People Requiring Short-Term Shelter (5)	Buildings Impacted (6)	Value Structure in $ Damaged (6)	Value Contents in $ Damaged (6)	Total Value (Structure and Contents in $) Damaged (6)	% of Total Value Damaged
Camarillo	1,046	3,585	333	495	$15,418,010	$16,471,533	$31,889,543	0.2%
Fillmore	119,360	6,212	355	2,207	$384,865,558	$271,540,819	$656,406,377	26.6%
Moorpark	9,231	3,318	217	967	$64,152,417	$111,003,160	$175,155,577	2.1%
Ojai	1,411	302	13	312	$12,264,840	$12,255,418	$24,520,258	1.0%
Oxnard	752,753	147,071	9,832	36,343	$3,473,281,467	$3,970,766,596	$7,444,048,063	22.6%
Port Hueneme	38,366	17,062	1,266	5,303	$346,121,830	$781,138,156	$1,127,259,987	24.2%
San Buenaventura	45,581	1,474	102	1,472	$214,837,863	$333,576,589	$548,414,452	2.3%
Santa Paula	291,295	10,518	1,015	3,726	$805,629,910	$861,507,999	$1,667,137,909	36.5%
Simi Valley	33,331	4,959	307	3,338	$256,466,127	$288,433,026	$544,899,154	2.2%
Thousand Oaks	26,709	936	75	1,097	$126,531,174	$120,995,496	$247,526,670	0.8%
Unincorporated	377,812	11,720	739	8,676	$1,096,303,200	$1,358,579,626	$2,454,882,825	8.4%
Total	**1,696,896**	**207,158**	**14,254**	**63,936**	**$6,795,872,395**	**$8,126,268,419**	**$14,922,140,815**	**8.3%**

Jurisdiction	Acres of Inundation Area	Number of Structures in Inundation Area (2)							
		Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	5,678	2,810	97	240	0	4	4	38	3193
Fillmore	5,184	2,069	97	16	2	7	35	4	2230
Moorpark	4,784	2,003	184	126	5	9	50	33	2410
Ojai	131	279	30	0	4	1	1	0	315
Oxnard	28,779	33,843	2,796	711	90	137	382	459	38418
Port Hueneme	4,708	4,926	275	26	0	16	312	55	5610
San Buenaventura	4,529	1,366	137	73	16	0	51	0	1643
Santa Paula	5,017	2,896	543	168	21	35	34	58	3755
Simi Valley	6,070	4,229	263	74	2	15	1	22	4606
Thousand Oaks	797	1,038	57	0	0	0	3	7	1105
Unincorporated	189,084	5,810	789	263	1,756	39	368	138	9163
Total	**254,761**	**61,269**	**5268**	**1697**	**1896**	**263**	**1241**	**814**	**72448**

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
Port Hueneme	21,954	6,413	5,583	$4,655,956,714
San Buenaventura	110,763	35,310	30,694	$23,838,143,638
Santa Paula	30,657	8,527	7,211	$4,571,072,937
Simi Valley	126,356	37,802	35,640	$24,328,139,279
Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
Unincorporated	94,003	49,022	32,568	$29,161,232,550
Total	**843,843**	**262,657**	**225,169**	**180,756,967,629**

(1)2020 population from State of California, Department of Finance. Table C1 - Summary Population and Housing Data: 2020, California, Counties, Incorporated Cities/Towns, and Census Designated Places (CDP). Summary from 2020 Census, Redistricting Data (Public Law 94-171) Summary File, generated August 2021.

(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) NEHRP soils data provided by the California Geological Survey.

(4) Percent of residential buildings exposed multiplied by the Estimated Population.

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Jurisdiction	NEHRP D & E Soils						
	Estimated Exposure						
	Estimated Buildings Exposed (2)	Population Exposed (4)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value
Camarillo	15,491	49,350	69.76%	7,456,431,275	6,204,632,212	13,661,063,487	77.15%
Fillmore	4,822	16,316	99.37%	1,464,670,770	982,603,711	2,447,274,481	99.17%
Moorpark	4,356	13,910	38.34%	2,125,297,386	1,864,215,595	3,989,512,981	48.52%
Ojai	2,917	6,501	85.13%	995,851,526	660,566,859	1,656,418,385	70.78%
Oxnard	45,834	201,963	99.95%	18,438,842,169	14,422,099,593	32,860,941,762	99.87%
Port Hueneme	6,367	21,785	99.23%	2,627,243,574	2,014,522,828	4,641,766,402	99.70%
San Buenaventura	32,419	100,893	91.09%	12,521,527,404	9,707,584,462	22,229,111,866	93.25%
Santa Paula	7,994	28,489	92.93%	2,443,835,102	1,841,164,958	4,285,000,060	93.74%
Simi Valley	27,124	89,850	71.11%	9,989,487,724	7,169,804,343	17,159,292,067	70.53%
Thousand Oaks	5,270	16,176	12.74%	3,187,049,866	2,461,055,120	5,648,104,986	18.48%
Unincorporated	25,385	43,142	45.89%	8,656,246,083	7,004,485,366	15,660,731,449	53.70%
Total	**177,979**	**588,376**	**69.73%**	**69,906,482,879**	**54,332,735,047**	**124,239,217,926**	**68.73%**

Jurisdiction	Number of Structures in Hazard Area (2)							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	13,713	481	818	11	52	257	159	15,491
Fillmore	4,283	325	39	6	17	67	85	4,822
Moorpark	3,745	289	144	47	12	57	62	4,356
Ojai	2,484	278	30	8	38	23	56	2,917
Oxnard	40,451	3,099	961	92	150	427	654	45,834
Port Hueneme	5,540	298	26	0	18	428	57	6,367
San Buenaventura	27,959	2,827	776	64	187	226	380	32,419
Santa Paula	6,701	819	190	53	69	44	118	7,994
Simi Valley	25,343	1,005	275	1	93	33	374	27,124
Thousand Oaks	4,631	440	43	0	20	55	81	5,270
Unincorporated	14,947	1,844	384	6,898	311	652	349	25,385
Total	**149,797**	**11,705**	**3,686**	**7,180**	**967**	**2,269**	**2,375**	**177,979**

Jurisdiction	Estimated Exposure				
	Estimated Population (1)	% Population Exposed	Total Number of Buildings (2)	Total Building Value (Structure and contents in $) (2)	% of Total Value Exposed
Camarillo	70,741	100%	21,829	$17,707,287,595	100%
Fillmore	16,419	100%	4,855	$2,467,839,895	100%
Moorpark	36,284	100%	10,697	$8,222,512,567	100%
Ojai	7,637	100%	3,531	$2,340,202,613	100%
Oxnard	202,063	100%	45,874	$32,903,823,044	100%
Port Hueneme	21,954	100%	6,413	$4,655,956,714	100%
San Buenaventura	110,763	100%	35,310	$23,838,143,638	100%
Santa Paula	30,657	100%	8,527	$4,571,072,937	100%
Simi Valley	126,356	100%	37,802	$24,328,139,279	100%
Thousand Oaks	126,966	100%	38,797	$30,560,756,798	100%
Unincorporated	94,003	100%	49,022	$29,161,232,550	100%
TOTAL	**843,843**	100%	**262,657**	**$180,756,967,629**	100%

(1)2020 population from State of California, Department of Finance. Table C1 - Summary Population and Housing Data: 2020, California, Counties, Incorporated Cities/Towns, and Census Designated Places (CDP). Summary from 2020 Census, Redistricting Data (Public Law 94-171) Summary File, generated August 2021.

(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) Calculated using a Census tract level, general building stock (GBS) analysis in Hazus 4.2 SP03.

(4) Calculated using an Advanced Engineering Building Model (AEBM) analysis in Hazus 4.2 SP03.

Jurisdiction	Economic Impact						
	Structure Debris (x 1,000 Tons) (3)	Number of Displaced Households (3)	People Requiring Short-Term Shelter (3)	Value Structure in $ Damaged (4)	Value Contents in $ Damaged (4)	Total Value (Structure and Contents in $) Damaged (4)	% of Total Value Damaged
Camarillo	255.47	16	9	$1,254,097,388	$564,455,389	$1,818,552,777	10.3%
Fillmore	59.46	3	3	$323,437,723	$126,271,963	$449,709,687	18.2%
Moorpark	95.45	5	4	$655,376,665	$296,600,537	$951,977,202	11.6%
Ojai	6.66	0	0	$33,663,983	$15,264,779	$48,928,763	2.1%
Oxnard	890.52	47	49	$4,073,453,482	$1,886,216,754	$5,959,670,236	18.1%
Port Hueneme	355.11	5	4	$754,540,064	$293,494,435	$1,048,034,499	22.5%
San Buenaventura	780.02	50	30	$2,576,223,556	$1,110,614,262	$3,686,837,817	15.5%
Santa Paula	182.62	11	12	$603,461,204	$260,943,809	$864,405,014	18.9%
Simi Valley	224.01	10	6	$1,616,097,167	$689,355,027	$2,305,452,194	9.5%
Thousand Oaks	96.58	1	1	$956,864,836	$407,551,372	$1,364,416,209	4.5%
Unincorporated	472.31	11	10	$2,062,054,977	$956,099,540	$3,018,154,517	10.3%
TOTAL	**3,418.21**	**160**	**127**	**$14,909,271,045**	**$6,606,867,869**	**21,516,138,914**	11.9%

Jurisdiction	Estimated Exposure				
	Estimated Population (1)	% Population Exposed	Total Number of Buildings (2)	Total Building Value (Structure and contents in $) (2)	% of Total Value Exposed
Camarillo	70,741	100%	21,829	$17,707,287,595	100%
Fillmore	16,419	100%	4,855	$2,467,839,895	100%
Moorpark	36,284	100%	10,697	$8,222,512,567	100%
Ojai	7,637	100%	3,531	$2,340,202,613	100%
Oxnard	202,063	100%	45,874	$32,903,823,044	100%
Port Hueneme	21,954	100%	6,413	$4,655,956,714	100%
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Santa Paula	30,657	100%	8,527	$4,571,072,937	100%
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(3) Calculated using a Census tract level, general building stock (GBS) analysis in Hazus 4.2 SP03.

(4) Calculated using an Advanced Engineering Building Model (AEBM) analysis in Hazus 4.2 SP03.

Jurisdiction	Economic Impact						
	Structure Debris (x 1,000 Tons) (3)	Number of Displaced Households (3)	People Requiring Short-Term Shelter (3)	Value Structure in $ Damaged (4)	Value Contents in $ Damaged (4)	Total Value (Structure and Contents in $) Damaged (4)	% of Total Value Damaged
Camarillo	24.30	0	0	$332,511,840	$161,595,849	$494,107,689	2.8%
Fillmore	68.22	4	3	$325,134,215	$127,875,613	$453,009,828	18.4%
Moorpark	23.26	0	0	$389,471,231	$180,226,732	$569,697,964	6.9%
Ojai	32.98	3	1	$114,379,858	$46,864,014	$161,243,872	6.9%
Oxnard	55.56	0	0	$856,288,550	$393,290,347	$1,249,578,897	3.8%
Port Hueneme	12.62	0	0	$112,352,575	$50,525,161	$162,877,736	3.5%
San Buenaventura	83.85	0	0	$724,508,648	$321,387,735	$1,045,896,383	4.4%
Santa Paula	93.74	2	2	$314,494,935	$130,588,518	$445,083,453	9.7%
Simi Valley	50.58	0	0	$786,013,425	$362,021,100	$1,148,034,525	4.7%
Thousand Oaks	21.83	0	0	$365,047,679	$161,480,442	$526,528,122	1.7%
Unincorporated	146.29	6	5	$1,047,501,134	$491,424,407	$1,538,925,541	5.3%
TOTAL	**613.21**	**14**	**11**	**$5,367,704,090**	**$2,427,279,918**	**7,794,984,008**	4.3%

Jurisdiction	Estimated Exposure				
	Estimated Population (1)	% Population Exposed	Total Number of Buildings (2)	Total Building Value (Structure and contents in $) (2)	% of Total Value Exposed
Camarillo	70,741	100%	21,829	$17,707,287,595	100%
Fillmore	16,419	100%	4,855	$2,467,839,895	100%
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Ojai	7,637	100%	3,531	$2,340,202,613	100%
Oxnard	202,063	100%	45,874	$32,903,823,044	100%
Port Hueneme	21,954	100%	6,413	$4,655,956,714	100%
San Buenaventura	110,763	100%	35,310	$23,838,143,638	100%
Santa Paula	30,657	100%	8,527	$4,571,072,937	100%
Simi Valley	126,356	100%	37,802	$24,328,139,279	100%
Thousand Oaks	126,966	100%	38,797	$30,560,756,798	100%
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TOTAL	**843,843**	100%	**262,657**	**$180,756,967,629**	100%

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(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) Calculated using a Census tract level, general building stock (GBS) analysis in Hazus 4.2 SP03.

(4) Calculated using an Advanced Engineering Building Model (AEBM) analysis in Hazus 4.2 SP03.

Jurisdiction	Economic Impact						
	Structure Debris (x 1,000 Tons) (3)	Number of Displaced Households (3)	People Requiring Short-Term Shelter (3)	Value Structure in $ Damaged (4)	Value Contents in $ Damaged (4)	Total Value (Structure and Contents in $) Damaged (4)	% of Total Value Damaged
Camarillo	8.03	0	0	$72,606,865	$36,652,157	$109,259,022	0.6%
Fillmore	6.78	0	0	$71,641,229	$26,926,763	$98,567,992	4.0%
Moorpark	3.50	0	0	$111,151,410	$51,817,233	$162,968,643	2.0%
Ojai	2.87	0	0	$19,176,336	$8,813,983	$27,990,319	1.2%
Oxnard	30.04	0	0	$114,269,681	$61,286,102	$175,555,783	0.5%
Port Hueneme	11.78	0	0	$28,011,094	$12,126,052	$40,137,146	0.9%
San Buenaventura	30.20	0	0	$164,878,846	$70,237,390	$235,116,236	1.0%
Santa Paula	11.46	0	0	$74,173,536	$32,450,321	$106,623,857	2.3%
Simi Valley	12.49	0	0	$278,004,931	$135,279,174	$413,284,105	1.7%
Thousand Oaks	6.07	0	0	$124,654,628	$57,664,112	$182,318,740	0.6%
Unincorporated	30.72	0	0	$308,335,672	$144,080,027	$452,415,699	1.6%
TOTAL	**153.94**	**0**	**0**	**$1,366,904,227**	**$637,333,313**	**2,004,237,540**	1.1%

Jurisdiction	Estimated Exposure						
	Estimated Population (1)	% Population Exposed	Total Number of Buildings (2)	Total Building Value (Structure and contents in $) (2)	% of Total Value Exposed	Structure Debris (x 1,000 Tons) (3)	Number of Displaced Households (3)
Camarillo	70,741	100%	21,829	$17,707,287,595	100%	70.37	1
Fillmore	16,419	100%	4,855	$2,467,839,895	100%	25.92	1
Moorpark	36,284	100%	10,697	$8,222,512,567	100%	11.74	0
Ojai	7,637	100%	3,531	$2,340,202,613	100%	19.19	0
Oxnard	202,063	100%	45,874	$32,903,823,044	100%	407.03	6
Port Hueneme	21,954	100%	6,413	$4,655,956,714	100%	119.50	1
San Buenaventura	110,763	100%	35,310	$23,838,143,638	100%	889.88	85
Santa Paula	30,657	100%	8,527	$4,571,072,937	100%	184.76	11
Simi Valley	126,356	100%	37,802	$24,328,139,279	100%	13.38	0
Thousand Oaks	126,966	100%	38,797	$30,560,756,798	100%	18.60	0
Unincorporated	94,003	100%	49,022	$29,161,232,550	100%	318.60	7
TOTAL	**843,843**	100%	**262,657**	**$180,756,967,629**	100%	**2,078.98**	**112**

(1)2020 population from State of California, Department of Finance. Table C1 - Summary Population and Housing Data: 2020, California, Counties, Incorporated Cities/Towns, and Census Designated Places (CDP). Summary from 2020 Census, Redistricting Data (Public Law 94-171) Summary File, generated August 2021.

(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) Calculated using a Census tract level, general building stock (GBS) analysis in Hazus 4.2 SP03.

(4) Calculated using an Advanced Engineering Building Model (AEBM) analysis in Hazus 4.2 SP03.

Jurisdiction	Economic Impact				
	People Requiring Short-Term Shelter (3)	Value Structure in $ Damaged (4)	Value Contents in $ Damaged (4)	Total Value (Structure and Contents in $) Damaged (4)	% of Total Value Damaged
Camarillo	0	$618,222,748	$291,545,429	$909,768,177	5.1%
Fillmore	1	$246,340,734	$94,279,012	$340,619,745	13.8%
Moorpark	0	$289,384,837	$136,815,405	$426,200,242	5.2%
Ojai	0	$66,661,698	$28,680,957	$95,342,655	4.1%
Oxnard	6	$2,825,603,981	$1,243,802,712	$4,069,406,692	12.4%
Port Hueneme	0	$410,536,239	$155,884,805	$566,421,043	12.2%
San Buenaventura	54	$2,875,871,126	$1,267,121,649	$4,142,992,775	17.4%
Santa Paula	12	$566,018,120	$243,512,464	$809,530,584	17.7%
Simi Valley	0	$281,527,722	$141,026,273	$422,553,996	1.7%
Thousand Oaks	0	$316,498,805	$142,979,353	$459,478,158	1.5%
Unincorporated	6	$1,576,389,169	$737,714,488	$2,314,103,657	7.9%
TOTAL	**79**	**$10,073,055,177**	**$4,483,362,547**	**14,556,417,724**	8.1%

Jurisdiction	Estimated Exposure				
	Estimated Population (1)	**% Population Exposed**	**Total Number of Buildings (2)**	**Total Building Value (Structure and contents in $) (2)**	**% of Total Value Exposed**
Camarillo	70,741	100%	21,829	$17,707,287,595	100%
Fillmore	16,419	100%	4,855	$2,467,839,895	100%
Moorpark	36,284	100%	10,697	$8,222,512,567	100%
Ojai	7,637	100%	3,531	$2,340,202,613	100%
Oxnard	202,063	100%	45,874	$32,903,823,044	100%
Port Hueneme	21,954	100%	6,413	$4,655,956,714	100%
San Buenaventura	110,763	100%	35,310	$23,838,143,638	100%
Santa Paula	30,657	100%	8,527	$4,571,072,937	100%
Simi Valley	126,356	100%	37,802	$24,328,139,279	100%
Thousand Oaks	126,966	100%	38,797	$30,560,756,798	100%
Unincorporated	94,003	100%	49,022	$29,161,232,550	100%
TOTAL	**843,843**	100%	**262,657**	**$180,756,967,629**	100%

(1)2020 population from State of California, Department of Finance. Table C1 - Summary Population and Housing Data: 2020, California, Counties, Incorporated Cities/Towns, and Census Designated Places (CDP). Summary from 2020 Census, Redistricting Data (Public Law 94-171) Summary File, generated August 2021.

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Jurisdiction	Economic Impact						
	Structure Debris (x 1,000 Tons) (3)	Number of Displaced Households (3)	People Requiring Short-Term Shelter (3)	Value Structure in $ Damaged (4)	Value Contents in $ Damaged (4)	Total Value (Structure and Contents in $) Damaged (4)	% of Total Value Damaged
Camarillo	41.80	14	8	$317,154,975	$166,355,625	$483,510,601	2.7%
Fillmore	7.40	2	2	$96,688,052	$38,647,908	$135,335,960	5.5%
Moorpark	16.07	5	4	$251,966,583	$121,552,386	$373,518,968	4.5%
Ojai	4.85	2	1	$20,372,924	$10,811,020	$31,183,944	1.3%
Oxnard	89.40	35	38	$1,671,772,446	$792,894,847	$2,464,667,293	7.5%
Port Hueneme	26.26	6	5	$238,732,202	$108,091,762	$346,823,964	7.4%
San Buenaventura	87.02	35	21	$621,218,009	$294,425,700	$915,643,709	3.8%
Santa Paula	19.90	7	7	$95,059,205	$47,029,170	$142,088,375	3.1%
Simi Valley	78.45	53	33	$789,228,569	$366,293,069	$1,155,521,638	4.7%
Thousand Oaks	44.82	26	14	$489,697,195	$235,427,670	$725,124,865	2.4%
Unincorporated	87.35	20	13	$814,238,984	$395,932,641	$1,210,171,626	4.1%
TOTAL	**503.31**	**205**	**147**	**$5,406,129,145**	**$2,577,461,798**	**7,983,590,943**	4.4%

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
Port Hueneme	21,954	6,413	5,583	$4,655,956,714
San Buenaventura	110,763	35,310	30,694	$23,838,143,638
Santa Paula	30,657	8,527	7,211	$4,571,072,937
Simi Valley	126,356	37,802	35,640	$24,328,139,279
Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
Unincorporated	94,003	49,022	32,568	$29,161,232,550
Total	**843,843**	**262,657**	**225,169**	**$180,756,967,629**

(1)2020 population from State of California, Department of Finance. Table C1 - Summary Population and Housing Data: 2020, California, Counties, Incorporated Cities/Towns, and Census Designated Places (CDP). Summary from 2020 Census, Redistricting Data (Public Law 94-171) Summary File, generated August 2021.

(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) Percent of residential buildings exposed multiplied by the Estimated Population.

(4) Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.2 SP03.

(5) Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.2 SP03, and adjusted to reflect the estimated population.

(6) Calculated using a user-defined (UDF) analysis in Hazus 4.2 SP03.

Jurisdiction	Estimated Building Exposure						
	Buildings Exposed (2)	Population Exposed (3)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value Exposed
Camarillo	1,361	4,077	5.8%	$811,577,706	$847,038,963	$1,658,616,669	9.4%
Fillmore	121	427	2.6%	$44,066,967	$26,622,071	$70,689,039	2.9%
Moorpark	229	691	1.9%	$171,600,334	$182,716,297	$354,316,631	4.3%
Ojai	84	152	2.0%	$32,023,450	$24,758,767	$56,782,217	2.4%
Oxnard	263	839	0.4%	$153,350,315	$153,090,160	$306,440,475	0.9%
Port Hueneme	3	4	0.0%	$5,817,027	$5,723,892	$11,540,919	0.2%
San Buenaventura	186	350	0.3%	$189,050,175	$196,450,450	$385,500,626	1.6%
Santa Paula	2,800	9,493	31.0%	$863,746,680	$706,530,251	$1,570,276,932	34.4%
Simi Valley	3,388	10,643	8.4%	$1,550,461,207	$1,397,529,498	$2,947,990,705	12.1%
Thousand Oaks	411	1,132	0.9%	$270,559,337	$214,327,558	$484,886,895	1.6%
Unincorporated	3,701	5,395	5.7%	$1,173,621,479	$926,591,347	$2,100,212,825	7.2%
Total	**12,547**	**33,202**	**3.9%**	**$5,265,874,679**	**$4,681,379,253**	**$9,947,253,933**	**5.5%**

Jurisdiction	Economic Impact							
	Structure Debris (Tons) (4)	Displaced Population (5)	People Requiring Short-Term Shelter (5)	Buildings Impacted (6)	Value Structure in $ Damaged (6)	Value Contents in $ Damaged (6)	Total Value (Structure and Contents in $) Damaged (6)	% of Total Value Damaged
Camarillo	995	874	80	924	$18,136,547	$14,704,765	$32,841,312	0.2%
Fillmore	445	80	6	67	$1,947,318	$1,702,111	$3,649,429	0.1%
Moorpark	8,372	154	12	126	$13,667,492	$21,518,311	$35,185,803	0.4%
Ojai	55	24	1	17	$455,128	$328,839	$783,967	0.0%
Oxnard	970	134	7	142	$3,868,280	$6,765,501	$10,633,781	0.0%
Port Hueneme	0	0	0	0	$0	$0	$0	0.0%
San Buenaventura	12,604	30	2	71	$11,004,892	$28,605,208	$39,610,101	0.2%
Santa Paula	8,063	6,168	528	1,871	$59,011,117	$71,219,090	$130,230,207	2.8%
Simi Valley	15,198	2,358	114	2,273	$104,290,055	$140,715,076	$245,005,131	1.0%
Thousand Oaks	1,293	133	8	274	$13,907,582	$29,357,341	$43,264,924	0.1%
Unincorporated	48,715	874	27	2,120	$81,700,290	$120,988,721	$202,689,011	0.7%
Total	**96,710**	**10,829**	**785**	**7,885**	**$307,988,701**	**$435,904,963**	**$743,893,665**	**0.4%**

Jurisdiction	Acres of Floodplain	Number of Structures in Floodplain (2)							
		Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	1,566	1,133	63	153	1	1	6	4	1361
Fillmore	545	112	1	1	1	1	3	2	121
Moorpark	522	186	18	18	0	0	7	0	229
Ojai	285	58	11	8	0	0	7	0	84
Oxnard	974	168	44	45	0	0	6	0	263
Port Hueneme	132	1	1	0	0	0	1	0	3
San Buenaventura	1,180	97	33	31	12	0	13	0	186
Santa Paula	1,421	2,233	336	109	41	17	14	50	2800
Simi Valley	2,091	3,002	231	126	0	7	0	22	3388
Thousand Oaks	568	324	34	0	0	2	7	44	411
Unincorporated	58,760	1,869	319	46	1,372	34	30	31	3701
Total	**68,046**	**9,183**	**1091**	**537**	**1427**	**62**	**94**	**153**	**12547**

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
Port Hueneme	21,954	6,413	5,583	$4,655,956,714
San Buenaventura	110,763	35,310	30,694	$23,838,143,638
Santa Paula	30,657	8,527	7,211	$4,571,072,937
Simi Valley	126,356	37,802	35,640	$24,328,139,279
Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
Unincorporated	94,003	49,022	32,568	$29,161,232,550
Total	**843,843**	**262,657**	**225,169**	**$180,756,967,629**

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(3) Percent of residential buildings exposed multiplied by the Estimated Population.

(4) Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.2 SP03.

(5) Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.2 SP03, and adjusted to reflect the estimated population.

(6) Calculated using a user-defined (UDF) analysis in Hazus 4.2 SP03.

Jurisdiction	Estimated Building Exposure						
	Buildings Exposed (2)	Population Exposed (3)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value Exposed
Camarillo	7,952	24,425	34.5%	$4,183,612,188	$3,705,692,898	$7,889,305,086	44.6%
Fillmore	312	998	6.1%	$81,648,513	$49,666,004	$131,314,517	5.3%
Moorpark	2,434	7,473	20.6%	$1,316,023,676	$1,233,811,450	$2,549,835,126	31.0%
Ojai	988	2,143	28.1%	$318,177,110	$214,977,791	$533,154,901	22.8%
Oxnard	16,417	72,101	35.7%	$6,271,339,016	$5,053,125,090	$11,324,464,106	34.4%
Port Hueneme	6,120	20,857	95.0%	$2,570,735,967	$1,978,060,303	$4,548,796,270	97.7%
San Buenaventura	1,520	3,969	3.6%	$1,089,151,905	$1,055,150,082	$2,144,301,988	9.0%
Santa Paula	4,955	16,742	54.6%	$1,549,736,567	$1,200,236,084	$2,749,972,651	60.2%
Simi Valley	4,309	13,430	10.6%	$2,227,840,029	$2,075,195,072	$4,303,035,101	17.7%
Thousand Oaks	698	2,040	1.6%	$418,573,237	$303,132,032	$721,705,268	2.4%
Unincorporated	9,273	16,594	17.7%	$3,205,899,184	$2,633,930,786	$5,839,829,970	20.0%
Total	**54,978**	**180,772**	**21.4%**	**$23,232,737,392**	**$19,502,977,592**	**$42,735,714,984**	**23.6%**

Jurisdiction	Economic Impact							
	Structure Debris (Tons) (4)	Displaced Population (5)	People Requiring Short-Term Shelter (5)	Buildings Impacted (6)	Value Structure in $ Damaged (6)	Value Contents in $ Damaged (6)	Total Value (Structure and Contents in $) Damaged (6)	% of Total Value Damaged
Camarillo	35,705	14,896	1,210	4,556	$323,354,969	$610,659,310	$934,014,279	5.3%
Fillmore	1,300	260	19	112	$2,834,318	$3,389,276	$6,223,594	0.3%
Moorpark	18,723	4,812	358	1,449	$161,918,925	$282,897,898	$444,816,823	5.4%
Ojai	8,058	1,140	81	709	$52,652,213	$58,900,791	$111,553,003	4.8%
Oxnard	40,476	54,691	3,603	5,622	$217,744,567	$368,166,618	$585,911,185	1.8%
Port Hueneme	47,197	20,268	1,573	5,396	$476,053,503	$1,091,892,221	$1,567,945,724	33.7%
San Buenaventura	24,795	1,217	98	681	$113,780,470	$247,453,885	$361,234,355	1.5%
Santa Paula	1,804	9,745	746	769	$25,853,761	$38,739,391	$64,593,152	1.4%
Simi Valley	83,396	3,685	198	1,313	$176,300,670	$358,500,485	$534,801,155	2.2%
Thousand Oaks	1,855	319	19	368	$17,928,380	$39,947,125	$57,875,505	0.2%
Unincorporated	133,015	6,068	317	6,687	$415,808,250	$640,849,397	$1,056,657,647	3.6%
Total	**396,325**	**117,102**	**8,221**	**27,662**	**$1,984,230,028**	**$3,741,396,396**	**$5,725,626,424**	**3.2%**

Jurisdiction	Acres of Floodplain	Number of Structures in Floodplain (2)							
		Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	5,203	6,787	277	492	12	25	249	110	7952
Fillmore	613	262	22	1	1	1	23	2	312
Moorpark	1,519	2,012	199	126	0	9	50	38	2434
Ojai	673	819	113	33	0	2	13	8	988
Oxnard	6,540	14,441	951	572	29	28	261	135	16417
Port Hueneme	2,812	5,304	299	26	0	17	430	44	6120
San Buenaventura	1,851	1,100	210	169	18	3	20	0	1520
Santa Paula	2,122	3,938	646	147	46	64	36	78	4955
Simi Valley	2,847	3,788	267	179	0	14	0	61	4309
Thousand Oaks	685	584	55	0	0	2	13	44	698
Unincorporated	77,155	5,749	698	197	2,266	55	145	163	9273
Total	**102,019**	**44,784**	**3737**	**1942**	**2372**	**220**	**1240**	**683**	**54978**

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
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Camarillo	70,741	21,829	19,657	$17,707,287,595
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Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
Unincorporated	94,003	49,022	32,568	$29,161,232,550
Total	**843,843**	**262,657**	**225,169**	**180,756,967,629**

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
Port Hueneme	21,954	6,413	5,583	$4,655,956,714
San Buenaventura	110,763	35,310	30,694	$23,838,143,638
Santa Paula	30,657	8,527	7,211	$4,571,072,937
Simi Valley	126,356	37,802	35,640	$24,328,139,279
Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
Unincorporated	94,003	49,022	32,568	$29,161,232,550
Total	**843,843**	**262,657**	**225,169**	**180,756,967,629**

(1)2020 population from State of California, Department of Finance. Table C1 - Summary Population and Housing Data: 2020, California, Counties, Incorporated Cities/Towns, and Census Designated Places (CDP). Summary from 2020 Census, Redistricting Data (Public Law 94-171) Summary File, generated August 2021.

(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) Susceptibility to Deep-Seated Landslides in California (CGS Map Sheet 58) provided by the CA Geological Survey. Susceptibility classes categorized as follows: Very High

(4) Percent of residential buildings exposed multiplied by the Estimated Population.

Jurisdiction	Landslide Susceptibility Category Very High (3)						
	Estimated Exposure						
	Estimated Buildings Exposed (2)	Population Exposed (4)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value
Camarillo	319	1,098	1.6%	$145,360,202	$76,937,994	$222,298,196	1.3%
Fillmore	17	57	0.3%	$7,191,809	$4,831,118	$12,022,927	0.5%
Moorpark	177	591	1.6%	$104,729,266	$82,711,386	$187,440,653	2.3%
Ojai	6	16	0.2%	$6,143,914	$3,071,957	$9,215,871	0.4%
Oxnard	1	0	0.0%	$2,295,792	$2,295,792	$4,591,584	0.0%
Port Hueneme	0	0	0.0%	$0	$0	$0	0.0%
San Buenaventura	1,218	4,240	3.8%	$418,645,287	$216,801,830	$635,447,117	2.7%
Santa Paula	79	319	1.0%	$27,764,158	$14,198,759	$41,962,917	0.9%
Simi Valley	214	716	0.6%	$141,777,522	$118,366,473	$260,143,994	1.1%
Thousand Oaks	821	2,756	2.2%	$385,793,664	$213,145,840	$598,939,504	2.0%
Unincorporated	1,891	2,707	2.9%	$562,531,836	$390,036,748	$952,568,584	3.3%
Total	**4,743**	**12,500**	**1.5%**	**$1,802,233,448**	**$1,122,397,897**	**$2,924,631,346**	**1.6%**

Jurisdiction	Landslide Susceptibility Category High (3)						
	Estimated Exposure						
	Estimated Buildings Exposed (2)	Population Exposed (4)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value
Camarillo	3,310	11,376	16.1%	$1,276,555,651	$760,035,742	$2,036,591,394	11.5%
Fillmore	282	956	5.8%	$84,242,891	$56,428,708	$140,671,600	5.7%
Moorpark	2,408	8,190	22.6%	$1,093,504,171	$656,025,717	$1,749,529,888	21.3%
Ojai	608	1,392	18.2%	$246,345,265	$152,323,811	$398,669,076	17.0%
Oxnard	522	2,347	1.2%	$211,406,543	$139,856,728	$351,263,272	1.1%
Port Hueneme	18	59	0.3%	$3,256,669	$1,881,834	$5,138,503	0.1%
San Buenaventura	4,764	15,528	14.0%	$1,623,676,875	$990,475,247	$2,614,152,122	11.0%
Santa Paula	1,201	4,626	15.1%	$352,153,064	$207,857,159	$560,010,223	12.3%
Simi Valley	7,205	24,505	19.4%	$3,049,935,458	$1,890,121,993	$4,940,057,452	20.3%
Thousand Oaks	15,214	50,335	39.6%	$6,861,797,417	$4,488,875,991	$11,350,673,408	37.1%
Unincorporated	16,522	32,552	34.6%	$5,398,296,121	$3,556,065,421	$8,954,361,542	30.7%
Total	**52,054**	**151,866**	**18.0%**	**$20,201,170,128**	**$12,899,948,351**	**$33,101,118,479**	**18.3%**

Jurisdiction	Landslide Susceptibility Category Moderate (3)						
	Estimated Exposure						
	Estimated Buildings Exposed (2)	Population Exposed (4)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value
Camarillo	334	1,112	1.6%	$160,265,279	$85,604,299	$245,869,578	1.4%
Fillmore	11	38	0.2%	$2,567,876	$1,334,235	$3,902,111	0.2%
Moorpark	1,006	3,458	9.5%	$474,259,020	$288,593,875	$762,852,896	9.3%
Ojai	63	131	1.7%	$18,627,630	$10,296,846	$28,924,475	1.2%
Oxnard	0	0	0.0%	$0	$0	$0	0.0%
Port Hueneme	0	0	0.0%	$0	$0	$0	0.0%
San Buenaventura	17	58	0.1%	$2,799,965	$1,446,188	$4,246,153	0.0%
Santa Paula	0	0	0.0%	$0	$0	$0	0.0%
Simi Valley	2,944	10,115	8.0%	$1,424,660,482	$816,256,331	$2,240,916,814	9.2%
Thousand Oaks	4,759	16,148	12.7%	$1,875,554,525	$1,049,243,077	$2,924,797,602	9.6%
Unincorporated	2,716	4,898	5.2%	$1,019,871,610	$672,102,212	$1,691,973,823	5.8%
Total	**11,850**	**35,958**	**4.3%**	**$4,978,606,389**	**$2,924,877,062**	**$7,903,483,451**	**4.4%**

Jurisdiction	Number of Structures in Category Very High (2)							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	305	7	0	1	0	6	0	319
Fillmore	15	0	0	1	0	1	0	17
Moorpark	159	4	2	2	1	2	7	177
Ojai	6	0	0	0	0	0	0	6
Oxnard	0	0	0	0	0	1	0	1
Port Hueneme	0	0	0	0	0	0	0	0
San Buenaventura	1,175	28	0	2	3	10	0	1,218
Santa Paula	75	1	0	2	0	1	0	79
Simi Valley	202	10	2	0	0	0	0	214
Thousand Oaks	789	16	0	0	5	10	1	821
Unincorporated	938	153	3	744	42	8	3	1,891
Total	**3,664**	**219**	**7**	**752**	**51**	**39**	**11**	**4,743**

Jurisdiction	Number of Structures in Category High (2)							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	3,161	88	17	12	7	9	16	3,310
Fillmore	251	17	3	0	0	4	7	282
Moorpark	2,205	86	10	69	0	4	34	2,408
Ojai	532	28	4	13	19	10	2	608
Oxnard	470	28	0	0	0	24	0	522
Port Hueneme	15	1	0	0	0	2	0	18
San Buenaventura	4,303	319	15	7	23	57	40	4,764
Santa Paula	1,088	74	4	3	1	6	25	1,201
Simi Valley	6,912	165	46	10	8	13	51	7,205
Thousand Oaks	14,410	448	130	1	75	71	79	15,214
Unincorporated	11,278	888	64	3,874	261	85	72	16,522
Total	**44,625**	**2,142**	**293**	**3,989**	**394**	**285**	**326**	**52,054**

Jurisdiction	Number of Structures in Category Moderate (2)							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	309	21	0	0	2	1	1	334
Fillmore	10	1	0	0	0	0	0	11
Moorpark	931	33	1	17	0	1	23	1,006
Ojai	50	6	0	6	0	1	0	63
Oxnard	0	0	0	0	0	0	0	0
Port Hueneme	0	0	0	0	0	0	0	0
San Buenaventura	16	1	0	0	0	0	0	17
Santa Paula	0	0	0	0	0	0	0	0
Simi Valley	2,853	49	8	10	2	8	14	2,944
Thousand Oaks	4,623	87	10	3	13	9	14	4,759
Unincorporated	1,697	195	7	757	31	8	21	2,716
Total	**10,489**	**393**	**26**	**793**	**48**	**28**	**73**	**11,850**

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
Port Hueneme	21,954	6,413	5,583	$4,655,956,714
San Buenaventura	110,763	35,310	30,694	$23,838,143,638
Santa Paula	30,657	8,527	7,211	$4,571,072,937
Simi Valley	126,356	37,802	35,640	$24,328,139,279
Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
Unincorporated	94,003	49,022	32,568	$29,161,232,550
Total	**843,843**	**262,657**	**225,169**	**180,756,967,629**

(1)2020 population from State of California, Department of Finance. Table C1 - Summary Population and Housing Data: 2020, California, Counties, Incorporated Cities/Towns, and Census Designated Places (CDP). Summary from 2020 Census, Redistricting Data (Public Law 94-171) Summary File, generated August 2021.

(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) 25cm of sea level rise inundation areas downloaded from Our Coast Our Future website.

(4) Percent of residential buildings exposed multiplied by the Estimated Population.

Jurisdiction	Sea Level Rise 25cm (3)						
	Estimated Exposure						
	Estimated Buildings Exposed (2)	Population Exposed (4)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value
Camarillo	0	0	0.00%	0	0	0	0.00%
Fillmore	0	0	0.00%	0	0	0	0.00%
Moorpark	0	0	0.00%	0	0	0	0.00%
Ojai	0	0	0.00%	0	0	0	0.00%
Oxnard	6	30	0.01%	1,844,110	922,055	2,766,165	0.01%
Port Hueneme	0	0	0.00%	0	0	0	0.00%
San Buenaventura	1	0	0.00%	13,147,511	13,147,511	26,295,022	0.11%
Santa Paula	0	0	0.00%	0	0	0	0.00%
Simi Valley	0	0	0.00%	0	0	0	0.00%
Thousand Oaks	0	0	0.00%	0	0	0	0.00%
Unincorporated	3	9	0.01%	782,482	391,241	1,173,722	0.00%
Total	**10**	**39**	**0.00%**	**15,774,103**	**14,460,807**	**30,234,909**	**0.02%**

Jurisdiction	Number of Structures in Hazard Area (2)							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	0	0	0	0	0	0	0	0
Fillmore	0	0	0	0	0	0	0	0
Moorpark	0	0	0	0	0	0	0	0
Ojai	0	0	0	0	0	0	0	0
Oxnard	6	0	0	0	0	0	0	6
Port Hueneme	0	0	0	0	0	0	0	0
San Buenaventura	0	0	0	0	0	1	0	1
Santa Paula	0	0	0	0	0	0	0	0
Simi Valley	0	0	0	0	0	0	0	0
Thousand Oaks	0	0	0	0	0	0	0	0
Unincorporated	3	0	0	0	0	0	0	3
Total	**9**	**0**	**0**	**0**	**0**	**1**	**0**	**10**

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
Port Hueneme	21,954	6,413	5,583	$4,655,956,714
San Buenaventura	110,763	35,310	30,694	$23,838,143,638
Santa Paula	30,657	8,527	7,211	$4,571,072,937
Simi Valley	126,356	37,802	35,640	$24,328,139,279
Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
Unincorporated	94,003	49,022	32,568	$29,161,232,550
Total	**843,843**	**262,657**	**225,169**	**180,756,967,629**

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(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) 100cm of sea level rise inundation areas downloaded from Our Coast Our Future website

(4) Percent of residential buildings exposed multiplied by the Estimated Population.

Jurisdiction	Sea Level Rise 100cm (3)						
	Estimated Exposure						
	Estimated Buildings Exposed (2)	Population Exposed (4)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value
Camarillo	0	0	0.00%	0	0	0	0.00%
Fillmore	0	0	0.00%	0	0	0	0.00%
Moorpark	0	0	0.00%	0	0	0	0.00%
Ojai	0	0	0.00%	0	0	0	0.00%
Oxnard	71	320	0.16%	19,837,269	11,436,689	31,273,958	0.10%
Port Hueneme	26	0	0.00%	41,938,508	41,938,508	83,877,017	1.80%
San Buenaventura	9	22	0.02%	17,805,334	16,492,114	34,297,448	0.14%
Santa Paula	0	0	0.00%	0	0	0	0.00%
Simi Valley	0	0	0.00%	0	0	0	0.00%
Thousand Oaks	0	0	0.00%	0	0	0	0.00%
Unincorporated	143	222	0.24%	61,259,909	51,582,876	112,842,786	0.39%
Total	**249**	**563**	**0.07%**	**140,841,021**	**121,450,187**	**262,291,208**	**0.15%**

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Jurisdiction	Number of Structures in Hazard Area (2)							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	0	0	0	0	0	0	0	0
Fillmore	0	0	0	0	0	0	0	0
Moorpark	0	0	0	0	0	0	0	0
Ojai	0	0	0	0	0	0	0	0
Oxnard	64	0	0	0	0	7	0	71
Port Hueneme	0	0	0	0	0	26	0	26
San Buenaventura	6	2	0	0	0	1	0	9
Santa Paula	0	0	0	0	0	0	0	0
Simi Valley	0	0	0	0	0	0	0	0
Thousand Oaks	0	0	0	0	0	0	0	0
Unincorporated	77	5	0	0	0	61	0	143
Total	**147**	**7**	**0**	**0**	**0**	**95**	**0**	**249**

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
Port Hueneme	21,954	6,413	5,583	$4,655,956,714
San Buenaventura	110,763	35,310	30,694	$23,838,143,638
Santa Paula	30,657	8,527	7,211	$4,571,072,937
Simi Valley	126,356	37,802	35,640	$24,328,139,279
Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
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(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) Percent of residential buildings exposed multiplied by the Estimated Population.

(4) Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.2 SP03.

(5) Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.2 SP03, and adjusted to reflect the estimated population.

(6) Calculated using a user-defined (UDF) analysis in Hazus 4.2 SP03.

Jurisdiction	Estimated Building Exposure						
	Buildings Exposed (2)	Population Exposed (3)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value Exposed
Camarillo	0	0	0.0%	$0	$0	$0	0.0%
Fillmore	0	0	0.0%	$0	$0	$0	0.0%
Moorpark	0	0	0.0%	$0	$0	$0	0.0%
Ojai	0	0	0.0%	$0	$0	$0	0.0%
Oxnard	3,680	17,365	8.6%	$1,353,632,901	$772,006,907	$2,125,639,808	6.5%
Port Hueneme	179	79	0.4%	$286,568,639	$285,192,330	$571,760,969	12.3%
San Buenaventura	1,324	4,338	3.9%	$455,402,336	$284,490,968	$739,893,304	3.1%
Santa Paula	0	0	0.0%	$0	$0	$0	0.0%
Simi Valley	0	0	0.0%	$0	$0	$0	0.0%
Thousand Oaks	0	0	0.0%	$0	$0	$0	0.0%
Unincorporated	2,117	5,845	6.2%	$607,923,225	$318,142,306	$926,065,532	3.2%
Total	**7,300**	**27,626**	**3.3%**	**$2,703,527,102**	**$1,659,832,511**	**$4,363,359,613**	**2.4%**

Jurisdiction	Economic Impact							
	Structure Debris (Tons) (4)	Displaced Population (5)	People Requiring Short-Term Shelter (5)	Buildings Impacted (6)	Value Structure in $ Damaged (6)	Value Contents in $ Damaged (6)	Total Value (Structure and Contents in $) Damaged (6)	% of Total Value Damaged
Camarillo	0	0	0	0	$0	$0	$0	0.0%
Fillmore	0	0	0	0	$0	$0	$0	0.0%
Moorpark	0	0	0	0	$0	$0	$0	0.0%
Ojai	0	0	0	0	$0	$0	$0	0.0%
Oxnard	1,681,815	13,969	991	1,136	$118,372,314	$190,275,068	$308,647,382	0.9%
Port Hueneme	2,743	13	1	6	$72,738	$351,789	$424,527	0.0%
San Buenaventura	12,848	2,772	293	22	$735,705	$1,320,813	$2,056,518	0.0%
Santa Paula	0	0	0	0	$0	$0	$0	0.0%
Simi Valley	0	0	0	0	$0	$0	$0	0.0%
Thousand Oaks	0	0	0	0	$0	$0	$0	0.0%
Unincorporated	58,074	5,202	299	133	$6,014,799	$6,695,977	$12,710,776	0.0%
Total	**1,755,480**	**21,957**	**1,584**	**1,297**	**$125,195,556**	**$198,643,647**	**$323,839,203**	**0.2%**

Jurisdiction	Acres of Inundation Area	Number of Structures in Inundation Area (2)							
		Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	0	0	0	0	0	0	0	0	0
Fillmore	0	0	0	0	0	0	0	0	0
Moorpark	0	0	0	0	0	0	0	0	0
Ojai	0	0	0	0	0	0	0	0	0
Oxnard	1,566	3,478	93	1	0	0	108	0	3680
Port Hueneme	555	20	43	0	0	0	116	0	179
San Buenaventura	782	1,202	77	3	18	0	18	6	1324
Santa Paula	0	0	0	0	0	0	0	0	0
Simi Valley	0	0	0	0	0	0	0	0	0
Thousand Oaks	0	0	0	0	0	0	0	0	0
Unincorporated	1,788	2,025	61	0	0	0	21	10	2117
Total	**4,690**	**6,725**	**274**	**4**	**18**	**0**	**263**	**16**	**7300**

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
Port Hueneme	21,954	6,413	5,583	$4,655,956,714
San Buenaventura	110,763	35,310	30,694	$23,838,143,638
Santa Paula	30,657	8,527	7,211	$4,571,072,937
Simi Valley	126,356	37,802	35,640	$24,328,139,279
Thousand Oaks	126,966	38,797	36,348	$30,560,756,798
Unincorporated	94,003	49,022	32,568	$29,161,232,550
Total	**843,843**	**262,657**	**225,169**	**180,756,967,629**

Jurisdiction	Estimated Population (1)	Total Number of Buildings (2)	Total Number of Residential Buildings (2)	Total Building Value (Structure and contents in $) (2)
Camarillo	70,741	21,829	19,657	$17,707,287,595
Fillmore	16,419	4,855	4,310	$2,467,839,895
Moorpark	36,284	10,697	9,769	$8,222,512,567
Ojai	7,637	3,531	2,918	$2,340,202,613
Oxnard	202,063	45,874	40,471	$32,903,823,044
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Total	**843,843**	**262,657**	**225,169**	**180,756,967,629**

(1)2020 population from State of California, Department of Finance. Table C1 - Summary Population and Housing Data: 2020, California, Counties, Incorporated Cities/Towns, and Census Designated Places (CDP). Summary from 2020 Census, Redistricting Data (Public Law 94-171) Summary File, generated August 2021.

(2) Values based off of 2021 tax assessor data provided by Ventura County.

(3) Fire and Resource Assessment Program (FRAP) wildfire severity zones data provided by California Department of Forestry and Fire Protection.

(4) Percent of residential buildings exposed multiplied by the Estimated Population.

Jurisdiction	Very High Wildfire Severity Zone (3)						
	Estimated Exposure						
	Estimated Buildings Exposed (2)	Population Exposed (4)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value
Camarillo	1,241	4,322	6.1%	$412,245,811	$253,108,930	$665,354,741	3.8%
Fillmore	590	2,084	12.7%	$135,636,784	$73,425,732	$209,062,516	8.5%
Moorpark	5,516	18,798	51.8%	$2,426,708,694	$1,612,958,481	$4,039,667,175	49.1%
Ojai	341	827	10.8%	$103,962,503	$54,880,475	$158,842,977	6.8%
Oxnard	0	0	0.0%	$0	$0	$0	0.0%
Port Hueneme	0	0	0.0%	$0	$0	$0	0.0%
San Buenaventura	4,482	14,629	13.2%	$1,398,813,270	$814,379,281	$2,213,192,552	9.3%
Santa Paula	530	2,181	7.1%	$170,305,792	$92,229,228	$262,535,020	5.7%
Simi Valley	10,911	37,102	29.4%	$4,922,319,612	$3,113,957,340	$8,036,276,952	33.0%
Thousand Oaks	17,407	58,118	45.8%	$8,260,681,793	$5,081,079,764	$13,341,761,557	43.7%
Unincorporated	17,660	37,699	40.1%	$6,420,219,970	$4,228,896,068	$10,649,116,038	36.5%
Total	**58,678**	**175,759**	**20.8%**	**$24,250,894,229**	**$15,324,915,299**	**$39,575,809,528**	**21.9%**

Jurisdiction	High Wildfire Severity Zone (3)						
	Estimated Exposure						
	Estimated Buildings Exposed (2)	Population Exposed (4)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value
Camarillo	0	0	0.0%	$0	$0	$0	0.0%
Fillmore	0	0	0.0%	$0	$0	$0	0.0%
Moorpark	0	0	0.0%	$0	$0	$0	0.0%
Ojai	0	0	0.0%	$0	$0	$0	0.0%
Oxnard	0	0	0.0%	$0	$0	$0	0.0%
Port Hueneme	0	0	0.0%	$0	$0	$0	0.0%
San Buenaventura	0	0	0.0%	$0	$0	$0	0.0%
Santa Paula	0	0	0.0%	$0	$0	$0	0.0%
Simi Valley	0	0	0.0%	$0	$0	$0	0.0%
Thousand Oaks	25	0	0.0%	$12,204,790	$12,204,790	$24,409,581	0.1%
Unincorporated	2,847	4,188	4.5%	$942,999,892	$713,358,653	$1,656,358,545	5.7%
Total	**2,872**	**4,188**	**0.5%**	**$955,204,682**	**$725,563,443**	**$1,680,768,126**	**0.9%**

Jurisdiction	Moderate Wildfire Severity Zone (3)						
	Estimated Exposure						
	Estimated Buildings Exposed (2)	Population Exposed (4)	% of Population Exposed	Value Structure in $ Exposed (2)	Value Contents in $ Exposed (2)	Value (Structure and contents in $) Exposed (2)	% of Total Value
Camarillo	1	0	0.0%	$2,956,756	$2,956,756	$5,913,513	0.0%
Fillmore	28	107	0.6%	$11,077,799	$5,538,900	$16,616,699	0.7%
Moorpark	0	0	0.0%	$0	$0	$0	0.0%
Ojai	0	0	0.0%	$0	$0	$0	0.0%
Oxnard	0	0	0.0%	$0	$0	$0	0.0%
Port Hueneme	0	0	0.0%	$0	$0	$0	0.0%
San Buenaventura	0	0	0.0%	$0	$0	$0	0.0%
Santa Paula	45	140	0.5%	$8,041,685	$4,930,717	$12,972,401	0.3%
Simi Valley	0	0	0.0%	$0	$0	$0	0.0%
Thousand Oaks	0	0	0.0%	$0	$0	$0	0.0%
Unincorporated	4,574	5,854	6.2%	$1,422,824,222	$1,085,736,342	$2,508,560,564	8.6%
Total	**4,648**	**6,101**	**0.7%**	**$1,444,900,462**	**$1,099,162,715**	**$2,544,063,177**	**1.4%**

Jurisdiction	Number of Structures in Category Very High (2)							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	1,201	38	2	0	0	0	0	1,241
Fillmore	547	38	2	1	0	2	0	590
Moorpark	5,061	190	67	101	2	18	77	5,516
Ojai	316	16	0	9	0	0	0	341
Oxnard	0	0	0	0	0	0	0	0
Port Hueneme	0	0	0	0	0	0	0	0
San Buenaventura	4,054	287	38	8	22	34	39	4,482
Santa Paula	513	11	0	0	0	6	0	530
Simi Valley	10,465	248	75	56	6	25	36	10,911
Thousand Oaks	16,638	378	125	7	76	88	95	17,407
Unincorporated	13,061	1,068	182	2,740	315	70	224	17,660
Total	**51,856**	**2,274**	**491**	**2,922**	**421**	**243**	**471**	**58,678**

Jurisdiction	Number of Structures in Category High (2)							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo								0
Fillmore								0
Moorpark								0
Ojai								0
Oxnard								0
Port Hueneme								0
San Buenaventura								0
Santa Paula								0
Simi Valley								0
Thousand Oaks	0	0	0	0	0	25	0	25
Unincorporated	1,451	178	0	1,141	28	31	18	2,847
Total	**1,451**	**178**	**0**	**1,141**	**28**	**56**	**18**	**2,872**

Jurisdiction	Number of Structures in Category Moderate (2)							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camarillo	0	0	0	0	0	1	0	1
Fillmore	28	0	0	0	0	0	0	28
Moorpark	0	0	0	0	0	0	0	0
Ojai	0	0	0	0	0	0	0	0
Oxnard	0	0	0	0	0	0	0	0
Port Hueneme	0	0	0	0	0	0	0	0
San Buenaventura	0	0	0	0	0	0	0	0
Santa Paula	33	11	0	1	0	0	0	45
Simi Valley	0	0	0	0	0	0	0	0
Thousand Oaks	0	0	0	0	0	0	0	0
Unincorporated	2,028	270	12	2,132	59	63	10	4,574
Total	**2,089**	**281**	**12**	**2,133**	**59**	**64**	**10**	**4,648**

Appendix D.2

Exposure of Critical Facilities

Dam Failure - Combined Dams

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	1	1	7	9	0	3	7	**28**
Fillmore	1		2	0	0	2	2	**7**
Moorpark	5	1	0	8	0	6	2	**22**
Ojai	0	0	1	0	0	2	0	**3**
Oxnard	23	27	9	16	2	46	28	**151**
Port Hueneme	7	2	1	2	0	7	7	**26**
San Buenaventura	0	2	1	0	0	0	3	**6**
Santa Paula	5	1	3	2	0	8	20	**39**
Simi Valley	2	1	0	7	0	3	13	**26**
Thousand Oaks	4	1	2	0	0	1	6	**14**
Unincorporated	6	5	15	4	0	12	42	**84**
Total	**54**	**41**	**41**	**48**	**2**	**90**	**130**	**406**

NEHRP Soils - D & E Soils

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	16	3	29	13	1	26	27	**115**
Fillmore	3	1	4	1	0	10	3	**22**
Moorpark	5	1	3	9	0	10	7	**35**
Ojai	4	1	11	0	0	10	1	**27**
Oxnard	24	30	9	22	2	59	33	**179**
Port Hueneme	7	2	1	2	0	7	8	**27**
San Buenaventura	32	9	5	6	3	53	63	**171**
Santa Paula	5	1	3	3	0	14	20	**46**
Simi Valley	18	4	4	13	1	45	62	**147**
Thousand Oaks	28	3	5	3	0	7	34	**80**
Unincorporated	9	16	46	6	0	36	188	**301**
Total	**151**	**71**	**120**	**78**	**7**	**277**	**446**	**1,150**

Flood 100-yr

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	4	1	1	3	0	0	11	**20**
Fillmore	0	0	0	0	0	0	0	**0**
Moorpark	0	0	1	0	0	0	1	**2**
Ojai	0	0	8	0	0	0	2	**10**
Oxnard	0	0	0	0	0	0	1	**1**
Port Hueneme	4	0	0	0	0	0	4	**8**
San Buenaventura	0	0	0	0	0	0	10	**10**
Santa Paula	0	1	1	1	0	4	4	**11**
Simi Valley	9	0	0	7	0	5	31	**52**
Thousand Oaks	1	1	1	0	0	1	4	**8**
Unincorporated	5	2	10	0	0	3	91	**111**
Total	**23**	**5**	**22**	**11**	**0**	**13**	**159**	**233**

Flood 500-yr

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	13	3	18	10	0	19	20	**83**
Fillmore	0	0	0	0	0	0	2	**2**
Moorpark	4	1	1	5	0	7	3	**21**
Ojai	0	1	9	0	0	4	2	**16**
Oxnard	5	13	4	9	0	12	19	**62**
Port Hueneme	7	2	1	2	0	6	8	**26**
San Buenaventura	3	1	0	1	0	1	12	**18**
Santa Paula	3	1	1	1	0	9	5	**20**
Simi Valley	9	0	0	8	0	10	34	**61**
Thousand Oaks	2	1	1	0	0	1	5	**10**
Unincorporated	6	8	20	1	0	9	103	**147**
Total	**52**	**31**	**55**	**37**	**0**	**78**	**213**	**466**

Landslide Susceptibility - Very High & High Categories

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	1	1	3	1	0	2	3	**11**
Fillmore	0	0	0	0	0	1	0	**1**
Moorpark	0	0	4	2	0	3	4	**13**
Ojai	0	0	3	0	0	0	1	**4**
Oxnard	0	1	0	0	0	0	1	**2**
Port Hueneme	0	0	0	0	0	0	0	**0**
San Buenaventura	4	1	1	0	0	8	6	**20**
Santa Paula	0	0	0	0	1	4	1	**6**
Simi Valley	0	0	0	3	0	7	22	**32**
Thousand Oaks	5	3	10	2	0	18	20	**58**
Unincorporated	28	21	48	1	0	14	82	**194**
Total	**38**	**27**	**69**	**9**	**1**	**57**	**140**	**341**

Sea Level Rise 25cm

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	0	0	0	0	0	0	0	**0**
Fillmore	0	0	0	0	0	0	0	**0**
Moorpark	0	0	0	0	0	0	0	**0**
Ojai	0	0	0	0	0	0	0	**0**
Oxnard	0	0	0	0	0	0	0	**0**
Port Hueneme	0	0	0	0	0	0	1	**1**
San Buenaventura	0	0	0	0	0	0	0	**0**
Santa Paula	0	0	0	0	0	0	0	**0**
Simi Valley	0	0	0	0	0	0	0	**0**
Thousand Oaks	0	0	0	0	0	0	0	**0**
Unincorporated	0	0	0	0	0	0	0	**0**
Total	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**

Sea Level Rise 100cm

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	0	0	0	0	0	0	0	**0**
Fillmore	0	0	0	0	0	0	0	**0**
Moorpark	0	0	0	0	0	0	0	**0**
Ojai	0	0	0	0	0	0	0	**0**
Oxnard	0	0	0	0	0	0	1	**1**
Port Hueneme	0	0	0	0	0	0	1	**1**
San Buenaventura	0	0	0	0	0	0	0	**0**
Santa Paula	0	0	0	0	0	0	0	**0**
Simi Valley	0	0	0	0	0	0	0	**0**
Thousand Oaks	0	0	0	0	0	0	0	**0**
Unincorporated	0	0	0	1	0	0	2	**3**
Total	**0**	**0**	**0**	**1**	**0**	**0**	**4**	**5**

Tsunami Inundation Zones

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	0	0	0	0	0	0	0	**0**
Fillmore	0	0	0	0	0	0	0	**0**
Moorpark	0	0	0	0	0	0	0	**0**
Ojai	0	0	0	0	0	0	0	**0**
Oxnard	2	1	0	0	0	1	3	**7**
Port Hueneme	2	0	0	0	0	0	2	**4**
San Buenaventura	0	0	2	0	0	1	1	**4**
Santa Paula	0	0	0	0	0	0	0	**0**
Simi Valley	0	0	0	0	0	0	0	**0**
Thousand Oaks	0	0	0	0	0	0	0	**0**
Unincorporated	0	0	5	0	0	1	1	**7**
Total	**4**	**1**	**7**	**0**	**0**	**3**	**7**	**22**

Wildfire - Very High & High Severity Zones

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Camarillo	0	0	1	0	0	0	4	**5**
Fillmore	0	1	0	0	0	0	0	**1**
Moorpark	1	1	6	4	0	9	8	**29**
Ojai	0	0	4	0	0	0	0	**4**
Oxnard	0	0	0	0	0	0	0	**0**
Port Hueneme	0	0	0	0	0	0	0	**0**
San Buenaventura	2	1	1	0	0	2	4	**10**
Santa Paula	0	0	0	0	1	1	0	**2**
Simi Valley	2	0	1	5	1	4	24	**37**
Thousand Oaks	10	2	14	2	0	16	17	**61**
Unincorporated	57	31	41	3	0	31	74	**237**
Total	**72**	**36**	**68**	**14**	**2**	**63**	**131**	**386**

Appendix D.3

Risk Ranking

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	Medium	2	14.30%	Medium	2	6
Fillmore	Medium	2	48.00%	High	3	9
Moorpark	Medium	2	20.50%	Medium	2	6
Ojai	Medium	2	9.56%	Low	1	3
Oxnard	Medium	2	83.62%	High	3	9
Port Hueneme	Medium	2	88.23%	High	3	9
San Buenaventura	Medium	2	4.45%	Low	1	3
Santa Paula	Medium	2	40.16%	High	3	9
Simi Valley	Medium	2	11.87%	Medium	2	6
Thousand Oaks	Medium	2	2.86%	Low	1	3
Unincorporated	Medium	2	17.84%	Medium	2	6
Total	Medium	2	31.66%	High	3	9

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	19.99%	Medium	2	4	0.18%	Low	1	1	**22**	**Medium**
Fillmore	42.03%	High	3	6	26.60%	High	3	3	**36**	**High**
Moorpark	31.95%	High	3	6	2.13%	Low	1	1	**26**	**Medium**
Ojai	7.12%	Low	1	2	1.05%	Low	1	1	**12**	**Low**
Oxnard	79.67%	High	3	6	22.62%	High	3	3	**36**	**High**
Port Hueneme	81.33%	High	3	6	24.21%	High	3	3	**36**	**High**
San Buenaventura	6.78%	Low	1	2	2.30%	Low	1	1	**12**	**Low**
Santa Paula	56.24%	High	3	6	36.47%	High	3	3	**36**	**High**
Simi Valley	12.77%	Medium	2	4	2.24%	Low	1	1	**22**	**Medium**
Thousand Oaks	2.50%	Low	1	2	0.81%	Low	1	1	**12**	**Low**
Unincorporated	20.65%	Medium	2	4	8.42%	Medium	2	2	**24**	**Medium**
Total	28.46%	High	3	6	8.26%	Medium	2	2	**34**	**High**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	Low	1	100.00%	High	3	9
Fillmore	Low	1	100.00%	High	3	9
Moorpark	Low	1	100.00%	High	3	9
Ojai	Low	1	100.00%	High	3	9
Oxnard	Low	1	100.00%	High	3	9
Port Hueneme	Low	1	100.00%	High	3	9
San Buenaventura	Low	1	100.00%	High	3	9
Santa Paula	Low	1	100.00%	High	3	9
Simi Valley	Low	1	100.00%	High	3	9
Thousand Oaks	Low	1	100.00%	High	3	9
Unincorporated	Low	1	100.00%	High	3	9
TOTAL	Low	1	100.00%	High	3	9

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	100.00%	High	3	6	10.27%	High	3	3	**18**	**Medium**
Fillmore	100.00%	High	3	6	18.22%	High	3	3	**18**	**Medium**
Moorpark	100.00%	High	3	6	11.58%	High	3	3	**18**	**Medium**
Ojai	100.00%	High	3	6	2.09%	Low	1	1	**16**	**Medium**
Oxnard	100.00%	High	3	6	18.11%	High	3	3	**18**	**Medium**
Port Hueneme	100.00%	High	3	6	22.51%	High	3	3	**18**	**Medium**
San Buenaventura	100.00%	High	3	6	15.47%	High	3	3	**18**	**Medium**
Santa Paula	100.00%	High	3	6	18.91%	High	3	3	**18**	**Medium**
Simi Valley	100.00%	High	3	6	9.48%	Medium	2	2	**17**	**Medium**
Thousand Oaks	100.00%	High	3	6	4.46%	Low	1	1	**16**	**Medium**
Unincorporated	100.00%	High	3	6	10.35%	High	3	3	**18**	**Medium**
TOTAL	100.00%	High	3	6	11.90%	High	3	3	**18**	**Medium**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	Low	1	100.00%	High	3	9
Fillmore	Low	1	100.00%	High	3	9
Moorpark	Low	1	100.00%	High	3	9
Ojai	Low	1	100.00%	High	3	9
Oxnard	Low	1	100.00%	High	3	9
Port Hueneme	Low	1	100.00%	High	3	9
San Buenaventura	Low	1	100.00%	High	3	9
Santa Paula	Low	1	100.00%	High	3	9
Simi Valley	Low	1	100.00%	High	3	9
Thousand Oaks	Low	1	100.00%	High	3	9
Unincorporated	Low	1	100.00%	High	3	9
TOTAL	Low	1	100.00%	High	3	9

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	100.00%	High	3	6	2.79%	Low	1	1	**16**	**Medium**
Fillmore	100.00%	High	3	6	18.36%	High	3	3	**18**	**Medium**
Moorpark	100.00%	High	3	6	6.93%	Medium	2	2	**17**	**Medium**
Ojai	100.00%	High	3	6	6.89%	Medium	2	2	**17**	**Medium**
Oxnard	100.00%	High	3	6	3.80%	Low	1	1	**16**	**Medium**
Port Hueneme	100.00%	High	3	6	3.50%	Low	1	1	**16**	**Medium**
San Buenaventura	100.00%	High	3	6	4.39%	Low	1	1	**16**	**Medium**
Santa Paula	100.00%	High	3	6	9.74%	Medium	2	2	**17**	**Medium**
Simi Valley	100.00%	High	3	6	4.72%	Low	1	1	**16**	**Medium**
Thousand Oaks	100.00%	High	3	6	1.72%	Low	1	1	**16**	**Medium**
Unincorporated	100.00%	High	3	6	5.28%	Medium	2	2	**17**	**Medium**
TOTAL	100.00%	High	3	6	4.31%	Low	1	1	**16**	**Medium**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	Medium	2	100.00%	High	3	9
Fillmore	Medium	2	100.00%	High	3	9
Moorpark	Medium	2	100.00%	High	3	9
Ojai	Medium	2	100.00%	High	3	9
Oxnard	Medium	2	100.00%	High	3	9
Port Hueneme	Medium	2	100.00%	High	3	9
San Buenaventura	Medium	2	100.00%	High	3	9
Santa Paula	Medium	2	100.00%	High	3	9
Simi Valley	Medium	2	100.00%	High	3	9
Thousand Oaks	Medium	2	100.00%	High	3	9
Unincorporated	Medium	2	100.00%	High	3	9
TOTAL	Medium	2	100.00%	High	3	9

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	100.00%	High	3	6	0.62%	Low	1	1	**32**	**Medium**
Fillmore	100.00%	High	3	6	3.99%	Low	1	1	**32**	**Medium**
Moorpark	100.00%	High	3	6	1.98%	Low	1	1	**32**	**Medium**
Ojai	100.00%	High	3	6	1.20%	Low	1	1	**32**	**Medium**
Oxnard	100.00%	High	3	6	0.53%	Low	1	1	**32**	**Medium**
Port Hueneme	100.00%	High	3	6	0.86%	Low	1	1	**32**	**Medium**
San Buenaventura	100.00%	High	3	6	0.99%	Low	1	1	**32**	**Medium**
Santa Paula	100.00%	High	3	6	2.33%	Low	1	1	**32**	**Medium**
Simi Valley	100.00%	High	3	6	1.70%	Low	1	1	**32**	**Medium**
Thousand Oaks	100.00%	High	3	6	0.60%	Low	1	1	**32**	**Medium**
Unincorporated	100.00%	High	3	6	1.55%	Low	1	1	**32**	**Medium**
TOTAL	100.00%	High	3	6	1.11%	Low	1	1	**32**	**Medium**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	Low	1	100.00%	High	3	9
Fillmore	Low	1	100.00%	High	3	9
Moorpark	Low	1	100.00%	High	3	9
Ojai	Low	1	100.00%	High	3	9
Oxnard	Low	1	100.00%	High	3	9
Port Hueneme	Low	1	100.00%	High	3	9
San Buenaventura	Low	1	100.00%	High	3	9
Santa Paula	Low	1	100.00%	High	3	9
Simi Valley	Low	1	100.00%	High	3	9
Thousand Oaks	Low	1	100.00%	High	3	9
Unincorporated	Low	1	100.00%	High	3	9
TOTAL	Low	1	100.00%	High	3	9

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	100.00%	High	3	6	5.14%	Medium	2	2	**17**	**Medium**
Fillmore	100.00%	High	3	6	13.80%	High	3	3	**18**	**Medium**
Moorpark	100.00%	High	3	6	5.18%	Medium	2	2	**17**	**Medium**
Ojai	100.00%	High	3	6	4.07%	Low	1	1	**16**	**Medium**
Oxnard	100.00%	High	3	6	12.37%	High	3	3	**18**	**Medium**
Port Hueneme	100.00%	High	3	6	12.17%	High	3	3	**18**	**Medium**
San Buenaventura	100.00%	High	3	6	17.38%	High	3	3	**18**	**Medium**
Santa Paula	100.00%	High	3	6	17.71%	High	3	3	**18**	**Medium**
Simi Valley	100.00%	High	3	6	1.74%	Low	1	1	**16**	**Medium**
Thousand Oaks	100.00%	High	3	6	1.50%	Low	1	1	**16**	**Medium**
Unincorporated	100.00%	High	3	6	7.94%	Medium	2	2	**17**	**Medium**
TOTAL	100.00%	High	3	6	8.05%	Medium	2	2	**17**	**Medium**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	Medium	2	100.00%	High	3	9
Fillmore	Medium	2	100.00%	High	3	9
Moorpark	Medium	2	100.00%	High	3	9
Ojai	Medium	2	100.00%	High	3	9
Oxnard	Medium	2	100.00%	High	3	9
Port Hueneme	Medium	2	100.00%	High	3	9
San Buenaventura	Medium	2	100.00%	High	3	9
Santa Paula	Medium	2	100.00%	High	3	9
Simi Valley	Medium	2	100.00%	High	3	9
Thousand Oaks	Medium	2	100.00%	High	3	9
Unincorporated	Medium	2	100.00%	High	3	9
TOTAL	Medium	2	100.00%	High	3	9

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	100.00%	High	3	6	2.73%	Low	1	1	**32**	**Medium**
Fillmore	100.00%	High	3	6	5.48%	Medium	2	2	**34**	**High**
Moorpark	100.00%	High	3	6	4.54%	Low	1	1	**32**	**Medium**
Ojai	100.00%	High	3	6	1.33%	Low	1	1	**32**	**Medium**
Oxnard	100.00%	High	3	6	7.49%	Medium	2	2	**34**	**High**
Port Hueneme	100.00%	High	3	6	7.45%	Medium	2	2	**34**	**High**
San Buenaventura	100.00%	High	3	6	3.84%	Low	1	1	**32**	**Medium**
Santa Paula	100.00%	High	3	6	3.11%	Low	1	1	**32**	**Medium**
Simi Valley	100.00%	High	3	6	4.75%	Low	1	1	**32**	**Medium**
Thousand Oaks	100.00%	High	3	6	2.37%	Low	1	1	**32**	**Medium**
Unincorporated	100.00%	High	3	6	4.15%	Low	1	1	**32**	**Medium**
TOTAL	100.00%	High	3	6	4.42%	Low	1	1	**32**	**Medium**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	High	3	5.76%	Low	1	3
Fillmore	High	3	2.60%	Low	1	3
Moorpark	High	3	1.90%	Low	1	3
Ojai	High	3	1.99%	Low	1	3
Oxnard	High	3	0.42%	Low	1	3
Port Hueneme	High	3	0.02%	Low	1	3
San Buenaventura	High	3	0.32%	Low	1	3
Santa Paula	High	3	30.97%	High	3	9
Simi Valley	High	3	8.42%	Low	1	3
Thousand Oaks	High	3	0.89%	Low	1	3
Unincorporated	High	3	5.74%	Low	1	3
Total	High	3	3.93%	Low	1	3

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	9.37%	Low	1	2	0.19%	Low	1	1	**18**	**Medium**
Fillmore	2.86%	Low	1	2	0.15%	Low	1	1	**18**	**Medium**
Moorpark	4.31%	Low	1	2	0.43%	Low	1	1	**18**	**Medium**
Ojai	2.43%	Low	1	2	0.03%	Low	1	1	**18**	**Medium**
Oxnard	0.93%	Low	1	2	0.03%	Low	1	1	**18**	**Medium**
Port Hueneme	0.25%	Low	1	2	0.00%	None	0	0	**15**	**Low**
San Buenaventura	1.62%	Low	1	2	0.17%	Low	1	1	**18**	**Medium**
Santa Paula	34.35%	High	3	6	2.85%	Low	1	1	**48**	**High**
Simi Valley	12.12%	Medium	2	4	1.01%	Low	1	1	**24**	**Medium**
Thousand Oaks	1.59%	Low	1	2	0.14%	Low	1	1	**18**	**Medium**
Unincorporated	7.20%	Low	1	2	0.70%	Low	1	1	**18**	**Medium**
Total	5.50%	Low	1	2	0.41%	Low	1	1	**18**	**Medium**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	Medium	2	34.53%	High	3	9
Fillmore	Medium	2	6.08%	Low	1	3
Moorpark	Medium	2	20.60%	Medium	2	6
Ojai	Medium	2	28.07%	High	3	9
Oxnard	Medium	2	35.68%	High	3	9
Port Hueneme	Medium	2	95.00%	High	3	9
San Buenaventura	Medium	2	3.58%	Low	1	3
Santa Paula	Medium	2	54.61%	High	3	9
Simi Valley	Medium	2	10.63%	Medium	2	6
Thousand Oaks	Medium	2	1.61%	Low	1	3
Unincorporated	Medium	2	17.65%	Medium	2	6
Total	Medium	2	21.42%	Medium	2	6

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	44.55%	High	3	6	5.27%	Medium	2	2	**34**	**High**
Fillmore	5.32%	Low	1	2	0.25%	Low	1	1	**12**	**Low**
Moorpark	31.01%	High	3	6	5.41%	Medium	2	2	**28**	**Medium**
Ojai	22.78%	Medium	2	4	4.77%	Low	1	1	**28**	**Medium**
Oxnard	34.42%	High	3	6	1.78%	Low	1	1	**32**	**Medium**
Port Hueneme	97.70%	High	3	6	33.68%	High	3	3	**36**	**High**
San Buenaventura	9.00%	Low	1	2	1.52%	Low	1	1	**12**	**Low**
Santa Paula	60.16%	High	3	6	1.41%	Low	1	1	**32**	**Medium**
Simi Valley	17.69%	Medium	2	4	2.20%	Low	1	1	**22**	**Medium**
Thousand Oaks	2.36%	Low	1	2	0.19%	Low	1	1	**12**	**Low**
Unincorporated	20.03%	Medium	2	4	3.62%	Low	1	1	**22**	**Medium**
Total	23.64%	Medium	2	4	3.17%	Low	1	1	**22**	**Medium**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	High	3	1.55%	Low	1	3
Fillmore	High	3	0.35%	Low	1	3
Moorpark	High	3	1.63%	Low	1	3
Ojai	High	3	0.21%	Low	1	3
Oxnard	High	3	0.00%	None	0	0
Port Hueneme	High	3	0.00%	None	0	0
San Buenaventura	High	3	3.83%	Low	1	3
Santa Paula	High	3	1.04%	Low	1	3
Simi Valley	High	3	0.57%	Low	1	3
Thousand Oaks	High	3	2.17%	Low	1	3
Unincorporated	High	3	2.88%	Low	1	3
Total	High	3	1.48%	Low	1	3

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	1.26%	Low	1	2	0.31%	Low	1	1	**18**	**Medium**
Fillmore	0.49%	Low	1	2	0.12%	Low	1	1	**18**	**Medium**
Moorpark	2.28%	Low	1	2	0.57%	Low	1	1	**18**	**Medium**
Ojai	0.39%	Low	1	2	0.10%	Low	1	1	**18**	**Medium**
Oxnard	0.01%	Low	1	2	0.00%	None	0	0	**6**	**Low**
Port Hueneme	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
San Buenaventura	2.67%	Low	1	2	0.67%	Low	1	1	**18**	**Medium**
Santa Paula	0.92%	Low	1	2	0.23%	Low	1	1	**18**	**Medium**
Simi Valley	1.07%	Low	1	2	0.27%	Low	1	1	**18**	**Medium**
Thousand Oaks	1.96%	Low	1	2	0.49%	Low	1	1	**18**	**Medium**
Unincorporated	3.27%	Low	1	2	0.82%	Low	1	1	**18**	**Medium**
Total	1.62%	Low	1	2	0.40%	Low	1	1	**18**	**Medium**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	High	3	0.00%	None	0	0
Fillmore	High	3	0.00%	None	0	0
Moorpark	High	3	0.00%	None	0	0
Ojai	High	3	0.00%	None	0	0
Oxnard	High	3	0.01%	Low	1	3
Port Hueneme	High	3	0.00%	None	0	0
San Buenaventura	High	3	0.00%	None	0	0
Santa Paula	High	3	0.00%	None	0	0
Simi Valley	High	3	0.00%	None	0	0
Thousand Oaks	High	3	0.00%	None	0	0
Unincorporated	High	3	0.01%	None	0	0
Total	High	3	0.00%	None	0	0

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	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	0.00%	None	0	0	0.00%	None	0	0	0	Low
Fillmore	0.00%	None	0	0	0.00%	None	0	0	0	Low
Moorpark	0.00%	None	0	0	0.00%	None	0	0	0	Low
Ojai	0.00%	None	0	0	0.00%	None	0	0	0	Low
Oxnard	0.01%	Low	1	2	0.01%	Low	1	1	18	Medium
Port Hueneme	0.00%	None	0	0	0.00%	None	0	0	0	Low
San Buenaventura	0.11%	Low	1	2	0.11%	Low	1	1	9	Low
Santa Paula	0.00%	None	0	0	0.00%	None	0	0	0	Low
Simi Valley	0.00%	None	0	0	0.00%	None	0	0	0	Low
Thousand Oaks	0.00%	None	0	0	0.00%	None	0	0	0	Low
Unincorporated	0.00%	None	0	0	0.00%	None	0	0	0	Low
Total	0.02%	Low	1	2	0.02%	Low	1	1	9	Low

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	Medium	2	0.00%	None	0	0
Fillmore	Medium	2	0.00%	None	0	0
Moorpark	Medium	2	0.00%	None	0	0
Ojai	Medium	2	0.00%	None	0	0
Oxnard	Medium	2	0.16%	Low	1	3
Port Hueneme	Medium	2	0.00%	None	0	0
San Buenaventura	Medium	2	0.02%	Low	1	3
Santa Paula	Medium	2	0.00%	None	0	0
Simi Valley	Medium	2	0.00%	None	0	0
Thousand Oaks	Medium	2	0.00%	None	0	0
Unincorporated	Medium	2	0.24%	Low	1	3
Total	Medium	2	0.07%	Low	1	3

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Fillmore	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Moorpark	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Ojai	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Oxnard	0.10%	Low	1	2	0.10%	Low	1	1	**12**	**Low**
Port Hueneme	1.80%	Low	1	2	1.80%	Low	1	1	**6**	**Low**
San Buenaventura	0.14%	Low	1	2	0.14%	Low	1	1	**12**	**Low**
Santa Paula	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Simi Valley	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Thousand Oaks	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Unincorporated	0.39%	Low	1	2	0.39%	Low	1	1	**12**	**Low**
Total	0.15%	Low	1	2	0.15%	Low	1	1	**12**	**Low**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	Probability Factor (3,2,1,0)	% Population Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor
Camarillo	Medium	2	0.00%	None	0	0
Fillmore	Medium	2	0.00%	None	0	0
Moorpark	Medium	2	0.00%	None	0	0
Ojai	Medium	2	0.00%	None	0	0
Oxnard	Medium	2	8.59%	Low	1	3
Port Hueneme	Medium	2	0.36%	Low	1	3
San Buenaventura	Medium	2	3.92%	Low	1	3
Santa Paula	Medium	2	0.00%	None	0	0
Simi Valley	Medium	2	0.00%	None	0	0
Thousand Oaks	Medium	2	0.00%	None	0	0
Unincorporated	Medium	2	6.22%	Low	1	3
Total	Medium	2	3.27%	Low	1	3

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Fillmore	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Moorpark	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Ojai	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Oxnard	6.46%	Low	1	2	0.14%	Low	1	1	**12**	**Low**
Port Hueneme	12.28%	Medium	2	4	0.00%	None	0	0	**14**	**Low**
San Buenaventura	3.10%	Low	1	2	0.00%	None	0	0	**10**	**Low**
Santa Paula	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Simi Valley	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Thousand Oaks	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Unincorporated	3.18%	Low	1	2	0.01%	None	0	0	**10**	**Low**
Total	2.41%	Low	1	2	0.03%	Low	1	1	**12**	**Low**

	Probability		Impact on People			
	Probability (High, Medium, Low, None)	**Probability Factor (3,2,1,0)**	**% Population Exposed**	**Impact (High, Medium, Low, None)**	**Impact Factor**	**Weighted Impact Factor**
Camarillo	Medium	2	6.11%	Low	1	3
Fillmore	Medium	2	12.69%	Medium	2	6
Moorpark	Medium	2	51.81%	High	3	9
Ojai	Medium	2	10.83%	Medium	2	6
Oxnard	Medium	2	0.00%	None	0	0
Port Hueneme	Medium	2	0.00%	None	0	0
San Buenaventura	Medium	2	13.21%	Medium	2	6
Santa Paula	Medium	2	7.11%	Low	1	3
Simi Valley	Medium	2	29.36%	High	3	9
Thousand Oaks	Medium	2	45.77%	High	3	9
Unincorporated	Medium	2	44.56%	High	3	9
Total	Medium	2	21.32%	Medium	2	6

	Impact on Property				Impact on Economy					
	% of Total Value Exposed	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	% of Total Value Damaged	Impact (High, Medium, Low, None)	Impact Factor	Weighted Impact Factor	Risk Ranking Score	Hazard Risk Rating
Camarillo	3.76%	Low	1	2	0.94%	Low	1	1	**12**	**Low**
Fillmore	8.47%	Low	1	2	2.12%	Low	1	1	**18**	**Medium**
Moorpark	49.13%	High	3	6	24.56%	High	3	3	**36**	**High**
Ojai	6.79%	Low	1	2	1.70%	Low	1	1	**18**	**Medium**
Oxnard	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
Port Hueneme	0.00%	None	0	0	0.00%	None	0	0	**0**	**Low**
San Buenaventura	9.28%	Low	1	2	2.32%	Low	1	1	**18**	**Medium**
Santa Paula	5.74%	Low	1	2	1.44%	Low	1	1	**12**	**Low**
Simi Valley	33.03%	High	3	6	16.52%	High	3	3	**36**	**High**
Thousand Oaks	43.74%	High	3	6	21.87%	High	3	3	**36**	**High**
Unincorporated	42.20%	High	3	6	21.10%	High	3	3	**36**	**High**
Total	22.82%	Medium	2	4	5.71%	Medium	2	2	**24**	**Medium**

Appendix E. Summary of Peak Discharges for the Planning Area

E. Summary of Peak Discharges for the Planning Area

Table E-1. Summary of Peak Discharges in Ventura County Waterways

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Adams Canyon Creek					
At Telegraph Road	8.40	1,200	3,100	4,200	7,400
Alamos Canyon Creek					
At Southern Pacific Railroad	6.00	*	*	3,800	*
Arroyo Las Posas					
Upstream of confluence of Peach Hill Wash	117.4	8,260	17,120	22,090	36,520
Downstream of confluence of Long Canyon Creek	143.4	9,390	19,460	25,100	41,500
Arroyo Santa Rosa					
Upstream of confluence with Arroyo Conejo	14.35	1,970	3,770	4,740	7,510
At confluence of Arroyo Santa Rosa Tributary	13.04	1,980	3,800	4,770	7,570
At East Las Posas Road	8.33	1,861	3,561	4,473	7,099
At Santa Rosa Road	8.61	1,770	2,610	2,830	3,650
Downstream of Duval Road	9.29	1,750	2,580	2,790	3,580
Arroyo Santa Rosa Tributary					
Upstream of confluence with Arroyo Santa Rosa	3.75	950	2,590	3,700	6,720
At Vista Arroyo Drive3.75950Upstream of confluence with Arroyo Santa Rosa1.73550At Vista Arroyo Drive Upstream of confluence with Arroyo Santa Rosa	1.73	550	1,060	1,330	2,110
Arroyo Simi					
Downstream of confluence with Happy Camp Canyon Creek	113.20	8,300	17,200	22,190	36,670
Downstream of Alamos Canyon	88.70	5,670	13,060	17,460	31,200
Downstream of North Simi Canyon	69.50	5,600	12,890	17,240	30,810
Upstream of Bus Canyon Drain	61.50	5,110	11,950	15,900	28,580
Upstream of Tapo Canyon Channel	32.30	4,440	10,220	13,670	24,420
Downstream of Meier Canyon	30.90	4,460	10,270	13,730	24,540
Upstream of Las Llajas Canyon Channel	10.40	2,410	5,540	7,400	13,230
Upstream of White Oak Canyon	2.70	1,000	2,300	3,080	5,500
Arundell Barranca					
At U.S. Highway 101	9.24	1,360	4,420	6,200	11,500
Barlow Barranca					
At U.S. Highway 101	2.13	380	1,250	1,700	3,200

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Beardsley Wash					
At Ventura Freeway[a]	15.00	2,100	4,600	6,200	11,000
Upstream of Wright Road	14.00	2,300	5,000	6,800	12,000
Bell Canyon Creek					
Upstream of Ventura/Los Angeles County boundary (approximately 1,860 feet downstream of East Bell Canyon Road)	5.13	700	2,340	3,300	6,200
Upstream of elevation 1,128 feet (approximately 2,150 feet downstream of North Buckskin Road)	3.32	490	1,650	2,300	4,300
Brea Canyon Creek					
At confluence with Arroyo Simi	2.10	*	*	1,250	*
Brown Barranca					
At confluence with Santa Clara River	3.49	600	1,930	2,660	5,000
Upstream of Telegraph Road Upstream of Telegraph Road	1.81	325	1,050	1,450	2,700
Bus Canyon Drain					
At confluence with Arroyo Simi	5.10	*	*	3,050	*
Above confluence of Bus Canyon Drain Tributary	3.70	*	*	2,800	*
Bus Canyon Drain Tributary					
At First Street	1.10	*	*	1,300	*
At Fitzgerald Road	0.80	*	*	1,050	*
Calleguas Creek					
At Highway 1[b]	262.00	12,230	28,140	37,630	67,240
Downstream of confluence of Conejo Creek	248.30	16,000	30,610	38,460	61,030
Upstream of Conejo Creek & Lewis Drain	168.70	10,390	21,520	27,770	45,900
At Seminary Road	164.90	10,350	21,450	27,680	45,760
Camarillo Hills Drain					
Upstream of confluence with Revolon Slough	8.1	1,720	3,564	3,564	7,620
Upstream of confluence of Las Posas Estates Drain1	7.5	1,670	3,336	3,336	7,440
Downstream of confluence of Crestview Drain	5.55	1,780	3,640	4,790	7,920
At Ventura Freeway	*	*	*	3,220	*
At Lantana Street	*	*	*	2,226	*
At Dunnigan Street	*	*	*	842	*
Downstream of Ponderosa Drive	*	*	*	737	*
Cañada Larga					
At confluence with Ventura River[a]	19.1	5,047	7,801	8,632	12,945
Just downstream of Ojai Freeway[a]	*	5,047	7,975	8,940	15,394
Approximately 450 feet upstream of Ojai Freeway[a]	*	4,917	9,087	11,586	21,266
At Canada Larga Right Overbank[a]	*	4,917	10,145	13,748	26,639
Approximately 1,800 feet upstream of Ojai Freeway	16.2	5,240	14,220	20,004	39,050
Downstream of confluence of Canada de Aliso	13.2	5,110	13,860	19,500	38,060
Downstream of confluence of Conche Creek	8.7	3,350	9,100	12,800	24,990
Downstream of confluence of Sulphur Creek	8.2	3,190	8,649	12,158	23,705

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Cañada Larga Left Overbank					
At confluence with Ventura River[d]	*	0	1,413	2,472	5,938
Approximately 400 feet downstream of Ojai Freeway[d]	*	0	1,562	3,200	8,684
At Norway Drive approximately 540 feet north of East Bounds Road intersection[d]	*	0	1,113	2,647	5,873
Cañada Larga Right Overbank					
At confluence with Ventura River[d]	*	322	4,156	6,616	13,511
At Ojai Freeway and Canada Larga Road[d]	*	324	5,134	8,419	17,785
Conejo Creek					
At confluence with Calleguas Creek	77.60	9,300	17,800	22,300	35,500
At Highway 101 bridge	71.90	9,560	18,300	22,000	36,500
Downstream of confluence of Arroyo Conejo	60.00	9,660	18,500	23,200	36,900
Coyote Creek					
Upstream of confluence with Ventura River	41.10	680	1,980	3,410	4,830
Approximately 570 feet downstream of Casitas Dam Spillway	40.10	671	1,953	3,363	4,766
At Casitas Dam Spillway	38.50	120	370	2,590	3,750
Cozy Del Canyon					
Downstream of confluence with McDonald Canyon Drain[a]	3.4	790	2,066	2,734	4,370
Upstream of confluence with McDonald Canyon Drain[a]	2.4	720	1,886	2,476	3,870
Approximately 705 feet downstream of Maricopa Highway[a]	*	590	1,546	1,998	2,968
Approximately 0.4 mile upstream of Maricopa Highway	2.1	590	1,610	2,262	4,420
Doris Avenue Drain					
At Patterson Road	0.40	50	150	250	750
Approximately 1,000 feet west of Ventura Road	0.10	10	20	50	130
Dry Canyon Drain					
At Heywood Street	3.70	*	*	3,350	*
At Southern Pacific Railroad	2.90	*	*	2,400	*
At Highway 118/Simi Valley Freeway2.20**1,750*At Heywood Street3.70**3,350*At Highway 118/Simi Valley Freeway	2.20	*	*	1,750	*
Edgemore Drain					
Downstream of Getman Street	*	*	*	451	*
Downstream of Aileen Street	*	*	*	366	*
El Rio Drain					
At confluence with Santa Clara River	1.70	90	220	300	800
At Vineyard Avenue	1.60	90	190	250	800
Downstream of Ventura Freeway	1.40	90	160	200	760
Upstream of Ventura Freeway	0.87	170	450	580	1,100
Downstream of Walnut Drive	0.26	70	170	220	400
Erringer Drain					
Upstream of confluence with Arroyo Simi	1.40	*	*	1,420	*
At Arcane Street	1.30	*	*	1,410	*
At Fitzgerald Street	1.20	*	*	1,410	*

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Happy Valley Drain					
Downstream of confluence with McDonald Canyon Drain South	1.55	636	1,126	1,370	2,058
Upstream of confluence with McDonald Canyon Drain South	1.32	608	1,077	1,310	1,968
Downstream of confluence with Happy Valley Drain South	1.23	602	1,067	1,298	1,949
Upstream of confluence with Happy Valley Drain South	1.23	620	1,099	1,337	2,008
Downstream of confluence with Happy Valley Drain Tributary	0.91	477	846	1,029	1,545
Upstream of confluence with Happy Valley Drain Tributary	0.51	318	563	685	949
Downstream of El Roblar Drive	0.44	285	504	613	840
Upstream of El Roblar Drive	0.31	210	372	452	679
Upstream of State Route 33	0.27	183	327	394	679
Happy Valley Drain South					
At confluence with Ventura River	1.1	410	730	890	1,840
Approximately 320 feet upstream of Old Baldwin Road	0.4	188	333	405	1,110
Upstream of confluence of Mira Monte Drain	0.2	166	296	359	1,046
Approximately 0.6 mile upstream of confluence of Mira Monte Drain	0.1	65	111	134	701
Happy Valley Drain Tributary					
Upstream of State Route 33	0.39	27	39	58	88
Downstream of State Route 33	0.13	83	147	178	268
At confluence with Happy Valley Drain	0.04	218	386	470	706
Harmon Barranca					
At confluence with Santa Clara River	5.28	700	2,320	3,270	6,100
Upstream of Telephone Road	4.59	610	2,070	2,900	5,400
Hummingbird Creek					
At Alscot Avenue	1.90	*	*	1,790	*
At Kyehner Drive	1.80	*	*	1,570	*
At Freeway	1.60	*	*	1,480	*
J Street Drain					
At mouth	1.90	200	550	900	3,000
At Pleasant Valley Road	1.70	200	500	850	2,900
At Bard Road	1.50	150	450	750	2,450
At Redwood Street	0.90	100	300	450	1,500
Lang Creek					
Upstream of confluence of Arroyo Conejo	6.80	1,390	2,670	3,350	5,320
Downstream of Wilbur Road	6.00	1,390	2,610	3,280	5,210
Las Llajas Canyon Channel					
At Industrial Street	12.50	*	*	2,800	*
Las Posas Estates Drain					
Upstream of confluence with Camarillo Hills Drive	2.50	380	1,240	1,710	3,200
Northeast of Central Avenue at elevation 103 feet	1.88	310	980	1,360	2,600

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Manuel Canyon					
At confluence with Ventura River[a]	*	520	1,331	1,614	2,925
Approximately 50 feet downstream of Crooked Palm Road[a]	*	520	1,337	1,768	3,379
Approximately 600 feet upstream of North Ventura Avenue	1.04	520	1,400	1,970	3,850
Manuel Canyon Left Overbank					
At confluence with Ventura River[a]	*	0	71	359	929
McDonald Canyon Drain South					
At confluence with McDonald Canyon Drain	0.2	67	119	314	993
Approximately 50 feet downstream of South La Luna Avenue	0.1	47	83	269	927
Approximately 410 feet upstream of West El Roblar Drive	*	20	40	169	775
McNell Creek					
Upstream of confluence with San Antonio Creek	2.2	570	1,540	2,170	4,240
Downstream of confluences of North and South Tributaries	1.1	470	1,270	1,780	3,470
Downstream of Upper McNell Creek South	0.6	220	590	833	1,630
Mills Road Drain					
At U.S. Highway 101	1.30	240	790	1,100	2,000
Mira Monte Drain					
At confluence with Happy Valley Drain South	0.7	180	480	680	1,330
Approximately 360 feet upstream of Loma Drive	0.4	107	280	394	773
Mirror Lake Drain					
At confluence with Ventura River[a]	0.39	139	330	433	851
Just upstream of Bonmark Drive[a]	*	139	238	394	620
Approximately 80 feet downstream of North Ventura Avenue[a]	*	16	34	46	80
Approximately 250 feet upstream of North Ventura Avenue[a]	*	16	39	54	102
Mirror Lake Drain Overland Reach					
At confluence with Mirror Lake Drain[a,e]	0.34	38	91	136	225
Approximately 1,000 feet upstream of confluence with Mirror Lake Drain[e]	*	40	124	241	622
Upstream of stormwater conduit approximately 0.4 mile upstream of confluence with Mirror Lake Drain	*	108	286	403	784
Mission Drain					
Downstream of Glenbrook Avenue	*	*	*	570	*
Downstream of Coe Street	*	*	*	666	*
North Simi Drain					
At confluence with Arroyo Simi	2.20	*	*	1,952	*
At First Street	1.80	*	*	1,610	*
At Simi Valley Freeway	1.40	*	*	789	*
Oak View Drain					
At confluence with Ventura River	0.9	430	760	919	1,380
At Ventura Highway	0.5	223	383	460	680

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Oxnard Industrial Drain					
At mouth	8.90	500	1,400	2,100	7,600
Above confluence of Rice Avenue Drain	3.40	250	600	950	3,400
At East Wooley Road	1.90	150	400	650	2,300
Oxnard West Drain					
At Edison Company Water Canal	4.9	400	1,050	1,750	5,850
At Channel Islands Boulevard	3.5	300	800	1,300	4,400
At West Hemlock Street	3.2	300	750	1,250	4,100
At Wooley Road	2.8	250	620	1,050	3,450
At West Fifth Street	2.2	200	500	800	2,650
Peach Hill Wash					
Upstream of confluence with Calleguas Creek/Arroyo Las Posas/Arroyo Simi	3.95	700	1,450	1,870	3,090
Upstream of Home Acres Drive	2.60	470	970	1,250	2,060
Downstream of confluence of Small Dam/Debris Basin Dike	1.13	530	1,100	1,420	2,350
Upstream of Peach Hill Road	0.43	240	500	650	1,080
Peck Road Drain					
At confluence with Santa Clara River	1.2	370[a]	980	1,150	1,370
At Santa Paula Street[a]	*	410	630	730	990
Just downstream of Foothill Road	*	850	1,500	1,820	2,730
Piru Creek					
At confluence with Santa Clara River	441	2,500	33,000	41,000	60,000
Pole Creek					
At confluence with Santa Clara River	9.10	6,178	6,827	7,484	14,686
Ponderosa Drain					
Downstream of Mobil Avenue	*	*	*	308	*
Reeves Creek					
At confluence with Thacher Creek	4.90	1,530	4,150	5,840	11,400
Upstream of confluence of McAndrews Canyon Creek	4.2	1,390	3,760	5,290	10,330
Downstream of Upper Reeves Creek	1.9	880	2,380	3,350	6,540
Revolon Slough					
Downstream of Camarillo Hills Drain	38.70	2,500	7,100	10,000	20,000
At Highway 101	30.00	2,200	6,200	8,700	16,500
Rice Avenue (Road) Drain					
At Rose Avenue	4.40	230	600	900	3,050
At Etting Road	4.10	200	550	800	2,600
At Ventura County limits south of Wooley Road	2.20	50	110	150	1,500
At downstream crossing of Southern Pacific Railroad	1.90	30	45	50	1,500
Approximately 500 feet upstream of Southern Pacific Railroad crossing	1.30	110	300	500	1,650

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Rincon Creek					
At confluence with Pacific Ocean	14.60	2,990	7,530	10,320	*
At U.S. Highway 101 culvert	14.60	2,990	7,530	8,500	*
Upstream of U.S. Highway 101 culvert	14.60	2,990	7,530	10,320	*
Runkle Canyon Creek					
At confluence with Arroyo Simi	2.80	*	*	1,400	*
At Fitzgerald Road	2.40	*	*	1,200	*
San Antonio Creek					
At confluence with Ventura River[a]	51.1	9,960	24,715	32,679	51,450
Approximately 410 feet upstream of North Ventura Avenue	49.7	9,930	26,946	37,893	73,689
Upstream of confluence of San Antonio Creek Tributary	46.5	10,430	28,300	39,800	77,690
Upstream of confluence with Lion Canyon Creek	33.8	7,760	21,050	29,600	57,780
Downstream of Stewart Canyon Creek	31.3	8,590	23,320	32,800	64,030
Upstream of confluence of Steward Canyon Creek	26.5	7,620	20,690	29,100	56,800
Downstream of confluence of Thacher Creek	25.4	7,490	20,330	28,600	55,830
Downstream of confluence of McNell Creek	13.5	5,760	15,630	21,980	42,900
Upstream of confluence of McNell Creek[c]	11.3	4,220	11,450	16,100	31,430
At the confluences of Senior Canyon Creek and Gridley Canyon Creek[c]	9.7	4,590	12,440	17,500	34,160
Upstream of confluence of Gridley Canyon Creek[c]	5.8	2,860	7,750	10,990	21,280
Santa Clara Ditch					
Upstream of Nyeland Sump	9.26	920	3,120	4,430	8,200
Upstream of Central Avenue	6.65	750	2,530	3,580	6,600
Santa Clara River					
At mouth	1,625	41,000	116,000	161,000	270,000
At Willard Bridge	1,534	41,000	116,000	161,000	270,000
Upstream of confluence of Santa Paula Creek	1,505	40,000	113,000	157,000	265,000
Downstream of confluence of Sespe Creek	1,500	40,000	113,000	157,000	265,000
Upstream of confluence of Sespe Creek	1,182	23,000	66,000	92,000	160,000
Downstream of confluence of Hopper Creek	1,174	40,000	113,000	157,000	265,000
Downstream of confluence of Piru Creek	1,100	40,000	113,000	157,000	265,000
At Ventura County/Los Angeles County boundary	644	15,000	43,000	60,000	104,000
Santa Clara River Breakout					
At mouth at Pacific Ocean	*	*	28,000	73,000	182,000
Santa Paula Creek					
At stream gauging station	40	6,800	18,000	26,000	48,000
Sespe Creek					
Approximately 4,000 feet downstream of Highway 126	263	33,000	72,000	92,000	145,000
Approximately 5,000 feet upstream of Southern Pacific Railroad	259	29,000	62,000	80,000	131,000

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Skyline Drain					
At the confluence with Ventura River[d,e]	1.0	440	737	936	1,427
Approximately 0.4 mile upstream of confluence with Ventura River[d,e]	*	10	137	336	827
Approximately 130 feet downstream of Willey Street[d,e]	*	10	45	202	629
Approximately 200 feet downstream of North Ventura Avenue[d,e]	*	10	29	180	594
Approximately 100 feet downstream of Valley Meadow Court	*	340	598	726	1,092
Somis Drain					
At Corby Avenue	*	*	*	582	*
At Shepherd Drive	*	*	*	952	*
South Branch Arroyo Conejo					
Upstream of Ventura Freeway	10.72	1,470	4,850	6,800	12,800
Upstream of Jenny Drive Extension	7.46	1,210	4,000	5,700	10,700
Stewart Canyon Creek					
Upstream of confluence with San Antonio Creek	5.0	1,382	4,059	5,941	12,830
Sycamore Canyon Creek					
Below detention dam	*	*	*	184	*
Tapo Canyon Channel					
At confluence with Arroyo Simi	20.70	*	*	8,500	*
At Tapo Canyon Road	17.80	*	*	8,500	*
Telephone Road Drain					
At confluence with Arundell Barranca	2.02	430	1,290	1,760	3,300
Upstream of U.S. Highway 101	1.68	375	1,110	1,500	2,800
Thacher Creek					
At confluence with San Antonio Creek	10.60	2,860	7,750	10,900	21,280
Downstream of confluence of Reeves Creek	8.70	3,200	8,670	12,200	23,810
Upstream of confluence of Reeves Creek	3.40	1,730	4,690	6,590	12,860
Thousand Oaks North Drain					
Upstream of confluence of Arroyo Conejo	1.26	780	1,490	1,870	2,970
At State Highway 23	1.13	740	1,420	1,780	2,830
At La Jolla Drive	0.90	630	1,210	1,530	2,420

Source/Location	Drainage Area (square miles)	Discharge (cubic feet/second)			
		10-Percent	2-Percent	1-Percent	0.2- Percent
Ventura River					
At Pacific Ocean[c]	226	34,000	67,000	78,000	103,000
At Shell Chemical Plant	223	41,300	67,900	78,900	105,500
Approximately 0.6 mile upstream of confluence of Canada Larga	191	36,583	59,999	70,055	93,593
At Casitas Vista Road	188	36,400	59,700	69,700	93,100
Approximately 1,400 feet upstream of Casitas Vista Road	148	35,529	57,135	67,239	90,127
Approximately 1,000 feet downstream of confluence of San Antonio Creek	144	35,000	56,600	66,600	89,000
Approximately 300 feet upstream of confluence of San Antonio Creek	92.8	16,449	25,493	29,104	37,856
At Baldwin Road	83.0	16,000	24,800	28,300	36,700
Approximately 1,120 feet upstream of Camino Cielo	72.4	15,000	24,000	27,100	35,200
Upstream of confluence of North Fork Matilija Creek	56.4	12,500	18,800	21,600	27,900
Walnut Canyon Drain					
At Walnut Canyon Road	0.61	310	640	820	1,360
West Camarillo Hills Tributary					
At Euclid Avenue	*	*	*	820	*
West Wooley Drain					
At West Hemlock Street	0.80	100	300	450	1,550
At Ventura Railway crossing	0.20	25	70	100	390
White Oak Creek					
At confluence with Arroyo Simi	4.20	*	*	3,470	*
At confluence with Hummingbird Creek	3.70	*	*	2,670	*
At freeway	1.50	*	*	960	*

Note: All locations are at mouth unless otherwise noted. Locations do not include jurisdictional boundaries.
*Data not available
a. Decrease due to overbank losses upstream
b. Decrease due to Bajo Aqua timing of hydrograph attenuation (Calleguas Creek)
c. Discharges are larger than those downstream due to updated hydrology (San Antonio Creek & Ventura River)
d. Discharge received from adjacent overbank flow
e. Discharge decreased to due stormwater conduit
Source: Ventura County FIS 06111CV002E, FEMA January 29, 2021

Appendix F. FEMA Approval and Partner Adoption Resolutions

F. FEMA APPROVAL AND PARTNER ADOPTION RESOLUTIONS

To be provided with final draft of this hazard mitigation plan update.